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Local Perspectives on Tree-based Restoration Projects in Madagascar: Expectations, Perceived Benefits and Challenges

GEO 511 Master's Thesis

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Abstract

Forests are crucial for life on this planet. They provide food and water, regulate the climate, and host a significant proportion of the world's biodiversity. In addition, forests offer opportunities for recreation and contribute to both physical and mental well-being. Despite their importance, forests are under increasing pressure, particularly in tropical regions, where intensive agriculture, climate change, and growing demand for land have resulted in extensive forest loss and degradation. In response, tree-based restoration initiatives have emerged worldwide with the aim of restoring forest ecosystems while simultaneously improving the livelihoods of local communities. This thesis examines the social dimension of tree-based restoration projects in the Boeny Region of Madagascar, a country characterized by exceptional biodiversity, widespread poverty, a strong dependence on forest resources, and severe forest degradation and loss. Although tree-based restoration efforts have expanded considerably over recent decades, their long-term effectiveness remains limited. Previous research suggests that insufficient consideration of local priorities and inadequate involvement of local communities are among the main factors constraining the success of tree-based restoration projects. To investigate these issues, interviews were conducted with 83 participants from the villages of Ankorefo Marohogo and Morarano. Using the Nature's Contributions to People (NCP) approach, the study explored which restoration outcomes are most valued by local communities, what benefits and restrictions they experience, how they perceive the alignment of their priorities with those of other restoration actors, and to what extent they feel involved in different project stages. The results indicate that local communities primarily value restoration outcomes directly connected to their livelihoods, such as income, food, and water, alongside environmental benefits like climate regulation. Crucially, the findings reveal that local communities are not homogeneous. Responses were highly variable and often contradictory, with some participants experiencing clear benefits like employment, while others faced severe restrictions regarding slash and burn practices, logging, or access to land. Despite these differences, there was a shared consensus that community involvement is largely limited to implementation, labor, and maintenance rather than early planning and decision-making. This thesis highlights the importance of recognizing local heterogeneity and adopting more inclusive and participatory approaches in restoration initiatives.

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1. Introduction

Forests and trees are essential for sustaining life on Earth. They purify air and water, store large amounts of carbon, and help regulate the climate (UN Decade, 2025a) and many other ecosystem processes (Murage et al., 2025). Moreover, they harbor most of the planet's biodiversity and secure the livelihoods of billions of people worldwide (Blicharska et al., 2019; UN Decade, 2025a). Forests provide humans with food and other valuable natural resources for construction and energy production (Murage et al., 2025). Additionally, forests offer space for recreation and contribute to mental and physical well-being (Murage et al., 2025).

Currently, forest ecosystems are under severe pressure caused by the expansion of human activities and the increasing demand for land and resources (Culbertson et al., 2022; UN Decade, 2025a). Today, more than half of the world's tropical forests have already been lost or degraded (Brancalion et al., 2019) through deforestation, agriculture, infrastructure development, and other human activities (Culbertson et al., 2022; UN Decade, 2025a). The remaining forests are increasingly threatened (Brancalion et al., 2019). Climate change further exacerbates these pressures (Favretto et al., 2020). The ongoing loss of forests has serious impacts on biodiversity, climate regulation, and the well-being of both rural and urban populations (Brancalion et al., 2019).

To reduce anthropogenic impacts on forests and thereby safeguard the many contributions that people derive from nature, conservation and restoration are necessary (Brancalion et al., 2019). Since 2010, many tropical countries have made progressive commitments to restore forests, aiming to conserve biodiversity, enhance carbon sequestration, and improve rural livelihoods (Rakotonarivo et al., 2023; Vincent et al., 2021). The Bonn Challenge is one of the largest international restoration initiatives (Erbaugh et al., 2020; IUCN, 2020). Its goal is to restore 150 million hectares of degraded and deforested landscapes by 2020 and 350 million hectares by 2030 (*The Bonn Challenge*, 2020). To achieve these international goals, a wide range of complementary projects and initiatives have been established at both global and local levels (Kabirigi et al., 2025). One example is the Africa-wide initiative AFR100, through which 34 African nations have committed to jointly restore 100 million hectares of deforested and degraded land by 2030 (Kabirigi et al., 2025, p.1). Building on these initiatives, the United Nations has declared 2021 to 2030 the Decade on Ecosystem Restoration (Buckingham et al., 2021; Osborne et al., 2021). A global call to halt ecosystem degradation, restore landscapes, and strengthen the links between biodiversity conservation, climate action, and human well-being, thereby accelerating progress toward the Bonn Challenge and related global targets (Elias et al., 2022; UN Decade, 2025b; Vincent et al., 2021).

Alongside these important and successful steps, there are challenges that need to be overcome. Researchers argue that global and national assessments of tree-based restoration potential tend to underestimate social aspects, even though these factors can strongly influence the effectiveness and equity of restoration outcomes (Rakotonarivo et al., 2023). Osborne et al. (2021) argue that, next to the environmental damage, also social aspects like structural inequities, equitable distribution of benefits and costs, power relations, involvement of most impacted groups, local decision-making, inclusion of land tenure rights and human well-being need to be addressed to ensure successful outcomes.

In this thesis, I examine the social dimensions of tree-based restoration in Madagascar. The country is characterized by its unique biodiversity (Ralimanana et al., 2022) as well as experiencing severe habitat degradation (Antonelli et al., 2022; Herrera et al., 2021), creating both a significant need and strong potential for tree-based restoration (Kabirigi et al., 2025). While tree-based restoration in Madagascar has been widely studied from an ecological perspective (Culbertson et al., 2022), there is still limited understanding of how local communities perceive, experience, and evaluate these initiatives (Bodonirina

et al., 2018). This study therefore places particular emphasis on amplifying the voices of local communities. Based on interviews conducted in two villages in the Boeny region in northwestern Madagascar, this research examines how local people have benefited from tree-based restoration projects and what restrictions they have experienced. It also examines their needs and expectations regarding such projects, the extent to which they feel included and perceive their needs to be considered, and how they view their priorities as differing from those of other stakeholders. A more detailed description of the study and the research questions is provided in the chapter "Research Questions and Objectives," and the following methods section. Before this, an overview of the theoretical background and the specific context of Madagascar is presented. The results are then outlined and subsequently discussed.

2. Theoretical background

2.1 Definition of important terms

There are several terms used to describe restoration actions. To avoid confusion, the most relevant ones are clarified and explained below. In general, ***restoration*** describes the process of returning something to its former state (Cambridge Dictionary, 2025). However, within the context of this thesis, the term restoration refers to "the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed", (Löfqvist et al., 2023, p.136). This is also known as ***ecosystem restoration***, which includes all types of ecosystems, such as forests, farmlands, cities, wetlands, and oceans (UN Decade, 2025b). Over time, the restoration of forest ecosystems has provided a wide range of benefits extending beyond ecological aspects, including biodiversity conservation, hydrological regulation, and livelihood improvement. This broader understanding led to the development of the concept of ***forest landscape restoration***, which emphasizes that the restoration of forests or degraded landscapes should contribute to multiple sustainability goals (Kabirigi et al., 2025; Rakotonarivo et al., 2023). According to Sijapati Basnett et al. (2017, p.3), "Forest Landscape restoration is a planned process that aims to regain ecological integrity and enhance human well-being in deforested and degraded landscapes". The focus is therefore not solely on forests but on degraded landscapes more generally, aiming to restore both ecological and social functions that were previously present (Rakotonarivo et al., 2023). Another commonly used term is ***reforestation***, which describes the process of restoring forest cover on land that was previously forested but has been cleared or degraded (Petruzzello, 2025). It is used for both the ecological recovery of natural forests and in managed areas such as timber or paper plantations. The term differs from forest landscape restoration in that it focuses specifically on forests rather than on broader landscapes and places a stronger emphasis on ecological and economic objectives (Petruzzello, 2025). Sometimes, the term reforestation is confused with ***afforestation***. Reforestation means planting trees on previously forested areas, while afforestation refers to planting trees on land that has not had tree cover for a long period of time (Petruzzello, 2025). Another related concept is ***tree-based restoration***. The term refers to restoration approaches in which trees or shrubs play a central role in the recovery of degraded or transformed landscapes. Areas suitable for tree-based restoration can include both converted land, such as croplands and pastures, and unconverted land, such as natural forests and woodlands. Depending on the land cover type, different restoration options are applied, for example, agroforestry on converted land and enrichment planting in existing forests or woodlands (Pedercini et al., 2021). The term tree-based restoration refers to a flexible approach, encompassing various types of restoration activities involving trees. As this thesis does not focus on one specific restoration type but rather on a broader concept that includes multiple approaches and dimensions, this term is used frequently.

Additionally, it is important to clarify the difference between deforestation and forest degradation. While ***deforestation*** represents the permanent conversion of forest areas for other purposes such as croplands or grazing, ***forest degradation*** refers to a gradual reduction in the quality and health of forest ecosystems (Peters et al., 2024). Löfqvist et al. (2023) highlight the anthropogenic drivers behind the loss of biodiversity and ecosystem functions in such areas. Deforestation often involves clear-cutting that completely removes the forest. However, even partial deforestation or accidental fires can thin out tree populations to such an extent that the forest undergoes significant changes without the land-use category necessarily changing (Pimm, 2026). In contrast, degradation is a more subtle process, yet it still significantly affects the forest's ability to provide key ecosystem services such as carbon sequestration and biodiversity (Peters et al., 2024). However, what is considered degraded forest by conservationists may, at the same time, represent valuable agricultural land or important grazing areas for local communities (Löfqvist et al., 2023).

Another term that frequently appears is ***livelihood.*** Throughout the thesis and in the interview questions, the term is used and translated in a sense that is consistent with the definition of (Singh et al., 2025, p. 27): "Livelihood refers to the means and resources through which individuals or households secure the necessities of life, such as food, water, shelter, and income. It encompasses various activities, assets, and strategies that people employ to sustain themselves economically and socially". Accordingly, the term is understood in a broad sense that extends beyond financial income and includes a wider range of resources, activities, and strategies that enable people to maintain their well-being and meet their basic needs (Singh et al., 2025).

2.2 Nature's Contributions to People

The environment plays a fundamental role in sustaining human quality of life (Brauman et al., 2020; Hill et al., 2021; Piccolo et al., 2022). The concept of ecosystem services (ES) has emerged as the leading approach for evaluating these environmental resources, including their economic value (Piccolo et al., 2022). It simplifies the complex relationship between humans and nature and helps to assess the value of ecosystems (Buitendijk et al., 2024). Recently, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) developed the new concept of Nature's Contributions to People (NCP) (Buitendijk et al., 2024), defining it as "all the positive contributions, or benefits, and occasionally negative contributions, losses or detriments, that people obtain from nature" (Pascual et al., 2017, p.9). By introducing this concept, the IPBES aims to highlight the many ways in which nature contributes to people's quality of life through their joint interaction (Hill et al., 2021).

The NCP concept overlaps with that of ES as it still builds on the idea of ecosystem services by considering nature in terms of its ecological, economic, and socio-cultural values (Moreira et al., 2025). Further, both frameworks help policymakers and stakeholders recognize and evaluate the diverse benefits that society gains from natural processes (Buitendijk et al., 2024). However, while the ES approach mainly focuses on ecological processes that are not easily noticeable to people, such as flood protection or erosion control, the NCP approach emphasizes how people directly experience nature (Moreira et al., 2025). The NCP approach is considered more inclusive (Piccolo et al., 2022), as it expands the ES approach, which mainly sees nature's value as either intrinsic or instrumental (Moreira et al., 2025), by involving the aspect that people understand and interpret reality, truth, and knowledge in different ways that may not always match the scientific perspective (Pascual et al., 2017). The concept recognizes that the value of nature and its contribution to people's quality of life depend strongly on cultural and institutional contexts (Moreira et al., 2025). By emphasizing the interconnections between biodiversity and cultural diversity, the IPBES seeks to decolonize nature conservation and give a voice to marginalized groups (Piccolo et al., 2022).

NCP are commonly grouped into three broad categories: the first group are ***material NCP,*** which include different kinds of natural resources such as food, energy, or medical resources. The second group are ***non-material NCP,*** which capture nature's influence on subjective or psychological aspects such as cultural identity, inspiration, and mental well-being. The last group are ***regulating NCP***, which include ecological processes that sustain and regulate the generation of both material and non-material benefits. Examples are processes like pollination or climate regulation (Hill et al., 2021). However, NCP can be analyzed from different perspectives. The first generalized perspective categorizes all NCP in the three already named categories. The context-specific perspective, on the other hand, analyzes how people interact with nature in specific cultural or local contexts. For example, in some indigenous communities, fishing provides primarily food and is therefore categorized as a material benefit, but it could also be

seen as traditional knowledge or cultural practices. In that case, it would belong to the non-material category (Petzold et al., 2024).

Besides its positive and inclusive aspects, the NCP concept is also criticized. Some argue that it promotes an anthropocentric view by giving the impression that the purpose of nature is to serve human well-being (Piccolo et al., 2022). Additionally, there are some limitations. E.g., the approach is less suited for quantitative analysis because parts of its values, like psychological perceptions, are difficult to measure (Moreira et al., 2025). In addition, it does not fully account for important abiotic factors such as water, minerals, or certain energy sources, which can lead to an incomplete understanding of ecosystem functions (Moreira et al., 2025).

The concept of NCP is closely linked to global challenges such as climate change and human-driven environmental degradation (Petzold et al., 2024). Declines in biodiversity and ecosystem functions directly affect the quantity and quality of benefits that nature provides, putting many NCP at risk (Brauman et al., 2020). Deforestation can be used as an example: When forests are lost, contributions such as air quality regulation are reduced, with significant consequences for human well-being (Petzold et al., 2024). However, such changes do not affect all people equally. Marginalized groups are more likely to experience environmental degradation, e.g., communities in the Global South are often disproportionately affected (Hill et al., 2021; Petzold et al., 2024). Tree-based restoration projects aim to reverse these impacts by restoring trees and forests and thereby the NCP they provide (Petzold et al., 2024).

The concept of NCP provides a useful framework for this thesis, as it goes beyond ecological or economic perspectives and highlights the importance of local values, knowledge, and experiences (Petzold et al., 2024; Piccolo et al., 2022). Conflicting values often influence the way decisions are made and how aspects like sustainability are understood (Pascual et al., 2017). The NCP approach is considered a supporting concept for improving communication among different actors in land system decision-making (Moreira et al., 2025). Therefore, the NCP concept can help to better understand how tree-based restoration measures are perceived and experienced by local communities, how different types of NCP are valued, and how these perceptions influence decision-making processes and the overall success of tree-based restoration projects.

2.3 Tree-based restoration

2.3.1 An overview

Tropical forests are under severe pressure (Culbertson et al., 2022) due to intensive, expanding agriculture (Vincent et al., 2021; WWF, 2026). According to Bodonirina et al. (2018, p.2), 92% of the tree cover loss in Africa is due to agriculture. However, other studies, such as Petzold et al. (2024), highlight anthropogenic climate change as an additional driver, noting that it amplifies human pressures, including land-use change, resource overexploitation, and environmental pollution. For example, air quality is reduced by slash-and-burn practices (Petzold et al., 2024). Forest loss and degradation lead to the reduction of natural habitats, which contributes to the extinction of valuable species (Herrera et al., 2021), as many cannot survive in the remaining forest fragments. This is especially concerning in tropical rainforests since they host more than half of all known species (Brancalion et al., 2019; WWF, 2026). Further, tropical forests store large amounts of CO_2 (Rakotonarivo et al., 2023). When these forests are removed, they can transform from being carbon sinks to being carbon emitters. Especially, loss through forest fires contributes to large amounts of carbon in the atmosphere, which contribute to rising temperatures, altered weather patterns, and more frequent extreme events (Sommers et al., 2014). Additionally, diminishing forests undermine the contributions of forests to people (Herrera et al., 2021), including

water, energy, and food security as well as the livelihood of local communities who depend on the forest for subsistence or income generation (Shelton et al., 2024; WWF, 2026). This results in a widespread decline of all three types of NCP, threatening the mental and physical well-being of rural communities (Petzold et al., 2024).

Tree-based restoration projects have the potential to counteract forest loss and degradation issues and achieve a wide range of social and ecological benefits (Buckingham et al., 2021; Favretto et al., 2020; Osborne et al., 2021). Thus, addressing some of today's most pressing challenges (Brancalion & Holl, 2020). Tree-based restoration projects contribute to climate change mitigation (Erbaugh et al., 2020; Favretto et al., 2020), as more planted trees can absorb larger amounts of CO_2 from the atmosphere and thus help limit global warming (Rakotonarivo et al., 2023). At the same time, tree-based restoration projects support climate change adaptation in several ways. First, forested areas are less exposed to extreme rainfall impacts (Brancalion et al., 2019), as vegetation stabilizes the soils and reduces erosion (Dahanayake et al., 2024). Second, establishing new forests can help mitigate heatwaves and reduce the spread of dust storms in densely populated regions (Brancalion et al., 2019). Third, they improve landscape connectivity, enabling species to migrate to more suitable habitats under changing climatic conditions (Brancalion et al., 2019). Beyond its climate-related benefits, tree-based restoration also plays a key role in biodiversity conservation (Erbaugh et al., 2020). For example, enhances increased landscape connectivity biodiversity (Brancalion et al., 2019). In addition to its environmental benefits, tree-based restoration can support human health and well-being while promoting the sustainable use of forest resources (Murage et al., 2025). It can contribute to energy production and strengthen food and water security (Buckingham et al., 2021) by providing food, wood, and clean water (Brancalion et al., 2019; Brancalion & Holl, 2020). Further, it supports more stable water availability throughout the year, since restoring tropical forests helps to protect waterways from sedimentation and erosion and improves water infiltration and groundwater recharge (Brancalion et al., 2019). Local communities can also benefit economically, as tree-based restoration projects can provide opportunities for income generation through the harvest of forest products (Brancalion & Holl, 2020).

2.3.2 Challenges

Despite many years of conservation and restoration efforts as well as the presence of ambitious commitments like the Bonn Challenge, forest degradation and loss continue, threatening the essential contributions they provide to billions of people (Osborne et al., 2021). The reasons for this phenomenon are diverse. Alongside its benefits, tree-based restoration entails certain costs and challenges (Elias et al., 2022). When implemented in the wrong locations, tree-based restoration projects can have negative impacts (Brancalion & Holl, 2020). They may change hydrological processes leading to water insecurity, increase risks of fire, or replace native ecosystems with associated biodiversity loss. Some tree species might become invasive (Brancalion & Holl, 2020; Löfqvist et al., 2023; Osborne et al., 2021). While many projects assume that implemented measures are inherently environmentally and socially beneficial (Brancalion et al., 2019), they can in practice lead to social costs at the local level (Rakotonarivo et al., 2023), which in turn may also hinder ecological effectiveness (Ladouceur et al., 2022).

The challenges arise already during the planning phase. Because tree-based restoration is inherently multidisciplinary (Kabirigi et al., 2025), it requires coordinating a diverse group of actors across various local and global levels with often conflicting interests (Kabirigi et al., 2025; Shelton et al., 2024). Research shows that national restoration priorities frequently diverge from local needs (Buckingham et al., 2021). Global organizations primarily aim to mitigate climate change and protect habitats and biodiversity (Brancalion & Holl, 2020). In contrast, local farmers have diverse interests depending on the context. As soil fertility is important (Shelton et al., 2024), local farmers tend to prefer planting trees only

in areas where agricultural productivity is low. Additionally, they often favor species that provide more immediate benefits, such as fruit trees (Brancalion & Holl, 2020), which contribute to increased food security. Other important aspects are water availability, generating income, and cultural significance (Shelton et al., 2024). Bringing these different interests and expectations together can be challenging. Compromises often result in outcomes that do not fully meet the preferences of either side (Brancalion & Holl, 2020). Another challenge is that decisions are typically made by external entities rather than the communities directly affected (Rakotonarivo et al., 2023). These top-down approaches often fail (Shelton et al., 2024) because they can trigger local resistance, social justice issues, and environmental conflicts (Osborne et al., 2021; Shelton et al., 2024). As a result, planted trees may not be maintained, since land is still used for grazing or recleared for agriculture. Plantings may even be intentionally destroyed due to a lack of participation in decision-making (Brancalion & Holl, 2020).

Recently, there has been growing awareness that focusing mainly on environmental factors is too simplistic. Many tree-based restoration approaches have been criticized for neglecting their impacts on human well-being (Elias et al., 2022; Löfqvist et al., 2023; Murage et al., 2025). They often fail to recognize the needs of the local communities and the social implications coming with it (Elias et al., 2022; Erbaugh et al., 2020). Values that are important to them, such as use for subsistence or cultural and spiritual significance, are often overlooked (Osborne et al., 2021). Even projects that intend their implemented measures to be socially and ecologically beneficial (Osborne et al., 2021) can in practice result in social costs at the local level (Rakotonarivo et al., 2023). Furthermore, recent research on tree-based restoration often overlooks the social and legal factors that influence how such projects are designed and implemented (Rakotonarivo et al., 2023). These factors strongly limit the influence of local communities on decision-making (Osborne et al., 2021) and also in the implementation stage, locals are often insufficiently included. Although local farmers play a key role in restoration, they often lack access to the necessary resources to participate fully (Buckingham et al., 2021). Favretto et al. (2020) state that stakeholder engagement is frequently just treated as a formality to satisfy donor requirements rather than addressing real community needs. Dawson et al. (2024) point out that initiatives described as "community-based", "co-managed" or "participatory" appear to ensure strong local involvement but are increasingly criticized for insufficient implementation of local communities and for even creating additional burdens. This neglect of social aspects and exclusion of local communities across multiple project stages can lead to unintended trade-offs, low acceptance by local communities, environmental conflicts, and ultimately reduced conservation benefits (Kabirigi et al., 2025; Murage et al., 2025).

The competition for land is a major challenge for large-scale tree-based restoration (Brancalion et al., 2019). Many areas suitable for restoration are essential to the livelihoods of local communities. As these communities are often excluded from decision-making processes (Löfqvist et al., 2023), tree-based restoration efforts have frequently failed to recognize traditional land rights, resulting in displacement and loss of livelihoods (Brancalion et al., 2019). Changes in land use and property values can restrict local access to land and forest resources (Elias et al., 2022; Murage et al., 2025). This raises ethical concerns, since local communities are forced to give up their livelihoods to bear the burden of a global carbon and biodiversity debt to which they have contributed very little (Erbaugh et al., 2020). In addition, implementing tree-based restoration on agricultural land can have a negative impact on food security. Forecasts indicate that the large-scale conversion of agricultural land into forest could lead to a substantial increase in food prices in most regions, creating serious socio-economic risks (Vincent et al., 2021). In particular, women and children are more vulnerable to malnutrition and therefore mainly affected by food insecurity, which in turn increases their risk of disease (Herrera et al., 2021). The alternative approach of focusing tree-based restoration efforts exclusively on remote forest areas may reduce conflicts with local communities. However, it also has significant limitations, as these regions represent only a small share of the global restoration potential. Moreover, they provide fewer direct benefits to people

due to their distance from settlements, and their contribution to biodiversity conservation is relatively limited (Erbaugh et al., 2020).

Another challenge surrounding tree-based restoration projects is the requirement of both, significant human effort for activities like tree planting and substantial financial investment (Elias et al., 2022), what sometimes leads to constraints (Kabirigi et al., 2025). At the same time, the use of socio-environmental benefits from tree-based restoration projects at the local level is often limited to more immediate needs, e.g., restricted access to basic services such as healthcare, drinking water and education (Favretto et al., 2020).

2.3.3 Improved Effectiveness

In the context of this thesis, effective tree-based restoration does not simply mean meeting tree-planting targets, but is defined as projects that ensure long-term ecological recovery while also promoting human well-being and procedural justice (Löfqvist et al., 2023). The literature suggests numerous measures to improve the effectiveness of tree-based restoration projects and to ensure a more equitable distribution of their costs and benefits. Many researchers are convinced that not treating the social aspects as a central priority of tree-based restoration projects significantly reduces positive restoration outcomes (Elias et al., 2022; Erbaugh et al., 2020; Löfqvist et al., 2023; Rakotonarivo et al., 2023). Löfqvist et al. (2023) argue that tree-based restoration cannot be effective nor equitable if local communities and marginalized groups are systematically excluded and single environmental outcomes are prioritized over sustainable and inclusive ecological management. Therefore, there is an urgent need to include local actors in tree-based restoration projects. This is particularly important in the early design phase, when key decisions on location, objectives, methods, and responsibilities are made (Dawson et al., 2024; Osborne et al., 2021). Local involvement should not be limited to solely participation in the on-ground implementation of reforestation measures. Rather, local communities must have meaningful influence over decision-making processes (Shelton et al., 2024). “Thus, […] [tree-based restoration] initiatives need to move beyond vague claims of stakeholder participation toward formal recognition of local management and governance” (Shelton et al., 2024, p.7). In this regard, the needs and goals of the different stakeholders, particularly those of local communities who are directly affected and depend on the respective area, must be considered and assessed to determine whether they can be combined (Brancalion & Holl, 2020; Ladouceur et al., 2022; Pascual et al., 2017; Sijapati Basnett et al., 2017). Afterwards, an appropriate method for achieving these goals must be identified (Brancalion & Holl, 2020), including consideration of the rights and livelihood needs of local communities (Buckingham et al., 2021; Favretto et al., 2020; Murage et al., 2025), along with clarification of the extent to which they will be involved in the project (Brancalion & Holl, 2020). The latter is particularly important because tree-based restoration requires location-specific knowledge (Ladouceur et al., 2022; Osborne et al., 2021). Therefore, besides the decision-making stage, it is also recommended to empower local communities in the implementation and management stages (Erbaugh et al., 2020). Local communities often support conservation through their values, traditional ecological knowledge (Dawson et al., 2024; Ladouceur et al., 2022), and long-standing practices that promote sustainability (Dawson et al., 2024). Their involvement can help address local uncertainties, incorporate traditional knowledge, and support communities in benefiting from reforestation (Erbaugh et al., 2020). Cross-sectoral partnerships with local actors can improve the necessary knowledge exchange and mutual understanding. On one hand, researchers can learn from them about practical constraints, priorities, and how to better connect research to the real-world setting (Ladouceur et al., 2022). On the other hand, local communities are empowered to play an active role in suitable tree-based restoration projects (Osborne et al., 2021). With this contextual knowledge and legitimacy, initiatives are better adapted to local needs and more widely accepted (Kabirigi et al., 2025). Research

generally shows that tree-based restoration projects planned and implemented by a network of diverse stakeholders are more efficient and equitable, and lead to more sustainable outcomes than those dominated by just few stakeholder groups, as such an approach enables the combination of complementary expertise and skills (Kabirigi et al., 2025; Petzold et al., 2024). Consequently, decision makers must recognize existing power imbalances and actively improve local access to knowledge and funding (Buckingham et al., 2021). Currently, however, the lack of standardized protocols and limited budgets continues to hinder the documentation and sharing of vital local expertise (Ladouceur et al., 2022).

Other important aspects for improving the effectiveness of tree-based restoration projects include long-term monitoring (Favretto et al., 2020), as young forests often persist only for a few years and are frequently reconverted into agricultural land (Rakotonarivo et al., 2023). With long-term monitoring, potential challenges (e.g., low seedling survival rates) can be identified early and corrected through targeted management interventions. In addition, it helps ensure long-term ecological effectiveness (Brancalion & Holl, 2020). Another key point is the clarification and establishment of land tenure rights (Osborne et al., 2021). They not only define who has access to which resources and how they can be used, but also influence people's motivation to invest in and sustainably manage them over time (Rakotonarivo et al., 2023). In general, tree-based restoration projects should prioritize social and environmental outcomes over financial gains, excluding fair compensation for local communities. Focusing mainly on measurable targets, such as the number of trees planted, often overlooks wider-reaching impacts like underlying social drivers (Löfqvist et al., 2023), which in turn reduces the long-term effectiveness as locals are less willing to continue the project (Herbohn et al., 2022). However, Brancalion & Holl (2020) argue that preventing deforestation and improving forest management are generally more effective and cost-efficient solutions than tree planting, as restored forests often provide lower benefits than intact ones and take decades to recover. Hence, addressing the causes of forest loss should be the main priority, alongside protective measures in restoration efforts.

2.3.4 The Role of Gender

Marginalized communities, particularly in low- and middle-income countries of the tropics, are especially affected by forest degradation and loss due to their strong dependence on fragile ecosystems for their livelihoods (Herrera et al., 2021; Murage et al., 2025). At the same time impacts, risks, and benefits are unevenly distributed across different social groups within these communities (Elias et al., 2022). Children, elderly people, women, and people with disabilities are particularly vulnerable to the loss of NCP (Petzold et al., 2024) and climate change impacts (Osborne et al., 2021). Tree-based restoration initiatives are also frequently embedded in broader struggles over access to and control of natural resources, shaped by intersecting power relations related to gender, class, ethnicity, indigeneity, and colonial histories. These dynamics influence whose knowledge is recognized, who has access to resources, and who ultimately benefits (Osborne et al., 2021). It is also important to recognize that these groups are not homogeneous in their interests, and that representatives such as community leaders do not necessarily represent the views or priorities of the entire community (Elias et al., 2022). Consequently, it is important to acknowledge this heterogeneity within the local communities (Löfqvist et al., 2023).

In particular, the role of gender in tree-based restoration projects has recently received greater potential by various researchers (de Siqueira et al., 2021; Löw, 2020; Sijapati Basnett et al., 2017, 2017). While women are frequently excluded from tree-based restoration projects and gender differences are often neglected (Löw, 2020), some initiatives claim to include women and other marginalized groups. However, this rarely translates into meaningful participation in decision-making processes (Shelton et al., 2024). More broadly, local communities are often excluded from decision-making, and when included, the perspectives of educated men with higher socio-economic status and land ownership tend to

dominate (Sijapati Basnett et al., 2017). This exclusion of women is the result of existing gender norms and male-dominated decision-making structures (de Siqueira et al., 2021) operating across household, community, and state levels, which limit women's ability to express their views and interests (Sijapati Basnett et al., 2017).

Evidence shows that women's participation can improve the effectiveness and sustainability of tree-based restoration projects, although gender differences remain insufficiently addressed in both research and practice (Sijapati Basnett et al., 2017). Globally, around 100 million indigenous women depend heavily on forest resources for their livelihoods and subsistence and should therefore be considered a key target group (Löw, 2020, p.92). Intersectional feminist perspectives further highlight their central role in forest conservation and sustainable management, as they have valuable knowledge about trees, soils, and whole ecosystems (Löw, 2020) that complements that of men (Sijapati Basnett et al., 2017). Additionally, it is often overlooked that women also play a substantial role in forest restoration activities (Löw, 2020), such as planting and nurturing seedlings (Sijapati Basnett et al., 2017). However, they are often excluded from management activities like planning and monitoring (de Siqueira et al., 2021). Moreover, unequal land rights often prevent women from benefiting equally from outcomes (Sijapati Basnett et al., 2017).

Ensuring a fair distribution of costs and benefits can prevent the persistence of gender inequalities, enhances local acceptance, and thereby improves both social and environmental outcomes (Sijapati Basnett et al., 2017). Moreover, considering women's needs can generate additional benefits. Improved access to food and energy resources reduces time spent on daily collection tasks, generating additional time for family care or education and project management roles, especially when men migrate for work (Shelton et al., 2024). Without integrating gender equality, there is a risk that tree-based restoration initiatives reinforce existing social inequalities (de Siqueira et al., 2021).

Therefore, local women and other vulnerable groups should be actively involved in tree-based restoration projects, and gender equality should be treated as a core objective of restoration projects (de Siqueira et al., 2021). This would support sustainable development, poverty reduction, and social inclusion, while reducing structural inequalities (Löw, 2020). However, enhancing women's participation in tree-based restoration projects requires targeted measures that address existing structural barriers. This includes interviewing women independently from men, reducing women's daily responsibilities such as cooking by providing meals during meetings, and ensuring that the timing and location of meetings are convenient for them (Shelton et al., 2024).

2.4 Tree-based Restoration Efforts in Madagascar

Madagascar is an Island located in the Indian Ocean around 500 km away from the African east coast. With an area of 580'000 km^2, it is the fourth largest island worldwide (Petzold et al., 2024, p.752). The island is home to 31,964,956 residents as of 2024 (*World Bank Open Data*, 2026), with 18 ethnic groups (Petzold et al., 2024, p.752). The low-income country is considered one of the poorest countries in the world (Favretto et al., 2020; Ralimanana et al., 2022). Approximately 69% of the people are living below the poverty line (*World Bank Open Data*, 2026). In 2025, 69% of the population was employed in agriculture (*World Bank Open Data*, 2026), while for many people in rural communities, subsistence farming is the primary livelihood (Herrera et al., 2021). Nevertheless, the island is characterized by a unique biota (Ralimanana et al., 2022). Due to its exceptional endemism, with over 80% of its flora and fauna being endemic (Antonelli et al., 2022, p.1; Culbertson et al., 2022, p. 1082), and its high species richness (Bodonirina et al., 2018), Madagascar is considered as one of the world's biodiversity hotspots (Favretto et al., 2020).

At the same time, Madagascar is home to the most vulnerable social and ecological systems, with special vulnerability to biodiversity loss, climate change, and extreme weather (Petzold et al., 2024). The increasing temperatures and the extensive spatial rainfall exacerbate the severity of droughts and floods (Favretto et al., 2020). Such extreme weather phenomena can devastate the harvest, leading many people depending on agriculture to food insecurity (Herrera et al., 2021). Children are particularly affected. Due to insufficient food or poor food quality many suffer from growth disorders and anemia and are underweight (Andriamparany et al., 2021). In Madagascar, seasonality has a big influence on the availability and quality of food. The shortage is most severe at the beginning of the rainy season in November and December, as the harvest of most main food crops, such as rice, does not begin until later (Andriamparany et al., 2021). Additionally, the island is characterized by severe habitat degradation (Antonelli et al., 2022; Herrera et al., 2021) and deforestation (Culbertson et al., 2022; Ralimanana et al., 2022). 63% of all recorded tree species are endangered (Ralimanana et al., 2022, p.4). From 1953 to 2014, about 44% of the island's natural forest cover was lost (Ralimanana et al., 2022, p.4). The main drivers for this loss are agriculture and overexploitation (Ralimanana et al., 2022). Especially, slash-and-burn methods are leading to forest and biodiversity decline (Bodonirina et al., 2018). However, many subsistence farmers have increasingly adopted these methods as a coping strategy in response to severe droughts and intensified flooding (Favretto et al., 2020), as slash-and-burn practices help maintain soil fertility without the use of fertilizer, compensate for declining agricultural productivity on existing land, and thereby ensure livelihood security (Bodonirina et al., 2018; Favretto et al., 2020). With an annual population growth rate of 2.4% as of 2024, the population of the island has grown exponentially in recent years (Culbertson et al., 2022; *World Bank Open Data*, 2026). This growth has resulted in an increased demand for land and resources, which has further intensified human activities, including slash-and-burn agriculture and logging that drive deforestation and threaten forest ecosystems and biodiversity (Bodonirina et al., 2018; Petzold et al., 2024; Ralimanana et al., 2022).

It is estimated that without major changes in the near future, around 93% of the island's forest area present in 2000 will have disappeared by 2050 (Ralimanana et al., 2022, p.4). This trend is particularly concerning as more than 90% of endemic species depend on forest habitats (Culbertson et al., 2022, p. 1082). Additionally, the diminishing forests have a negative impact on the various NCP they provide, what consequently affects the physical and mental well-being of local communities (Petzold et al., 2024). These conditions make Madagascar a global conservation priority (Favretto et al., 2020; Petzold et al., 2024), with a pressing need for tree-based restoration efforts (Kabirigi et al., 2025). To address these challenges Madagascar is a part of the Africa-wide initiative AFR100 (Kabirigi et al., 2025). The country has committed to contributing to the initiative's restoration goals by restoring 4 million hectares of degraded and deforested land (Rakotonarivo et al., 2023, p.2)

Despite the recognition of the need for tree-based restoration in Madagascar (Culbertson et al., 2022) and over 30 years of international conservation efforts (Bodonirina et al., 2018, p.2), there is little evidence of success (Culbertson et al., 2022). Many scientists argue that one of the main reasons for this is the insufficient involvement of local communities (Bodonirina et al., 2018; Elias et al., 2022; Favretto et al., 2020). In response, the GELOSE law (Gestion Locale Sécurisée) was introduced in 1996 in Madagascar (Pollini & Lassoie, 2011, p. 814) to decentralize state control and transfer greater responsibility for natural resource management to local communities. The main idea behind the law was that local communities would manage resources more sustainably if they were formally involved in decision-making processes (Ranjatson et al., 2019). However, the implementation of GELOSE has often proved problematic. Better educated or more influential individuals frequently gained control over local organizations, while external actors such as NGOs strongly influenced management rules, contributing to social conflicts and inequalities within communities (Pollini & Lassoie, 2011). Although responsibility for forest management has since been partially transferred to local communities, placing community-

based conservation more centrally within environmental policy (Favretto et al., 2020), recent research still shows a clear imbalance in stakeholder participation (Kabirigi et al., 2025). Financial considerations and limited knowledge play a key role in shaping tree-based restoration efforts. Madagascar's dependence on external financial support, the limited capacity of local government to independently manage resources, and the weak institutional frameworks result in tree-based restoration projects that are often initiated and led by academic institutions and international NGOs with greater financial resources and technical expertise. These predominantly top-down approaches limit the involvement of community-based organizations. Consequently, decisions about local land use are frequently made by external actors rather than by the communities directly affected (Kabirigi et al., 2025). Some researchers argue that this approach is not sustainable (Andriamihaja et al., 2021) because external actors lack the necessary expertise to maintain restoration, which, in turn, hinders the achievement of environmental goals. Further, most benefits are indirect, long-term, and environmental (Kabirigi et al., 2025). Kabirigi et al. (2025) argue that engagement of local people will remain small if initiatives cannot convince them with immediate benefits. In addition, about 67% of the areas with high potential for tree-based restoration are located on untitled land where tenure is unclear or controversial. This poses a significant challenge, as unresolved land tenure issues are a major barrier to effective forest restoration (Rakotonarivo et al., 2023, p.1). Many locals fear that tree-based restoration could threaten their land rights to access, use, and benefit from their resources, leading to low levels of acceptance within the communities (Rakotonarivo et al., 2023) and few incentives to motivate them for participation (Kabirigi et al., 2025). There are experienced local farmers who continue slash-and-burn agriculture despite restrictive policies, due to past experiences with limited success of alternative approaches. These alternatives often require unrealistic labor inputs and entail financial risks that farmers with limited resources are unwilling or unable to take (Rakotonarivo et al., 2017). Additionally, for the majority of locals, practices like slash-and-burn are still essential as they often have no alternatives for securing their livelihoods (Bodonirina et al., 2018). Although these challenges have long been recognized, compensation measures are often insufficient, implemented late, or entirely absent (Favretto et al., 2020; Rakotonarivo et al., 2017). As the involvement of local communities appears to be crucial for the success of tree-based restoration projects, it is indispensable to identify ways to incorporate their needs and aspirations (Kabirigi et al., 2025). However, to successfully incorporate local needs, it must be acknowledged that communities are not homogeneous (Elias et al., 2022). Further, certain needs or wishes conflict with the long-term ecological objectives of tree-based restoration (Kari & Korhonen-Kurki, 2013; Sijapati Basnett et al., 2017). The continued need to use slash-and-burn agriculture methods provides an example (Bodonirina et al., 2018; Rakotonarivo et al., 2017). Although this reflects a strong need among local communities, it is essential to limit such drivers of forest degradation and deforestation (Brancalion & Holl, 2020). Nevertheless, this need should be acknowledged, and local people should be provided with information and accessible resources for feasible alternatives, rather than simply imposing bans and leaving them to cope with it on their own (Bodonirina et al., 2018; Pollini & Lassoie, 2011).

3. Research Question and Objective

3.1 Context

This thesis is written within the scope of the Demand4Restoration project in Madagascar (Demand4Restoration, 2025). The project aims to integrate the concept of restoration demand into restoration science and practice. The guiding assumption of the project is that aligning restoration efforts with local needs enhances both social effectiveness (e.g., income, food security, equity) and ecological effectiveness (e.g., biodiversity, climate and water regulation).

The project aims to understand four different questions:

I. Which social and ecological factors influence restoration projects in Madagascar, and are costs and benefits shared across different actors?
II. Is there a demand for restoration among the local communities, and if so, where, in what form, and for which purposes?
III. How does the community's restoration demand align with or diverge from the demands of regional, national, and international actors?
IV. How can restoration projects be designed in collaboration with actors to effectively meet their needs? (Demand4Restoration, 2025).

To answer all these questions, the project is divided into three subprojects. Subproject A aims to quantify the effectiveness of past restoration projects by comparing restoration outcomes with local community demand and by examining the social and ecological factors that explain these relationships across three regions of Madagascar (humid forest, transition forest, dry forest and mangroves). Subproject B aims to understand where and what kind of restoration local communities want, researching the same regions as subproject A. To do this, methods such as group discussions, mapping, and exploring future scenarios are used together with local communities and other actors. Subproject C aims to co-create three new restoration projects together with local partners. With the knowledge gained, these projects aim to take people's needs into account from the beginning and contribute to a better understanding of how restoration can be successfully designed in both social and ecological terms (Demand4Restoration, n. d.).

This thesis is affiliated with an interview series of subproject C. Ten villages were visited in three regions of Madagascar, and about 40 interviews were conducted with community members in every village. The interview series of subproject C aims to understand how local communities are involved in restoration projects, from being consulted and informed to having representation in decision-making. Furthermore, it questions benefits experienced, awareness of national strategies, and the challenges that could affect the success of restoration efforts. This thesis investigates the expectations and hopes of the local communities regarding the outcomes of restoration projects in one of the three regions. In addition, the aim was to assess which benefits and disadvantages they have experienced after the implementation of past restoration projects and whether the local people perceive their demands as aligning with the expectations of other actors.

The following research question and sub-questions frame this thesis:

Research question

What are the aspirations of local communities in Madagascar regarding the outcomes of tree-based restoration projects, and how do they perceive the benefits, barriers, their involvement in restoration processes, and the alignment of their interests with those of other actors?

Sub-questions

1. *Which ecological, economic, and social outcomes of tree-based restoration projects are most valued by local communities?*
2. *What positive and negative impacts do local communities experience after the implementation of tree-based restoration projects?*
3. *How do local communities perceive the alignment of intentions and priorities of other actors involved in tree-based restoration projects with their own priorities and needs?*
4. *How do local communities perceive their involvement in different stages of tree-based restoration projects?*

3.2 Expectations

Based on the reviewed literature, an expectation was formulated for each sub-question. In the Discussion chapter, it is then examined whether these expectations could be confirmed.

1. Sub-question: *Which ecological, economic, and social outcomes of tree-based restoration projects are most valued by local communities?*

Expectation:

Research indicates that local communities tend to prioritize immediate economic and livelihood outcomes such as food and water security and income generation over long-term ecological outcomes like biodiversity conservation and climate change mitigation (Brancalion & Holl, 2020; Shelton et al., 2024), which may involve costs and restrictions at the local level (Rakotonarivo et al., 2023). Given that approximately 69% of Madagascar's population lives in poverty (World Bank Open Data, 2026) and that most rural households rely on subsistence farming for their livelihoods (Herrera et al., 2021), I expect the findings reported in the literature to be reflected in the interview responses.

2. Sub-question: *What positive and negative impacts do local communities experience after the implementation of tree-based restoration projects?*

Expectation:

Since many tree-based restoration projects focus on ecological aspects (Elias et al., 2022), I expect that local communities in Madagascar mainly experience ecological benefits. An example would be forests that become less vulnerable to extreme rainfall (Brancalion et al., 2019) due to more stable soils resulting from the increased vegetation cover (Dahanayake et al., 2024). Another would be improved water security, as greater vegetation helps protect waterways from sedimentation and erosion and enhances water infiltration and groundwater recharge (Brancalion et al., 2019). Although tree-based restoration can have positive effects on biodiversity and climate mitigation (Erbaugh et al., 2020; Favretto et al., 2020), I do not expect these benefits to be directly perceived by local communities. However, I expect experienced negative impacts particularly in relation to land tenure, as in some cases, tree-based restoration projects do not sufficiently consider local rights (Brancalion et al., 2019), which can lead to communities losing

access to their land and therefore to forest resources and their livelihoods (Elias et al., 2022; Murage et al., 2025).

3. Sub-question: *How do local communities perceive the intentions and priorities of other actors involved in tree-based restoration projects compared to their own priorities and needs?*

Expectation:
Research shows that the needs and priorities of local communities often diverge from those of external actors (Buckingham et al., 2021), who tend to focus on ecological priorities such as biodiversity conservation and climate change mitigation (Brancalion & Holl, 2020). In contrast, local communities typically prioritize immediate benefits, including food and water security as well as income generation (Brancalion & Holl, 2020; Shelton et al., 2024). Furthermore, several studies suggest that some projects fail to adequately consider the needs of local communities (Elias et al., 2022; Erbaugh et al., 2020). This reinforces the assumption that priorities differ among stakeholders. Therefore, I expect that local communities perceive their own priorities as being clearly different from those of other actors.

4. Sub-question: *How do local communities perceive their involvement in different stages of tree-based restoration projects?*

Expectation:
Literature indicates that local communities are not sufficiently involved in tree-based restoration projects (Elias et al., 2022; Osborne et al., 2021; Rakotonarivo et al., 2023), particularly in the decision-making and planning phases (Löfqvist et al., 2023). While some community members are engaged in implementation or maintenance activities (Shelton et al., 2024), literature suggests that even this level of involvement is often insufficient (Buckingham et al., 2021). Consequently, I expect that local communities perceive themselves as more strongly represented in the later stages of projects rather than in the planning phase. At the same time, I anticipate that many community members feel insufficiently involved overall. Furthermore, I expect perceptions to differ by gender, with men being seen as more involved than women since research shows that men are more engaged, particularly in decision-making processes (Löw, 2020; Sijapati Basnett et al., 2017).

3.3 Positionality

Positionality describes the relationship between the researcher and the research topic (Goundar, 2025). Acknowledging this relationship is particularly important because the researcher's worldview and perspective can strongly influence the choice of topic, the way research is conducted, and the interpretation of the findings. In addition, a researcher's own social and cultural background can shape whether they are positioned as an insider or outsider in the field, which may affect how they are perceived by participants and how participants respond to them. Researchers in social science should therefore be aware of the importance of their own positionality and critically reflect on how it may influence their work throughout the research process (Goundar, 2025).

I am a 24-year-old white Swiss woman. I grew up in a small house in a suburban village in a middle-class household with both of my parents working. Apart from trips to Kyrgyzstan and Sri Lanka, I have spent my entire life in Europe and have had limited exposure to countries and cultures outside of my own continent. Prior to my fieldwork in Madagascar, I had never been to the African continent, and my understanding of life in Madagascar was primarily based on literature and documentary films. As a visibly Western person with lifelong access to education and a privileged background, there was a significant structural difference between me and the local communities I visited during my fieldwork. In this context, I was positioned as an outsider.

Before the fieldwork, I reflected on how to best navigate this role and what impact my presence might have on local participants. I may have been perceived as being connected to an international NGO or as being a potential funder. Furthermore, my presence may have influenced participants' responses, leading them to answer in ways they assumed I wanted to hear. To minimize these potential influences, several measures were taken. My research partner and I were introduced by the local person we accompanied, and our roles were clearly explained. In addition, a trusted person from each village (the guide) was present during all interviews. While my male research partner experienced a few instances in which participants assumed he was a funder, which in some cases affected their attitude towards him, I did not observe such reactions in my own interactions. From my perspective, participants were generally neutral, and in many cases even particularly open and interested. I believe this may be partly related to my gender, although this remains an interpretation.

Whether and to what extent participants' responses were influenced by my presence cannot be determined with certainty. However, it must be assumed that some level of influence occurred and should be considered in the analysis. In addition, language barriers may have affected the results. As I do not speak the local language, I was not able to conduct the interviews myself or communicate directly with participants. The implications of language barriers are discussed in more detail in the later chapter Challenges and Limitations.

4. Methods

4.1 Interview Questions

For the thesis, four interview questions were added to an existing project questionnaire. The questionnaire consisted of two parts: the first asked for personal data, the second part included six questions with sub-questions. The interview questions designed for this thesis were added to the second part of the questionnaire. The aim was to formulate them in a way that they cover all aspects of the research question and its associated sub-questions. Since some aspects were already covered by the existing six interview questions, they were not addressed again in the additional questions. The following section provides an overview of the research sub-questions and their corresponding interview questions. The overview includes both the questions developed specifically for this thesis (Question 7–10) and the previously existing questions of the questionnaire (Question 1–6). All questions from the questionnaire that provide helpful additional information but do not directly address the sub-research questions can be viewed in the appendix (p.100).

Sub-question 1: Which ecological, economic, and social outcomes of tree-based restoration projects are most valued by local communities?

1e) What steps should institutions take to carry out forest restoration in your village (land tenure, social, ecological aspects)? (Select one or more options in each category)

Land tenure aspects

- *Clarification of land tenure rights*
- *Recognition of customary land rights*
- *Formal agreement with the community*
- *Participatory delineation of restoration areas*
- *Land tenure security*
- *Other*

Social aspects

- *Prior and inclusive consultation*
- *Participation of women and youth*
- *Consideration of local livelihoods*
- *Creation of local employment opportunities*
- *Community capacity building*
- *Other*

Ecological aspects

- *Use of adapted local species*
- *Respect for local natural resource management practices*
- *Species diversification*
- *Biodiversity protection*
- *Participatory ecological monitoring*
- *Other*

7a. If you could decide on the outcomes a restoration project on community land should achieve, which three outcomes would you value most for you and your community?
(Select three in each category)

Social outcomes

- *Improved livelihoods for community members*
- *Stronger community cohesion and cooperation*
- *Greater involvement of women and youth*
- *Strengthened local governance and decision-making*
- *Increased knowledge and skills within the community*

Economic outcomes

- *Creation of sustainable local jobs*
- *Increased household income*
- *Improved agricultural productivity*
- *Diversification of income-generating activities*
- *Better access to markets and economic opportunities*

Environmental outcomes

- *Restoration of degraded land*
- *Improved soil fertility*
- *Increased forest cover*
- *Protection of water sources*
- *Conservation of biodiversity*

Land tenure and governance outcomes

- *Improved land tenure security*
- *Recognition of customary land rights*
- *Clear rules for land use and access*
- *Reduced land-use conflicts*

Long-term sustainability outcomes

- *Long-term maintenance of restored areas*
- *Community ownership of restoration activities*
- *Resilience to climate change*
- *Sustainable management of natural resources*

→ Originally, this would have been an open-ended question, but for the survey multiple-choice options were added.

7b. For each category, please select the three benefits from nature that are most important to you.

Group 1: Environmental regulation

1. *Habitat creation and maintenance*
2. *Pollination*
3. *Seed dispersal*
4. *Regulation of air quality*
5. *Regulation of climate*
6. *Regulation of freshwater quantity*
7. *Regulation of freshwater quality*
8. *Regulation of soil fertility*
9. *Protection of soils*
10. *Regulation of hazards and extreme events*
11. *Control of harmful organisms (pests and diseases for crops and humans)*

Group 2: Material benefits

1. *Firewood*
2. *Charcoal*
3. *Food*
4. *Animal feed*
5. *Materials for construction*
6. *Materials for handcrafts*
7. *Materials for weaving (ropes, mat, baskets, hat, bags ….)*
8. *Medicinal plants*
9. *Genetic resources (for biotechnology innovation: crops and medicines)*

Group 3: Non-materials benefits

1. *Learning and inspiration (cultural exchange, artistic, scientific or technological)*
2. *Recreation and Aesthetic enjoyment*
3. *Therapeutic and restorative benefits (break from modern life, peace, stress relief ….)*
4. *New and unique experiences*
5. *Supporting culture and identity (ancestral ties, local or traditional heritage, sacred place)*
6. *Social cohesion and bounding (community building, socializing with others, friendships, …)*
7. *Intergenerational benefits (maintaining options for current and future generations)*

Sub-question 2: What positive and negative impacts do local communities experience after the implementation of tree-based restoration projects?

3. What benefits (social, economic, environmental) have you observed in your community as a result of these projects? (Select one or more options in each category)

Social benefits

- *Strengthened community cohesion*
- *Creation of temporary or permanent local jobs*
- *Improved local skills and knowledge*
- *Greater inclusion of women and youth*
- *Improved local governance*
- *Other*

Economic benefits

- *Increased household income*
- *Diversification of income sources*
- *Improved agricultural productivity*
- *Access to new economic opportunities*
- *Stimulation of the local economy*
- *Other*

Environmental benefits

- *Improved forest cover*
- *Reduced soil erosion*
- *Improved soil fertility*
- *Protection of water resources*
- *Return or increase of biodiversity*
- *Other*

8. What challenges or restrictions have you experienced because of past restoration projects, for example regarding access to land, forests, or other resources? (open question)

10a. Does everyone benefit equally from the projects, or are there groups or families that have more advantages/restrictions than others?

- *Everyone benefits equally*
- *There are groups or families that have more advantages than others*

Please explain (comment field).

Sub-question 3: How do local communities perceive the alignment of intentions and priorities of other actors involved in tree-based restoration projects with their own priorities and needs?

5b. Do you think they consider local priorities well? (select one option)

- *Strong alignment with local priorities*
- *Partial alignment with local priorities*
- *Limited consideration of local priorities*
- *Strategies perceived as disconnected from local realities*
- *Other*

9. How do you perceive the goals and priorities of the other actors involved in the project compared to your own? (select one option)

Scale
1. Totally different
2. Somewhat different
3. Somewhat aligned
4. Mostly aligned
5. Totally aligned

Is there something you want to add? (comment field)

Sub-question 4: How do local communities perceive their involvement in different stages of tree-based restoration projects?

2a. Do you think the local community is sufficiently involved in restoration projects? (yes/no)

2b. Why or why not? (Select one or more options)

- *Lack of early consultation*
- *Limited consideration of community inputs*
- *Time or resource constraints*
- *Insufficient information about project objectives*
- *Strong collaboration with project implementers*
- *Other*

2c. How is the involvement of local community for each following stage of the project?
Project stages: Implementation, Maintenance, Labor, Representatives, Decision-making
(select one option per project stage)

Scale:

1. *No involvement*

2. *Low involvement*
3. *Limited involvement*
4. *Active involvement*

10b. To what extent are the following groups involved in the planning of restoration projects? (Please rate each people category on a scale from 1 to 5.)

Scale:

1. *Not involved at all*
2. *Slightly involved*
3. *Moderately involved*
4. *strongly involved*
5. *Very strongly involved*

Other option: I don't know

Group 1: Gender

- *women*
- *men*

Group 2: Land ownership

- *Landowners*
- *Land tenant*
- *Sharecropper*
- *landless, but working on someone's land*
- *not using land*

Group 3: Responsibility within the community

- *Farmers*
- *Local government officials*
- *Teachers*
- *Conservationists*
- *Researcher/scientists*
- *Local entrepreneurs*
- *Private sector*
- *Law enforcement,*
- *Environmental educators*
- *Environmental organization*
- *Funding agencies*

4.2 Survey Methodology

The survey followed the methodology developed within the Demand4Restoration project. Together with a team of four local researchers from the Demand4Restoration project and a fellow researcher from the University of Zurich, I travelled to the villages of Morarano and Ankorefo Marohogo to conduct the interviews. Upon arrival in the villages, the research team first met with the village chief and four inhabitants selected by the village chief, who had the role of local guides during the interview sessions. After a brief introduction and exchange with the local guides, the interviews commenced. The research team divided into four groups. In each group, one of the local researchers assumed the role of the interviewer. My partner and I each accompanied one of the interviewers (always the same person). Both of

us took on the role of observers during the interviews. Each group was additionally accompanied by one of the four local guides to ensure a good understanding of the context and smooth communication.

The interviewed households were selected randomly. To avoid potential biases associated with official household registration lists, the selection was based on residents who were present in the village at the time of the survey. In each village, the four interview groups started from the center of the village and spread out in different directions, ensuring that the same household was not interviewed more than once. All households were selected using an alternating sampling method: After completing an interview with one household, the neighboring household was skipped, and the following household was approached for participation. Participants were asked to represent their household and were required to be at least 21 years old. Efforts were made to also interview women from the households as far as possible; this was achieved in around 34% of cases. After identifying a potential household, the local guide introduced the research team and explained the interview and objective to reassure participants. Afterwards, he asked whether the household member was willing to participate voluntarily in the interview. If a person was willing to participate, they needed to sign a consent form confirming that their participation was voluntary and that they had been informed about the background and purpose of the study. The interviewer then briefly explained the interviewing procedure, including the participants' right to withdraw from the interview at any time and their option to receive the results of the study afterwards. All interviews were conducted in the local dialects, which were fluently spoken by the local researchers and guides. The interviewers used a digital version of the questionnaire on their mobile phones. This allowed them to ask the questions directly and record the selected responses within the survey application. For open-ended questions, key points or short comments were documented in designated comment fields. Each interview lasted between 30 minutes and 2 hours. After the interview, participants received financial compensation of 5,000 MGA (Ariary) as thank for their voluntary participation. This compensation is approximately equivalent to 1 CHF and corresponds to the cost of two warm meals at a modest restaurant. Following this, participants were asked to complete a short form by hand, providing their name, email address or phone number (if available), and a signature confirming that they have received the compensation.

As my partner and I do not speak the local dialects, we assumed the role of observers during the interviews. Since all interviews were conducted simultaneously, we were able to attend approximately half of the interviews. During the interviews, we documented contextual aspects such as the surroundings, the participants' reactions to the questions, their body language, and their general manner of responding. No structured observation grid was used; however, field notes were systematically organized into three categories: (1) **surroundings** (e.g., location of the interview, presence of other people, background noise), (2) **information about the participant** (e.g., name, approximate age, whether they had previously listened to another interview), and (3) **response behavior** (e.g., emotional tone, length of responses, hesitation, openness). While these observations do not constitute the primary focus of the analysis, they provide complementary contextual information that supports the interpretation of the survey data.

The initial plan was to visit three of the ten villages included in the Demand4Restoration research team's study. In each village, 40 households were intended to be interviewed, with the goal of conducting a total of 120 interviews. Due to unforeseen difficulties, only two villages could be visited. In Morarano, which is relatively small, 20 interviews were conducted (13 men & 7 women), whereas in Ankorefo Marohogo, which is larger, 63 interviews were completed (42 men & 21 women). Consequently, a total of 83 interviews were available for the analysis in this study.

4.3 Study Area

4.3.1 Boeny Region

The interviews were conducted in the villages Morarano and Ankorefo Marohogo, both located in the Mahajanga II district of the Boeny Region. The Boeny Region lies in northwestern Madagascar (Peters et al., 2024; Randrianasolo et al., 2022) and is characterized by a tropical dry climate with a distinct rainy season from November to April and a dry season from May to October (Peters et al., 2024). The average annual rainfall is approximately 1,700 mm and occurs mainly during the rainy season (Ranjatson et al., 2019, p.8), while the average annual temperature is around 27 °C (Favretto et al., 2020, p.4). The region covers approximately 31'000 km^2 (Peters et al., 2024, p.3; Randrianasolo et al., 2022, p. 89). With a population density of around 30 inhabitants per km^2 (Randrianasolo et al., 2022, p.89) and a growth rate of 3.48% between 1993 and 2020 (Peters et al., 2024, p.3), the region remains sparsely populated. Most of the land is covered by natural habitats, while areas used for permanent agriculture and settlements together account for about 13% of the total land area (Randrianasolo et al., 2022, p. 89).

The region is dominated by tropical dry deciduous forests and some other deciduous plant species (Antonelli et al., 2022; Ranjatson et al., 2019). Common vegetation types include woody savannas, raffia palm stands, dry dense forests, mangrove forests, grassy savannas, and wetland complexes (Randrianasolo et al., 2022). The Boeny Region hosts a high number of endemic plant and animal species (Ranjatson et al., 2019). However, extensive forest fragmentation, mainly driven by abusive fires and logging for construction materials and charcoal production, has reduced the dry forests to only a few large, continuous patches, while other areas have been converted into species-poor secondary savannas dominated by grasses (Bloesch, 1999; Favretto et al., 2020; Ranjatson et al., 2019). Between 1990 and 2013, approximately 7,500 hectares of forest were lost, resulting in an average annual loss of 2.7 million tons of stored carbon (Favretto et al., 2020, p.4).

Agriculture serves as the primary source of income for most rural inhabitants in the region. While rice is the most widely cultivated crop, followed by maize and cassava, peanuts and a variety of vegetables are also commonly grown (Bloesch, 1999; Ranjatson et al., 2019). Forests are central to local livelihoods, providing both subsistence resources and products such as charcoal, raffia leaves, and honey, which are sold in local and distant markets (Randrianasolo et al., 2022). Furthermore, cattle play a central role in the region's culture and economy. They represent a source of wealth and prestige while providing essential labor for ploughing fields and pulling carts. This tradition of cattle keeping remains highly influential, shaping the economic and socio-cultural life of local communities (Bloesch, 1999; Ranjatson et al., 2019). Historically, the region was settled by the Sakalava and later dominated by both Sakalava and Tsimihety, ethnic groups who traditionally relied on pastoral and agro-pastoral activities (Randrianasolo et al., 2022). Over time, the fertile land has attracted a heterogeneous mix of immigrant communities, contributing to the region's current demographic diversity (Ranjatson et al., 2019). However, rapid population growth has intensified pressure on natural resources, leading to further forest clearance and degradation (Bloesch, 1999; Peters et al., 2024).



Figure 1 Map of the Boeny Region in Madagascar and the locations of the two study villages Morarano and Ankorefo Marohogo (own illustration).

4.3.2 Description of the villages

The village of Ankorefo Marohogo is connected to the regional capital of Mahajanga via a 90-minute drive east along National Highway 4. The route to Morarano follows the same highway but continues slightly further before branching off, with the village situated a few kilometers inland from the main road. In both locations, the sale of agricultural products such as rice, maize, vegetables, and fruit serves as an important source of income. While the majority of residents in Morarano work in the agricultural sector, including livestock farming, the livelihoods in Ankorefo Marohogo are more varied. In addition to farming, many inhabitants there earn wages through daily, seasonal, or permanent employment, or by operating small businesses that sell charcoal, meals, and other essential goods. Educational backgrounds also differ between the two villages. In Morarano, most residents attended secondary school, though a small number have higher or lower levels of formal education. In Ankorefo Marohogo, the educational level is more diverse. Many have completed primary or secondary school, yet there are also individuals who have either never attended school or have reached high school. In both communities, only a very small percentage of the population holds a university degree. Despite these differences, both villages face significant challenges regarding food and water security. Approximately 60% of inhabitants in both areas report insufficient food supplies during the year, and most residents experience water shortages lasting anywhere from two to twelve months annually. Most of the information presented above is based on our own data collected in the first part of the survey, which focused on personal and demographic

characteristics. This data was essential for describing the two villages, as little relevant information was available from online sources. To enhance the credibility and representativeness of the findings, a researcher from Madagascar was consulted for her expert assessment.

In Morarano, many households depend on subsistence agriculture. The most accessible cultivation method is slash-and-burn, which, however, contributes to biodiversity loss and other forms of environmental degradation. To address this, several projects provide financial incentives for villagers to stop slash-and-burn practices, thereby allowing the vegetation to regenerate. Another initiative promotes reforestation through tree planting. However, interview participants noted that many of the planted species do not meet local needs, as they require long periods before yielding benefits. Instead, residents tend to prefer fruit trees, which provide quicker and more reliable returns. In contrast, projects in the village of Ankorefo Marohogo primarily focus on addressing the persistent issue of water scarcity. Limited water availability constrains both agricultural production and daily household use. The village has seen the implementation of several completed projects, alongside ongoing initiatives targeting this challenge (oral information).

4.3.3 Projects

In both villages, different restoration projects are currently being implemented, while others have already been completed. The following projects were explicitly mentioned by participants: in Ankorefo Marohogo, the Eden Project, ProSol, and SOCTAM were named; in Morarano, the Eden Project and ProSol were mentioned (oral information). The Eden Project is a classical tree-based restoration project. It focuses on supporting local communities in Madagascar by combining environmental restoration with socio-economic development. The program engages residents in tree-planting activities, thereby generating income opportunities, strengthening their capacity to adapt to environmental change, and contributing to the reduction of deforestation. Since 2008, the initiative has placed particular emphasis on the restoration of mangrove ecosystems (Favretto et al., 2020). ProSol (Protection et réhabilitation des Sols pour améliorer la sécurité alimentaire) was implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH and mainly operates in the Boeny and Androy regions of Madagascar. According to its own statement, ProSol focuses on protecting and restoring degraded soils, helping smallholder farmers adapt to climate change, promoting agroecological approaches, improving land management practices, and restoring pasture and forest areas (ProSol Madagascar, 2023). Tree-based restoration is therefore part of the project, but it is not its only focus. SOCTAM is a subsidiary within Imperial Brands Madagascar and operates only in Madagascar in the areas of tobacco production and forestry (Imperial Brands, 2026). According to company information, Imperial Brands considers SOCTAM an important actor in reforestation activities in the country. The company reports that it has invested several billion Ariary in reforestation programs in recent years and has planted more than two million trees (Imperial Brands, 2021). However, it was difficult to find detailed and reliable scientific information about these projects, and in some cases only limited publicly available documentation exists. Consequently, the available information should be treated with caution.

4.4 Data Analysis

4.4.1 Analysis of the closed-ended Questions

Coding

To facilitate the analysis of the data, the response options to the closed-ended interview questions were coded. Response options with an inherent order were assigned numerical values (e.g., *Not involved at*

all = 1, *Slightly involved* = 2, *Moderately involved* = 3, *Strongly involved* = 4, *Very strongly involved* = 5) as well as lists of various answer options with no particular order (e.g. income sources: *sale of agricultural products = 1, livestock rearing and sale of animals = 2, Fishing or aquaculture = 3, …*). For questions with the options yes and no, *yes* was coded as 1 and *no* as 0. In cases where multiple options could be selected simultaneously, each option was evaluated individually and coded as *0 = not selected* and *1 = selected*. Other dichotomous questions were coded with one and two (e.g., *Everyone benefits equally* = 1, *There are groups or families that have more advantages than others* = 2). It happened that a specific aspect was mentioned very frequently in the "other" comment field of a question. In some of such cases, an additional category was added to the existing response options to include this option in the statistical analysis.

Analysis in RStudio

For the analysis, mainly the software RStudio (Posit team, 2026) was used. The first part of the interview questions (personal data) was not systematically analyzed. Only variables that were used for group comparisons in the second part of the survey or for describing the study area were analyzed. These variables included age, gender, primary income source, village, ethnic group, the number of months with water shortage per year, and whether respondents had sufficient food throughout the year. The analysis of these variables was very simple and primarily consisted of presenting the distribution of responses in tabular form. For the analysis of the closed-ended questions from the second part of the survey, first each question was examined individually to assess the distribution of responses. Subsequently, potential differences in responses were analyzed across several socio-demographic variables, including gender, village of residence, age, and the respondents' main source of income.

In most cases, the analysis involved the creation of a bar chart or a box plot to visually illustrate differences in responses. In many instances, results were presented as percentages because the groups defined by gender, village, age, and income source contained different numbers of respondents. For questions with many response options or where graphical representations were less clear, tables showing the percentage distribution of responses were created to provide a clearer overview. Subsequently, statistical tests were conducted to determine whether the observed differences were statistically significant. For questions with a large number of response categories and an overall significant test result ($p < 0.05$), post hoc analyzes of standardized residuals were additionally conducted. This enabled the identification of the specific response categories contributing most to the observed differences. For all other cases, the significant patterns were readily identifiable from the bar charts.

The choice of the implemented statistical test depended on the structure of the data and on the number of participants within the respective groups. To analyze if the overall distribution of responses within a group (one variable) differed from the expected distribution, the Chi-square goodness-of-fit test was applied to all nominal and ordinal single-choice questions (e.g., Question 4a) (Field et al., 2013). For nominal multiple-choice questions, where respondents were permitted to select more than one option (e.g., Question 1e), a Cochran's Q test was conducted. This approach is methodologically required because the resulting response categories cannot be treated as independent observations (Agresti, 2013). In cases where participants rated several stages or groups using the same ordinal scale, the study constituted a repeated-measures design in which observations were not independent. In such cases, the Friedman test was applied (e.g., Question 2c) (Field et al., 2013). For the comparison of the responses between different groups (village, gender, age, and income source),the Fisher's exact test was used in most cases, while the Chi-square test of independence was applied only in a few instances. In principle, both tests are appropriate for this type of analysis. However, some age and income source groups had relatively small sample sizes, making the Fisher's exact test more suitable (Field et al., 2013). To maintain methodological consistency, the Fisher's exact test was later also used for most comparisons involving gender

and village groups. For the group comparisons of questions that were previously analyzed using the Friedman test, the Wilcoxon-Rank Sum/Mann–Whitney U test was applied. This test is well suited for comparing independent groups when the data are measured on an ordinal scale (Agresti, 2013; Field et al., 2013).

As the age of respondents was recorded as a numerical value in the survey, age groups were created for the analysis. Participants were categorized into three groups: young (=<30 years), middle (31–50 years), and older (>50 years). Even though some income source groups contain only a very small number of people, the variable primary income source is analyzed individually. The reason for this is, first, that no meaningful grouping was possible, and second, that even with somewhat sensible grouping, some groups would still contain very few people.

All the questions from the second part of the interview questionnaire were analyzed; even though they did not provide a specific answer to my research question or the sub-questions, they may be able to provide valuable information for the discussion of the research question.

Table 1 Overview of all statistical tests conducted for the overall analysis and the comparison of variables for each interview question, as well as all additional analytical procedures conducted in RStudio (Posit team, 2026).

Interview Question (short)	Comparison Total	Village Comparison	Gender Comparison	Age Comparison	Income Comparison
1a) How many ecosystem restoration projects are there in your area?	Bar Chart Box Plot Histogram Shapiro Wilcoxon Rank sum Cohens_d	-	-	In village since Comparison: Shapiro Kruskal Wallis Median Mean	-
1e) What steps should institutions take to carry out forest restoration in your village (land tenure, social & ecological aspects)?	Bar chart [%] per Category Cochran's Q	Bar chart [%] per Category Fisher's exact	Bar chart [%] per Category Fisher's exact	Bar chart [%] per Category Fisher's exact Cramérs V	Bar chart [%] per Category Fisher's exact Cramérs V
2a) Do you think the local community is sufficiently involved in restoration projects? (yes/no)	Bar chart Table (village & gender) Chi2	Bar chart [%] Fisher's exact	Bar chart [%] Fisher's exact	Bar chart [%] Fisher's exact Cramérs V	Bar chart [%] Fisher's exact Cramérs V
2b) Why or why not?	Bar chart [%] Table Cochran's Q	- No/yes (2a) Groups: Bar chart [%] Fisher's exact	-	-	-
2c) How is the involvement of local community for each following stage of the project? Stages: implementation, maintenance, labor, representatives, decision-making	Bar chart [%] Friedman Wilcoxon signed-rank	Bar chart [%] Wilcoxon Rank sum	Bar chart [%] Wilcoxon Rank sum	Bar chart [%] Wilcoxon Rank sum	No/yes (2a) Groups: Bar chart [%] Wilcoxon Rank sum
3) What benefits (social, economic, environmental) have you observed in your community as a result of these projects?	Bar chart [%] per Category Boxplot Cocran's Q	Bar chart [%] per Category Fisher's exact	Bar chart [%] per Category Fisher's exact	Bar chart [%] per Category Fisher's exact Cramérs V	Bar chart [%] Table form of Bar Chart Fisher's exact

	Turkey (post hoc) Wilcoxon signed-rank				Cramérs V
4a) Do you have a clear contact person for asking questions or getting updates on the restoration projects?	Bar chart [%] Chi2 + Test for residuals	Bar chart [%] Fisher's exact Cramérs V	Bar chart [%] Fisher's exact Cramérs V	Bar chart [%] Fisher's exact Cramérs V	Bar chart [%] Fisher's exact Cramérs V
4b) How often are you informed about the restoration projects?	Bar chart [%] Chi2 + Test for residuals	Bar chart [%] Fisher's exact Cramérs V	Bar chart [%] Fisher's exact Cramérs V	Bar chart [%] Fisher's exact Cramérs V	Bar chart [%] Fisher's exact Cramérs V
5a) Are you aware of the national restoration strategies (such as National Strategy for Forest Landscape Restoration - SNRPF or National Forest Policy)?	Bar chart [%] Chi2 + Test for residuals	Bar chart [%] Fisher's exact Cramérs V	Bar chart [%] Fisher's exact Cramérs V	Bar chart [%] Fisher's exact Cramérs V	Bar chart [%] Fisher's exact Cramérs V
5b. Do you think they consider local priorities well?	Bar chart [%] Chi2 + Test for residuals	Bar chart [%] Fisher's exact Cramérs V	Bar chart [%] Fisher's exact Cramérs V	Bar chart [%] Fisher's exact Cramérs V	Bar chart [%] Fisher's exact Cramérs V
6a) What obstacles can prevent the success of restoration?	Bar chart [%] Cochran's-Q McNemar post hoc	Bar chart [%] Fisher's exact	Bar chart [%] Fisher's exact	Bar chart [%] Fisher's exact Cramérs V	Bar chart [%] Fisher's exact Cramérs V Table for Option 3 ($p<0.05$)
6b) What are your recommendations to ensure restoration is successful?	Bar chart [%] Cochran's-Q McNemar post hoc	Bar chart [%] Fisher's exact	Bar chart [%] Fisher's exact	Bar chart [%] Fisher's exact Cramérs V	Bar chart [%] Fisher's exact Cramérs V Table for Option 4 ($p<0.05$)
7a) If you could decide on the outcomes a restoration project on community land should achieve, which are the three outcomes would you value most for you and your community?	Bar chart [%] Table: votes for most chosen option/group	Bar chart [%] Fisher's exact (for most chosen option/group)	Bar chart [%] Fisher's exact (for most chosen option/group	Bar chart [%] Fisher's exact Cramérs V (For most chosen option/group	Bar chart [%] Fisher's exact Cramérs V (For most chosen option/group
7b) For each category, please select the three benefits from nature that are most important to you.	Bar chart [%] Cochran's-Q Table: most chosen options/group	Bar chart [%] Fisher's exact Table: most chosen options/group	Bar chart [%] Fisher's exact Table: most chosen options/group	Bar chart [%] Fisher's exact Cramérs V Table: most chosen options/group	Bar chart [%] Fisher's exact Cramérs V
8) What challenges or restrictions have you experienced	Table	Table	Table	Table	Table

because of past restoration projects?		Chi2	Chi2	Fisher's exact Cramérs V	Fisher's exact Cramérs V
9) How do you perceive the goals and priorities of the other actors involved in the project compared to your own?	Bar chart [%] Chi2	Bar chart [%] Fisher's exact Cramérs V	Bar chart [%] Fisher's exact Cramérs V	Bar chart [%] Fisher's exact Cramérs V	Bar chart [%] Fisher's exact Cramérs V
10a) Does everyone benefit equally from the projects, or are there groups or families that have more advantages/restrictions than others?	Bar chart [%] Chi2	Bar chart [%] Fisher's exact	Bar chart [%] Fisher's exact	Bar chart [%] Fisher's exact Cramérs V	Bar chart [%] Fisher's exact Cramérs V
10b) To what extent are the following groups involved in the planning of restoration projects? (Please rate each people category on a scale from 1 to 5.)	For all 3 categories separately: Wilcoxon signed rank or Friedman Table (Mean & Median) Bar chart [%] Boxplot	Just for gender category: Linear mixed Model Table (Mean & Median)	-	-	-
Further testing	**Correlation of 9 and 5b:** Spearman's rank Correlation				

4.4.2 Analysis of the open-ended Questions

Translation

As the responses to the open-ended questions were recorded as keywords in French or Malagasy, they first had to be translated to enable systematic analysis and comparison. To determine the most appropriate translation tool, several sample translations from Malagasy to English were compared using both DeepL (DeepL SE, 2026) and ChatGPT (OpenAI, 2026). The results indicated that ChatGPT generally produced more accurate and contextually appropriate translations; therefore, it was used for the majority of the Malagasy to English translations. In cases where the translation was unclear or uncertain, a Malagasy-speaking researcher was asked to verify the translation. Translations from French to English were conducted primarily using DeepL.

Coding

The coding system for the text responses in the interviews was based on Mayring's inductive content analysis (Mayring, 2010). The first step involved defining the unit of analysis. As most responses were brief or recorded in keywords, individual terms or short units were used as coding units. The second step, paraphrasing, was largely omitted, as the material was already condensed and did not require further reduction. In the third step, an inductive categorization was carried out. The responses to each interview question were analyzed separately. After repeatedly reviewing the data, relevant categories were developed directly from the data. In the fourth step, all interview responses were assigned to the developed categories. During this process, additional categories were created if responses did not fit the existing category system. In the fifth step, intra-coder reliability was assessed by re-coding the data a few days after the initial coding. A high level of agreement was considered an indicator of reliability. Finally, in the sixth step, the frequency of categories within each interview question was compared. However, categories mentioned only once were also retained, as they could still be of analytical relevance.

5. Results

5.1 Sub-question 1

Which ecological, economic, and social outcomes of tree-based restoration projects are most valued by local communities?

Question 1b: What steps should institutions take to carry out forest restoration in your village?

The separate statistical analysis of the three groups (ecological, social, land tenure) indicates that differences between the aspects within one group are statistically significant in all three cases (all statistical tests conducted and their exact results are listed in the table in the appendix, p.108). In the ecological category, "Use of adapted local species" was the most frequently selected option (nearly 70%), followed by "Participatory ecological monitoring" (60%). Notably, all options in this category were chosen by at least 40% of participants (see Fig. 2).

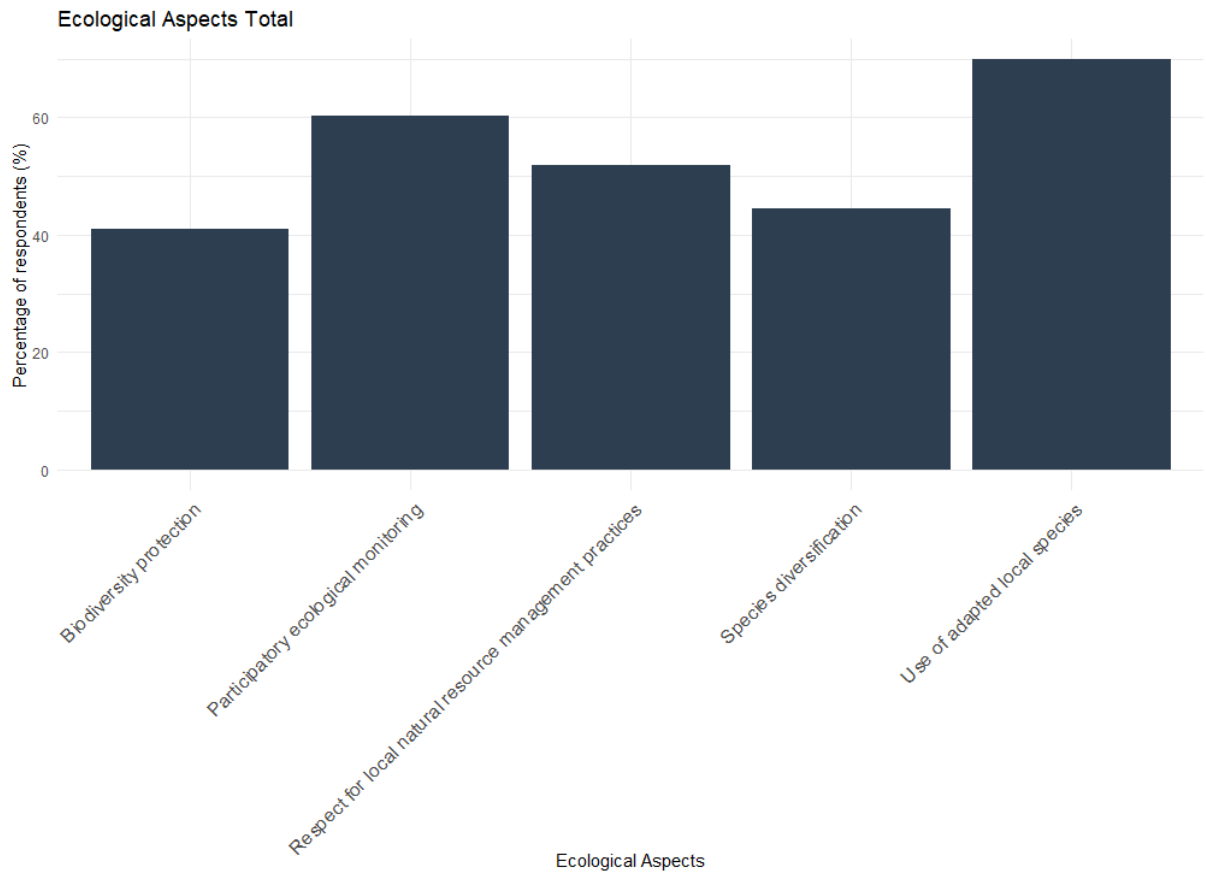


Figure 2 Distribution (in %) of how often different ecological aspects were selected by the participants.

In the land tenure category, one option stood out clearly: “Formal agreement with the community” was selected by nearly 80% of participants, while all other options ranged between 33% and 43% (see Fig. 3).

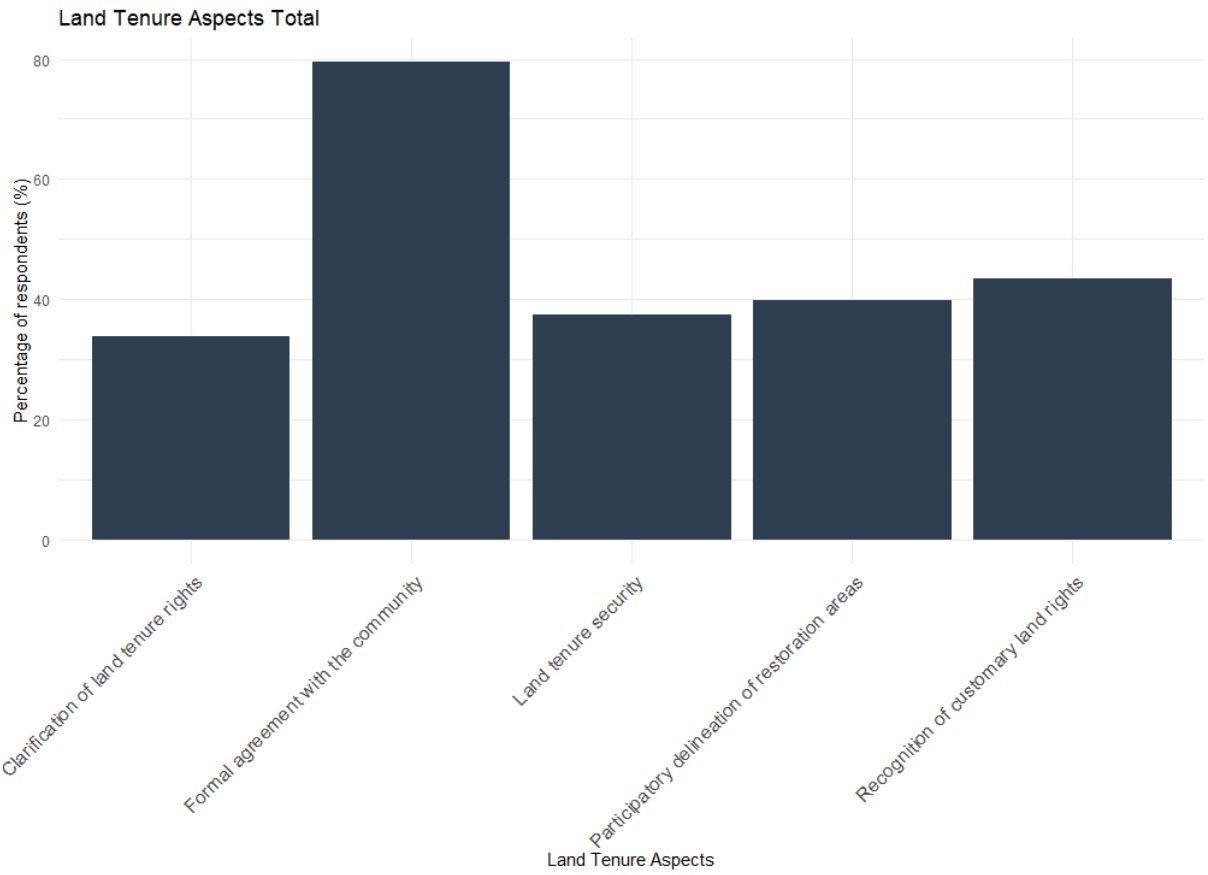


Figure 3 Distribution (in %) of how often different land tenure aspects were selected by the participants.

In the social category, all options were selected by more than 43% of participants. “Creation of local employment opportunities” (63%) and “Prior and inclusive consultation” (66%) were the most frequently chosen steps. Overall, the sum of all aspects within one category shows that ecological (267%) and social aspects (271%) were selected slightly more often than land tenure aspects (234%) (see Fig. 4).

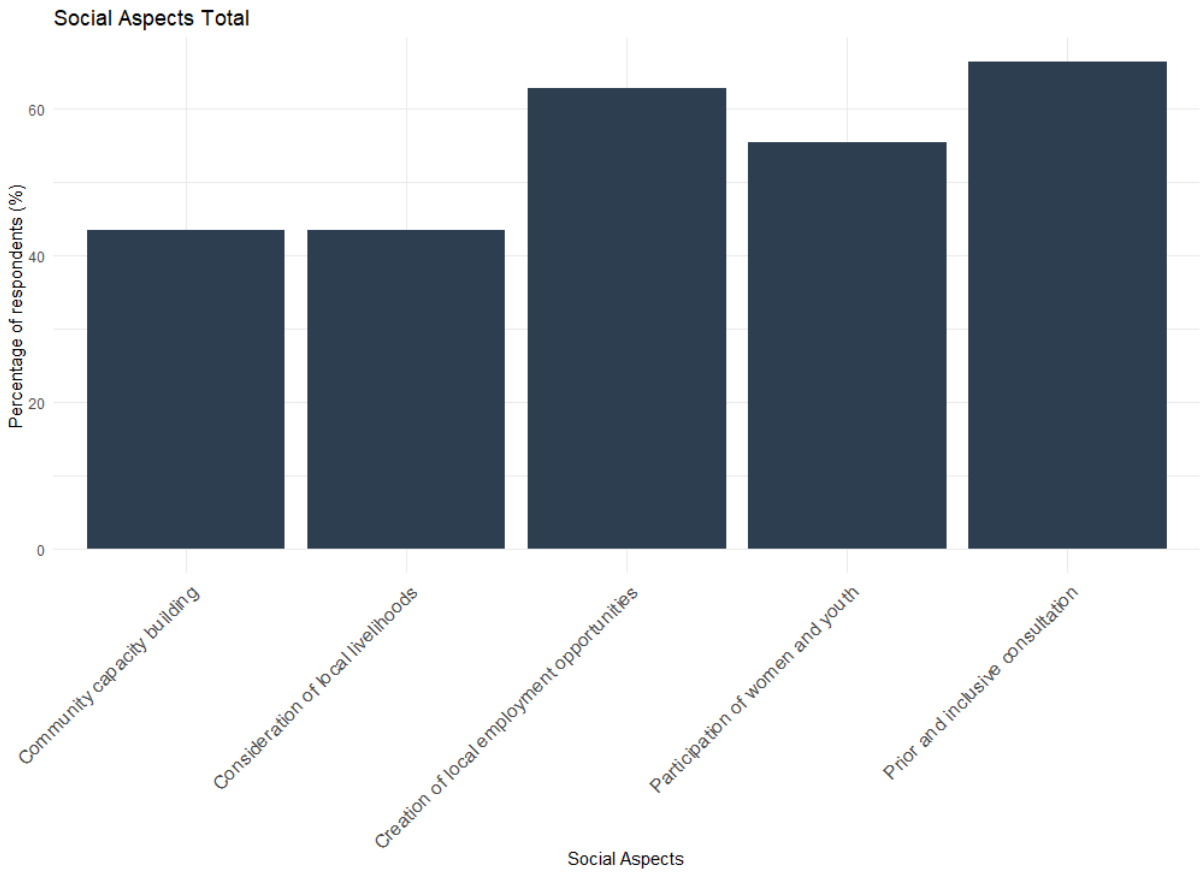


Figure 4 Distribution (in %) of how often different social aspects were selected by the participants.

The statistical test examining whether participants from the two villages selected different steps showed no significant differences for most steps. Only the ecological step "Biodiversity protection" differed significantly, it was selected more often in Ankorefo. The p-value of the aspect "Participatory ecological monitoring" was close to 0.05 and therefore nearly significant. This aspect was chosen more frequently in Morarano (see Fig. 5). A similar pattern emerged for the gender comparison. In most cases, no significant differences were found between men and women. An exception was the social step "Creation of local employment opportunities" which was selected more often by men (see Fig. 6). The p-values of the ecological step "Species diversification" and the social step "Community capacity building" were both close to 0.05, suggesting that men tend to choose these options more frequently. Across the age groups, a significant difference was found regarding the aspect "Land tenure security", which was significantly less often chosen by younger participants (see Fig. 7). For the comparison of the income source groups, the analysis focuses on the four main groups (agriculture, livestock, small business, and salaried job), as all other categories included very few participants (<=4). A significant difference was found for the land tenure steps "Clarification of land tenure rights," which was more frequently selected by participants relying on subsistence farming or rental and "Recognition of customary land rights", which was not selected by multiple income groups. However, the four main income groups did not differ much in both cases. Another significant difference was observed for the social step "Consideration of local livelihoods", which was not selected by participants with small businesses but was relatively common among those with salaried jobs. A further nearly significant difference appears for "land tenure security," although variation between the main income groups remains limited (see Fig. 8 & 9).

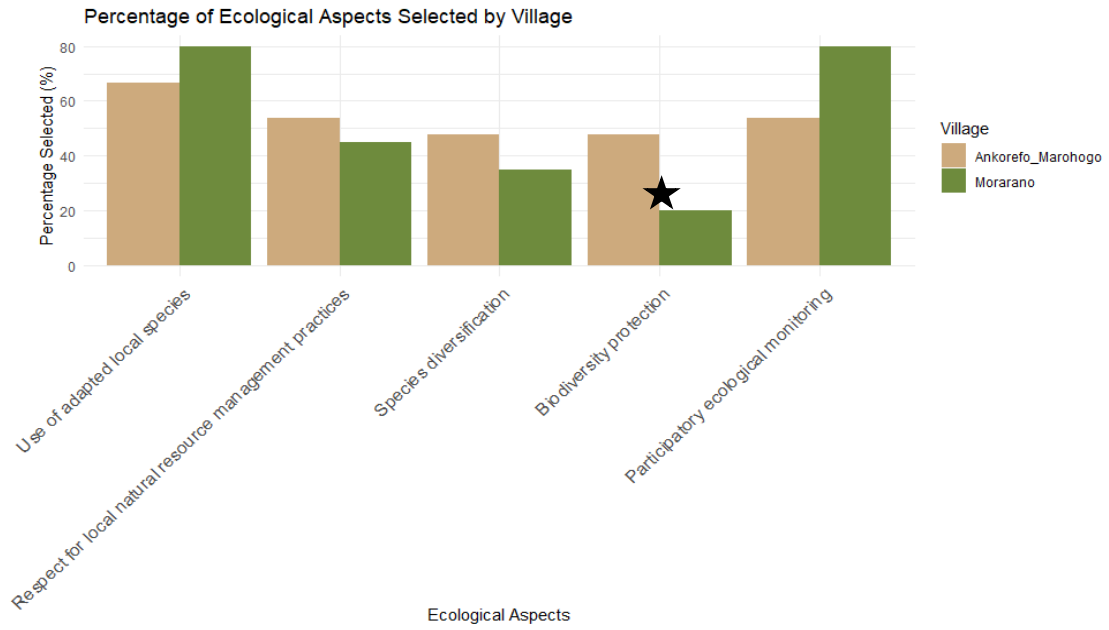


Figure 5 Comparison of the distribution (in %) of how often various ecological aspects were selected by participants from the two villages. Statistically significant differences are marked with a star.

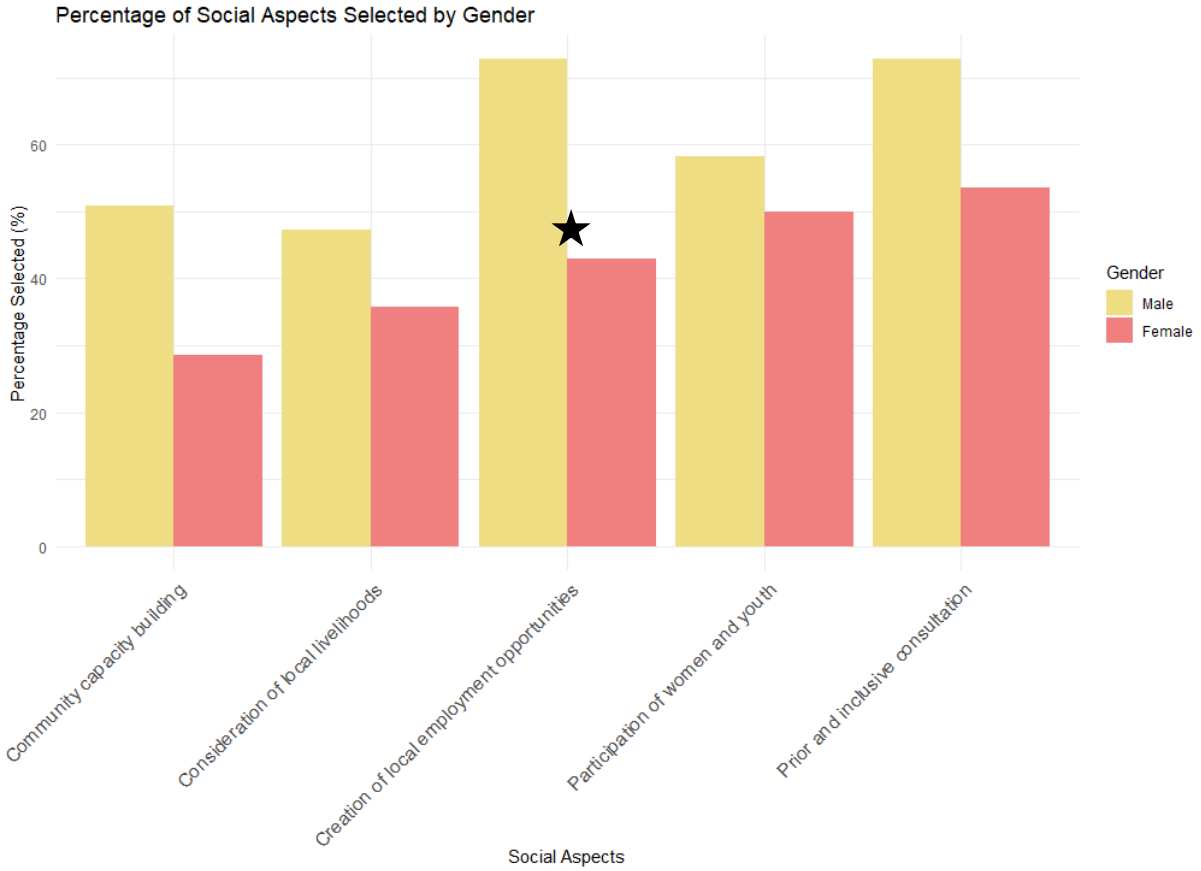


Figure 6 Comparison of the distribution (in %) of how often various social aspects were selected by men and women. Statistically significant differences are marked with a star.

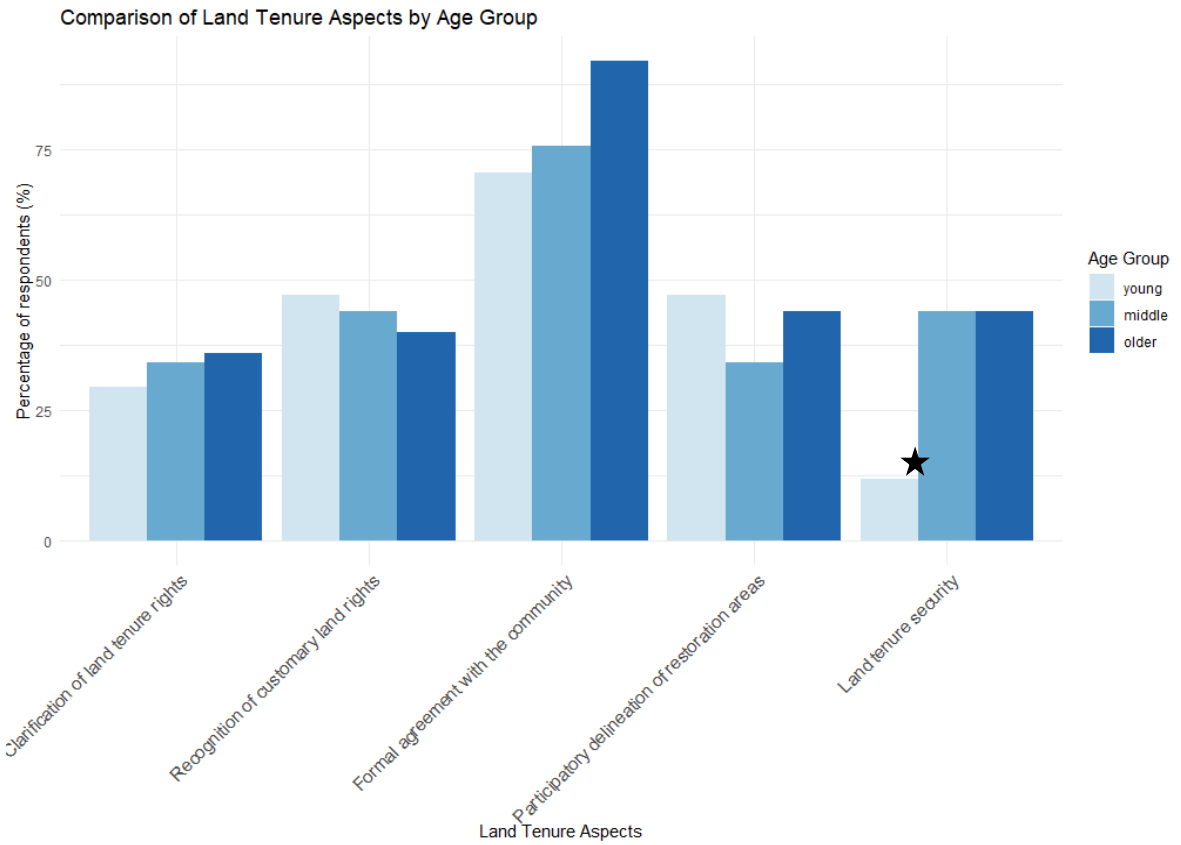


Figure 7 Comparison of the distribution (in %) of how often various land tenure aspects were selected by participants from different age groups. Statistically significant differences are marked with a star.

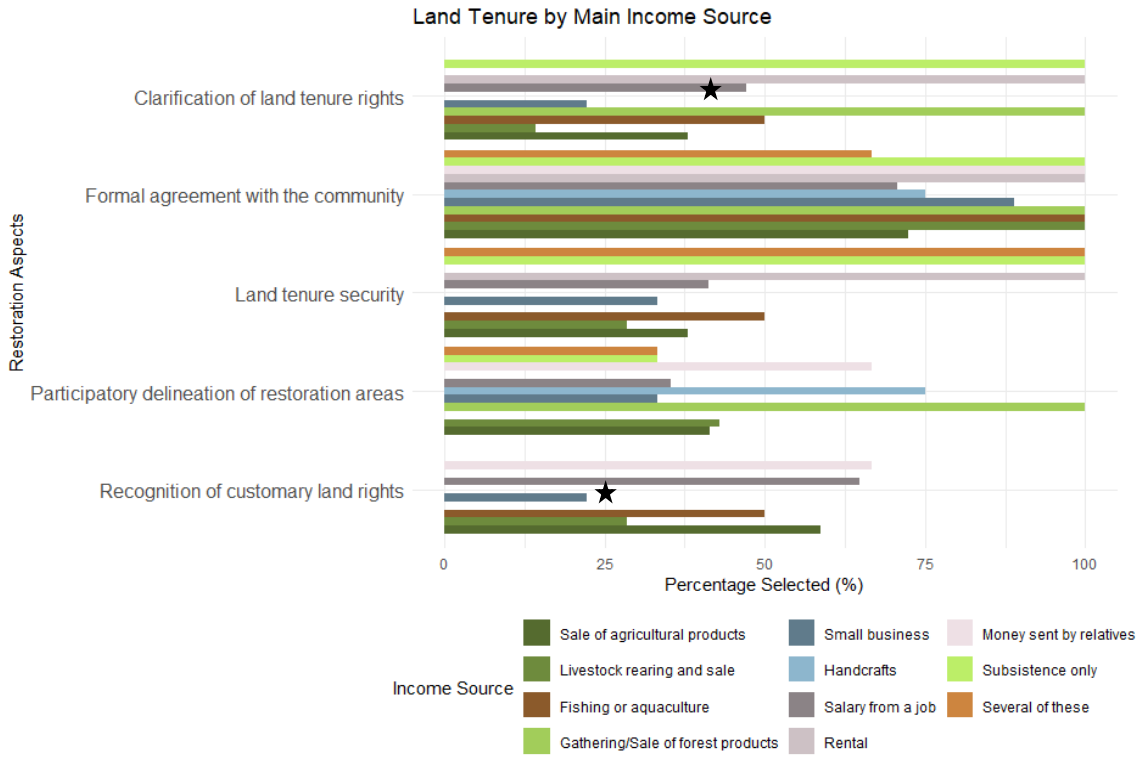


Figure 8 Comparison of the distribution (in %) of how often various land tenure aspects were selected by participants from different income source groups. Statistically significant differences are marked with a star.

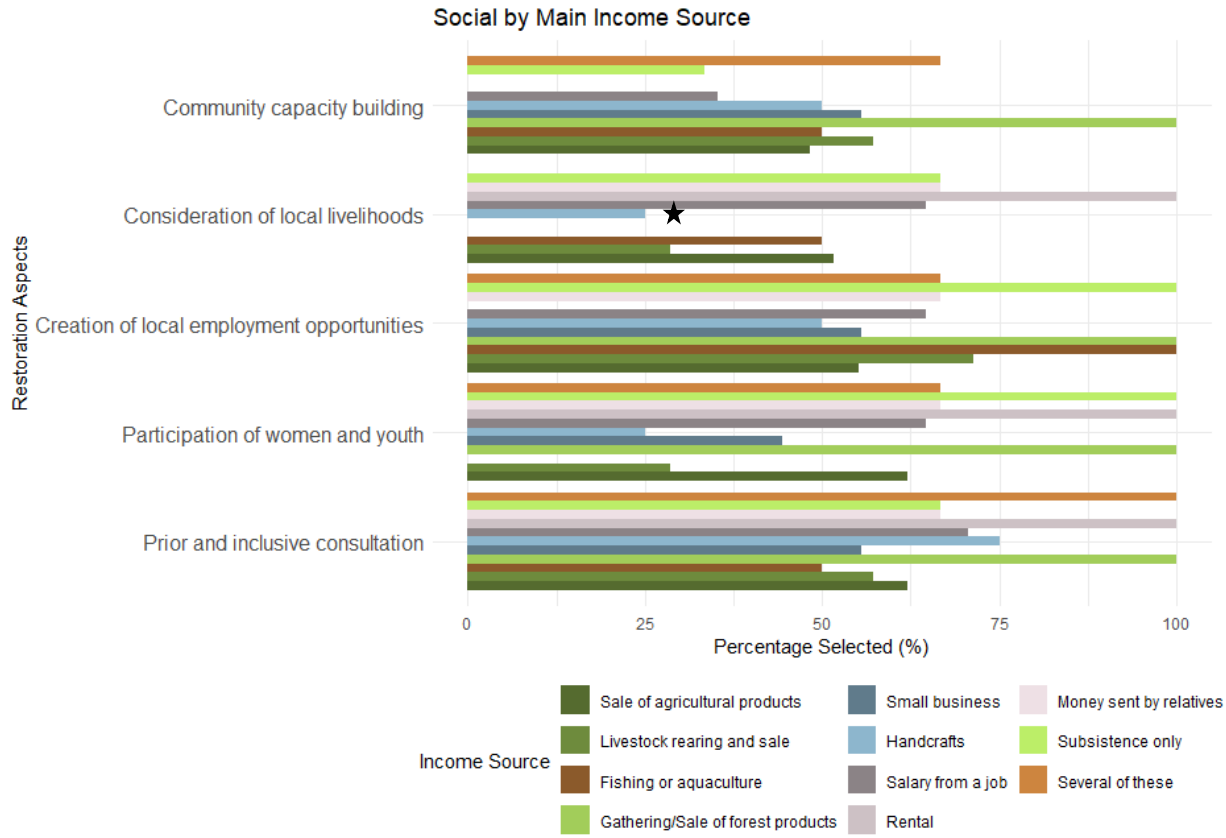


Figure 9 Comparison of the distribution (in %) of how often various social aspects were selected by participants from different income source groups. Statistically significant differences are marked with a star.

Table 2 Comments provided in the 'Other' section of Interview Question 1b.

1b) Option "other", n = 10		
Category name	**Description**	**Occurrence**
Talk to Locals	Talk to the people of the local community, inform them/ask about their needs	3
Fire	Implement measures to prevent fires	2
Suitable Species	Plant species that are suitable in the area	2
Official Route	One should follow the official route	2
Rules	Strict rules to prevent people from disrupting the work	1

In the "Other" section, it becomes clear once again that participants consider communication with the local community to be important, as three participants mentioned this additionally to the answer options.

Question 7a: If you could decide on the outcomes a restoration project on community land should achieve, which three outcomes would you value most for you and your community?

In this question, only the most frequently selected option per category (see Fig. 10) is analyzed. The reason for this is that participants were required to choose the three most important outcomes in each category. As only four to six options were available in most cases, participants may have been forced to select options they did not necessarily value.

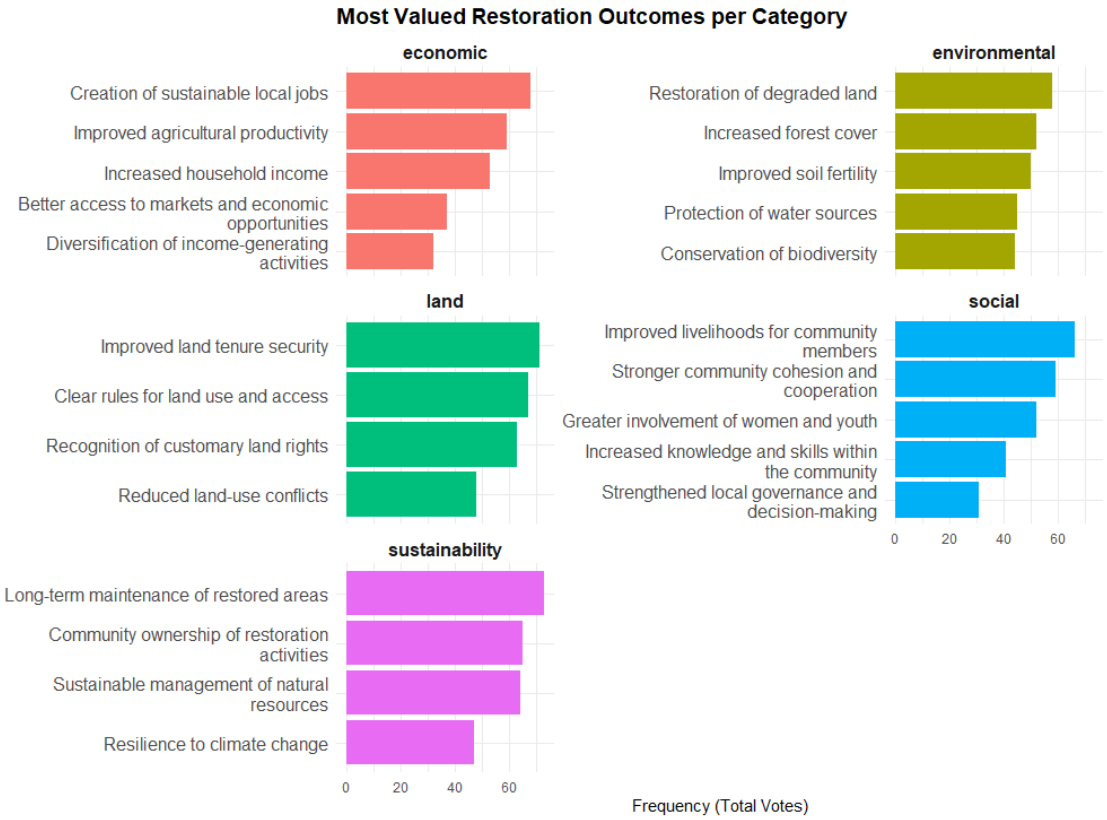


Figure 10 Distribution (in %) of how often different restoration outcomes were selected per category.

Table 3 Most chosen outcomes per category.

Category	Outcomes	n [total votes]
Social	Improved livelihoods for community members	66
Economic	Creation of sustainable local jobs	68
Environmental	Restoration of degraded land	58
Land tenure and Governance	Improved land tenure security	71
Long-term Sustainability	Long-term maintenance of restored areas	73

In the group comparison, it was analyzed whether participants from different groups rated the most frequently selected option per category differently. In the gender and income source comparison, no statistically significant differences were found among the most frequently selected options. The village comparison indicated that participants from Ankorefo selected the top economic outcome significantly more often than those from Morarano (see Fig. 11). Within this category, participants from Morarano more often preferred the outcomes "Improved agricultural productivity" and "Increased household income." Additionally, the p-value for the top sustainability outcome was close to 0.05, indicating the tendency that participants from Ankorefo chose this option more often than the ones from Morarano. In all other categories, the distribution was similar.

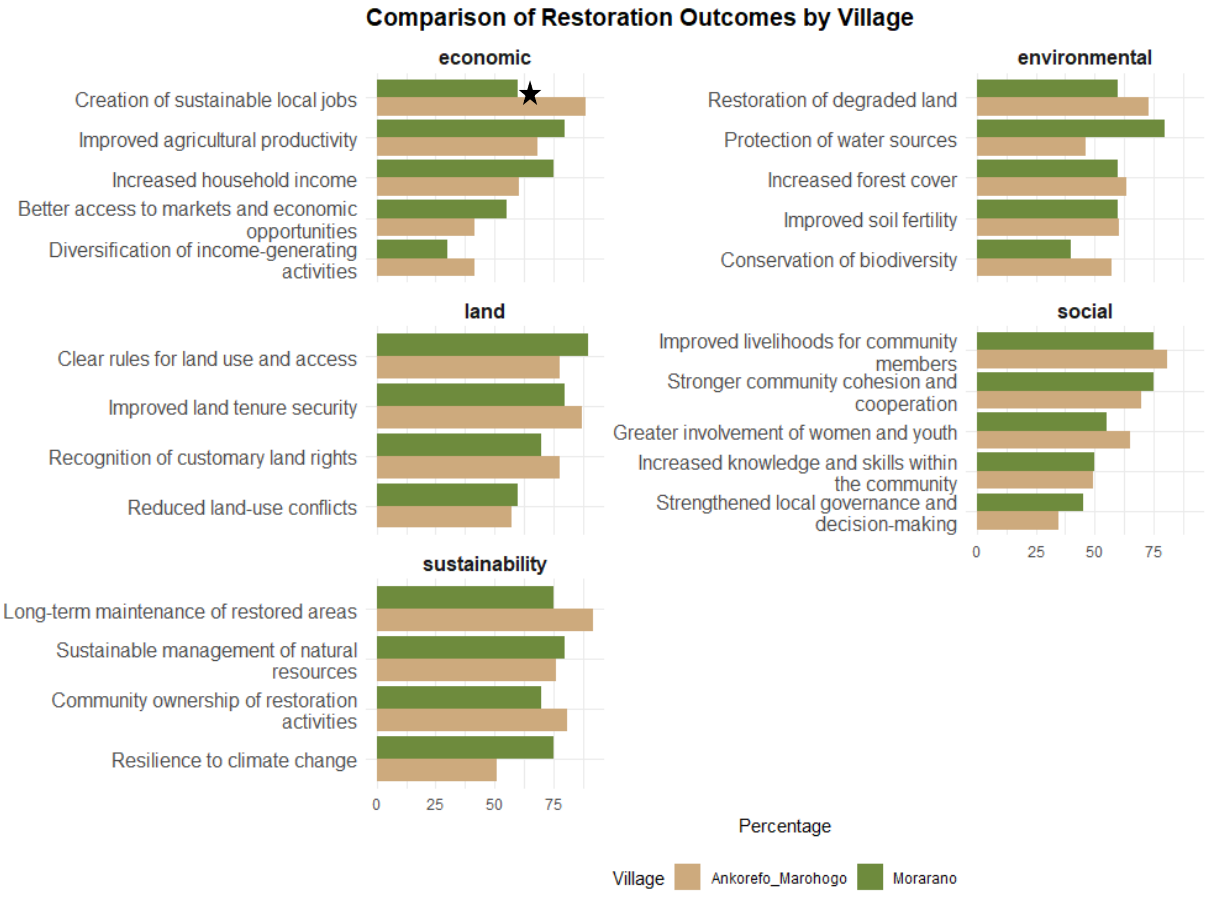


Figure 11 Comparison of the distribution (in %) of how often various restoration outcomes were selected by participants from the two villages. Statistically significant differences among the most chosen outcomes are marked with a star.

The age comparison showed that the top land tenure option was selected significantly more often by younger participants, while older participants preferred “Reduced land use conflicts” (see Fig. 12).

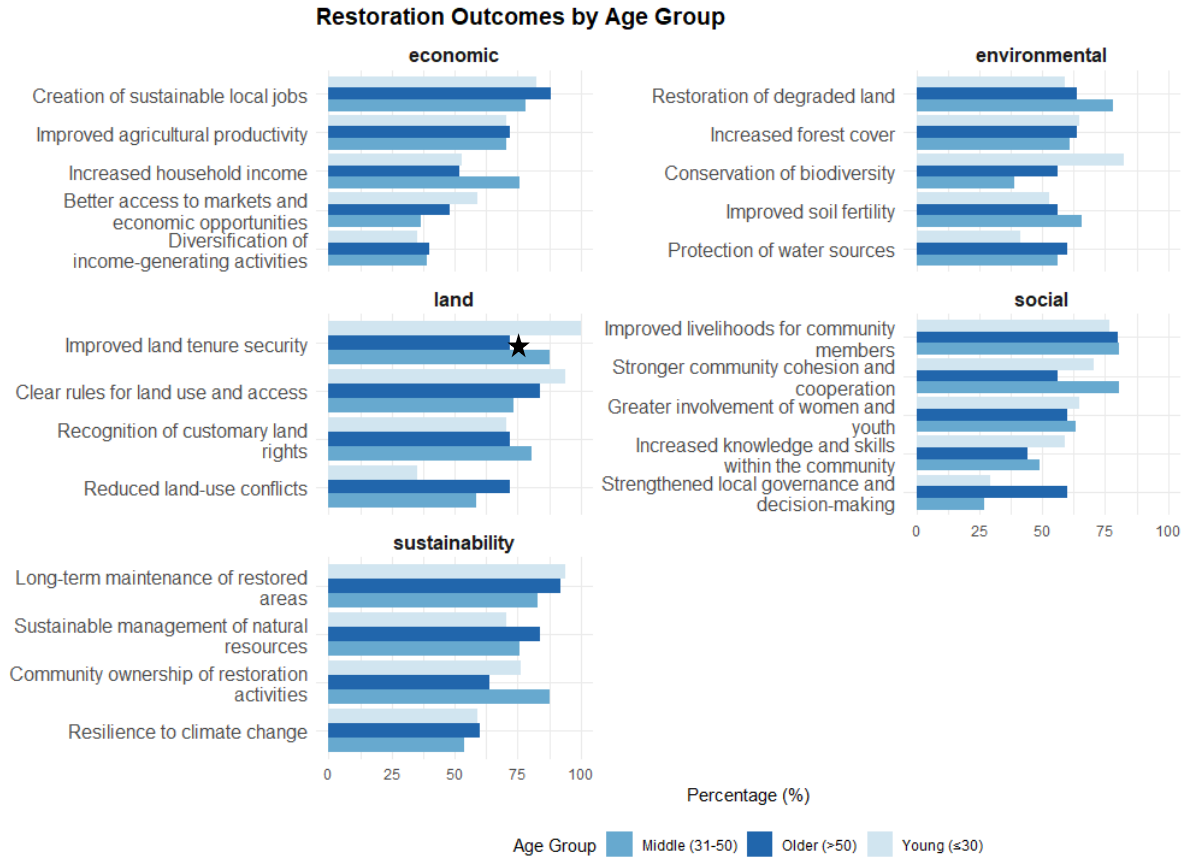


Figure 12 Comparison of the distribution (in %) of how often various restoration outcomes were selected by participants from different age groups. Statistically significant differences among the most chosen outcomes are marked with a star.

Question 7b: For each category, please select the three benefits from nature that are most important to you.

In this question, each category included between seven and eleven possible benefits. Therefore, the three most frequently selected options were analyzed. The statistical test indicated that the distribution of responses within each category differed significantly from the expected distribution (see Fig. 13).

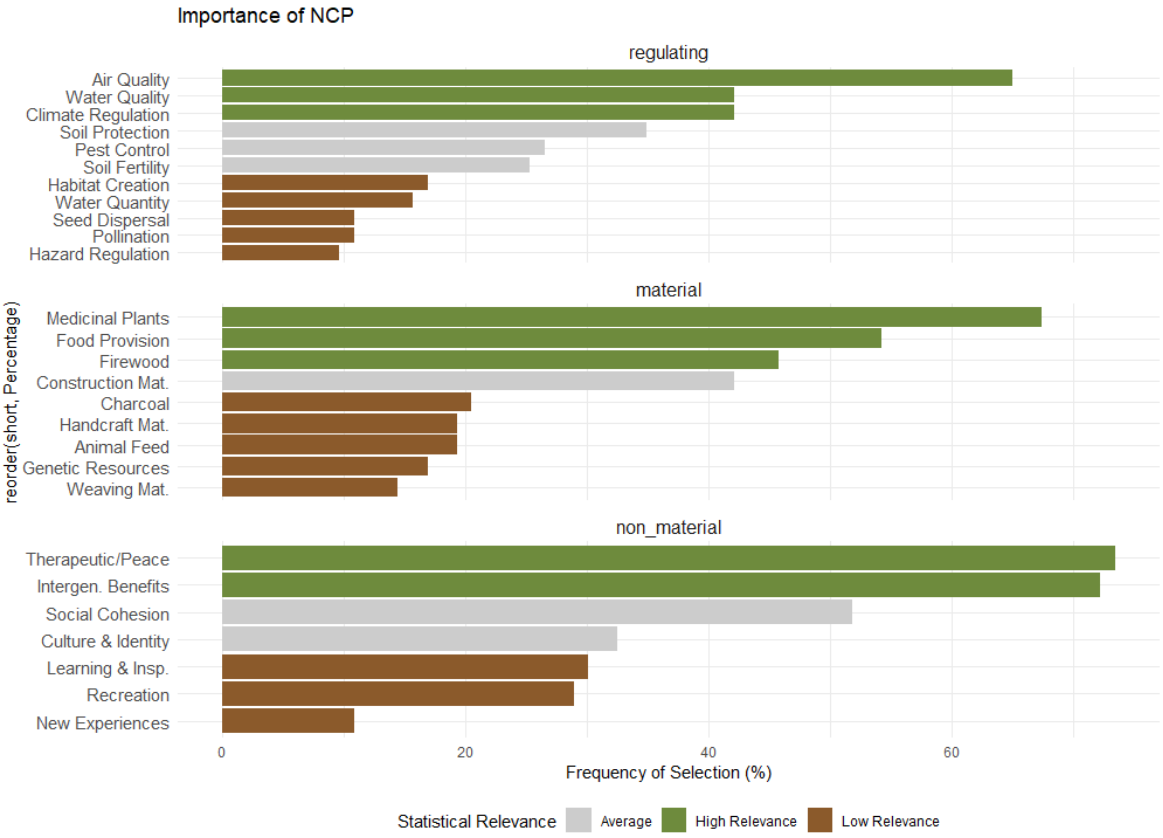


Figure 13 Distribution (in %) of how often different NCP were selected per category.

The village comparison showed no statistically significant differences between the two villages. Nevertheless, the three most chosen options are not the same for both villages.

Table 4 Three most frequently chosen NCP within one category selected by participants from (a) Ankorefo and (b) Morarano.

Ankorefo

Category	Most chosen	[%]	Second most chosen	[%]	Third most chosen	[%]
Regulating	Air quality	63	Climate Regulation	46	Water Quality	41
Material	Medicinal Plants	63	Food Provision	54	Construction material	46
Non-material	Therapy	75	Intergenerational Benefits	73	Social Cohesion	52

Morarano

Category	Most chosen	[%]	Second most chosen	[%]	Third most chosen	[%]
Regulating	Air Quality	70	Soil Protection	45	Water Quality	45
Material	Medicinal Plants	80	Firewood	55	Food Provision	55
Non-material	Intergenerational benefits	70	Therapy	70	Social Cohesion	50

The statistical analysis of the gender groups showed that there are some statistical differences. The environmental regulation benefit “Water quantity” was significantly more often chosen by women, while the non-material benefit “Intergenerational benefits” was significantly more often chosen by men (see Fig. 14).

Table 5 Three most frequently chosen NCP within one category selected by (a) Men and (b) Women.

Men

Category	Most chosen	[%]	Second most chosen	[%]	Third most chosen	[%]
Regulating	Air Quality	65	Water Quality	47	Climate Regulation	40
Material	Medicinal Plants	75	Food Provision	49	Construction material	45
Non-material	Intergenerational Benefits	80	Therapy	73	Social Cohesion	51

Women

Category	Most chosen	[%]	Second most chosen	[%]	Third most chosen	[%]
Regulating	Air Quality	64	Climate Regulation	46	Soil Protection	36
Material	Food Provision	64	Medicinal Plants	54	Firewood	50
Non-material	Therapy	75	Intergenerational Benefits	57	Social Cohesion	54

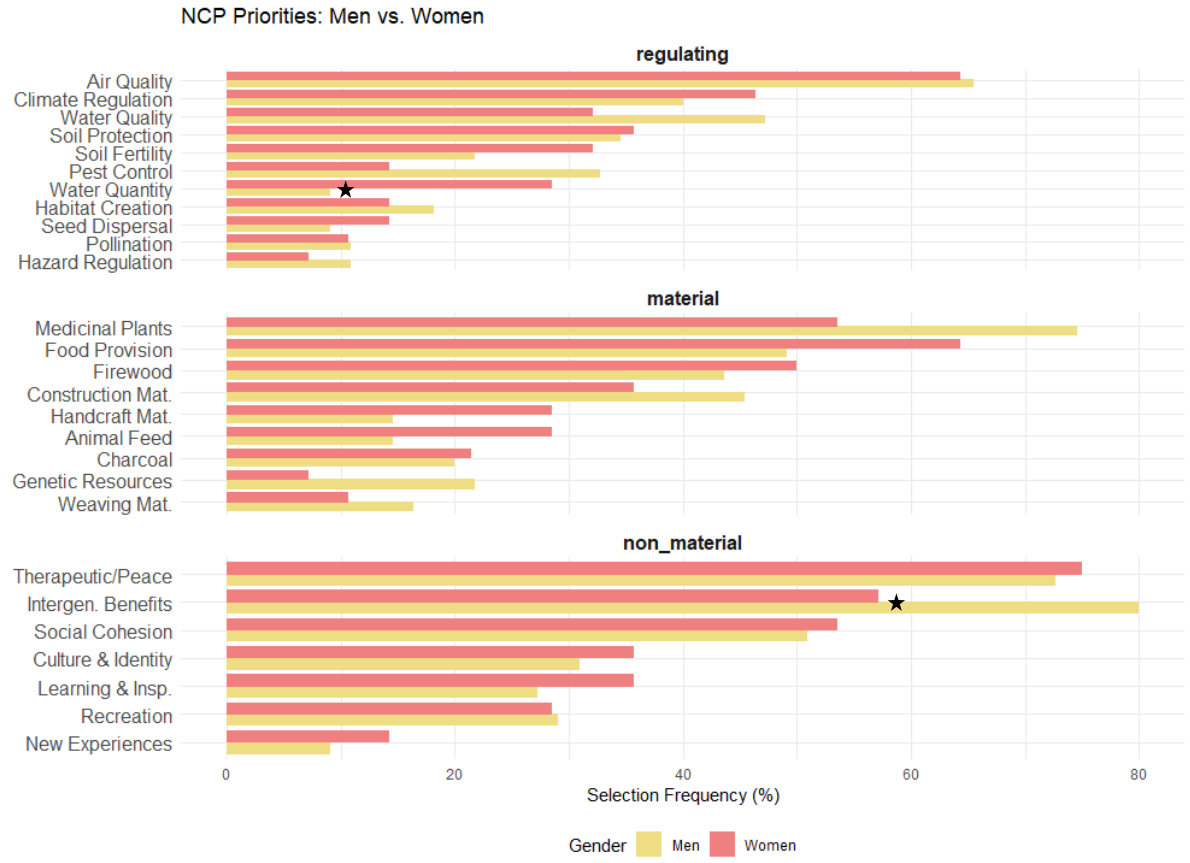


Figure 14 Comparison of the distribution (in %) of how often various NCP were selected by men and women. Statistically significant differences are marked with a star.

In the age comparison, no significant differences were found. However, two p-values were close to 0.05 and thus nearly significant: the regulating NCP "Air Quality," which was selected more often by younger participants, and the material NCP "Animal Feed," which was selected less often by older participants.

Table 6 Three most frequently chosen NCP within one category selected by (a) young, (b) middle-aged, and (c) older participants.

Young

Category	Most chosen	[%]	Second most chosen	[%]	Third most chosen	[%]
Regulating	Air Quality	88	Soil Protection	47	Climate Regulation	41
Material	Medical Plants	64	Food Provision	59	Construction Material	41
Non-material	Intergenerational Benefits	76	Therapy	56	Culture & Identity	41

Middle

Category	Most chosen	[%]	Second most chosen	[%]	Third most chosen	[%]
Regulating	Air Quality	56	Climate Regulation	49	Water Quality	41
Material	Medical Plants	66	Food Provision	54	Firewood	46
Non-material	Therapy	71	Intergenerational Benefits	66	Social Cohesion	56

Older

Category	Most chosen	[%]	Second most chosen	[%]	Third most chosen	[%]
Regulating	Air Quality	64	Water Quality	52	Soil Protection	44
Material	Medical Plants	52	Construction Material	56	Firewood	52
Non-material	Intergenerational Benefits	80	Therapy	76	Social Cohesion	60

The income group comparison revealed some statistically significant differences between the various income groups. In the material section, the benefit "Charcoal" was frequently chosen by participants who own a small business, but very rarely by those earning a living from selling agricultural products. For the material benefit "Food Provision", some income groups selected this option frequently while others never did. Nevertheless, all four main income groups chose this benefit often. No statistically significant differences were observed for any of the other NCP. These results are visible in Fig. 15.

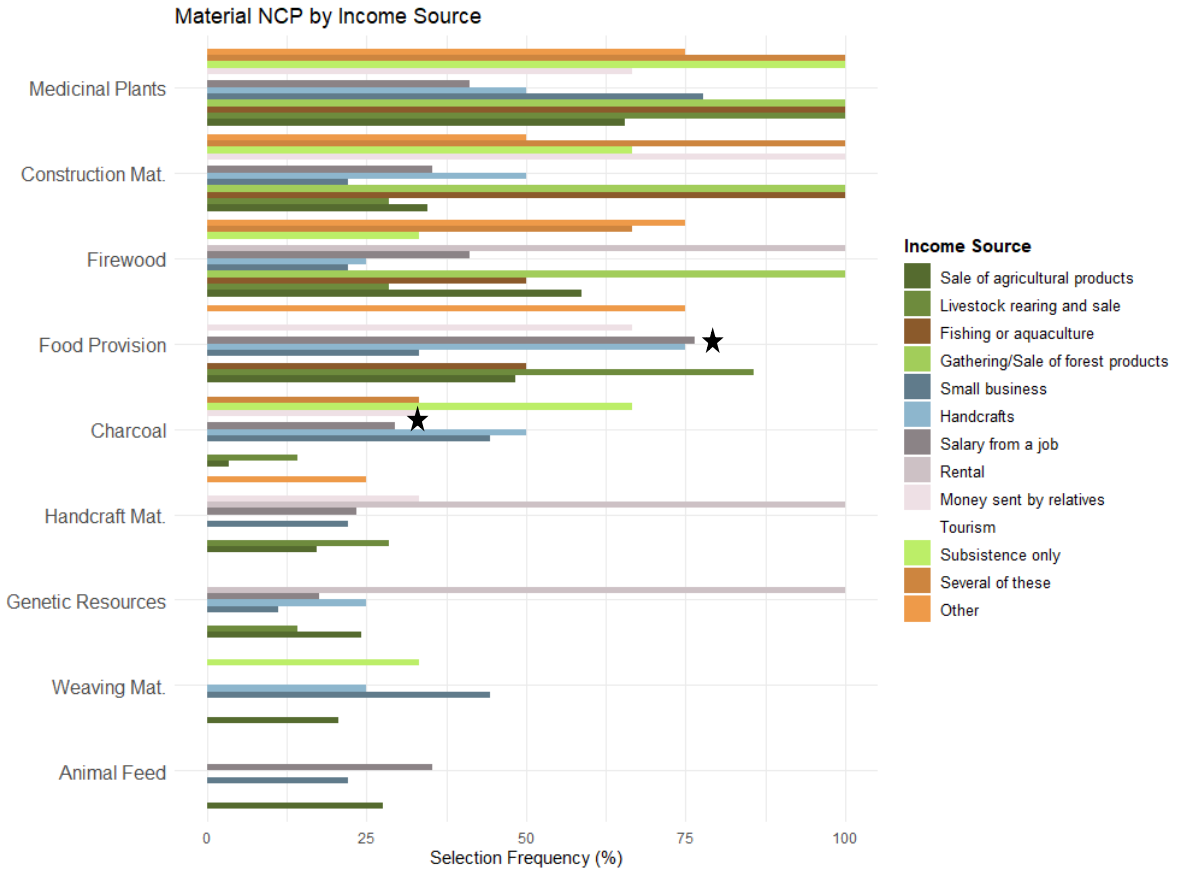


Figure 15 Comparison of the distribution (in %) of how often various material NCP were selected by participants from different income source groups. Statistically significant differences are marked with a star.

5.2 Sub-question 2

What positive and negative impacts do local communities experience after the implementation of tree-based restoration projects?

Question 3: What benefits (social, economic, environmental) have you observed in your community as a result of these projects?

The statistical analysis of the overall results showed that the different benefits were selected with significantly different frequencies within each category. In the social category, the benefit "Creation of temporary or permanent local jobs" was chosen most frequently (65%), while "Improved local governance" was selected least often (25%) (see Fig. 16). In the economic category, the benefit "Stimulation of the local economy" stood out, as it was chosen by only about 10% of participants. In contrast, "Increased household income" was the most frequently selected option in this category (58%) (see Fig. 17). In the environmental category, "Improved forest cover" was selected by 59% of the participants, whereas "Protection of water resources" was chosen in only 19% of the cases (see Fig. 18). In addition, the statistical tests indicated that economic and environmental benefits were selected at similar rates, while social benefits were chosen significantly more often.

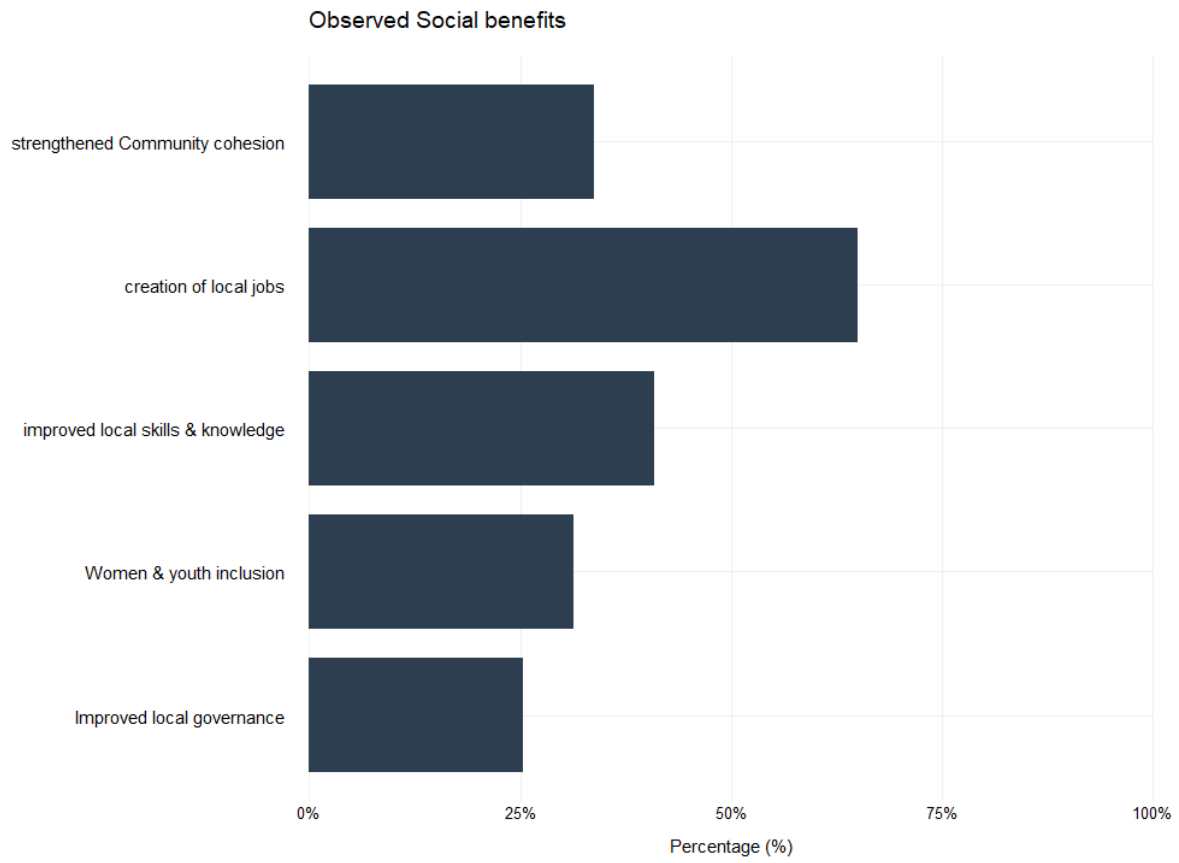


Figure 16 Distribution (in %) of how often different social benefits were observed by the participants.

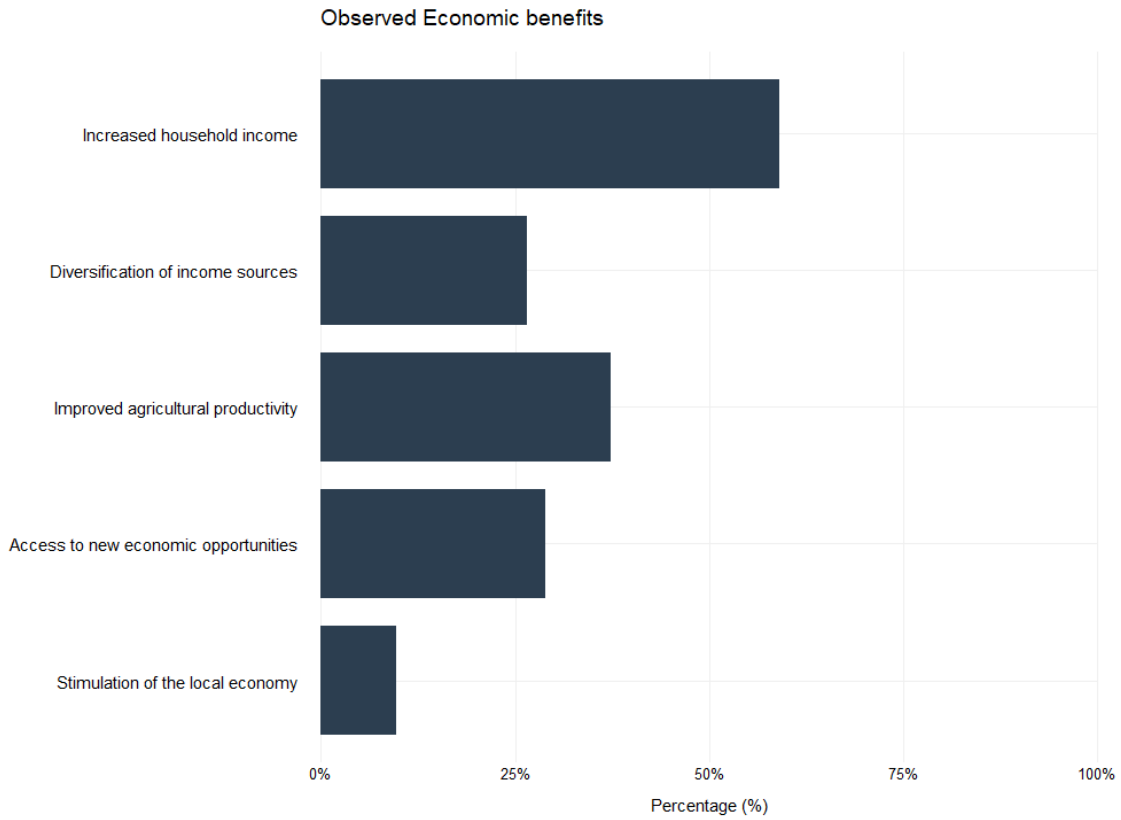


Figure 17 Distribution (in %) of how often different economic benefits were observed by the participants.

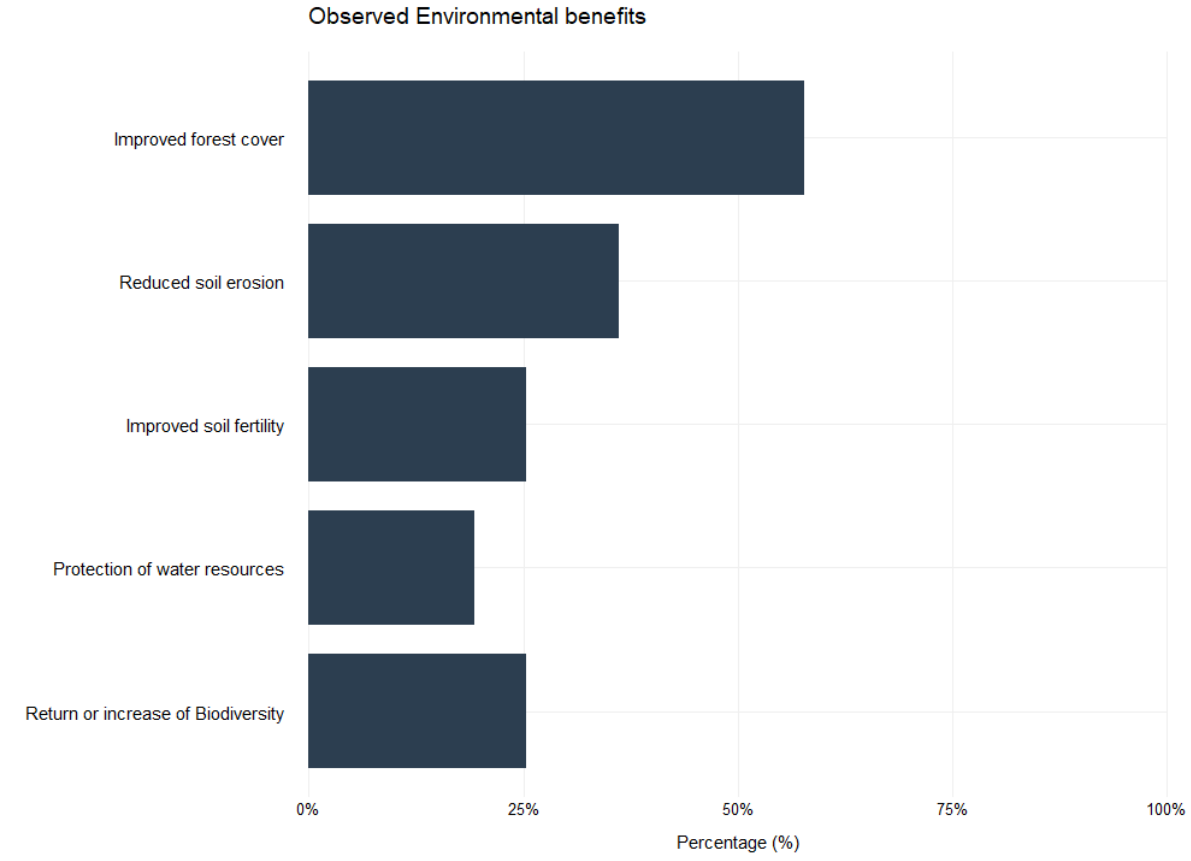


Figure 18 Distribution (in %) of how often different environmental benefits were observed by the participants.

The statistical group comparison of the two villages made visible that no benefit was significantly more often chosen by participants from Morarano or Ankorefo. However, the p-value of the environmental benefit “Protection of water resources” was close to 0.05 and therefore nearly significant, indicating a tendency for respondents from Morarano to select this benefit more frequently (see Fig. 19).

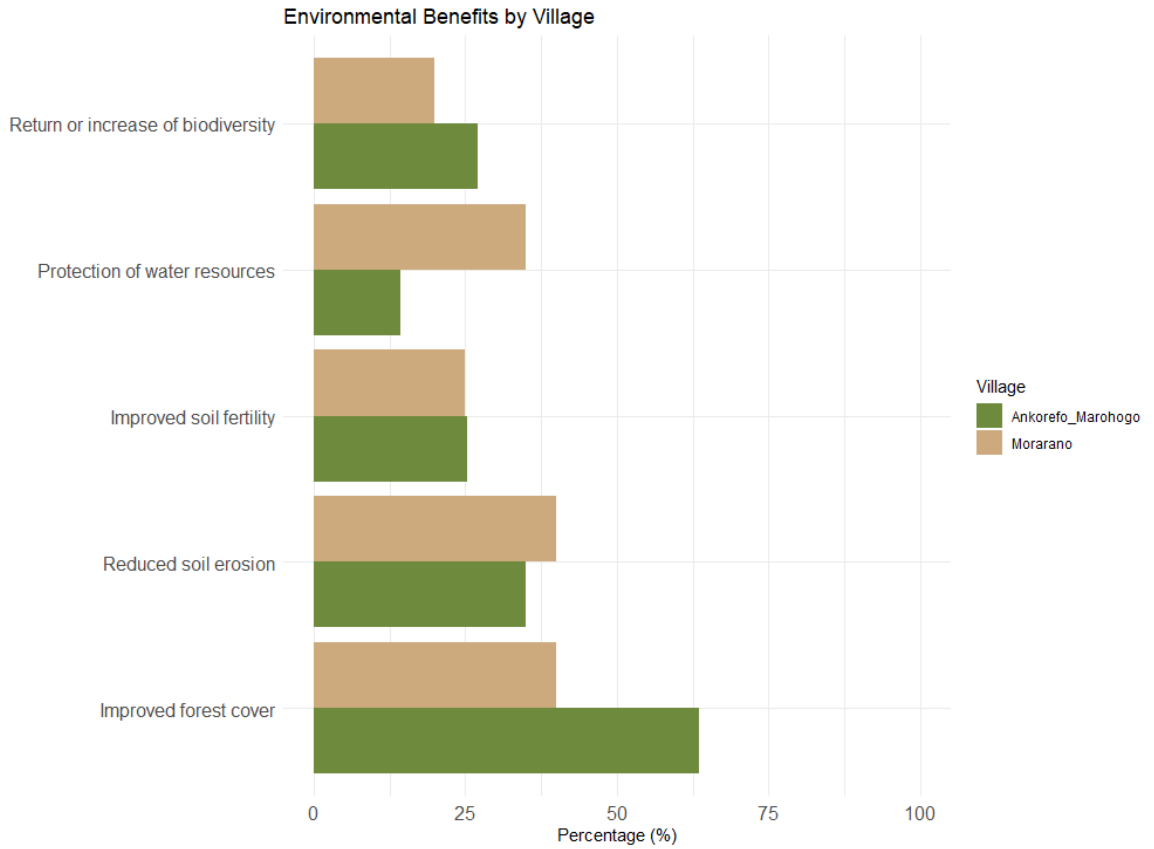


Figure 19 Comparison of the distribution (in %) of how often various environmental benefits were observed by participants from the two villages.

The gender comparison revealed that the environmental benefit “Improved soil fertility” was significantly more often chosen by men (see Fig. 20).

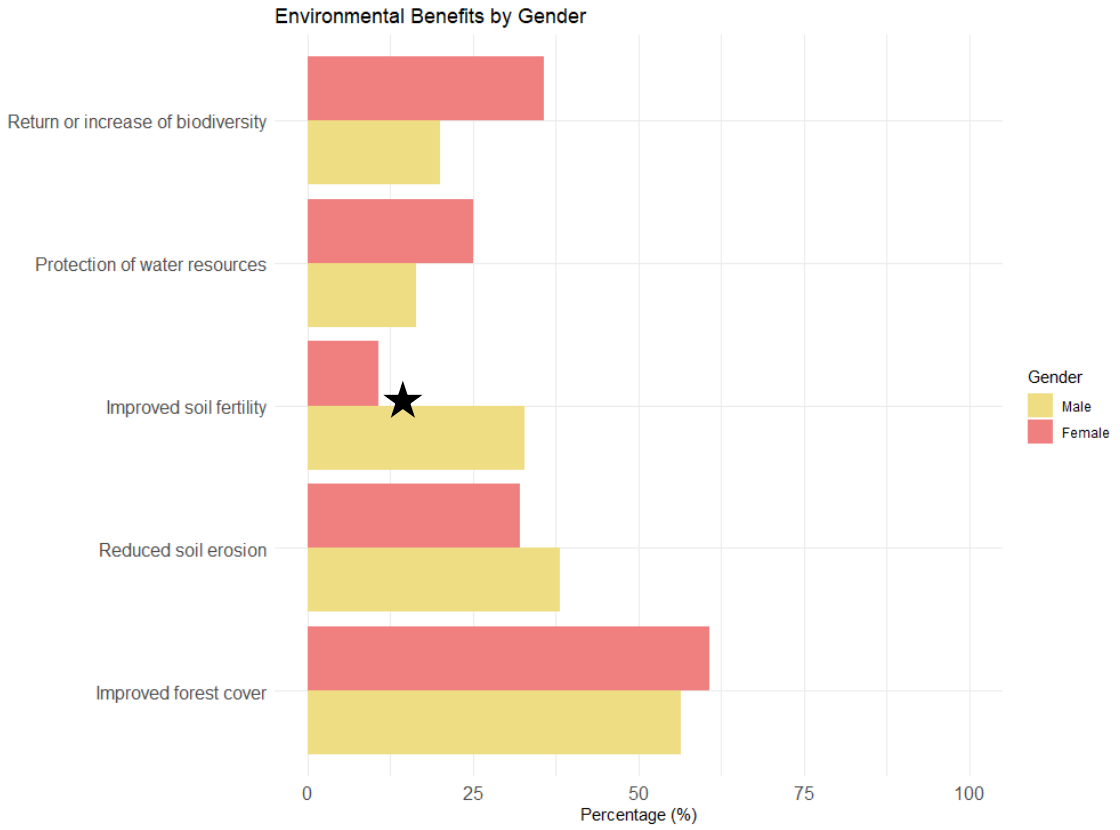


Figure 20 Comparison of the distribution (in %) of how often various environmental benefits were observed by men and women. Statistically significant differences are marked with a star.

The age group comparison indicated that the social benefit “Creation of temporary or permanent local jobs” as well as the economic benefit “Diversification of income sources” were significantly less chosen by older people (see Fig. 21 & 22). In the comparison of the income source groups, no significant difference could be found.

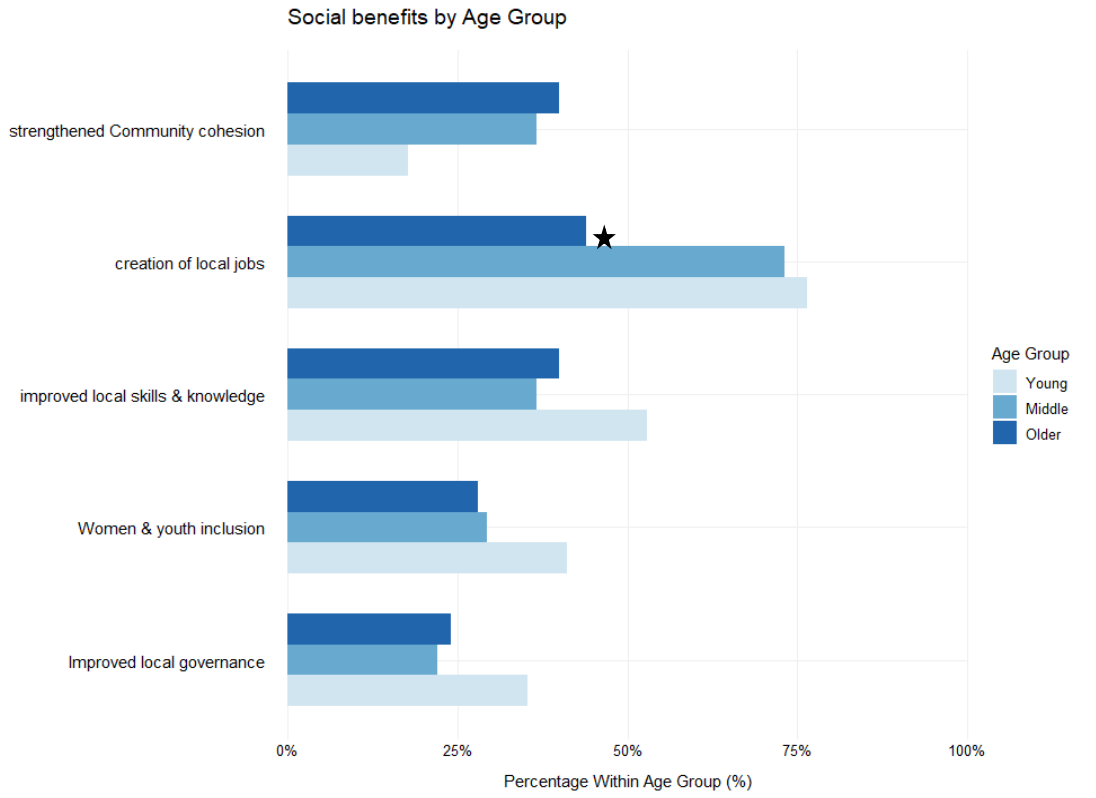


Figure 22 Comparison of the distribution (in %) of how often various social benefits were observed by participants from different age groups. Statistically significant differences are marked with a star.

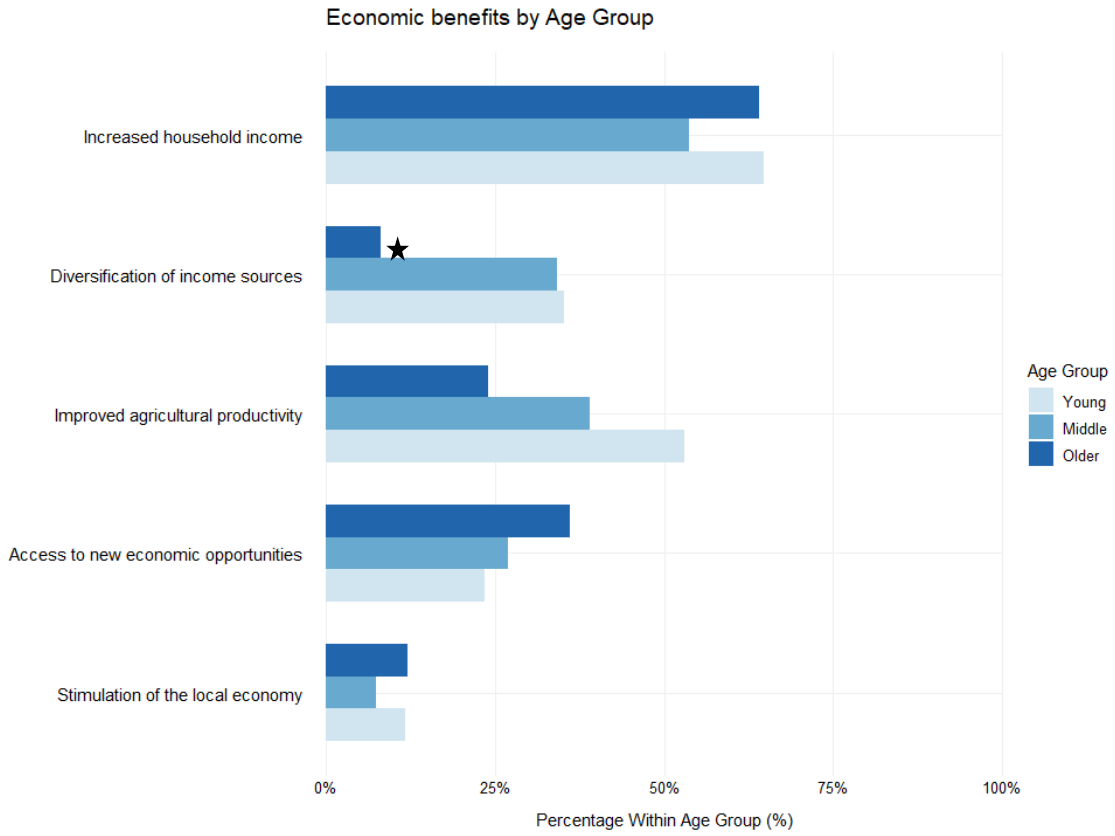


Figure 21 Comparison of the distribution (in %) of how often various economic benefits were observed by participants from different age groups. Statistically significant differences are marked with a star.

Table 7 Comments provided in the 'Other' section of Interview Question 3a.

3a) Option "other", n = 37		
Category name	**Description**	**Occurrence**
No economic advantage	There are no economic advantages or benefits	12
No social advantage	There are no social advantages or benefits	11
No environmental advantage	There are no environmental advantages or benefits	9
Money	There is a financial profit for the community	3
Water Channels	Construction of water channels	1
Fresh Air	Improved air quality	1

The "Other" section shows that many participants mentioned that they have not experienced benefits or advantages in one or multiple categories. Some participants mentioned again the financial profit which further emphasizes the economic benefit of an increased household income.

Question 8: What challenges or restrictions have you experienced because of past restoration projects, for example regarding access to land, forests, or other resources?

Table 8 Responses to the Interview Question 8, grouped by Category.

8) What challenges or restrictions have you experienced because of past restoration projects, for example regarding access to land, forests, or other resources? (n = 83)		
Category name	**Description**	**Occurrence**
Fire Ban	Slash-and-burn practices are forbidden	38
Ban on Cutting Wood	It's forbidden to cut wood	24
No Livestock	Livestock is forbidden in protected areas	14
None	There are no restrictions or challenges	12
Environmental Protection	The environment (nature, animals, reforested areas) needs to be protected	7
No Access	We have no access to protected areas	3
Improvement	Improvement of the legal framework, the monitoring strategies, and safeguarding the project	2
Autonomy	Autonomy (especially for women)	1
No Project	I have not yet carried out any environmental protection work	1

With the answers to this open-ended question, it remains uncertain whether all interview participants fully understood the question the way it was meant. It seems that many respondents named regulations that were part of the restoration process, without indicating whether these regulations were perceived as restrictive, meaning that they limit daily activities and may cause difficulties in everyday life.

Nearly half of the participants mentioned the prohibition of slash-and-burn practices in protected areas, while about one quarter additionally noted that unauthorized logging is forbidden in these areas. Another frequently mentioned regulation was the prohibition of livestock grazing in restored areas. Only in about 10% of the answers were reasons for these restrictions, such as conserving natural resources, protecting reforested areas, promoting sustainable forest use, or maintaining Madagascar's greenery, provided. Approximately 14% of participants stated that they did not experience any restrictions or challenges resulting from past restoration projects. However, the statistical group comparisons were not statistically significant in any case. Consequently, this statement cannot be linked to any of the defined village, gender, age, or source of income groups.

In some responses, only keywords such as "Forest protection" were recorded in the comment field. This makes it difficult to determine whether respondents experienced forest protection as a challenge or

restriction, or whether they were merely identifying it as a regulation. Three participants explicitly stated that they do not have access to reforested areas, identifying this as a restriction. One of them additionally said that environmental greening and increasing water resources are challenging. Two participants pointed to areas requiring improvement, including the legal framework, monitoring systems, and overall project safeguarding, though they also emphasized the difficulty of implementing such improvements. Finally, one woman highlighted the need for greater autonomy, particularly for women.

Question 10a: Does everyone benefit equally from the projects, or are there groups or families that have more advantages/restrictions than others?

The overall analysis shows a statistically significant difference, indicating a distribution that deviates from what would be expected. While only 29% of the participants stated that some people have more advantages and restrictions than others, significantly more participants (71%) believe that everyone benefits equally (see Fig. 23). All group comparisons display a similar pattern, and no significant differences between the groups were detected.

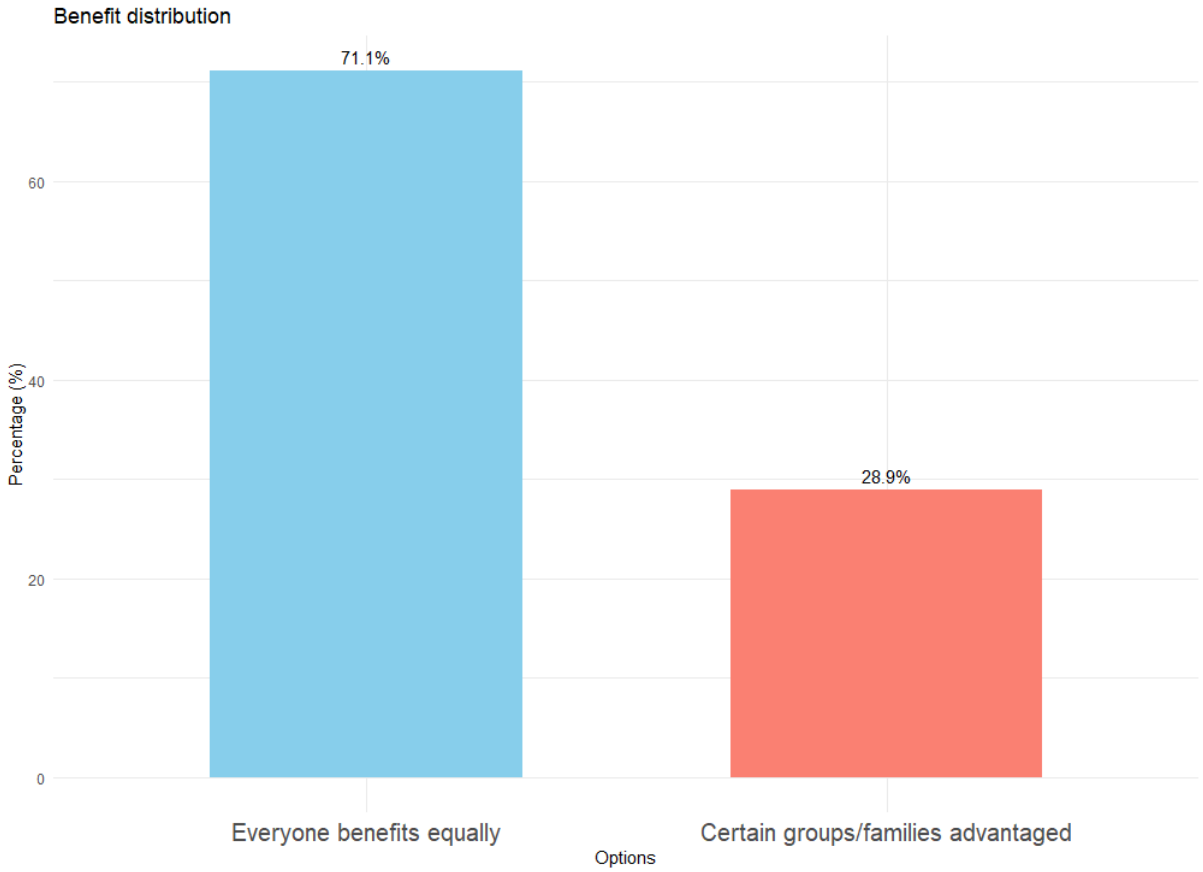


Figure 23 Distribution (in %) of the frequency with which the two response options were selected by participants.

Table 9 Required explanation of the choice in Interview Question 10a.

10a) Explanation of the question (n = 83)		
Category name	**Description**	**Occurrence**
Equal Treatment	Everyone is treated equally, as everyone benefits from having more water and everyone earns the same amount of money	52
Limited Access	Access to the benefits is limited, as only riverside people profit from access to water and only employees earn money, recruitment of employees is limited	15
Favoritism	Some people have more benefits than others, there is favoritism	8
No Benefits	There are no benefits	5
Same Goals	We share the same willingness to accomplish the work	2
Unsuitable Plants	The planted species never adapt to these areas	1
No	Not all are benefiting equally?	1

In the comment section, about 63% of participants explained that everyone is treated equally and receives the same benefits. Things like all profit from water access and everyone receives the same salary for their work were frequently mentioned. Nevertheless, some participants noted that access to benefits is always limited. E.g., mainly people living close to the river can benefit from water access, and only those who work on the projects can earn money. Since there are limited job opportunities, not everyone can benefit. Some participants also mentioned that certain people are always chosen for jobs and consistently receive benefits, while others never have the chance. Others referred to favoritism by project leaders or noted that individuals gain more benefits if they are the village chief or belong to a "close circle". Another group of participants stated that there are no benefits at all.

5.3 Sub-question 3

How do local communities perceive the alignment of intentions and priorities of other actors involved in tree-based restoration projects with their own priorities and needs?

Question 5b: Do you think they consider local priorities well?

The overall analysis of this question indicates that the options "Strategies perceived as disconnected from local realities" (33.7%) and "Partial alignment with local priorities" (30.1%) were significantly more often chosen than expected, while the option "Limited consideration of local priorities" (9.6%) was significantly less often chosen than expected (see Fig. 24).

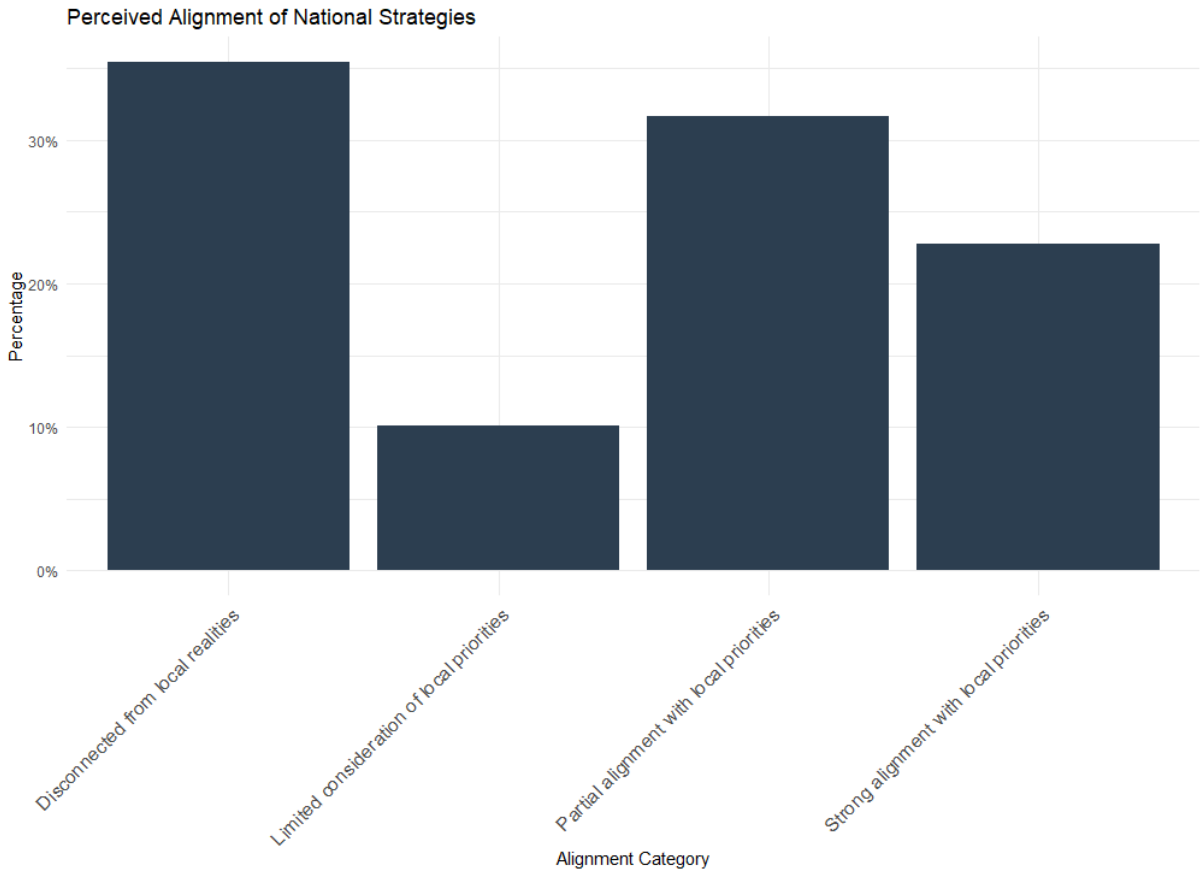


Figure 24 Distribution (in %) of participants' perceptions of the alignment between national strategies and their own priorities.

The group comparisons showed a statistically significant difference between participants from the two villages. The option "Strong strategy alignment with local priorities" was selected only by participants from Ankorefo, while all other options were more frequently chosen by respondents from Morarano. In particular, the option "Limited consideration of local priorities" was often selected by this group (see Fig. 25). The comparison between men and women showed no statistically significant differences. Nevertheless, the bar chart indicates that more men tended to report that the alignment of priorities is either completely disconnected or at least limited, whereas more women tended to report a partial or strong alignment of priorities (see Fig. 26). Comparisons by age and income source did not reveal statistically significant differences, and the bar charts did not show substantial visual variation as well.

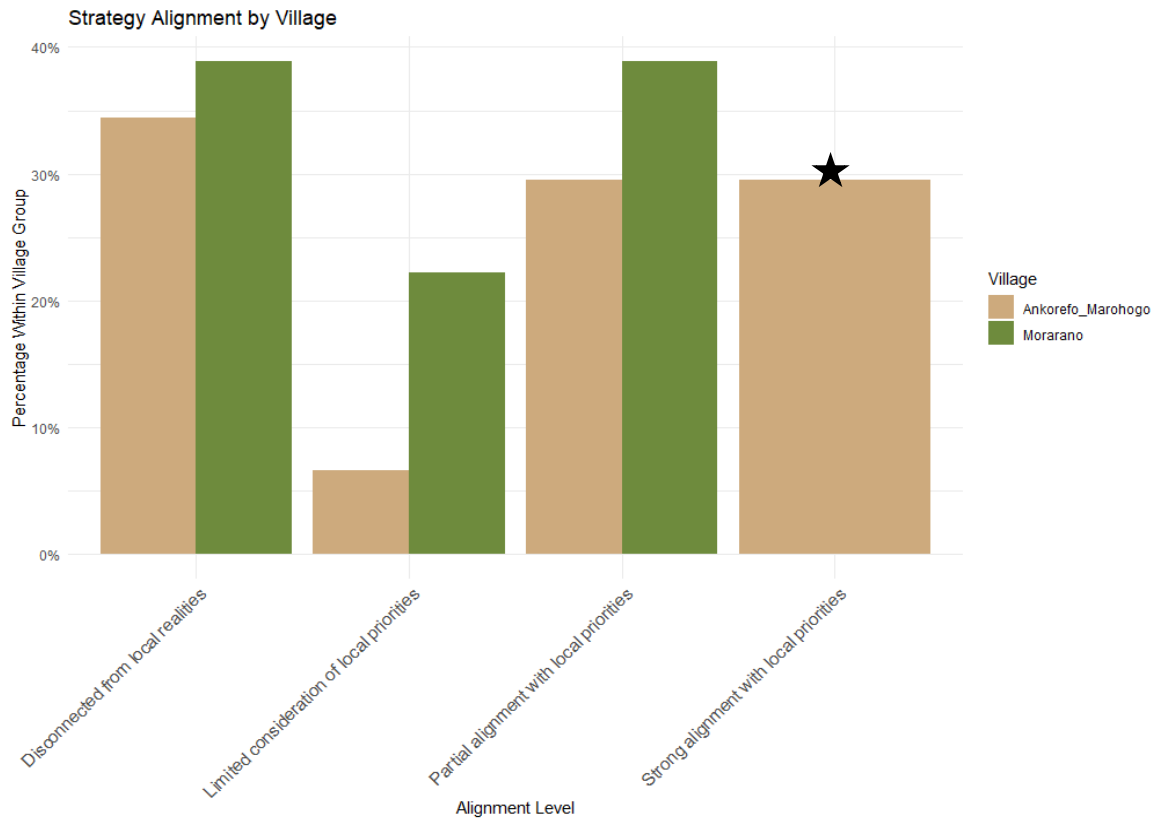


Figure 25 Comparison of the distribution (in %) of participants from different villages' perceptions of the alignment between national strategies and their own priorities. Statistically significant differences are marked with a star.

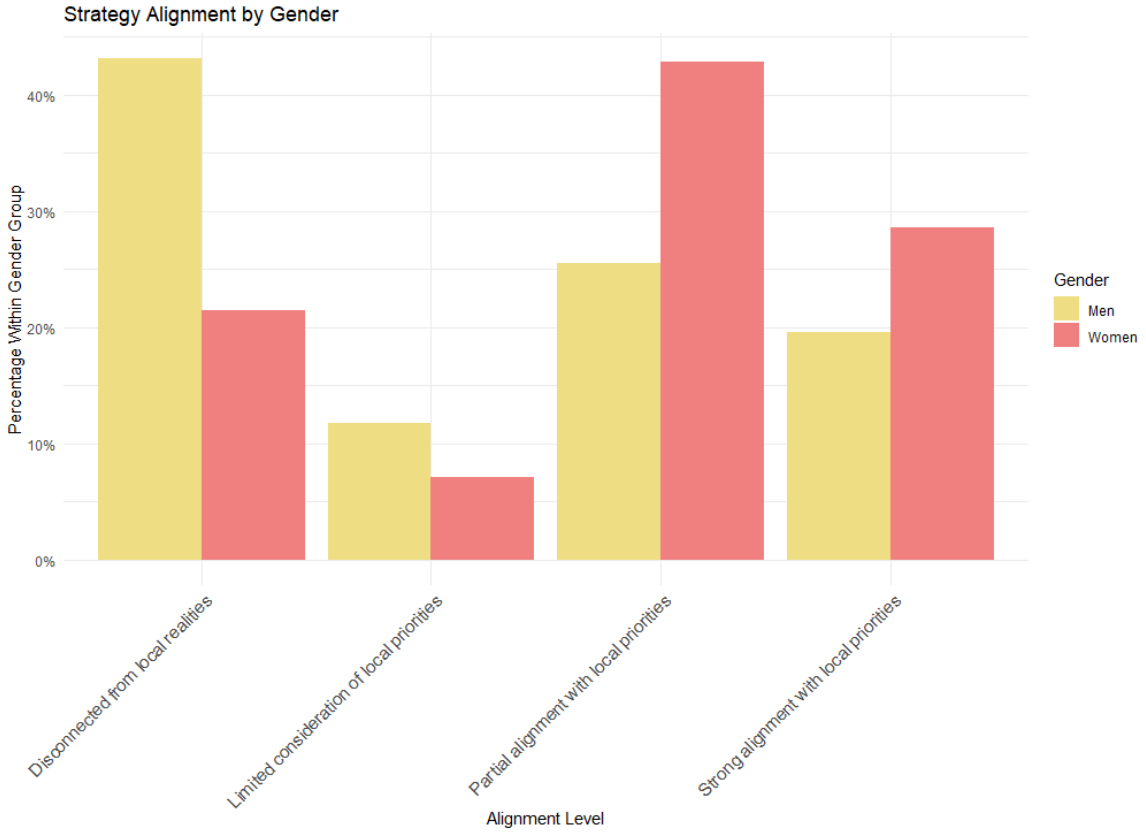


Figure 26 Comparison of the distribution (in %) of men and women's perceptions of the alignment between national strategies and their own priorities.

Table 10 Comments provided in the 'Other' section of Interview Question 5b

5b) Option "other", n = 6		
Category name	**Description**	**Occurrence**
No Knowledge	They don't know	5
Specific No	No, because he plants trees on people's property without permission from the owners	1

The option "Other" indicates that there are some participants who don't know if the local priorities are considered enough.

Question 9: How do you perceive the goals and priorities of the other actors involved in the project compared to your own?

The analysis of the overall answer distribution revealed statistically significant differences in the responses. The option "Somewhat aligned" was with 28.9% chosen significantly more often than the other options, while "Totally aligned" was with 6% selected significantly less frequently (see Fig. 27).

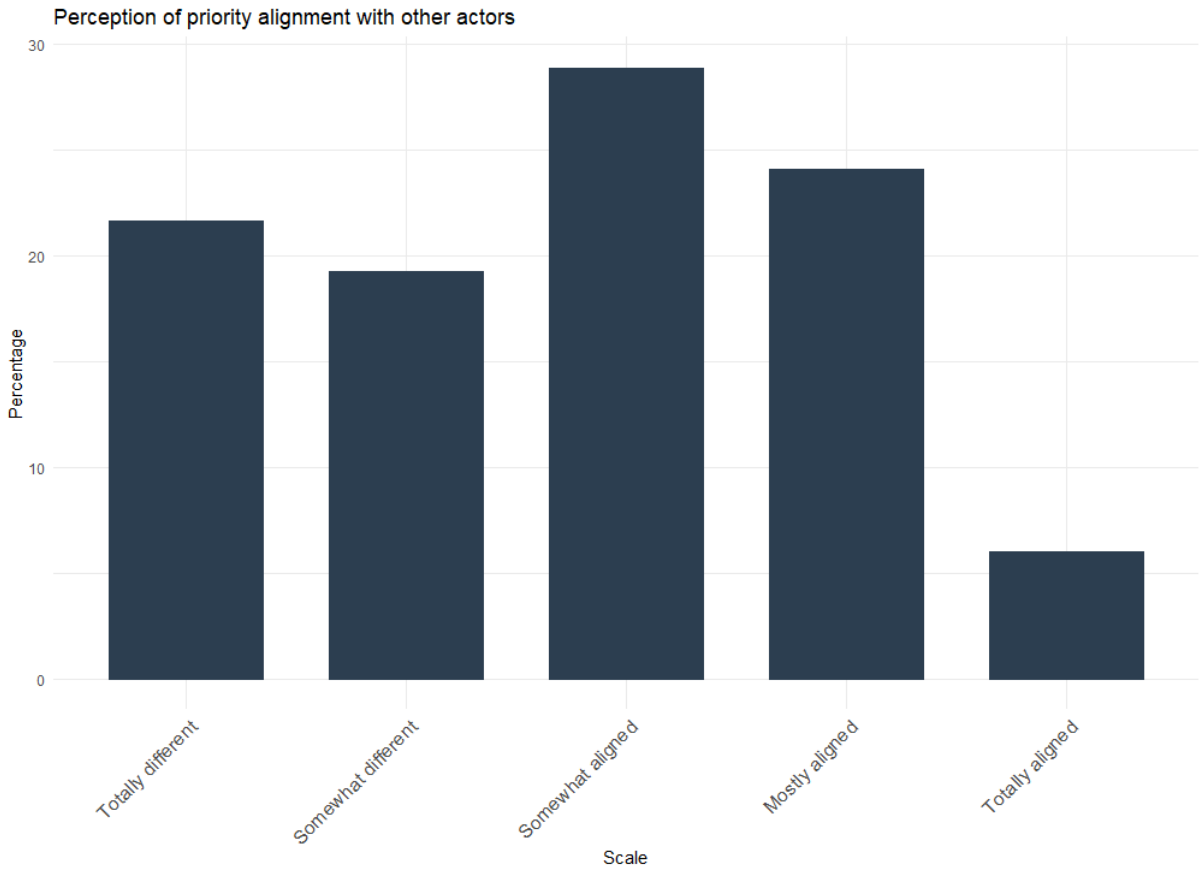


Figure 27 Distribution (in %) of participants' perceptions of the alignment between the priorities and goals of other actors and their own.

All statistical group comparisons showed no significant differences between the groups. The most noticeable visual differences were observed between the age groups. This aligns with the statistical analysis where the p-value was close to 0.05. It is evident that older participants generally perceive their goals and priorities as mostly aligned, whereas none of them considered them to be completely aligned. In contrast, younger participants were more likely to feel that their goals are entirely different (see Fig. 28). For gender and village group comparisons, all differences between the two groups were less than 10%.

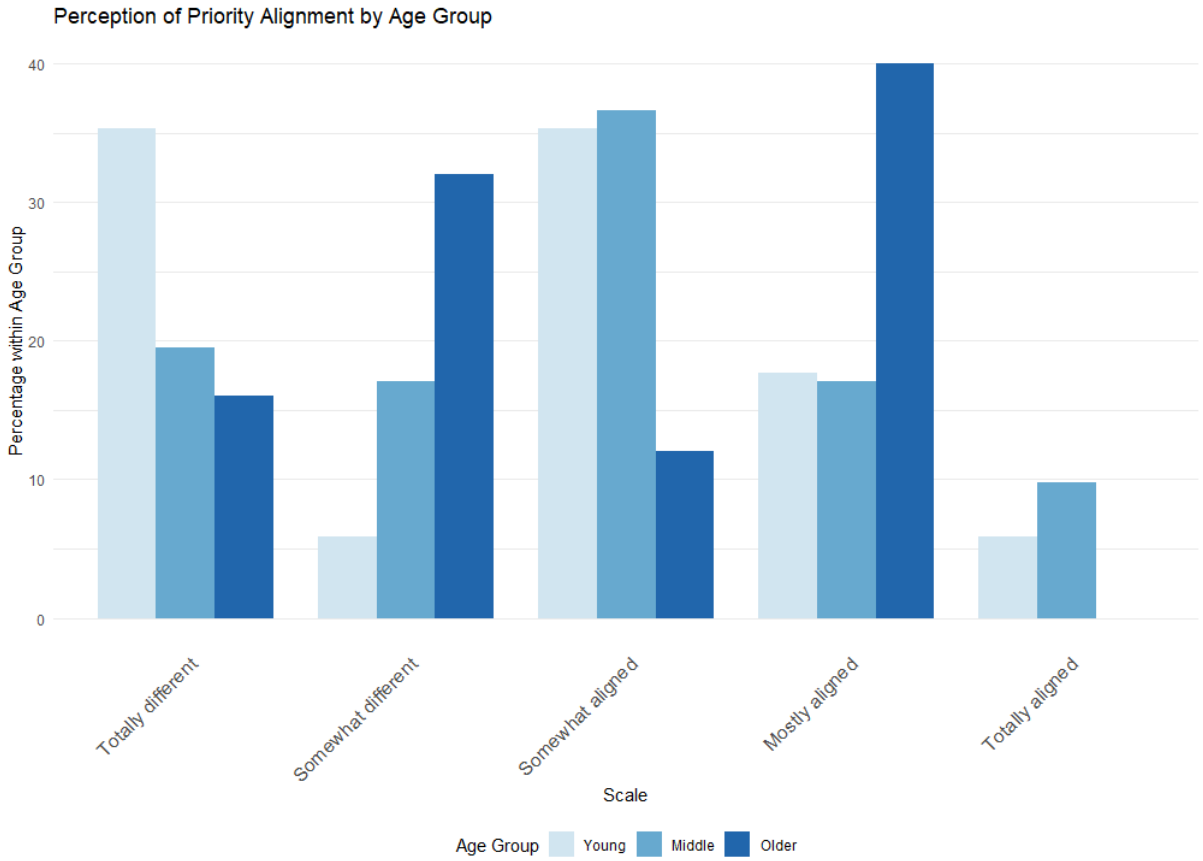


Figure 28 Comparison of the distribution (in %) of participants from different age groups' perceptions of the alignment between other actors' priorities and goals and their own.

Table 11 Comments provided on the Interview Question 9.

9) Comments on the question (n = 83)		
Category name	**Description**	**Occurrence**
Same Goal	Everyone wants the same (to improve the environment)	20
Lack of Communication	The local community is not sufficiently involved, informed, and talked to.	15
Different Opinions & Knowledge	Different actors but also people within one community have different priorities and knowledge about the projects	14
Money	Some people only see the financial aspect	12
No	Nothing to add	9
Unsuitable Plants	The planted trees are not suitable for the area and don't meet the population's needs	7
Lack of Monitoring	Lack of long-term monitoring of the reforested areas	6
Good project	Effort and work are visible, they should continue	3
No Knowledge	I don't know	2
Self-Sufficiency	Everyone wants to be self-sufficient	1
Increase of Rainwater Retention	Reforestation increases rainwater retention	1

Nearly one-fourth of all participants commented that everyone wants the same or that everyone simply wants to improve the environment. Nevertheless, many participants also noted that different actors, as well as people within the community, have different priorities.

Another frequently mentioned comment was that many people are motivated to participate in projects primarily by the opportunity to earn money. While some argued that local community members are mainly motivated by financial gain, others stated that other actors are primarily driven by money. However, there were also comments in which it was unclear which actor group was being referred to.

As in many other comment sections of the survey, several participants emphasized that local communities are not sufficiently included and that communication is lacking. They say that it is necessary to inform local people about all project steps and to include their ideas and opinions. Additionally, as noted in other questions, some participants commented that certain projects plant species that do not meet local interests or needs and that monitoring of reforested areas is insufficient.

5.4 Sub-question 4

How do local communities perceive their involvement in different stages of tree-based restoration projects?

Question 2a: Do you think the local community is sufficiently involved in restoration projects?

The overall analysis of the responses shows no significant differences in the frequency with which the two answer options were selected. While 43 participants believe that the local community is sufficiently involved, 40 participants hold the opposite view. Comparisons across the four variables revealed largely similar patterns. The distributions for gender, village, and age appear visually even and the statistical tests also indicate that there is no statistically significant difference. Only the bar chart for income source shows some noticeable variation (see Fig. 29). The proportion of "yes" responses exceeds 55% among the main groups agriculture and small business, whereas it is somewhat lower among salaried employees at 41%, and particularly low among the livestock group at just 14%. Nevertheless, statistical testing confirms that these observed differences are also not statistically significant.

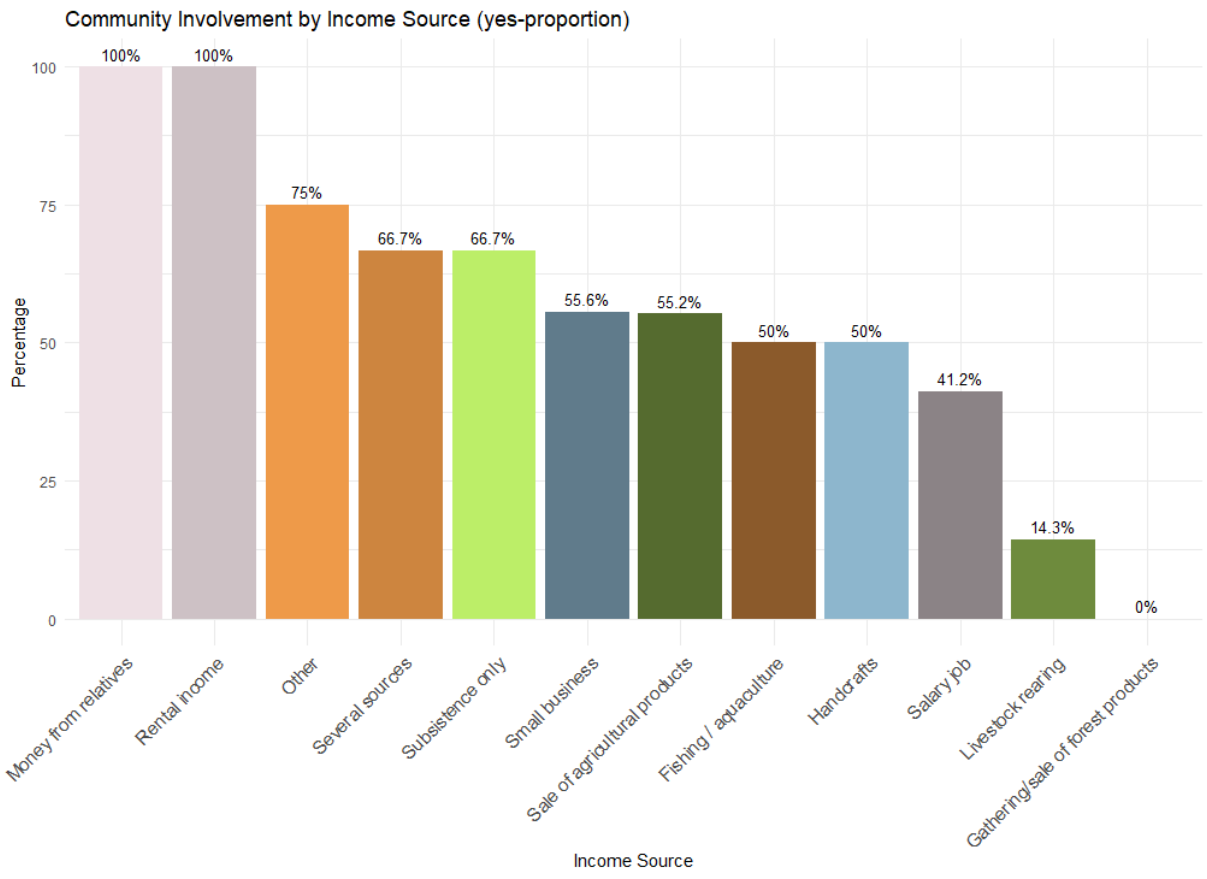


Figure 29 Distribution (in %) of the proportion of 'yes' responses regarding perceived community involvement across income source groups.

Question 2b: Why or why not?

The overall analysis indicates a statistically significant difference in the frequency of the selected answer options. The reason "Strong collaboration with project implementers" was chosen most frequently (47%), substantially exceeding all other options. The second most frequently selected reason, "Lack of early consultation," was chosen in only 23% of cases. The least selected reason "Limited consideration of community inputs" was chosen by only 7% (see Fig. 30).

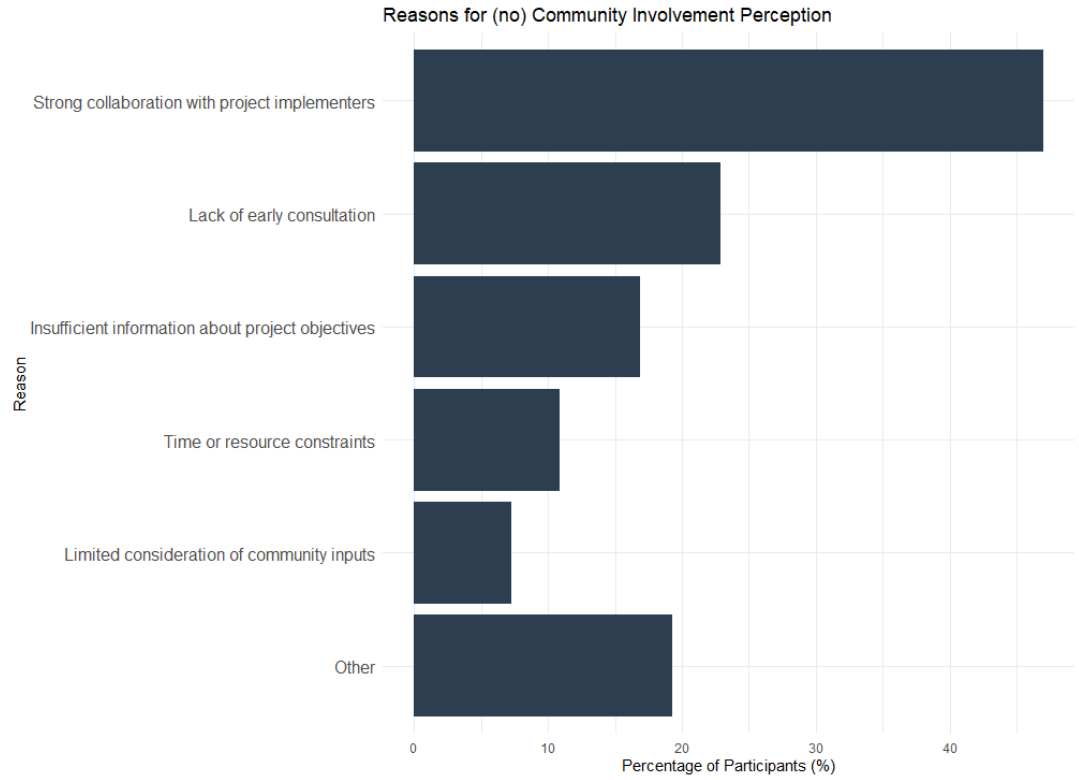


Figure 30 Distribution (in %) of participants' reasons for sufficient or insufficient involvement of local communities.

A comparison between participants who answered Question 2a with "yes" and those who answered with "no" reveals distinct patterns. Statistical tests show that "Strong collaboration with project implementers" was significantly more often selected by participants who perceive community involvement as sufficient. In contrast, all other reasons were selected significantly more often by participants who perceive community involvement as insufficient (see Fig. 31).

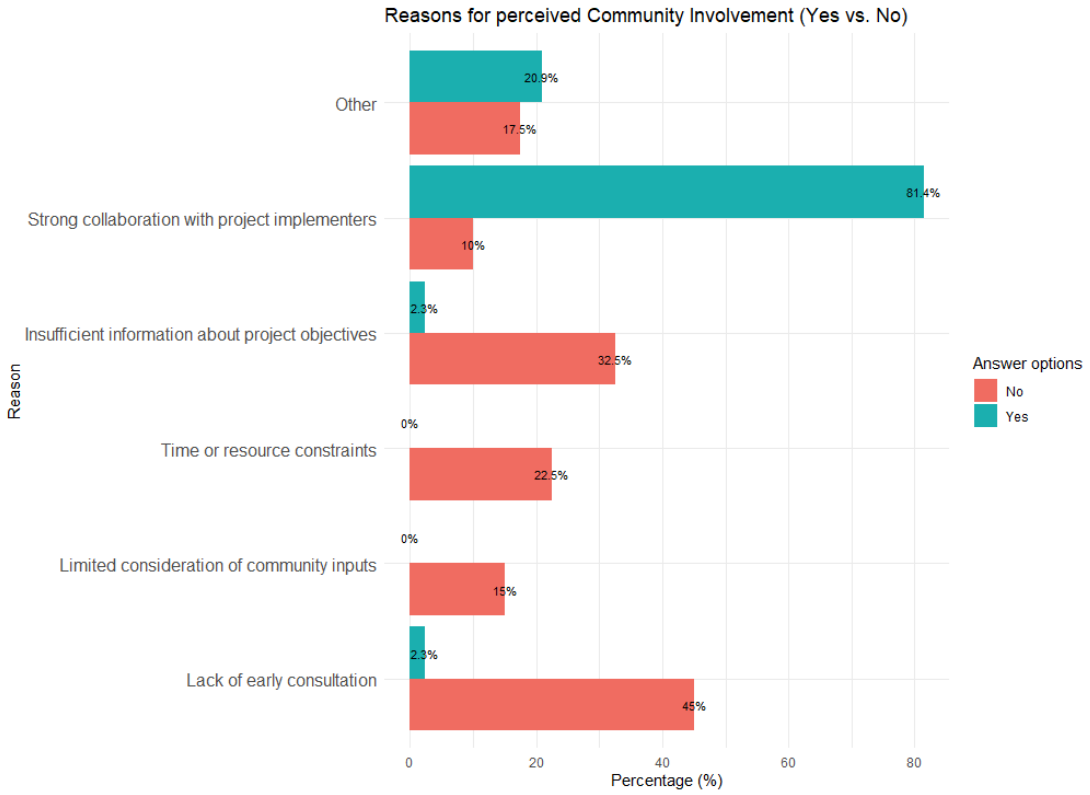


Figure 31 Distribution (in %) of participants' reasons for sufficient or insufficient involvement of local communities, divided into two groups based on whether participants considered the involvement sufficient or insufficient.

Table 12 Comments provided in the 'Other' section of Interview Question 2b.

2b) Option "other", n = 16		
Category name	**Description**	**Occurrence**
Motivation	People are generally motivated for the projects	5
Fire Prevention	The projects help to stop bushfires	3
Money	Local populations are mainly motivated by financial compensation	3
Lack of local Involvement	The local communities are not sufficiently included	3
Fire events	There are still events of bushfires	2

In the "Other" category, several participants noted that members of local communities are generally motivated. This statement was made in four out of five cases by participants belonging to the "yes" group. Similarly, the argument that projects contribute to preventing bushfires was exclusively mentioned by this group. In contrast, participants in the "no" group emphasized the continued occurrence of fire events. People from this group also indicated that local communities are not sufficiently involved. The view that local communities are primarily motivated by financial incentives was mentioned by participants from both groups.

Question 2c: How is the involvement of local community for each stage of the project?

The overall analysis showed that the perceived local community involvement differed significantly across project stages (see Fig. 32). A post hoc test indicated that involvement was rated significantly lower in the Representatives and Decision-making stages compared to the Implementation, Maintenance, and Labor stages. While no significant differences were found among the Implementation, Maintenance, and Labor stages, involvement was rated significantly lower in the Decision-making stage than in the Representatives stage.

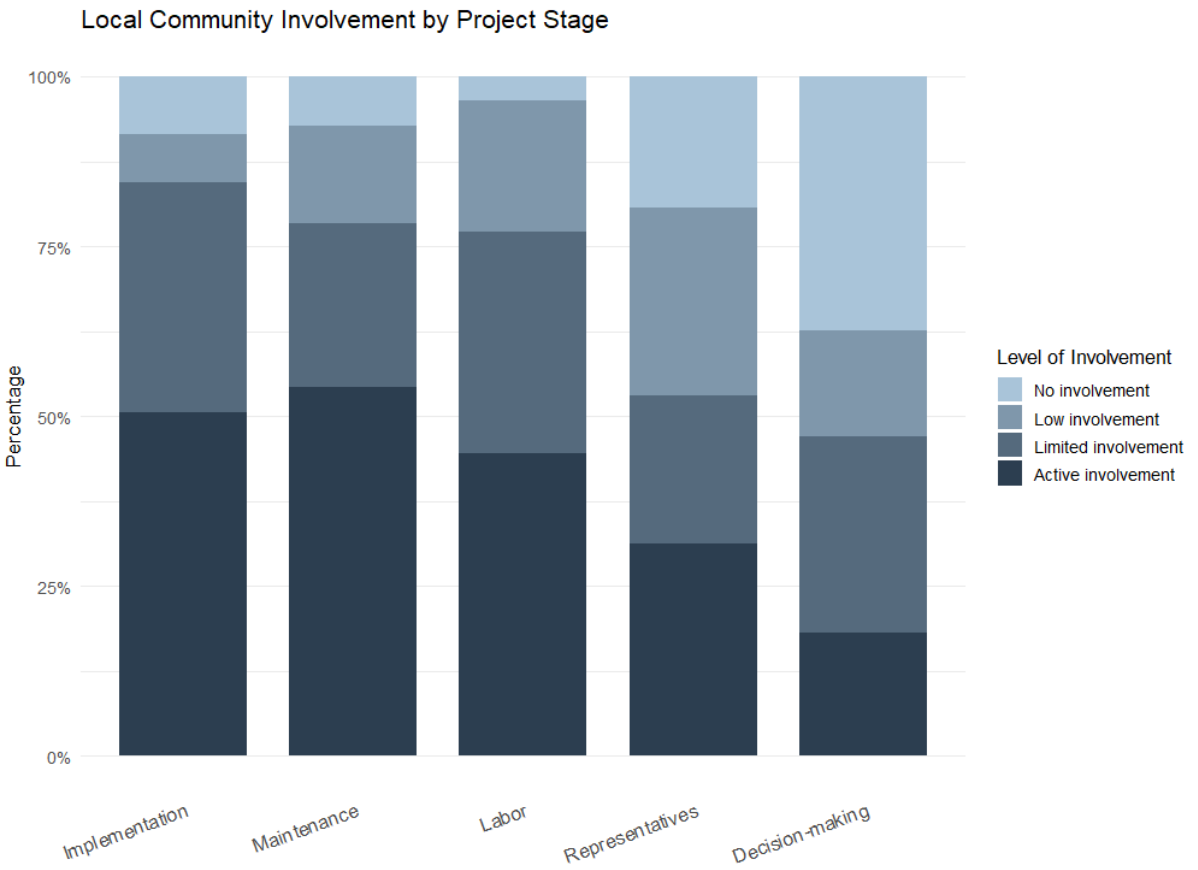


Figure 32 Distribution (in %) of perceived project involvement of local communities per project stage.

The group comparisons revealed no significant differences in perceived involvement based on village, gender, and age group, and also between the “yes” and “no” groups from Question 2a no significant difference could be detected.

Question 10b: To what extent are the following groups involved in the planning of restoration projects?

In the overall statistical analysis, it was examined whether there are significant differences in project involvement between specific groups within the following categories: gender, land ownership, as well as responsibility within the community. Project involvement was measured on a scale from 1 (not involved at all) to 5 (very strongly involved).

In the Gender category, a significant difference in perceived involvement was observed (see Fig. 33). While the mean perceived involvement for women was 3.48 (median = 3), men reached a mean of 4.2 (median = 4), indicating the perception that men are significantly more involved than women.

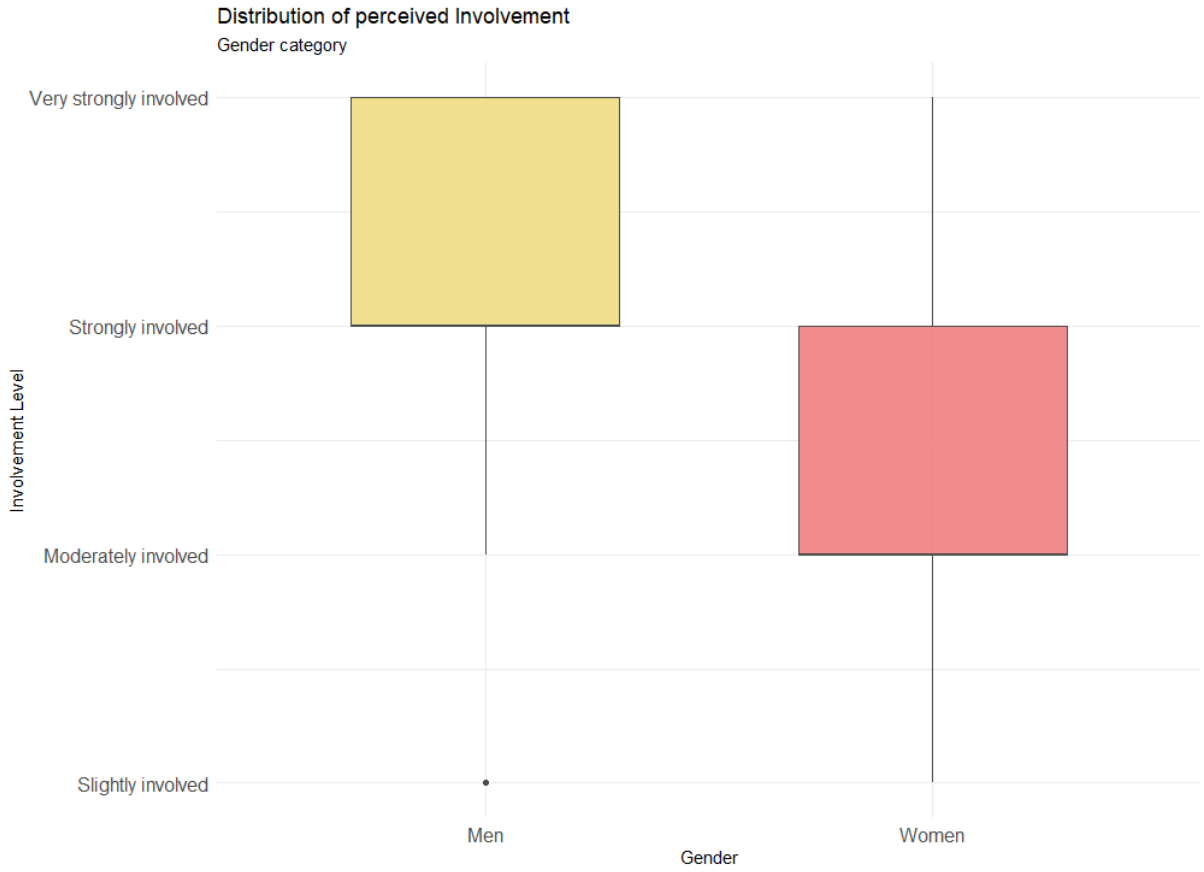


Figure 33 Perceived involvement rates of men and women from local communities in tree-based restoration projects.

The perceived involvement of different landowner types also showed significant differences (see Fig. 34). People not using land (mean = 2.73, median = 3) were perceived as significantly less involved than landowners (mean = 3.91, median = 4). Other landowner types had means ranging from 3.23 to 3.45, placing them in the middle.

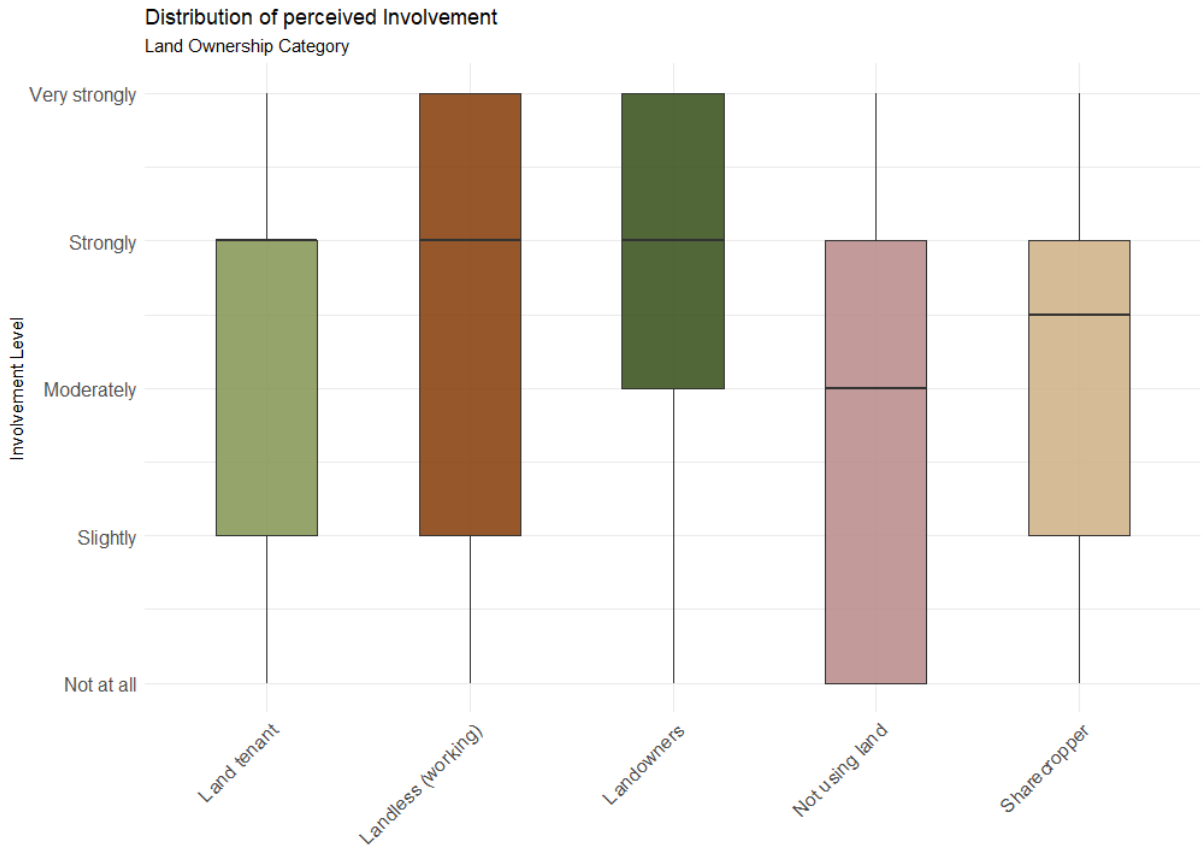


Figure 34 Perceived involvement rates of people from different land ownership categories in tree-based restoration projects.

In the category Community Responsibility, a statistically significant difference was detected (see Fig. 35). Farmers (mean = 4.46, median = 5) and conservationists (mean = 4.18, median = 5) were rated as especially involved, whereas other roles such as teachers, scientists, entrepreneurs, private sector actors, funding agencies, or law enforcement had means under 3.61. However, it should be noted that all these lower-ranked groups (except teachers) were rated by less than half of the interview participants, as many chose the option "I don't know." Groups with intermediate involvement, with very similar means over 3.9 and under 4, included environmental organizations, environmental educators, and the local government.

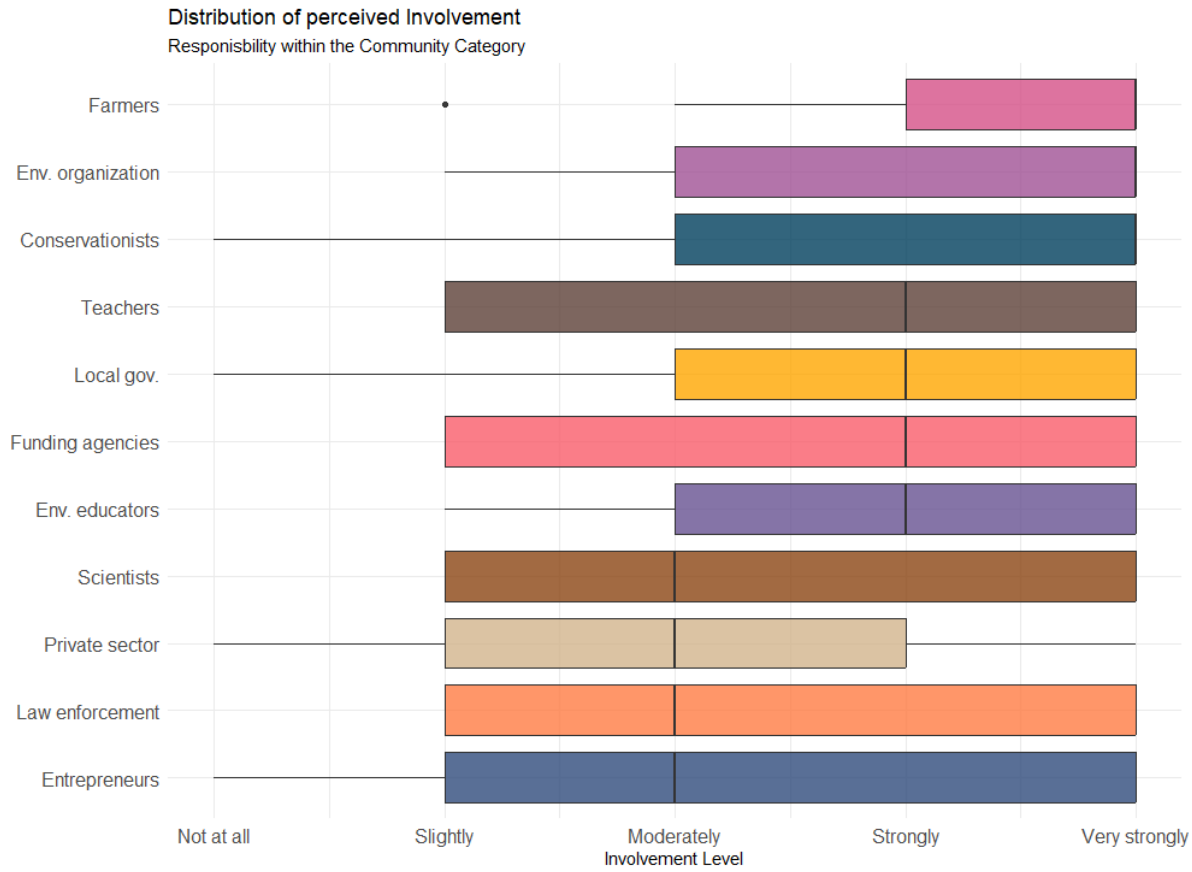


Figure 35 Perceived involvement rates of people with different responsibilities within the community in tree-based restoration projects.

It was also analyzed whether women and men rated the gender groups differently. Statistical testing indicated that there is no significant difference in the rating behavior between the two groups. However, the absolute numbers show that female respondents rated the involvement of women and men slightly higher (women's mean = 3.63, men's mean = 4.22) than male respondents (women's mean = 3.41, men's mean = 4.19).

5.5 Analysis of the remaining Interview Questions

Question 1a: How many ecosystem restoration projects are there in your area?

Varying numbers of restoration projects were reported (see Fig. 36). In both villages, some participants stated that no projects existed, while others reported several. In Ankorefo, one respondent mentioned up to seven projects, whereas in Morarano the maximum reported number was three. The mean number of projects mentioned is similar in both villages but slightly higher in Ankorefo (A = 2.27; M = 1.85), while the median is 2 in both cases. A statistical test was conducted to assess whether the reported number of projects differed between the villages. The resulting p-value of 0.211 indicates that there is no statistically significant difference. The test examining whether the reported number differs depending on how long people have lived in the respective village showed that the mean (m) of the following groups: 0–5 years (m = 1.93), 6–15 years (m = 2.24), 15–20 (m = 2.29) years, and more than 30 years (m = 2) do not differ statistically.

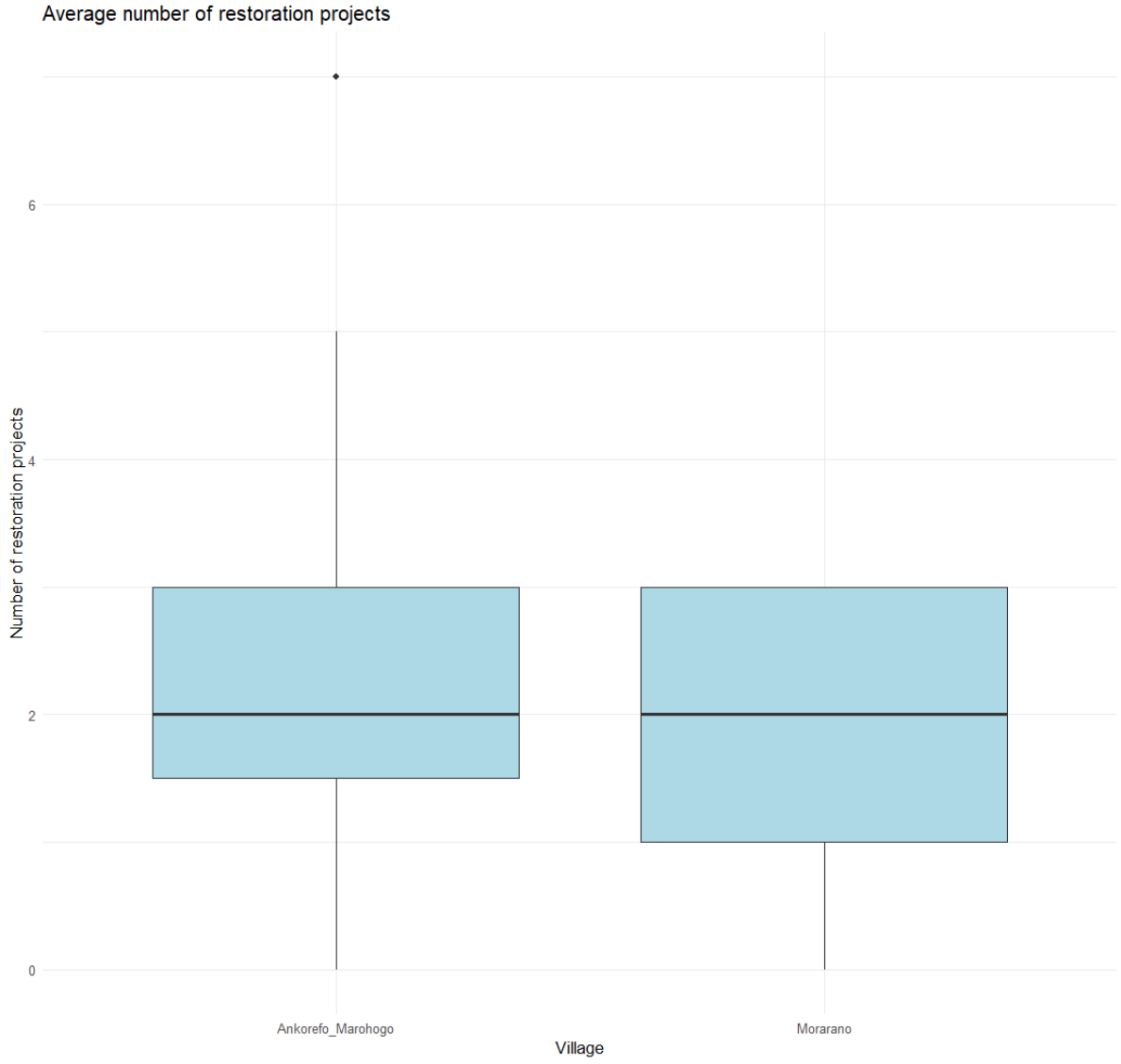


Figure 36 Boxplots showing the distribution of reported numbers of projects in the two villages Morarano and Ankorefo.

Question 4a: Do you have a clear contact person for asking questions or getting updates on the restoration projects?

The statistical analysis of the overall responses showed that the option “No clear contact person” was selected more often than expected (69%), while the option “Contact person available only at the municipal or regional level” was selected less often than expected (6%) (see Fig. 37). No statistically significant differences were found in the group comparisons.

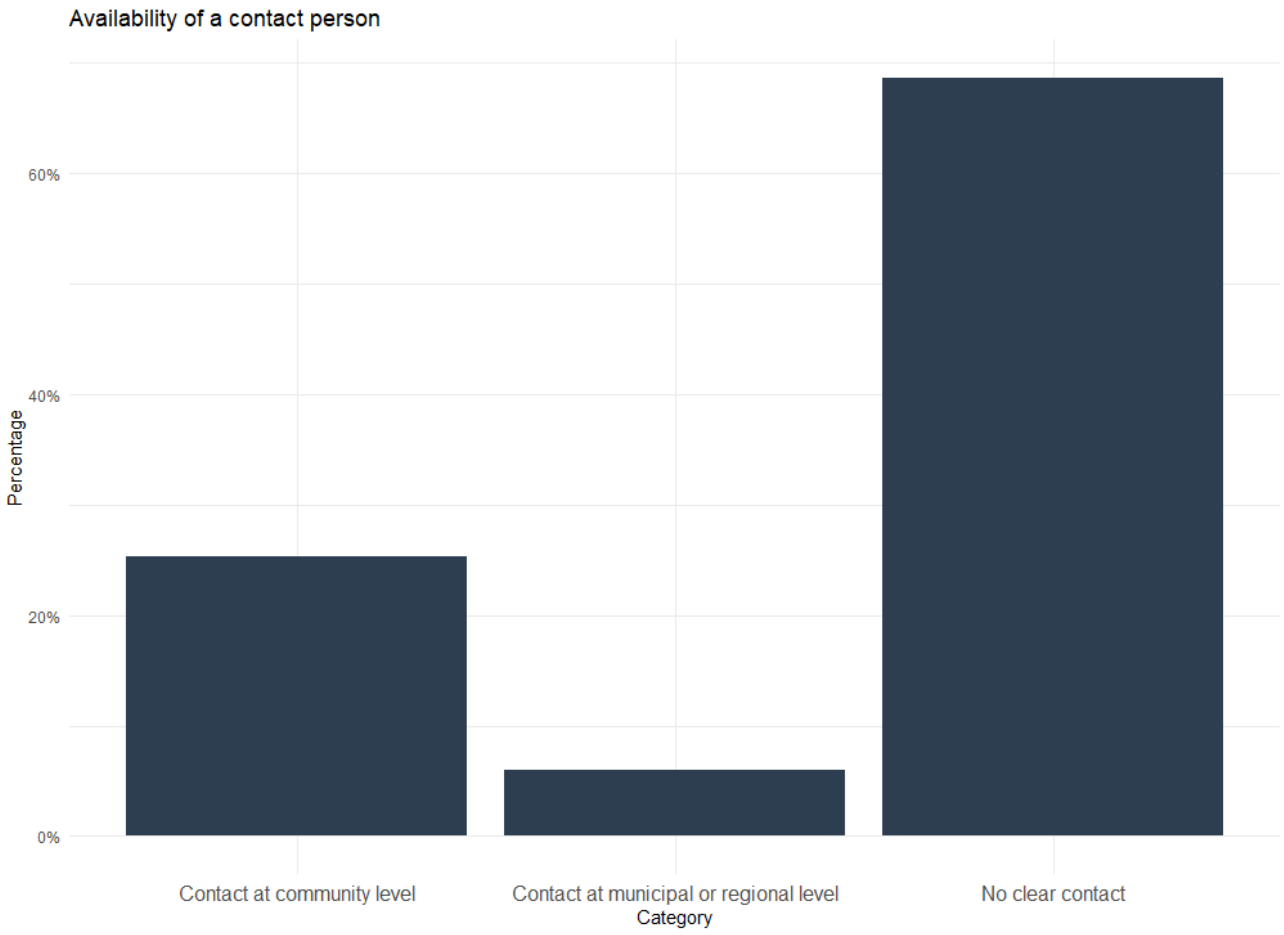


Figure 37 Distribution (in %) of participants’ perceptions of the availability of a contact person.

Question 4b: How often are you informed about the restoration projects?

In this case, the statistical analysis of the overall responses indicates that the option "No clear communication mechanism with the community" was with 41% selected significantly more often than expected. The second most chosen option was "only during field activities" with only 18.1%, while the least chosen option was "Regular basis" with 13.3% (see Fig. 38). In the group comparison of gender, village, age, and income source, no significant differences could be found between the respective groups.

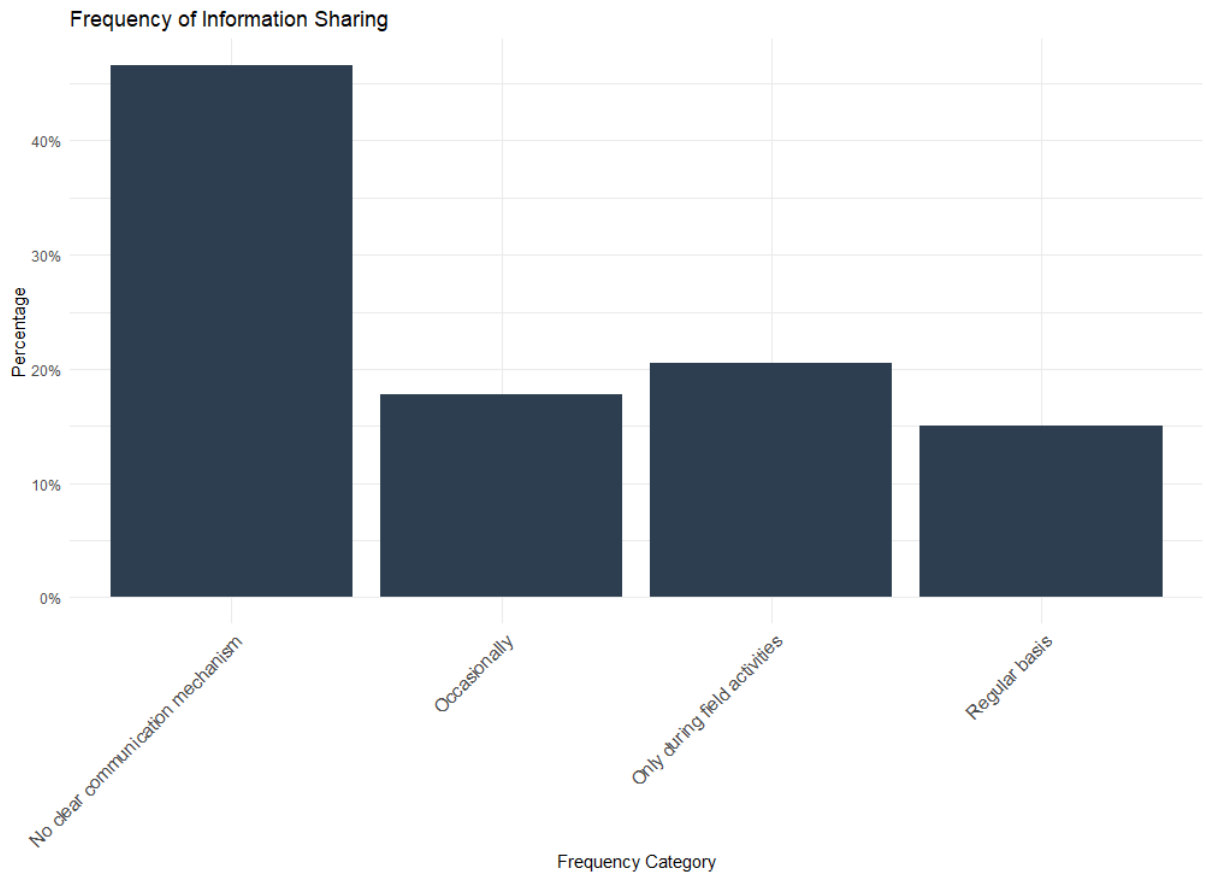


Figure 38 Distribution (in %) of participants' perceptions regarding how frequently they are informed about the projects.

Table 13 Comments provided in the 'Other' section of Interview Question 4b.

4b) Option "other", n = 10		
Category name	**Description**	**Occurrence**
No Information	The people don't get informed at all	5
No Knowledge	They don't know	2
Improved Strategy	Improvement of the governance strategy for completed projects	1
Only twice	Information about the projects is only given twice	1
Information from the Staff	Information provided by the staff involved in this project.	1

In the "Other" section, some participants mentioned that they get not informed at all, which further reinforces the previously mentioned finding.

Question 5a: Are you aware of the national restoration strategies?

The overall analysis shows that the options "Good awareness of national strategies" and "Limited dissemination of national strategies at the local level" both chosen in 10.8% of the cases, were selected significantly less often than expected, whereas the option "No knowledge of national strategies" which was selected in 43.3% of the cases was selected significantly more often than expected (see Fig. 39). The group comparisons revealed no statistically significant differences between the different gender, village, age, or source of income groups.

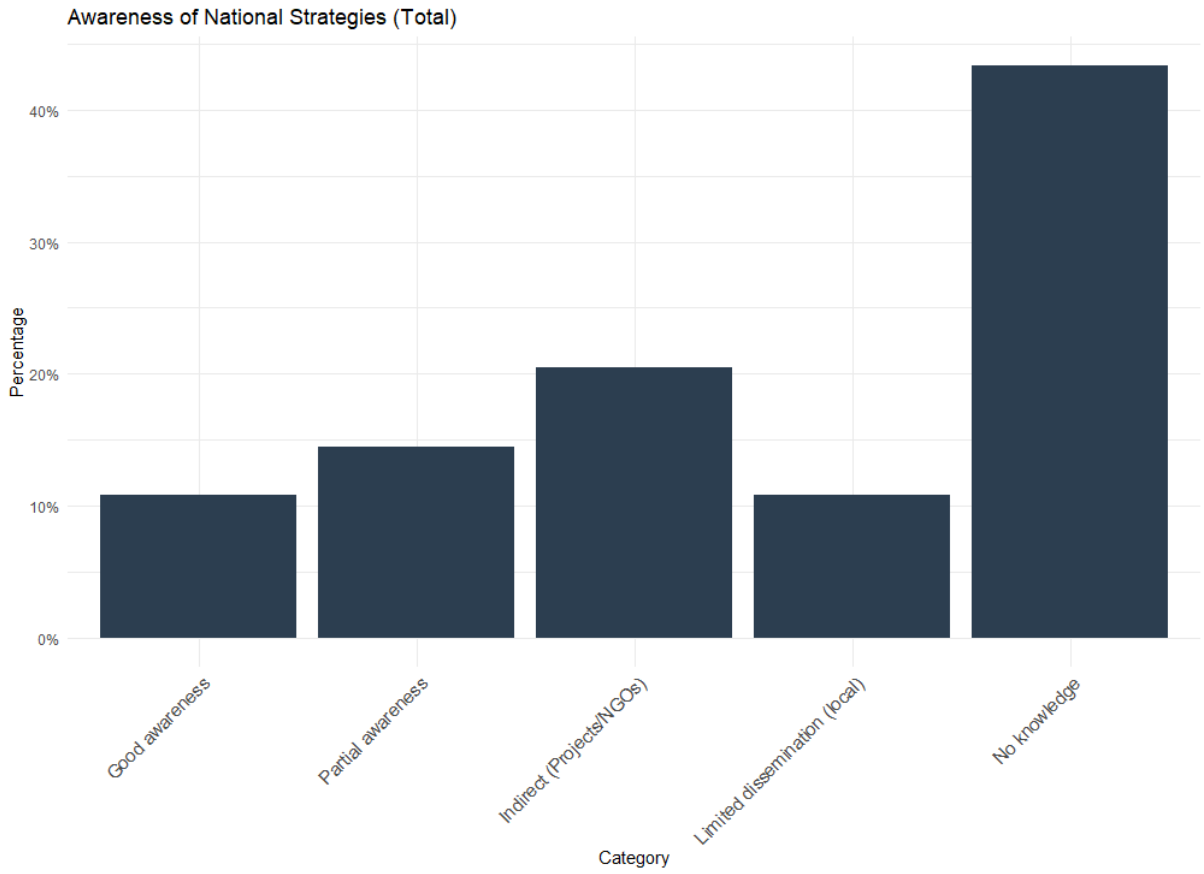


Figure 39 Distribution (in %) of participants' perceptions regarding their awareness of national strategies.

Question 6a: What obstacles can prevent the success of restoration?

The overall analysis shows that the obstacle "Short-term projects without long-term follow-up" was with 57.8% selected significantly more often than all other options, except for "Lack of coordination among stakeholders." In contrast, the obstacle "Land tenure insecurity" was with 9.6% selected significantly less often than most of the other options (see Fig. 40).

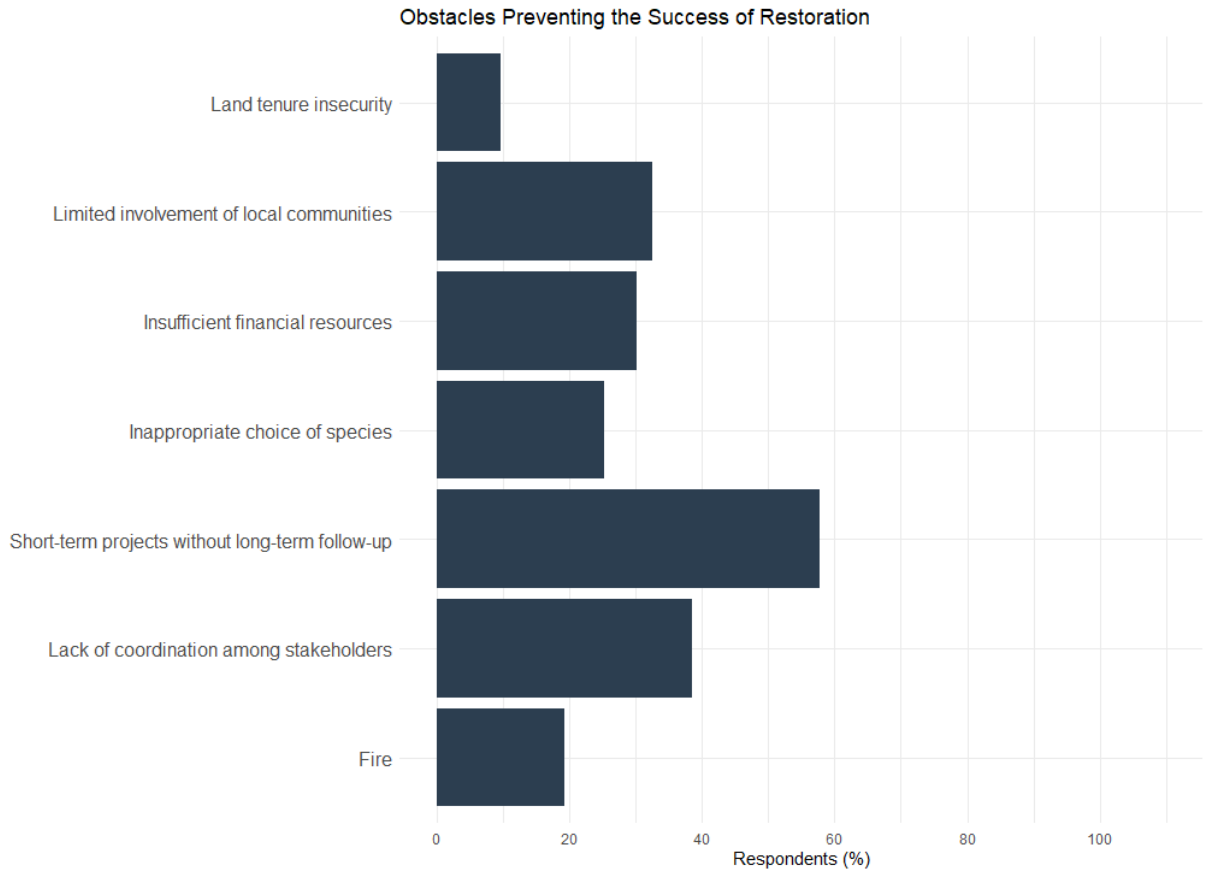


Figure 40 Distribution (in %) of participants' perceptions regarding obstacles preventing the success of tree-based restoration projects.

In the statistical analysis of the gender and village comparison, no statistically significant difference was found. In the age comparison, a nearly statistically significant difference was found for the option "Limited involvement of local communities," with older participants selecting this option more frequently. This pattern is also reflected in the bar chart (see Fig. 41). In the income source group comparison, a statistically significant difference was identified for the obstacle "Insufficient financial resources". However, the differences among the four main income groups are minimal (see Fig. 42).

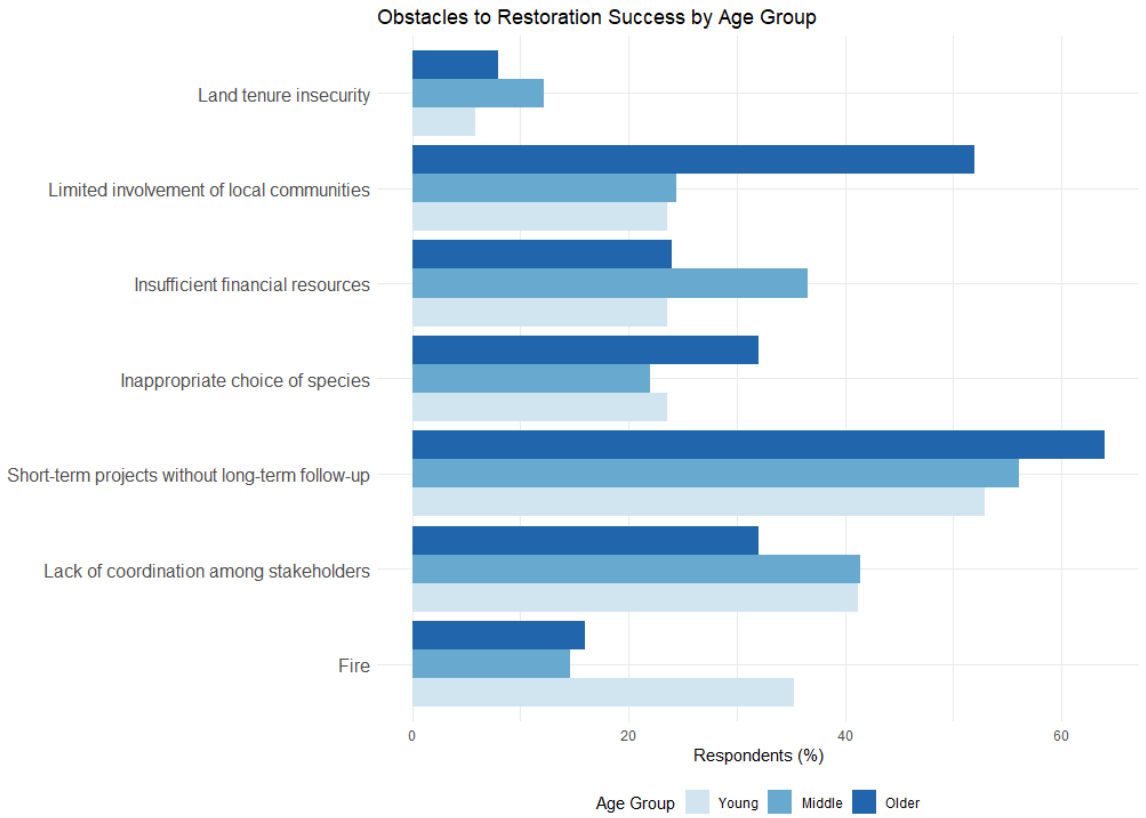


Figure 41 Comparison of the distribution (in %) of perceived obstacles to restoration selected by participants from different age groups.

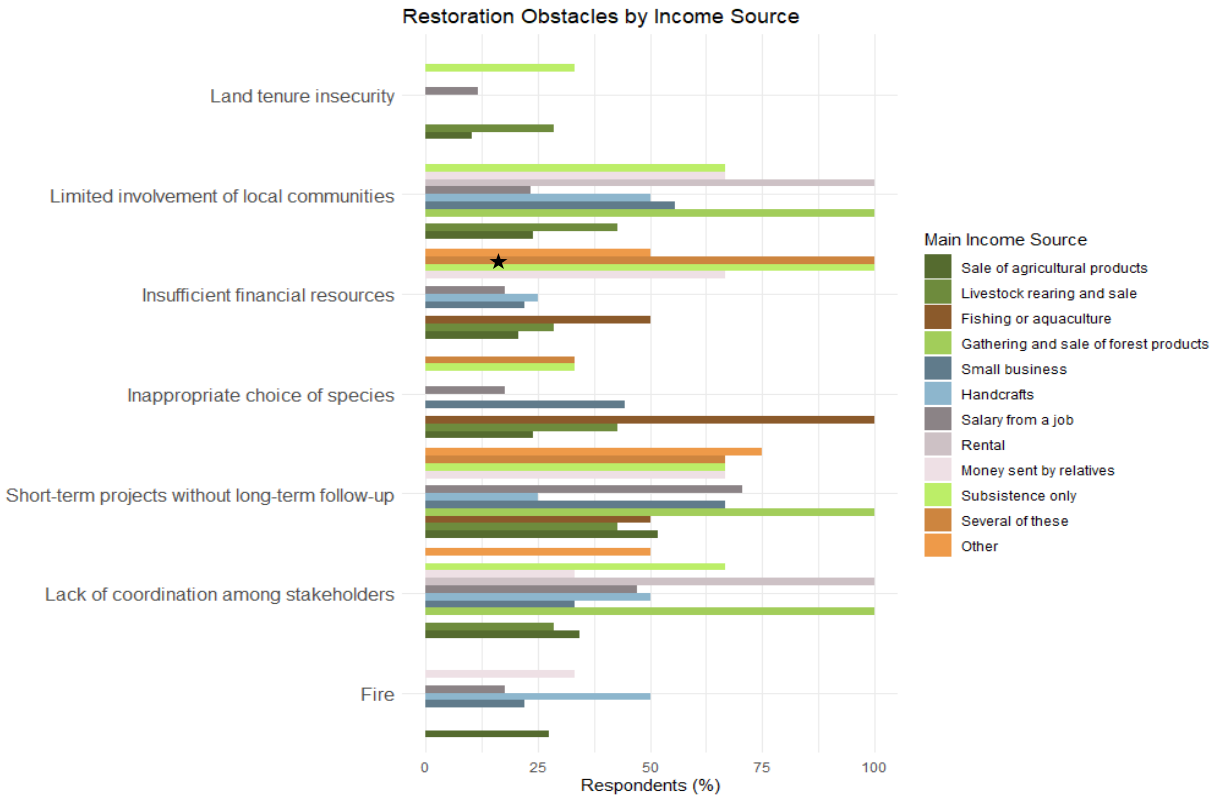


Figure 42 Comparison of the distribution (in %) of perceived obstacles to restoration selected by participants from different income source groups.

Table 14 Comments provided in the 'Other' section of Interview Question 6a.

6a) Option "other", n = 9		
Category name	**Description**	**Occurrence**
Lack of Information	Local people don't get informed about project benefits	2
Unsuitable Planting	Plants are planted at the wrong time, or are unsuitable	2
Insecurity	Insecurity	1
Water Shortage	There is no water	1
Lack of Monitoring	Lack of monitoring and evaluation	1
Incompetent Manager	The manager on site despises the employees and does not know how to manage money.	1
Deforestation	Deforestation in general	1

In the "Other" section, the inappropriate choice of species and incorrect planting time were again mentioned by two participants. Additionally, limited involvement of local communities was further emphasized, with two participants stating that local people are not adequately informed about the benefits of the projects.

Question 6b: What are your recommendations to ensure restoration is successful?

The overall analysis shows that the recommendation "Strengthen land tenure security" was with 18.1% selected significantly less often than the three most frequently chosen recommendations. In contrast, the results indicate that "Improve community participation" (61.4%) and "Establishing long-term monitoring mechanisms" (61.4%) were selected significantly more often than most of the other options (see Fig. 43).

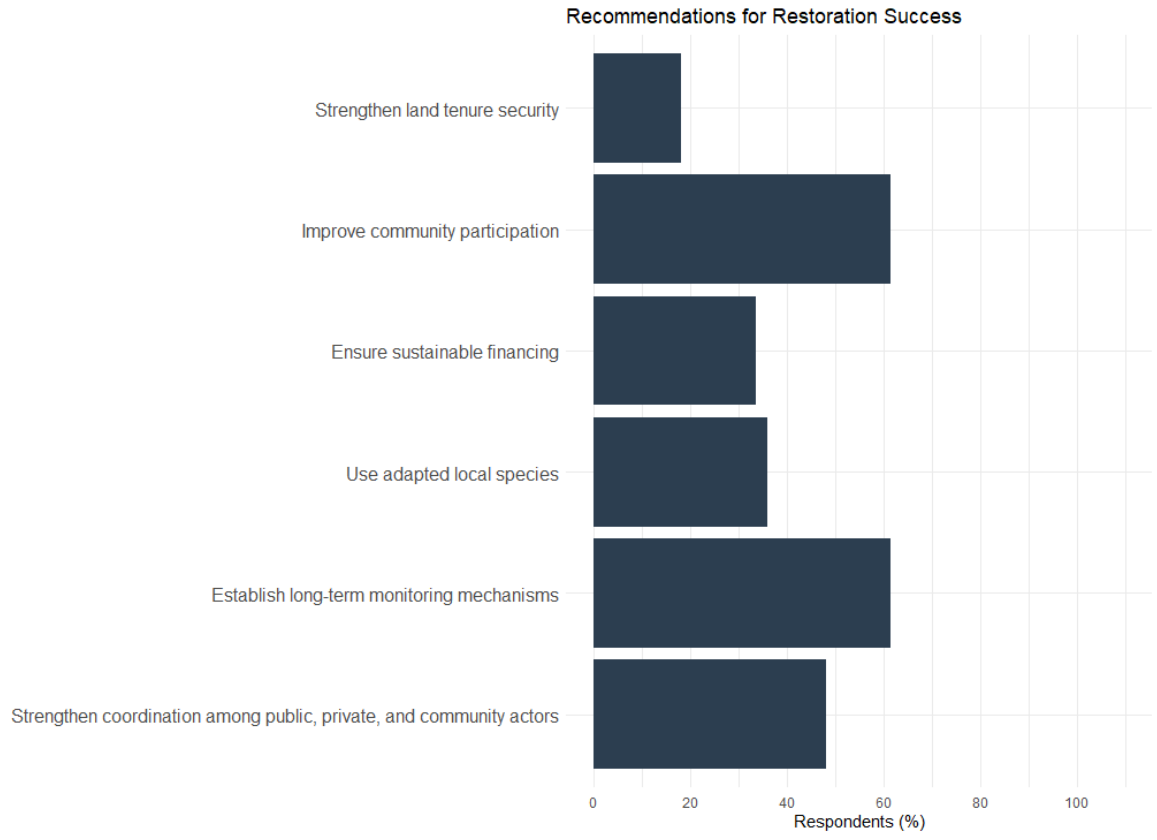


Figure 43 Distribution (in %) of participants' recommendation for restoration success.

In the group comparisons, no statistically significant difference could be found among the different villages and the age groups. The gender comparison showed a nearly significant difference for the recommendation "Establishing long-term monitoring mechanisms", which was more often chosen by men. This difference is also visible in the bar chart (see Fig. 44), which shows that all options were selected more frequently by men, suggesting that men provided more recommendations overall.

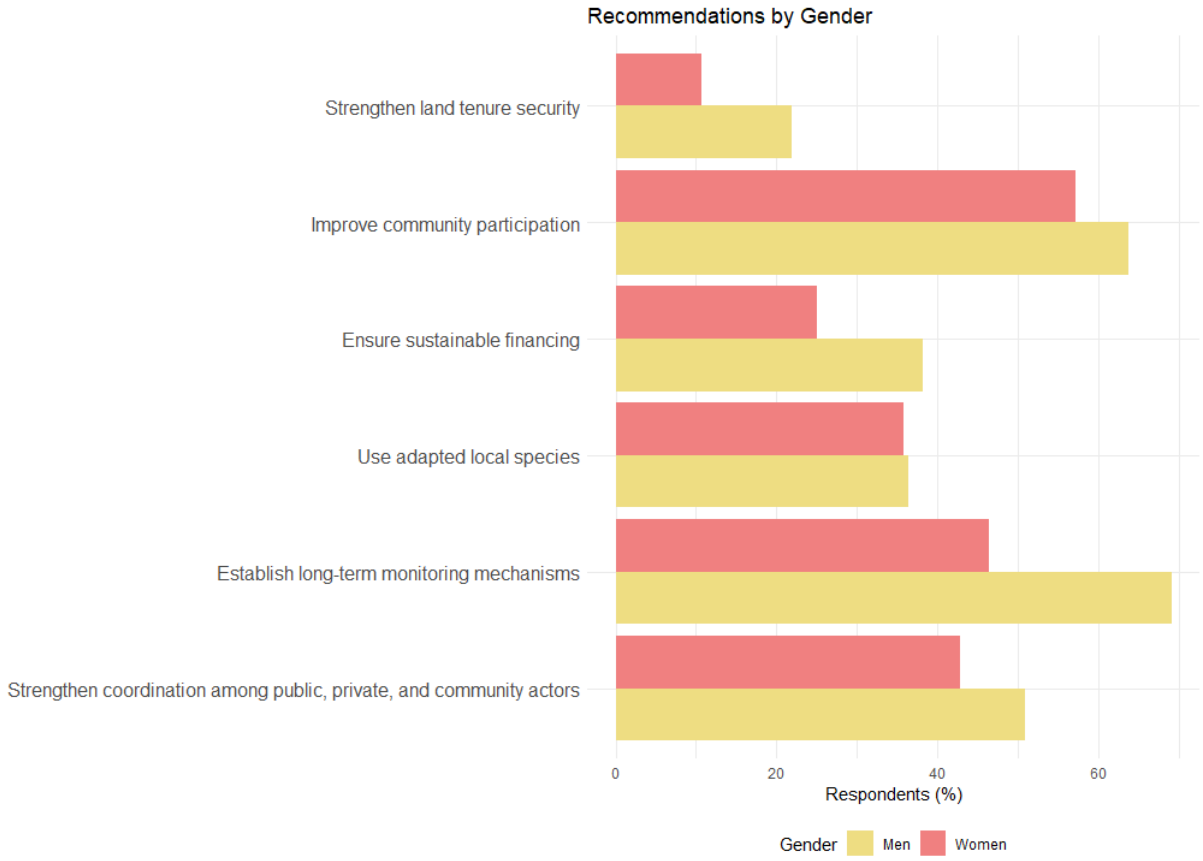


Figure 44 Comparison of the distribution (in %) of men and women's recommendations for restoration success.

In the income group comparison, the only statistically significant difference was observed for "Use adapted local species", which was selected more frequently by participants with small businesses and rarely by those with salaried employment (see Fig. 45).

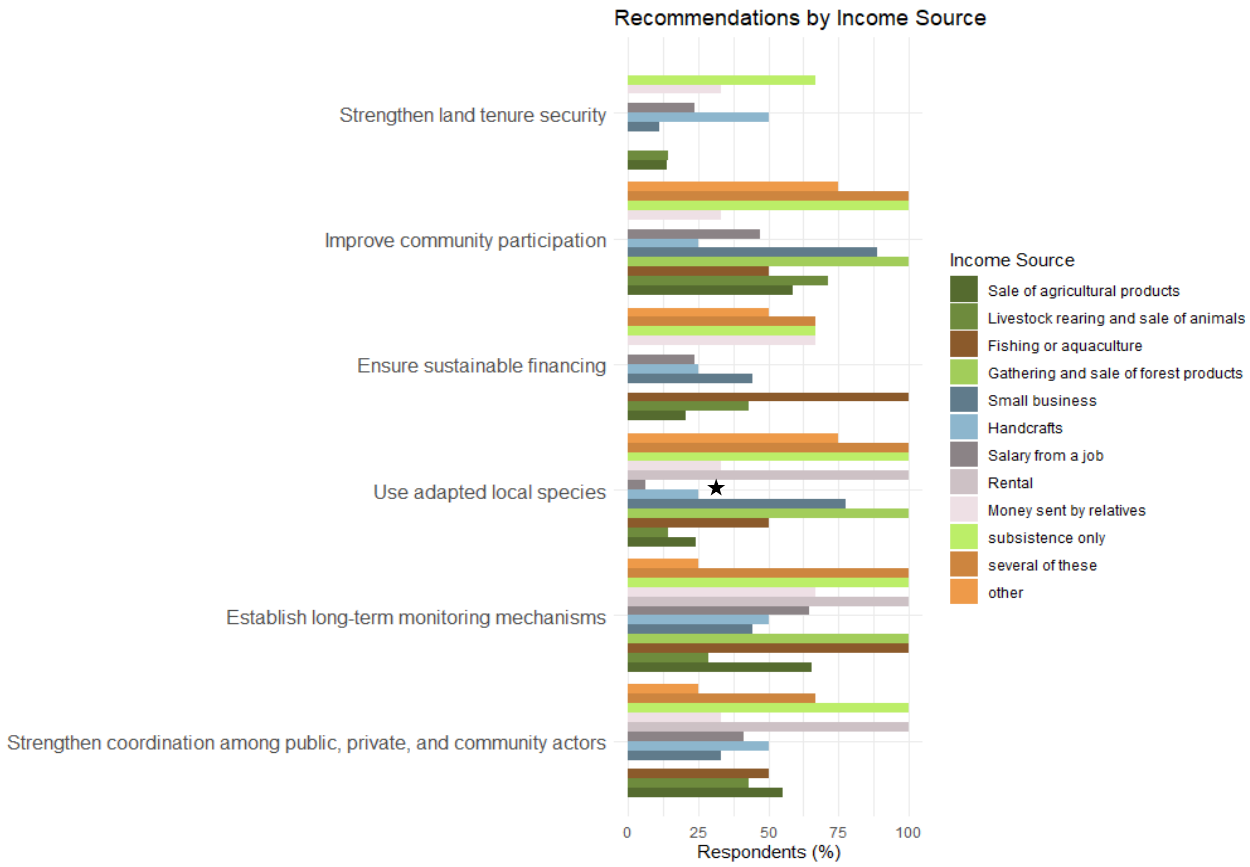


Figure 45 Comparison of the distribution (in %) of restoration success recommendations among participants from different income source groups.

Table 15 Comments provided in the 'Other' section of Interview Question 6b.

6b) Option "other", n = 24		
Category name	**Description**	**Occurrence**
Inclusion, Information & Training	Enhanced inclusion, information and training for the local community	7
Stop Fire	Take action or pass on information to prevent bushfires	5
Better Monitoring	Strengthening of the monitoring system	3
Strengthen the forest	Plant & distribute and protect suitable trees	3
No Knowledge	I don't know	1
Continuity	Continuity of existing projects	1
Corruption	Avoid corruption through projects	1
Preliminary Study	Preliminary Study	1
Water Scarcity Solution	Search for solutions to water scarcity	1
Income Generation	Income-generating offers for local community	1
Restore cohesion	Cohesion must be restored	1

The "Other" section shows that many participants further emphasized the importance of informing local communities, providing training opportunities, and generally involving them more. Another frequently mentioned recommendation was the need to stop and prevent bushfires as a key step toward successful restoration. Additionally, the recommendations to plant suitable species and to strengthen long-term monitoring mechanisms were each further emphasized by three additional comments in the "Other" section.

5.6 Further Comparisons

The statistical analysis of the correlation of question 9 and 5b was successful. The significant p-value indicates that participants who think that the priorities of local communities and other actors involved in tree-based restoration projects are mostly or totally aligned tend to think also that their priorities are well considered in the project strategies (see Fig. 46).

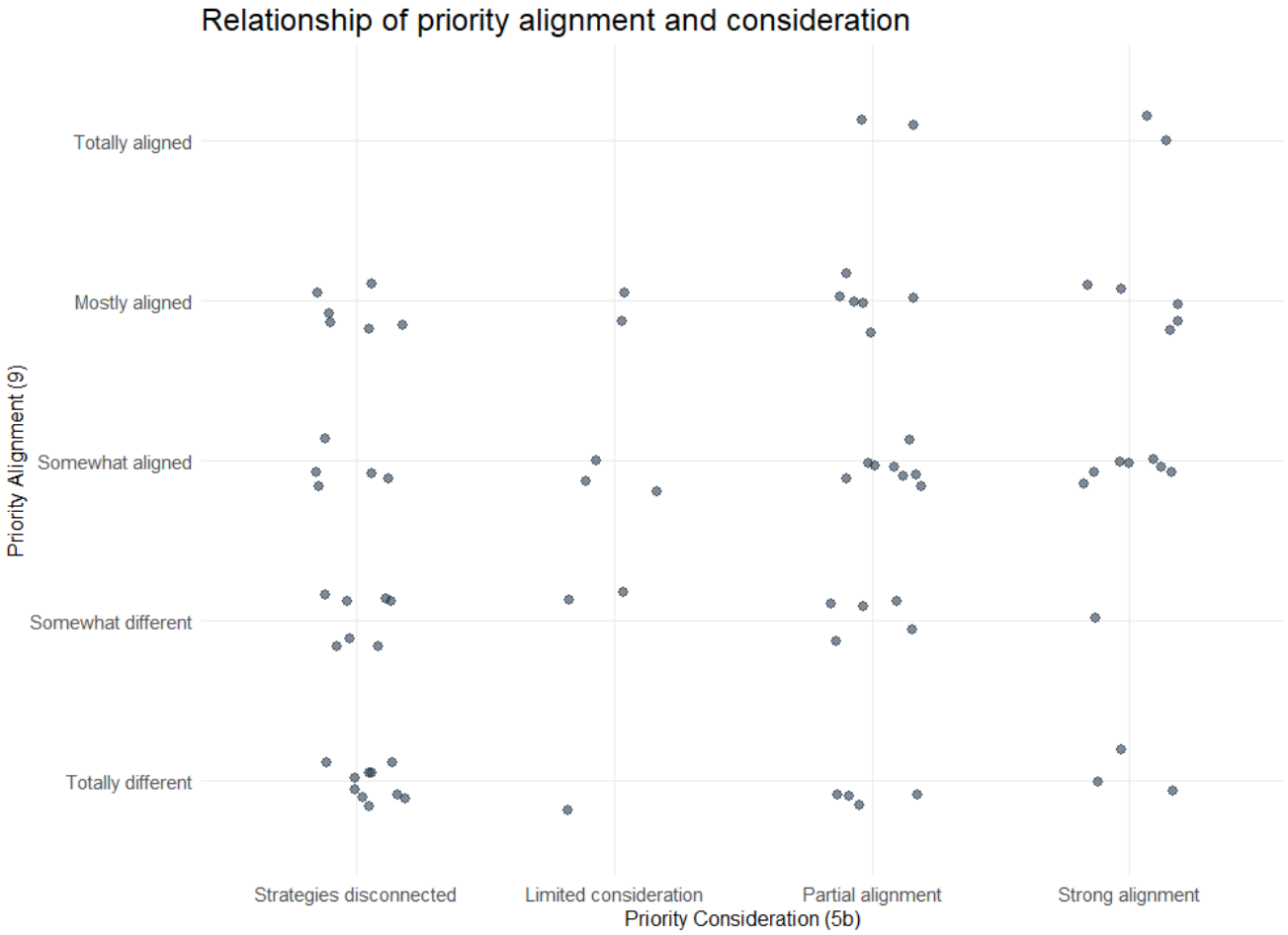


Figure 46 Visualization of the test results examining whether participants who perceive the priorities and goals of other actors to be aligned with those of local communities also tend to report that the priorities of local communities are strongly considered in tree-based restoration projects

5.7 Observation

In Morarano, nine interviews were observed, including three women and six men; in Ankorefo, 26 interviews were observed, with ten women and 16 men. In both villages, approximately two-thirds of respondents (Morarano: 7 of 9; Ankorefo: 18 of 26) answered the questions with a high degree of confidence, whereas about one-third appeared more reserved, shy, and quiet.

In Morarano, the proportion of respondents who became somewhat louder and appeared angry and emotional (2 of 9) was slightly higher than in Ankorefo, where this applied to 5 of 26 respondents. It is noteworthy that slightly less than half of the female respondents (5 of 13) displayed rather reserved behavior, compared to less than one quarter of the male respondents (5 of 23). Respondents who appeared angry or emotional, for example, by raising their voice, displaying dissatisfaction, or both, were almost exclusively male (6 of 7).

In four cases, spouses intervened in the interviews. In some instances, the wife assumed the leading role, while in others, the husband did so. Overall, these observations suggest that there were no substantial differences between the two villages; however, responses varied somewhat by gender. It is also notable that the majority of respondents who reacted in a heated, angry, and emotional manner were estimated to be over 60 years of age in 5 out of 7 cases.

6. Discussion

6.1 Interpretation of the Results

The results indicate that restoration projects were already present in both villages. When asked about the number of projects in their village, participants reported a wide range of responses, from one to seven projects. Initially, an association between the reported number and the length of time participants had lived in their respective villages was assumed. However, statistical testing did not support this assumption. Further, there was no substantial difference between the mean values of the two villages, and according to a fellow researcher from Madagascar (oral information), similar projects were implemented in both locations. This simplifies the analysis of the total responses, as the two villages Ankorefo Marohogo and Morarano appear to have similar initial conditions.

Sub-Question 1: Which ecological, economic, and social outcomes of restoration projects are most valued by local communities?

Multiple interview questions addressed the first sub-research question. As question 1b (asking about the steps required to carry out restoration projects) partially overlaps with questions 7a and 7b (focusing on preferred restoration outcomes and personally important NCPs), the responses were analyzed both separately and comparatively. Comparisons revealed that the results of question 7a sometimes did not correspond with those of question 1b or 7b. Specific cases in which this occurred are discussed in other sections of this sub-chapter. Since participants in question 7a were required to select the three most important outcomes within each category, even though only four to six options could be selected, they may have been forced to choose options they did not necessarily value. Consequently, this may have distorted the results, even though the analysis primarily focused on the most frequently selected responses. For this reason, in cases of inconsistency, the results from question 1b and 7b are given greater weight and are considered as more representative.

Regarding ecological aspects, participants mainly prioritized practical considerations such as the use of locally adapted species and participatory monitoring. The literature likewise emphasizes that the selection of appropriate tree species and participatory monitoring are both crucial for the success of tree-based restoration projects (Brancalion & Holl, 2020). However, some authors point out that certain tree-based restoration projects tend to promote fast-growing exotic species, such as Eucalyptus or Acacia, which primarily serve short-term economic objectives and therefore provide limited long-term benefits for both the environment and local communities (Osborne et al., 2021). In Madagascar, this has already led to the displacement of native species (Culbertson et al., 2022). Participatory monitoring is important as it supports social learning, adaptive management, collaboration, and improved natural resource management (Brancalion & Holl, 2020). In practice, however, monitoring is often conducted by external actors (Shelton et al., 2024), resulting in the frequent exclusion of social impacts from monitoring processes (Elias et al., 2022). It is likely that recent events further influenced this interview result. In Morarano, residents recently experienced a case in which a project planted tree species on their land that the local population did not consider useful or appropriate. This issue was repeatedly mentioned throughout different parts of the interviews. However, as this step was not significantly more often chosen and not exclusively mentioned by people from Morarano, it appears to be a general challenge. Also, the lack of monitoring was mentioned in multiple parts of the interviews. Consequently, the interview findings as well as the literature indicate that participatory monitoring and the use of locally adapted species are often insufficiently addressed (Elias et al., 2022; Osborne et al., 2021; Shelton et al., 2024), which may explain why participants identified them as important steps.

Long-term maintenance of restored areas, enhanced air and water quality, and climate regulation emerged as the most important outcomes in the sustainability and environmental categories of question 7a and b. Long-term maintenance is connected to the apparent importance of participatory monitoring, as projects that empower local communities to plan, implement, and monitor tree planting activities themselves reduce dependence on external support and thereby help to ensure long-term engagement (Brancalion & Holl, 2020). A common problem is that local people are often hired to maintain restored areas in whose planning they had little involvement. Once this employment ends, maintenance is no longer financially supported, often reducing motivation and forcing communities to seek other income-generating activities. This undermines the long-term success of the projects (Herbohn et al., 2022). Since long-term maintenance is apparently often not ensured in practice, it is understandable that local communities identified it as an important need, especially when they are expected to adapt to new regulations or invest considerable effort at the beginning of a project. In the sustainability category, "Resilience to climate change" was the least chosen outcome, while "Climate regulation" was the second most frequently selected regulating NCP. This contradiction suggests that participants attached greater importance to maintaining a regulated climate than to increasing resilience to climate change through different adaptation measures. Studies from Madagascar show that local communities are highly exposed to the impacts of climate change (Favretto et al., 2020). Droughts and crop damage caused by extreme rainfall events frequently lead to harvest failures, which in turn contribute to food insecurity (Favretto et al., 2020). Water scarcity and food shortages were also mentioned by most participants in the first part of the interviews. Both the literature and the interviews therefore illustrate how strongly local communities in Madagascar are affected by climate change and how their basic needs are increasingly threatened by its impacts (Favretto et al., 2020). Consequently, it is not surprising that climate regulation is considered particularly important by participants. The low ranking of "Resilience to climate change" could reflect differing perceptions regarding the value, feasibility, or effectiveness of adaptation measures to increase resilience, maybe because of past experiences. Nevertheless, the forced-choice bias of question 7a could also be an explanation.

Next to climate regulation, air- and water-quality were most valued among the regulating NCP. "Regulation of air quality" was the most chosen regulating NCP. The literature emphasizes that air quality is an important regulating NCP and a frequently mentioned reason for tree-based restoration projects (Brancalion & Holl, 2020). However, literature also states that local communities tend to place greater importance on regulating NCP that are directly linked to their well-being and everyday livelihoods, such as water availability or soil fertility (Shelton et al., 2024). The NCP "Regulation of freshwater quality" was, together with "Regulation of climate", the second most chosen option and therefore partly represents these findings in literature. In contrast, "Regulation of soil fertility" ranked sixth out of eleven and "Regulation of freshwater quantity" ranked eighth. It is therefore somewhat unexpected that air quality was selected among the top three regulating NCP by many participants. However, several participants mentioned in multiple comment sections of the interview that forest fires must be contained. Emissions from forest fires can drastically reduce air quality, posing significant health risks to local communities (Sommers et al., 2014). A study conducted in Madagascar found that local communities perceive forests as essential for maintaining good air quality and consequently, for supporting human well-being (Kari & Korhonen-Kurki, 2013). This suggests that air quality is also directly linked to well-being and therefore, consistent with the findings in the literature, even if it wasn't explicitly mentioned. Interestingly, the NCP "Regulation of freshwater quantity" as well as the environmental outcome "Protection of water sources" of 7a were ranked relatively low, while the "Regulation of freshwater quality" was the second most chosen regulating NCP. This is particularly surprising because protecting water sources could also contribute to improved water quality (Brancalion et al., 2019). One reason for this inconsistency might again be the forced-choice bias. Nevertheless, this does not explain the different rankings of water quality and water quantity, especially because most participants indicated that they experience water

shortages for at least two to twelve months annually. One explanation could be that participants did not want to choose two out of three options that were both related to water, but this still does not explain why quality was rated substantially higher than quantity. Water quality in Madagascar and also particularly in the Boeny Region, is often classified as inadequate and is therefore considered a serious health risk (Szopińska et al., 2024). It is possible that participants have previously experienced infections or diseases caused by contaminated water and therefore place particular importance on water quality. Interestingly, the NCP "Regulation of freshwater quantity" was selected more frequently by women. This may be related to traditional gender roles in household labor, where women are often primarily responsible for cooking and collecting water (de Siqueira et al., 2021), potentially leading to a closer relationship with water availability and daily water use.

Regarding environmental aspects, the restoration of degraded land was highly prioritized, whereas biodiversity conservation and protection was the least valued outcome. The low ranking of biodiversity protection and conservation is consistent with the findings in the literature which emphasize that external actors in tree-based restoration projects often prioritize biodiversity protection, whereas local communities tend to value outcomes with more direct impacts on their everyday lives and issues (Shelton et al., 2024). Regarding the desire of local communities to restore degraded land in Madagascar, only limited evidence could be found in the literature. On the contrary, several studies describe that land considered by conservationists to be a degraded forest landscape may still be perceived as valuable agricultural land or useful grazing areas for cattle by local communities (Löfqvist et al., 2023; Rakotonarivo et al., 2023). Furthermore, the classification of land as degraded is often described as a justification for state-led land grabbing (Sijapati Basnett et al., 2017). Consequently, it is somewhat unexpected and contrasting to the literature that this aspect was the most frequently selected outcome, while other benefits, such as "Improved soil fertility", were ranked lower.

The classification of land as degraded can have important implications for land rights and access to land (Rakotonarivo et al., 2023; Sijapati Basnett et al., 2017), linking it directly to the next category of question 1b: land tenure. In this section, formal agreements and improved land tenure security were among the most highly prioritized governance-related outcomes. The step "Formal agreement with the local community" was selected by nearly 80% of participants and was therefore chosen considerably more often than all other aspects. Numerous studies confirm that this aspect is often not sufficiently achieved in tree-based restoration projects (Bodonirina et al., 2018; Dawson et al., 2024; Ranjatson et al., 2019; Sijapati Basnett et al., 2017). Participants also mentioned a lack of communication and early consultation in other parts of the interviews, particularly in the social category of question 1b, where "Prior and inclusive consultation" was the most frequently selected step. Therefore, it is not surprising that this aspect was chosen by so many participants. In the land tenure section of question 7a, the outcome "Improved land tenure security" was selected most frequently. This makes sense as this outcome can be achieved when other outcomes, such as "Recognition of customary land rights", "Clear rules for land use and access", and "Reduced land use conflicts", are fulfilled. The literature likewise emphasizes that land tenure security is an important aspect for the effectiveness and equity of tree-based restoration projects and that local people often fear displacement or loss of access to their land because of tree-based restoration initiatives (Rakotonarivo et al., 2023). At the same time, "Land tenure insecurity" was the least chosen aspect of question 6a "What obstacles can prevent the success of restoration?". This indicates that participants from the two villages may currently perceive other issues, such as "Short-term projects without long-term follow-up" and "Lack of coordination among stakeholders", as more immediate challenges. This suggests that people regard land tenure security as an important outcome for themselves but not necessarily as a major obstacle to project success if it is not achieved. However, it should be noted that in the land tenure category of question 7a, respondents were not able to select options unrelated to land tenure, whereas question 6a included multiple aspects. This implies that

participants generally perceive other factors as more important or problematic than land tenure issues. A similar pattern is also evident in the land tenure category of Question 1b, where the only aspect not exclusively related to land tenure was selected most frequently. These findings contradict the existing literature, where land tenure challenges are perceived as a key barrier to the success of tree-based restoration projects (Rakotonarivo et al., 2023).

Social and economic priorities were mainly focused on inclusion, cooperation, and livelihood-related outcomes such as employment and basic needs. In the social section of 7a, the option "Stronger community cohesion and cooperation" was the second most chosen option. In the "other" section of question 1b, participants also repeatedly added that local communities should be better informed and consulted about their needs. These findings indicate a strong desire among local communities to be informed and involved, which is also emphasized in other parts of the interviews and in the literature (Rakotonarivo et al., 2017; Ranjatson et al., 2019). This makes it particularly surprising that the aspect "Strengthened local governance and decision-making" was the least frequently selected option in the social category of question 7a. A reason for that could be that participants may have interpreted strengthened local governance and decision-making as a more abstract and institutional concept, which is not directly connected to their own preferences for being informed, consulted, and involved. Through the top-down approach in Madagascar, where key decisions are mainly dominated by NGOs and scientific institutions (Kabirigi et al., 2025), participants may perceive decision-making structures as the responsibility of governments or NGOs, rather than something they can be a part of. However, the forced-choice bias may also partly explain this result. Besides prior consultation, the step "Creation of local employment opportunities" was also clearly more often chosen than the remaining steps. The aspect "Creating local jobs" was likewise the most frequently selected outcome in the economic section of question 7a. This consistency highlights the importance of income generation for local communities, for example, to pay school fees or cover everyday living costs (Rakotonarivo et al., 2017). While the employment-related step was selected significantly more often by men, participants from Ankorefo chose the aspect "Creation of local jobs" more frequently overall. One possible explanation for the gender difference could be that, according to interview participants in both villages, men tend to be more involved in tree-based restoration activities and are therefore more likely to work within related projects. However, literature suggests that women are also involved in implementation and maintenance stages, where most employment opportunities occur (de Siqueira et al., 2021), and that some projects actively try to increase women's participation (Ranjatson et al., 2019). As no data could be found on gender balance in tree-based restoration employment or on whether women and men have equal employment conditions and receive the same salary, this cannot be verified. None of the participants mentioned in question 10a, "Does everyone benefit equally from the projects or are there groups or families that have more advantages/restrictions than others?" that men are treated differently from women. Nevertheless, this does not necessarily imply the absence of gender inequalities. Existing differences may not be perceived as unequal treatment if they are socially accepted or embedded in local norms and practices. Consequently, further research is needed. The discrepancy between the two villages regarding the "Creation of local jobs" option may be explained by differences in livelihoods and economic structures. In Morarano, the majority of residents appear to rely primarily on subsistence and agriculture, whereas salaried jobs seem to play a more significant role in Ankorefo. In Ankorefo, several people are engaged in paid employment or operate small shops selling everyday goods and food items, while such businesses were not observed in Morarano. Furthermore, in Ankorefo, many children appeared to travel to school by bus, whereas in Morarano, only a few children seemed to have this opportunity (oral information/own observation). These observations suggest that Ankorefo may be more strongly integrated into a market economy, which could influence the different priorities and perceptions. In the social section of 7a, more than half of all participants chose the option "Improved livelihoods of the community members", a relatively broad statement that can be interpreted in different ways. This may already explain why it was the most

popular choice. Nevertheless, the strong emphasis on improving livelihoods suggests that many people face challenging living conditions and therefore prioritize outcomes that directly address their basic needs and everyday well-being (Bodonirina et al., 2018; Shelton et al., 2024). This is also reflected in the material NCP considered most important by participants: “Medical plants” was the most frequently selected NCP in this category, followed by “Food provision” and “Firewood”. These findings further emphasize the importance of securing necessities for everyday survival. Within this category, a significant difference was detected for the NCP “Charcoal”, which was selected more frequently by participants owning small businesses. This is understandable, as many people operating small shops in the villages were also selling charcoal.

Non-material NCP were mainly valued for their therapeutic benefits and importance for future generations, highlighting their role in well-being and long-term thinking. In this category, “Therapeutic and restorative benefits” was the most frequently chosen NCP. The high importance attributed to therapeutic and restorative benefits partly aligns with previous studies from Madagascar, which emphasize that ecosystems contribute not only to material livelihoods but also to social and emotional well-being (Kari & Korhonen-Kurki, 2013; von Heland & Folke, 2014). However, the therapeutic and restorative dimension itself appears to receive comparatively little explicit attention in literature. Instead, other non-material NCP, particularly cultural identity and intergenerational values, are more strongly emphasized (Kari & Korhonen-Kurki, 2013; Rakotonarivo et al., 2017). For example, forests are described as an important aspect of cultural identity for local communities in Madagascar (Kari & Korhonen-Kurki, 2013), although this NCP was ranked only fourth out of seven in the present study. Similarly, the argument that future generations of the community should also benefit from the NCP provided by forests is also highlighted in the literature as an important aspect for local communities (Kari & Korhonen-Kurki, 2013; Rakotonarivo et al., 2017). In this study, the NCP “Intergenerational benefits” was the second most chosen non-material NCP and therefore consistent with the emphasized aspects in the literature. It is interesting that this NCP was selected significantly more often by men. However, no clear explanation or supporting evidence for this gender difference could be identified in the existing literature. Therefore, this finding should be interpreted with caution and may represent a chance finding, requiring further investigation in future research.

The findings partially support the initial expectation that local communities value short-term economic and livelihood outcomes over ecological outcomes. Economic aspects, such as income generation through employment opportunities, as well as basic livelihood needs including medicine, food, firewood, and access to water, were perceived as highly important by participants. It can be observed that certain environmental goals, particularly biodiversity conservation, are less prioritized. However, this pattern does not apply uniformly across all environmental dimensions. Climate-related outcomes, in particular climate regulation, were considered highly important due to their direct and immediate impacts on livelihoods. This suggests that environmental outcomes are not rejected, but rather valued when they are closely linked to everyday well-being. Overall, the findings indicate that communities do not prioritize economic outcomes over environmental ones in a strict sense but rather value environmental outcomes that are directly relevant to their livelihoods over more abstract ecological objectives. However, the different categories were difficult to compare directly, as respondents were restricted to options within a single category, limiting comparability across categories. As a result, the analyzed data primarily provide insights into variations within categories rather than clear comparisons between them.

Sub-Question 2: What positive and negative impacts do local communities experience after the implementation of restoration projects?

Overall, local communities most frequently reported social benefits, while environmental and economic benefits were less often experienced. This result was unexpected. Given that most tree-based restoration projects place a strong emphasis on ecological objectives (Elias et al., 2022), a higher proportion of environmental benefits would have been anticipated.

Within environmental benefits, increased vegetation cover was most experienced, while biodiversity and water-related benefits were less frequently reported. The most frequently reported environmental benefits are consistent with the literature. As many global restoration initiatives primarily focus on quantitative targets like planting as many trees as possible (Löfqvist et al., 2023), it is not surprising that "Improved forest cover" was the most commonly experienced environmental benefit. Among other benefits, such as biodiversity recovery and greater biomass production for energy (Culbertson et al., 2022), increased vegetation cover can enhance soil stability (Dahanayake et al., 2024). This aligns with the second most frequently reported benefit "Reduced soil erosion". Surprisingly, the protection of water resources was the least experienced environmental option, despite evidence that increased forest cover can enhance water security (Brancalion et al., 2019). An explanation for that could be that most participants did not make that connection during the interviews. Nevertheless, it needs to be considered that this result varies considerably between villages. While overall only 19% of the participants reported this benefit, over 30% of the respondents from Morarano did so. This difference is likely explained by spatial factors. Morarano is located close to a small river, whereas many households in Ankorefo rely on wells. Although biodiversity enhancement is a key objective in many restoration projects (Brancalion & Holl, 2020), it was among the least frequently reported benefits. One possible explanation is that the tree-based restoration projects that were present in their villages may involve monoculture planting schemes, which are less effective in enhancing biodiversity (Suarez & Gwozdz, 2023). Alternatively, respondents may not be familiar with the concept of biodiversity or may not have perceived ecological changes.

Improved local governance was the least frequently experienced social benefit, which aligns with existing studies highlighting that local land-use decisions are mostly made by external actors rather than by local communities themselves (Dawson et al., 2024; Kabirigi et al., 2025). The most often experienced social benefits were primarily driven by employment opportunities and improved skills. The creation of temporary or permanent employment was the most frequently reported benefit in the social section, as well as the overall most frequently experienced benefit. This is consistent with the survey results of question 2c and the literature, which both indicate that local communities are commonly involved in implementation and maintenance phases of tree-based restoration projects (Buckingham et al., 2021). Especially the Eden project, which was present in both villages, emphasizes that they want to hire locals for activities like tree planting (Favretto et al., 2020). As some tree-based restoration actors provide local communities with technical training, with the expectation that this will also contribute to the success of the project (Favretto et al., 2020), it makes sense that the second most frequently experienced benefit in this category was the improvement of local skills and knowledge.

Generally, employment-related benefits were reported less frequently by older participants compared to younger and middle-aged groups. That's interesting, as older people tend to live longer in the villages and could therefore be expected to have encountered more opportunities. Nevertheless, it has already been established that people who live longer in the villages do not automatically report more projects in the village. One explanation is that many tree-based restoration projects have only been implemented in recent decades (Brancalion & Holl, 2020). Additionally, physical limitations or health issues may reduce older individuals' ability to participate in physically intensive activities. It is also possible that project implementers preferentially hire younger individuals, as they may benefit from and apply newly

acquired skills and knowledge over a longer time span. However, this pattern is not strongly supported in existing literature and requires further research.

Experienced economic benefits largely correspond with social outcomes. They were mainly reflected in increased household income and improved agricultural productivity, which are closely linked to employment and skills development. More than half of respondents experienced an increased household income, slightly fewer than those reporting employment. This is expected, as employment in tree-based restoration projects is typically salaried (Buckingham et al., 2021). The small proportion of respondents who reported employment but no increase in income may indicate that earnings were too low to be perceived as a meaningful improvement in household income. Improved agricultural productivity was the second most frequently reported economic benefit. This finding is consistent with the reported increase in knowledge and skills, which was selected by a similar number of respondents. The association may be explained by the fact that the skills and knowledge acquired through tree-based restoration activities can contribute to higher agricultural productivity (Favretto et al., 2020). 17 participants reported that they have not experienced any benefits across one or more categories. This aligns with literature suggesting that local needs and priorities are not always sufficiently integrated into tree-based restoration projects, limiting their profit (Elias et al., 2022).

Most participants perceived benefits from tree-based restoration projects as being distributed equally across community members, although some inequalities and structural differences were also reported. More than two thirds of the participants stated that everyone benefits equally from tree-based restoration projects. This is unexpected, as previous studies indicate that benefits are often unevenly distributed (de Siqueira et al., 2021). It could also be that some participants were afraid to admit that benefits are distributed unequally, or wanted to avoid explicitly pointing to inequalities within the community. Some participants argued that there are no benefits at all, implying that no inequality exists when benefits are absent. Others highlighted structural limitations, such as restricted access to water resources or employment opportunities. For example, only individuals living near the river benefit from improved water access. This is also visible in the data, where particularly people from Morarano talked about improvements in protected water resources. In addition, some participants mentioned that certain people are repeatedly chosen for jobs within the projects and therefore consistently receive benefits, while others are excluded. Some also mentioned favoritism by project leaders, sometimes connected to social structures, such as being the village chief or belonging to a “close circle”. While literature suggests that wealthier households may benefit more from such projects (Murage et al., 2025), in the results of this study, no specific social groups could be explicitly identified as benefiting more than others.

It is uncertain whether all interview participants fully understood the interview question “What challenges or restrictions have you experienced because of past restoration projects, for example, regarding access to land, forests, or other resources?” the way it was meant. This makes it difficult to answer this part of the sub-question. Reported restrictions mainly referred to land-use regulations. However, the answers give the impression that many respondents simply listed regulations that appeared as part of the restoration process. The notes of the answers often do not clearly indicate whether they perceive these regulations as restrictive or as personal challenges. The most frequently mentioned restriction was the prohibition of slash-and-burn agriculture, followed by bans on logging and livestock grazing in restored areas. Only three participants explicitly reported a lack of access to restored forests. However, restricted access to forest resources or cultivation land is frequently discussed in the literature (Murage et al., 2025), as it can negatively affect the quality of life of local communities depending on these resources (Rakotonarivo et al., 2017). Therefore, I would have expected more participants to report this as a distinct restriction. The other mentioned aspects, like the prohibition of slash-and-burn and logging in restored areas, are common regulations of tree-based restoration projects and therefore consistent with the

literature (Bodonirina et al., 2018). However, it remains unclear whether local communities perceive these regulations as restrictive, which limits the evaluation. Only the three respondents who said that they have no access to the restored areas made clear that this is a distinct challenge for them. Some respondents provided reasons for these restrictions, such as conserving natural resources, protecting reforested areas, promoting sustainable forest use, or maintaining Madagascar's vegetation. However, only around 10% of participants included such explanations, leaving it unclear whether most respondents are aware of the underlying reasons. At the same time, approximately 14% of the participants stated that they did not experience any restrictions or challenges resulting from past restoration projects. In these cases, It is assumed that they understood the question correctly, as they are subject to the same regulations as others in their village. However, they do not appear to perceive those as limiting. It would have been plausible if these statements came from people who don't work in the agricultural sector. However, statistical analysis shows no systematic differences across gender, age, village, or income source, suggesting that perceptions of restrictions are not strongly group-dependent.

The results only partially support the initial expectation that local communities mainly experience environmental benefits, such as improved soil stability and enhanced water security, and that they face social challenges, particularly related to land tenure, including restricted access to land and forest resources. Some environmental benefits, especially improved forest cover and the resulting reduction in soil erosion, were indeed frequently experienced, confirming that vegetation-related restoration outcomes are commonly perceived. However, enhanced water security was mentioned less often than expected. In contrast to the initial assumption, livelihood-related social and economic benefits were particularly prominent. The creation of temporary and permanent employment was one of the most frequently reported benefits in both villages, followed by subsequent improvements in household income, as well as the acquisition of new skills and knowledge. Although this aspect was not included in the original assumption, it is strongly supported by the empirical findings and aligns with existing literature.

Regarding restrictions and challenges, an unexpectedly high number of participants reported no restrictions at all. While land-related issues, particularly restricted access to land and forest resources, were mentioned, they occurred less frequently than expected. Instead, more general project regulations such as bans on slash-and-burn agriculture, logging, and livestock grazing in restored areas were reported more often. These regulations are closely linked to land tenure, as they affect access to and use of land and natural resources. Nevertheless, it remains unclear whether participants perceive these measures as actual personal restrictions or rather as neutral management rules. This substantial uncertainty makes it difficult to adequately interpret the results.

Sub-Question 3: How do local communities perceive the alignment of intentions and priorities of other actors involved in restoration projects with their own priorities and needs?

Only a small number of participants, who belong to the young and middle-age groups, perceived their intentions and priorities as "totally aligned" with those of other actors. All remaining responses covered a broad spectrum ranging from "mostly aligned" to "totally different". These findings are mostly consistent with the literature, where multiple studies suggest that the priorities of external actors often diverge from local needs (Buckingham et al., 2021; Kabirigi et al., 2025; Shelton et al., 2024). In the comment section, some participants mentioned projects that introduce plant species that do not meet local needs and that monitoring of restored areas is insufficient. The literature highlights the potential of participatory monitoring approaches, as they actively involve local communities in decision-making, for example, by defining what is monitored, how data is collected, and who participates. This can help rebalance power relations and support more context-specific outcomes (Elias et al., 2022). At the same time, several respondents acknowledged at least some overlap in priorities. These variations highlight the heterogeneity within local communities. Multiple studies show that it is necessary to consider the differences within the local communities themselves (Elias et al., 2022; Herbohn et al., 2022; Vincent et al., 2021), which are influenced by factors such as gender, age, and socioeconomic status (Löfqvist et al., 2023). Accordingly, community representatives (e.g., community leaders) may not fully represent the interests of the entire community (Elias et al., 2022). This diversity was also evident in earlier results, where participants expressed a wide range of preferred outcomes and stated that stakeholder objectives differ not only between groups but also within communities.

Many participants perceived financial incentives as a major driver of participation in restoration projects. This aspect was frequently mentioned among interviewees. While some participants viewed local community members as primarily motivated by money, others attributed this motivation to external actors. In several cases, however, the referenced group remained unclear. The literature supports the importance of financial incentives for engaging local communities (Herbohn et al., 2022; Kabirigi et al., 2025). Nevertheless, some studies also report cases in which local communities reject financial compensation, either because they have limited opportunities to invest it or because they are unwilling to trade their land and land-use practices for money, as they place a higher value on it and its returns (Rakotonarivo et al., 2017). Local communities may perceive tree-based restoration actors as financially motivated because some tree-based restoration projects are increasingly linked to profits from timber and carbon markets. As private investors invest in forestland for both wood and monetized environmental benefits (Vincent et al., 2021), restoration may appear driven more by financial incentives than by environmental protection.

Differences were also observed across age groups: older participants tended to perceive their goals and priorities as mostly aligned, whereas younger participants more often reported their priorities as totally different from those of other actors. However, existing literature provides limited support for this pattern. In contrast, a study from the Boeny region found that especially older people expressed dissatisfaction with the Eden project (Ranjatson et al., 2019), implying their feeling that their priorities were not taken into account.

Despite generally mixed perceptions of alignment, many participants expressed the belief that all actors ultimately share the same environmental goals. Even though the option "Totally aligned" was chosen in only 6% of the cases, nearly one-fourth of all participants commented that everyone wants the same or that everyone simply wants to improve the environment. The comparison of the answers shows that this view was also expressed by participants who indicated that priorities and goals are mostly or somewhat aligned. This is surprising as literature mostly emphasizes that local communities are more interested in immediate benefits (Kabirigi et al., 2025), like food and water security and income generation, than in

long-term ecological outcomes (Brancalion & Holl, 2020; Shelton et al., 2024). Nevertheless, researchers argue that long-term environmental concerns among local communities are not absent but are often weighed against more immediate livelihood needs (Herbohn et al., 2022). Some community members explicitly express a desire to protect forests in order to pass on their benefits, including recreational value to future generations (Rakotonarivo et al., 2017).

Participants generally perceived restoration projects as insufficiently considering local priorities. Responses to the question "Do you think they consider local priorities well [in tree-based restoration projects]?" largely reflected these findings. Most participants perceived project strategies as not aligning with local priorities, and a slightly smaller proportion perceived them as partially aligning. This corresponds to the findings in the literature, which indicate that substantial decisions such as the selection of tree species or the delineation of areas are often made by external actors based on technical data and therefore do not take into account the priorities of the local population (Dawson et al., 2024). Only about one-fifth reported strong consideration of local priorities. Spatial differences were also evident: respondents from Ankorefo more frequently reported strong consideration of local priorities, whereas participants from Morarano tended to perceive the consideration of their priorities more as completely different or only partially aligned. One possible explanation is again that a project in Morarano recently failed to address the local needs, while planting unsuitable species. Similar trends were identified by Favretto et al. (2020), who show that while some restoration initiatives successfully address local needs, others fail to do so at all.

The initial expectation was that local communities would perceive their priorities as mainly different from those of other actors (e.g. NGOs, government, international institutions), which primarily focus on ecological objectives, while the priorities of local communities are centered on immediate social and economic needs. However, this expectation cannot be fully supported by the results. While a great discrepancy between external actors' goals and local priorities was expected, the findings reveal a much more diverse picture within the communities themselves. Responses ranged from perceptions of "mostly aligned" priorities to views that they are "completely different," indicating a broad spectrum rather than a consistent pattern of divergence. This variation highlights the importance of recognizing heterogeneity within local communities, which was not sufficiently considered in the initial assumption. Overall, the results suggest that perceptions of alignment are highly context- and person-dependent and cannot be reduced to a simple distinction between external ecological priorities and local social and economic needs.

Sub-Question 4: To what extent are different groups within local communities involved in different stages of restoration projects?

Perceptions of local community involvement in tree-based restoration projects were highly divided among participants. About half of the participants believe that they are sufficiently involved, while the other half hold the opposite view. This is a surprising result, as literature mostly indicates that local communities are not sufficiently included and that this is one of the main reasons for project failure (Herbohn et al., 2022; Löfqvist et al., 2023). It's interesting that among the variables village, gender, age, and source of income no meaningful pattern could be detected. Consequently, it wasn't possible to find out which factor led to this big discrepancy between the perceptions of the participants.

Participants who reported sufficient involvement attributed this primarily to strong collaboration with the project implementers. Nevertheless, it needs to be considered that this was also the only option influencing the involvement positively. In the "other" section, those participants mentioned additionally that people are generally motivated for the projects. Participants who perceive the involvement of local communities as insufficient most frequently identified "Lack of early consultation" and "Insufficient information about project objectives" as the main reasons. Further, in the comment section of question 9, several participants mentioned that local communities are not sufficiently included and that communication is lacking. They said that it is necessary to inform local people about all project steps more and to include their ideas and opinions. This aspect aligns more with findings in the literature, where researchers describe issues such as the initiation of projects without obtaining the consent of local communities (Ranjatson et al., 2019), the withholding of important information (Buckingham et al., 2021) and the general exclusion of local populations from certain stages of the project (Favretto et al., 2020). The fact that nearly 70% of participants reported not having a clear contact person who provides information or answers questions further reinforces the previous findings. In addition, many participants indicated that there is no regular communication. If information is provided at all, it is often shared only during field activities. Interview question 5a makes this visible as well, as over half of all participants stated they know nothing or have only limited information about national strategies. These findings are in line with previous research showing that inadequate communication regarding important information and decisions, often made solely by external actors, can lead to low levels of participation (Dawson et al., 2024).

Perceived involvement also differed considerably across the different stages of restoration projects. About half of the local communities perceive themselves as actively involved in the implementation and maintenance stages. In the decision-making and representative stage on the other hand only about 18% respectively 30% feel actively involved. Again, the findings correspond with literature, where multiple studies argue that even if local communities sometimes have the opportunities to actively participate in some project stages, they are insufficiently involved in decision-making (Dawson et al., 2024; Löfqvist et al., 2023).

Perceived involvement also differed across social groups, such as gender, with women generally considered less involved in restoration projects than men. Generally, men are seen as more involved than women, and in question 8, one woman highlighted the need for greater autonomy, particularly for women. Although women are mostly engaged in domestic activities such as cooking (Shelton et al., 2024) or water and firewood collection (de Siqueira et al., 2021), multiple researchers argue that they are also involved in practical restoration activities such as planting and nursing seedlings (Löw, 2020; Sijapati Basnett et al., 2017). Especially, in cases where men migrate for paid work the implementation and maintenance responsibilities fall largely on women (Herbohn et al., 2022). Nevertheless, in the literature, it's argued that while women are often involved in the labor stages of tree-based restoration,

they are clearly underrepresented in other stages like decision-making, planning, or monitoring (de Siqueira et al., 2021; Shelton et al., 2024).

Individuals directly connected to land use, particularly landowners and farmers, were perceived as the most involved actors in restoration projects. In the landownership category, people who own land were rated as being involved the most, followed by landless people who are working on someone else's land and land tenants. People who are not using land were rated as least involved in this category. As agricultural land provides great potential for tree-based restoration activities (Vincent et al., 2021), it makes sense that the owners and those who are using it are more involved than others. Farmers are often identified as the main implementers of tree-based restoration measures (Buckingham et al., 2021). This is also visible in the category "Responsibility within the community", where farmers are ranked the highest, showing that especially people engaged in the agricultural sector are involved. In this category, farmers are followed by conservationists, environmental organizations, and the local government. The latter findings are also supported by the literature. It is emphasized that environmental NGOs play a key role in tree-based restoration projects as they have the technical expertise and financial resources needed to design and implement such large-scale projects. In addition, formal assessments and approvals by governmental authorities are required before such projects can be implemented (Kabirigi et al., 2025). The local government is described as a crucial interface between the state and the local community. It often identifies suitable land for restoration measures and allocates these areas to projects (Ranjatson et al., 2019). However, it's surprising that farmers are ranked that high, despite their possibly limited involvement across some project stages (Buckingham et al., 2021). One possible explanation for that could be that local communities are often excluded from planning and decision-making processes (Rakotonarivo et al., 2023). As a result, they may be unaware of which actors are involved at these stages. Therefore, they can primarily assess participation based on activities taking place within their village. This may also explain the comparatively low ranking of other actors, such as scientists' involvement. As they mainly work behind the scenes using their scientific expertise to design new projects (Culbertson et al., 2022), neither they nor their influence is directly noticeable to the local communities. This assumption is also supported by the fact that more than half of the participants chose the option "I don't know" for this group.

The initial expectation was that local communities would perceive their involvement in tree-based restoration projects as limited, with stronger participation in implementation and maintenance stages than in planning and decision-making phases. It was also expected that overall involvement would be perceived as insufficient and that men would be seen as more involved than women. However, these assumptions were only partially supported by the findings. The first part of the expectations can be clearly rejected, as perceptions of involvement are highly divided: approximately half of the participants reported that they feel sufficiently involved in tree-based restoration projects. This indicates that involvement is not generally perceived as limited but rather varies substantially among respondents. However, other elements of the assumption are supported. The results confirm that involvement is perceived as stronger in the implementation and maintenance phases compared to the planning and decision-making stages, where participation is considerably lower. In addition, the findings support the expectation of a gender difference, with men being perceived as more involved than women across several project activities. Overall, the results suggest that while patterns of uneven participation across project phases and between genders do exist, the overall perception of involvement is more balanced and heterogeneous than initially assumed.

6.2 Methodological and Conceptual Reflection

The chosen method of a survey interview consisting primarily of multiple-choice questions and a small number of open-ended questions was well-suited for covering a broad range of perspectives from different participants. The approach resulted in a substantial amount of data, with which it was possible to identify patterns and answer the research questions. However, including a greater number of open-ended questions could have given more contextual information and could have made the reasoning behind certain responses clearer. That could have made it possible to answer the research questions with less reliance on interpretation and more direct evidence from participants' own statements. In many interviews, respondents shared detailed explanations and additional insights, yet only a limited portion of this information could be captured in the multiple-choice format or the brief notes from the open-ended interview questions. At the same time, a more qualitative approach would have involved considerable trade-offs. Conducting fully open-ended interviews would have required significantly more time for recording, transcription, translation, and analysis. As a result, it would not have been possible to include such a high number of participants or capture such a broad range of opinions. Moreover, this work would have to rely even more heavily on other team members for tasks such as transcription and translation. In its current form, the survey allowed me to conduct most stages of the analysis independently. The observations during the interviews also provided valuable insights. However, interpreting the underlying reasons for certain reactions and emotions proved challenging, particularly because I did not understand the local language and cultural nuances. More on the language barrier is explained later in Chapter 6.3.

The NCP approach was useful for understanding the importance of intact forests for local communities and the essential contributions they make to people's lives. It highlighted that forests provide not only material resources but also equally important non-material and regulating benefits. The concept also guided the design of the survey by ensuring that all relevant dimensions of human–forest relations were considered and reflected in the questionnaire and response options. Furthermore, the NCP concept helped to contextualize the findings by revealing the strong dependence of local communities on forest resources and the diverse values associated with them. It helped to interpret responses and better understand the motivations behind specific perceptions and behaviors. In addition, it highlighted key dependencies, needs, and values that shape local priorities and decision-making. This additionally contributed to a better understanding of why the perspectives and actions of local communities may differ from those of external actors.

6.3 Challenges and Limitations

The biggest challenge was the language barrier, which created difficulties throughout several stages of the thesis. One major issue concerned interview question 8. Originally, it had been designed as an open-ended question, with the intention of recording, transcribing, and later translating the responses. However, due to the final interview setup, audio recordings were not included. As a result, the interviewers mainly documented keywords rather than complete statements. This made interpretation more difficult, as important contextual information was missing. Additionally, my own positionality could also lead to misinterpretations. In the case of question 8, many of the recorded keywords suggested that participants were just describing the new regulations that came with tree-based restoration projects, whereas the aim of the question had been to identify which regulations or aspects they perceived as challenging or restrictive. During the analysis, I realized that the wording of the question may have allowed for different interpretations. In future studies, it would therefore be useful to discuss the questions and their intended purpose in greater detail with everyone involved beforehand. In general, I could not fully assess whether the intended meaning of each interview question was preserved during translation. However, it was helpful to review the questions together with the translator beforehand to ensure that the original

intentions were communicated as clearly as possible. Another challenge concerned question 7a, which was ultimately implemented as a multiple-choice question instead of an open-ended one. Looking back, it would have been beneficial to review the final questionnaire together before the interviews began, as adjustments were no longer possible afterwards.

More generally, it was challenging that I could not understand the participants during the interviews. Since many responses were later summarized in single- or multiple-choice formats, some of the conversational context was inevitably lost. While my observations provided insight into participants' emotions and reactions, it would have been valuable to better understand the reasons behind them, particularly because only a limited portion of the discussions could be documented. Further, the communication with the other team members was sometimes challenging. Although everyone made considerable efforts to communicate in French, it was neither my first language nor that of the other team members. As a result, there were situations in which nuances or intended meanings may not always have been conveyed fully. This forms a common challenge in this type of research and highlights the gaps between team members and the need for mutual learning and experience.

Another challenge arose particularly in Ankorefo Marohogo, where some participants appeared to have difficulties understanding parts of the interview questions. Since I do not speak Malagasy, I could not directly assess the exact reasons for these misunderstandings and therefore relied on feedback from other team members. This made it somewhat difficult to evaluate what could best be improved in future interviews. Nevertheless, simplifying the wording of some questions could likely help.

7. Conclusion

The findings of this thesis made it possible to answer the research question: “What are the aspirations of local communities in Madagascar regarding the outcomes of tree-based restoration projects, and how do they perceive the benefits, barriers, their involvement in restoration processes, and the alignment of their interests with those of other actors?”. However, first and foremost, the results show that it is not possible to treat local communities as a homogeneous group, even if they live in the same village or region. The variation in responses highlights the importance of recognizing heterogeneity within local communities. This was particularly evident in responses to the question of whether participants perceived their priorities as aligning with those of other actors. While some respondents reported that their priorities are mostly aligned, others stated that they are completely different. Similarly, responses to the question of whether local communities feel sufficiently involved in tree-based restoration projects were contradictory, as approximately half of the participants felt sufficiently involved, while the other half held the opposite view. Nevertheless, participants agreed that they are more involved in the implementation, labor, and maintenance phases compared to the planning and decision-making stages. The aspirations of the participants also showed some regularities. The findings indicate that local communities mainly prioritize outcomes from restoration projects that are directly connected to their livelihoods and have the potential not to increase, or even reduce, existing struggles. Economic aspects and direct livelihood needs, such as water, food, and medicine were therefore considered important, but also environmental goals that directly affect everyday well-being, such as climate regulation, were highly valued. On a positive note, it was found that the creation of temporary or permanent employment and the resulting increase in household income, as well as the acquisition of new skills and knowledge, were among the most frequently experienced benefits. In addition, improved forest cover and a reduction in soil erosion were also frequently mentioned. However, inequality among participants was also evident here, as some reported not having experienced any benefits at all. Similarly, some participants indicated that they did not experience any challenging restrictions resulting from tree-based restoration projects, while others struggle with multiple constraints, like restrictions on slash-and-burn practices, logging, and livestock grazing, or reduced access to their land.

Further research in other regions of Madagascar would be valuable to assess whether the findings from the Boeny Region are transferable or context-specific. In addition, comparative studies in other countries with similar socio-ecological contexts could provide further insights into the generalizability of these results. Another important aspect for future research is the gender dimension. In this thesis, it was not possible to fully examine the different roles of women and men in tree-based restoration projects and the potential implications of these differences. Further research could therefore provide a more detailed understanding of gender-specific experiences, responsibilities, and impacts within tree-based restoration.

This thesis can contribute to current tree-based restoration approaches by emphasizing that local communities should not be viewed as homogeneous groups with identical interests and priorities, but rather as diverse groups of individuals with different needs, priorities, perceptions, and experiences of costs and benefits. This heterogeneity needs to be acknowledged when planning and implementing tree-based restoration projects. The perceived lack of involvement of local communities in decision-making and planning processes confirms an already well-known challenge in tree-based restoration and highlights the need for more inclusive and participatory approaches.

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Appendix

Final Survey (January 2026)

I. Personal data

1. What is your name?

2. What is your gender?
   - Male
   - Female
   - Other

3. What is your current marital status?
   - Single
   - Married
   - Widowed

4. Where do you live?
   - a. Region
   - b. District
   - c. Commune
   - d. Fokontany
   - e. Village

5. For how many years or since which year have you lived in this village?

6. How old are you or when were you born?

7. Which ethnic group do you belong to?

8. What is your highest level of education?
   - No formal education
   - Primary school
   - Secondary school
   - High school
   - University

9. How many people live in your household?

10. What is your role in the household?
    - Head of household
    - Spouse
    - Son/Daughter
    - Sibling
    - Parents

- Other

11. What is the primary source of income for your household?
    - Sale of agricultural products (rice, maize, vegetables, fruits)
    - Livestock rearing and sale of animals (zebu, chickens, goats, etc.)
    - Fishing or aquaculture
    - Gathering and sale of forest products (wood, charcoal, honey, medicinal plants)
    - Small business (grocery shop, market sales, stalls)
    - Handicrafts (basket weaving, carpentry, pottery, sewing)
    - Salary from a job (daily, seasonal, or permanent)
    - Rental of land, house, or equipment
    - Money sent by relatives from another town or abroad
    - Work in tourism (guide, accommodation, catering)
    - Other

12a. Do you have enough food throughout the year?
Yes/No

12b. If no, during which months do you lack food?

13a. Ten years ago, for how many months did you not have water?

13b. And today, for how many months?

13c. What is the reason?

14a. Do you own land?

14b. If yes, what is its main use?
    - Forest fragment
    - Tree plantation
    - Monocrop agroforestry
    - Traditional/complex agroforestry
    - Rice paddy field
    - Hillside cropland
    - Woody fallow
    - Grassland
    - Other

15a. Do you have access to land owned by your family?

15b. If yes, what is its main use?
    - Forest fragment
    - Tree plantation
    - Monocrop agroforestry
    - Traditional/complex agroforestry
    - Rice paddy field

- Hillside cropland
- Woody fallow
- Grassland
- Other land use

16a. Do you rent land from someone?

16b. If yes, what is its main use?
- Forest fragment
- Tree plantation
- Monocrop agroforestry
- Traditional/complex agroforestry
- Rice paddy field
- Hillside cropland
- Woody fallow
- Grassland
- Other land use

II Questions for the local community

1a. How many ecosystem restoration projects are there in your area?

1b. What steps should institutions take to carry out forest restoration in your village (land tenure, social, ecological aspects)?

Land tenure aspects
- Clarification of land tenure rights
- Recognition of customary land rights
- Formal agreement with the community
- Participatory delineation of restoration areas
- Land tenure security
- Other

Social aspects
- Prior and inclusive consultation
- Participation of women and youth
- Consideration of local livelihoods
- Creation of local employment opportunities
- Community capacity building
- Other

Ecological aspects
- Use of adapted local species
- Respect for local natural resource management practices
- Species diversification
- Biodiversity protection
- Participatory ecological monitoring
- Other

2a. Do you think the local community is sufficiently involved in restoration projects?

2b. Why or why not?

- Lack of early consultation
- Limited consideration of community inputs
- Time or resource constraints
- Insufficient information about project objectives
- Strong collaboration with project implementers
- Other

2c. How is the involvement of local community for each following stage of the project?
(For: implementation, maintenance, labour, representatives, decision-making)
Scale:

1. No involvement
2. Low involvement
3. Limited involvement
4. Active involvement

3. What benefits (social, economic, environmental) have you observed in your community as a result of these projects?

3a. Social benefits

- Strengthened community cohesion
- Creation of temporary or permanent local jobs
- Improved local skills and knowledge
- Greater inclusion of women and youth
- Improved local governance
- Other

3b. Economic benefits

- Increased household income
- Diversification of income sources
- Improved agricultural productivity
- Access to new economic opportunities
- Stimulation of the local economy
- Other

3c. Environmental benefits

- Improved forest cover
- Reduced soil erosion
- Improved soil fertility
- Protection of water resources
- Return or increase of biodiversity
- Other

4a. Do you have a clear contact person for asking questions or getting updates on the restoration projects?

- No clear contact person
- Clearly identified focal point at the community level
- Contact person available only at the municipal or regional level

4b. How often are you informed about the restoration projects?

- No clear communication mechanism with the community
- Information shared on a regular basis
- Information shared occasionally
- Information shared only during field activities
- Other

5a. Are you aware of the national restoration strategies (such as *National Strategy for Forest Landscape Restoration* - SNRPF or *National Forest Policy*)?

- Good awareness of national strategies
- Partial awareness of national strategies
- Information received indirectly through projects or NGOs
- Limited dissemination of national strategies at the local level
- Other

5b. Do you think they consider local priorities well?

- Strong alignment with local priorities
- Partial alignment with local priorities
- Limited consideration of local priorities
- Strategies perceived as disconnected from local realities
- Other

6a. What obstacles can prevent the success of restoration?

- Land tenure insecurity
- Limited involvement of local communities
- Insufficient financial resources
- Inappropriate choice of species
- Short-term projects without long-term follow-up
- Lack of coordination among stakeholders
- Other

6b. What are your recommendations to ensure restoration is successful?

- Strengthen land tenure security
- Improve community participation
- Ensure sustainable financing
- Use adapted local species
- Establish long-term monitoring mechanisms
- Strengthen coordination among public, private, and community actors
- Other

7a. If you could decide on the outcomes a restoration project on community land should achieve, which three outcomes would you value most for you and your community?

Social outcomes

- Improved livelihoods for community members
- Stronger community cohesion and cooperation
- Greater involvement of women and youth
- Strengthened local governance and decision-making

- Increased knowledge and skills within the community
- Other

Economic outcomes

- Creation of sustainable local jobs
- Increased household income
- Improved agricultural productivity
- Diversification of income-generating activities
- Better access to markets and economic opportunities

Environmental outcomes

- Restoration of degraded land
- Improved soil fertility
- Increased forest cover
- Protection of water sources
- Conservation of biodiversity

Land tenure and governance outcomes

- Improved land tenure security
- Recognition of customary land rights
- Clear rules for land use and access
- Reduced land-use conflicts

Long-term sustainability outcomes

- Long-term maintenance of restored areas
- Community ownership of restoration activities
- Resilience to climate change
- Sustainable management of natural resources

7b. For each category, please select the three benefits from nature that are most important to you.

Group 1: Environmental regulation

1. Habitat creation and maintenance
2. Pollination
3. Seed dispersal
4. Regulation of air quality
5. Regulation of climate
6. Regulation of freshwater quantity
7. Regulation of freshwater quality
8. Regulation of soil fertility
9. Protection of soils
10. Regulation of hazards and extreme events
11. Control of harmful organisms (pests and diseases for crops and humans)

Group 2: Material benefits

1. Firewood
2. Charcoal
3. Food
4. Animal feed
5. Materials for construction
6. Materials for handcrafts
7. Materials for weaving (ropes, mat, baskets, hat, bags ....)

8. Medicinal plants
9. Genetic resources (for biotechnology innovation: crops and medicines)

Group 3: Non-materials benefits

1. Learning and inspiration (cultural exchange, artistic, scientific or technological)
2. Recreation and Aesthetic enjoyment
3. Therapeutic and restorative benefits (break from modern life, peace, stress relief ....)
4. New and unique experiences
5. Supporting culture and identity (ancestral ties, local or traditional heritage, sacred place)
6. Social cohesion and bounding (community building, socializing with others, friendships)
7. Intergenerational benefits (maintaining options for current and future generations)

8. What challenges or restrictions have you experienced because of past restoration projects, for example regarding access to land, forests, or other resources? (open question)

9. How do you perceive the goals and priorities of the other actors involved in the project compared to your own?

Scale:

6. Totally different
7. Somewhat different
8. Somewhat aligned
9. Mostly aligned
10. Totally aligned

Is there something you want to add? (comment field)

10a. Does everyone benefit equally from the projects, or are there groups or families that have more advantages/restrictions than others?

10b. To what extent are the following groups involved in the planning of restoration projects? (Please rate each people category on a scale from 1 to 5.)

Scale:

11. Not involved at all
12. Slightly involved
13. Moderately involved
14. strongly involved
15. Very strongly involved

Other option: I don't know

Group 1: Gender

- women
- men

Group 2: Land ownership

- Landowners
- Land tenant
- Sharecropper
- landless, but working on someone's land
- not using land

Group 3: Responsibility within the community

- Farmers
- Local government officials
- Teachers
- Conservationists
- Researcher/scientists
- Local entrepreneurs
- Private sector
- Law enforcement,
- Environmental educators
- Environmental organization
- Funding agencies

Table with statistical test and results

Question	Test Item	Statistical Test	P-Value
1a			
Test for normality	Are the values within the two village groups normally distributed?	Shapiro test for normalty W = 0.88106 W = 0.85821	 Ankorefo Marohogo = 1.90E-05*** Morarano = 0.007338**
	Are the values within the four time groups for participants living in the respective villages normally distributed?	W = 0.7627 W = 0.86473 W = 0.87934 W = 85329	0-5 years = 1.79E-03*** 6-15 years = 7.60E-05*** 15-30 years = 0.05687* >30 years = 0.08099
Village Comparison	Is there a difference in the average number of projects mentioned between the two villages?	Wilcoxon Rank-Sum: W = 743 Cohens_d Effect size = 0.389	Total= 0.211
Village Duration Comparison	Does the number of projects mentioned depend on how long people have lived in the respective village?	Kruskal-Wallis: Chi^2 = 1.0206	Total= 0.7963
1b			
Total Comparison	Are there any differences in the frequency with which the options are selected within a group?	Cochran's Q: Q = 50.199 Q = 16 Q = 19.449	 Land tenure= 3.28E-10*** Social= 0.003019*** Ecological= 0.0006413***
Village Comparison	Did participants from different villages choose different steps? (each step analysed separately)	Fisher's exact: Odds ratio = 0.8008266 Odds ratio = 1.4169303 Odds ratio = 0.4982715 Odds ratio = 1.7272515 Odds ratio = 1.1573290 Fisher's exact: Odds ratio = 0.7007749 Odds ratio = 0.9780357 Odds ratio = 1.8436619 Odds ratio = 0.5043988 Odds ratio = 1.0897617 Fisher's exact: Odds ratio = 1.984572 Odds ratio = 0.7009156 Odds ratio = 0.5960129 Odds ratio = 0.2790356 Odds ratio = 3.365085	**Land tenure** Clarification of land tenure rights= 0.7899390 Recognition of customary land rights= 0.6062437 Formal agreement with the community= 0.3389333 Participatory delineation of restored areas= 0.3055014 Land tenure security= 0.7958613 **Social** Prior consultation and inclusive consultation= 0.5894262 Participation of women and youth= 1 Consideration of local livelihoods= 0.3017718 Creation of local employment opportunities= 0.1956386 Community capacity building= 1 **Ecological** Use of adapted local species= 0.4017024 Respect for local resource management practices= 0.6090287 Species diversification= 0.4398623 Biodiversity protection= 0.03723143* Participatory ecological monitoring= 0.06467554
Gender Comparison	Did men and women choose different steps? (each step analysed separately)	Fisher's exact: Odds ratio = 0.5436009 Odds ratio = 0.4954334 Odds ratio = 1.2799572 Odds ratio = 0.9709306 Odds ratio = 0.5604003 Fisher's exact: Odds ratio = 0.4373558 Odds ratio = 0.7216552 Odds ratio = 0.6232338 Odds ratio = 0.2860449 Odds ratio = 0.3901635 Fisher's exact: Odds ratio = 1.1169043 Odds ratio = 0.5844927 Odds ratio = 0.3631049 Odds ratio = 0.9013934 Odds ratio = 0.5319840	**Land tenure** Clarification of land tenure rights= 0.3265703 Recognition of customary land rights= 0.1653854 Formal agreement with the community= 0.7787897 Participatory delineation of restored areas= 1 Land tenure security= 0.337490 **Social** Prior consultation and inclusive consultation= 0.09191389 Participation of women and youth= 0.49416485 Consideration of local livelihoods= 0.35616824 Creation of local employment opportunities= 0.01546822* Community capacity building= 0.06351432 **Ecological** Use of adapted local species= 1 Respect for local resource management practices= 0.25742241 Species diversification= 0.06074601 Biodiversity protection= 1 Participatory ecological monitoring= 0.23604428
Age Comparison	Did participants from different age groups choose different steps? (each step analysed separately)	Fisher's exact: (Cramérs V) Effect strength = 0.0494 Effect strength = 0.0508 Effect strength = 0.209 Effect strength = 0.115 Effect strength = 0.268 Fisher's exact: (Cramérs V) Effect strength = 0.138 Effect strength = 0.114 Effect strength = 0.213 Effect strength = 0.215 Effect strength = 0.234	**Land tenure** Clarification of land tenure rights= 0.960 Recognition of customary land rights= 0.918 Formal agreement with the community= 0.158 Participatory delineation of restored areas= 0.566 Land tenure security= 0.0495* **Social** Prior consultation and inclusive consultation= 0.510 Participation of women and youth= 0.609 Consideration of local livelihoods= 0.182 Creation of local employment opportunities= 0.140 Community capacity building= 0.103

		Fisher's exact: (Cramérs V) Effect strength = 0.0403 Effect strength = 0.176 Effect strength = 0.165 Effect strength = 0.0983 Effect strength = 0.133	**Ecological** Use of adapted local species= 0.960 Respect for local resource management practices= 0.288 Species diversification= 0.307 Biodiversity protection= 0.690 Participatory ecological monitoring= 0.512
Income Source Comparsion	Did participants with different main income sources choose different steps? (each step analysed separately)	Fisher's exact: (Cramérs V) Effect strength = 0.476 Effect strength = 0.476 Effect strength = 0.298 Effect strength = 0.295 Effect strength = 0.459	**Land tenure** Clarification of land tenure rights= 0.0465* Recognition of customary land rights= 0.029* Formal agreement with the community= 0.749 Participatory delineation of restored areas= 0.839 Land tenure security= 0.065
		Fisher's exact: (Cramérs V) Effect strength = 0.224 Effect strength = 0.388 Effect strength = 0.473 Effect strength = 0.290 Effect strength = 0.295	**Social** Prior consultation and inclusive consultation= 0.981 Participation of women and youth= 0.307 Consideration of local livelihoods= 0.0175* Creation of local employment opportunities= 0.885 Community capacity building= 0.81
		Fisher's exact: (Cramérs V) Effect strength = 0.316 Effect strength = 0.280 Effect strength = 0.299 Effect strength = 0.435 Effect strength = 0.457	**Ecological** Use of adapted local species= 0.731 Respect for local resource management practices= 0.876 Species diversification= 0.835 Biodiversity protection= 0.0805 Participatory ecological monitoring= 0.0725
2a		Chi2 test:	
Total Comparison	Is there a significant difference in the frequency with which the answer options were selected?	X^2= 0.10843 Fisher's exact test	Total= 0.7419
Village Comparison	Did participants from different villages choose different answer options?	Odds ratio = 0.9101371	Total= 1
Gender Comparison	Did men and women choose different answer options?	Odds ratio = 0.8977343 Fisher's exact: (Cramérs V)	Total= 0.8211
Age Comparison	Did participants from different age groups choose different answer options?	Effect strength = 0.135	Total= 0.481
Income Comparison	Did participants with different income sources choose different answer options?	Effect strength = 0.366	Total= 0.4333
2b		Cochran's Q:	
Total Comparison	Is there a significant difference in the frequency with which the answer options were selected?	Q = 43.389	Total= 8.594e-09
Yes/No Comparison	Did people who answered question 2a with yes choose different reasons than the ones who said no? (each reason analysed separately)	Fisher's exact test= Odds ratio= 0.03024710 Odds ratio= 0 Odds ratio= 0 Odds ratio= 0.05098524 Odds ratio= 36.70611922	Lack of early consultation= 2.271782e-06*** Limited consideration of community inputs= 1.016932e-02** Time or resource constraints= 8.318961e-04*** Insufficient information about project objectives= 2.340515e-04*** Strong collaboration with project implementers= 2.384765e-11***
2c		Friedman test:	
Total Compraison	Does the perceived involvement level differ between the different project stages?	Chi-squared= 76.306	Total= 1.055e-15***
Post hoc test	Which options were chosen significantly more or less often than others?	Wilcoxon signed-rank test: V = 358 V = 484 V = 960 V = 1186 V = 268 V = 855 V = 1220 V = 1024 V = 1365 V = 641	Implementation vs. Maintenance = 1 Implementation vs. Labour = 1 Implementation vs. Representativeness = 0.001*** Implementation vs. Decision-making = 0.000000813*** Maintenance vs. Labour = 1 Maintenance vs. Representativeness = 0.0000208*** Maintenance vs. Decision-making = 0.00000011*** Labour vs. Representativeness = 0.000239*** Labour vs. Decision-making = 0.000000434*** Representativeness vs. Labour = 0.002**
Village Comparison	Did participants from different villages rate the involvement within one stage differently?	Wilcoxon-Rank Sum: W = 756 W = 640 W = 640 W = 774 W = 760	p-value (adjusted) Implementation= 0.715 Maintenance= 1 Labour= 1 Representatives= 0.575 Decision-Making= 0.745
Gender Comparison	Did men and women rate the involvement within one stage differently?	W = 878 W = 744 W = 776 W = 735 W = 688	Implementation= 1 Maintenance= 1 Labour= 1 Representatives= 1 Decision-Making= 1
Yes/No Comparison	Did participants who answered question 2a with no rated the involvement within one stage differently than the ones who said yes?	W = 678 W = 694	Implementation= 0.348 Maintenance= 0.478

		W = 671 W = 795 W = 704	Labour= 0.328 Representatives=1 Decision-Making= 0.685
Age Comparison	Did participants from different age groups rate the involvement within one stage differently?	W = 264 W = 148 W = 566 W = 313 W = 186 W = 610 W = 338 W = 214 W = 660 W = 278 W = 186 W = 646 W = 213 W = 127 W = 596	**Implementation** Young vs. Middle= 0.574 Young vs. Old= 0.639 Middle vs. Old= 0.973 **Maintenance** Young vs. Middle= 0.677 Young vs. Old= 0.435 Middle vs. Old= 0.534 **Labour** Young vs. Middle= 0.364 Young vs. Old= 0.092 Middle vs. Old= 0.207 **Representatives** Young vs. Middle= 0.786 Young vs. Old= 0.471 Middle vs. Old= 0.295 **Decision-Making** Young vs. Middle= 0.123 Young vs. Old= 0.253 Middle vs. Old= 0.674
3 Total Comparison	Were some options within one benefit category significantly more often chosen than others?	Cochran's Q: Q = 36.827 Q = 49.165 Q = 35.711	 Social = 1.956e-07*** Economic = 5.394e-10*** Environmental = 3.318e-07***
	Were the benefits of one group chosen significantly more or less often than those of others?	Wilcoxon signed-rank test: V = 428 V = 148 V = 290	 Economic vs. Environmental = 1 Economic vs. Social = 0.004** Environmental vs. Social = 0.025*
Village Comparison	Did participants from different villages choose different benefits?	Fisher's exact: Odds ratio = 0.8008266 Odds ratio = 1.3370304 Odds ratio = 1.2403261 Odds ratio = 0.4698897 Odds ratio = 0.2607684 Odds ratio = 1.3873857 Odds ratio = 0.6283429 Odds ratio = 1.5167701 Odds ratio = 1.0705301 Odds ratio = 1.0548645 Odds ratio = 0.3880011 Odds ratio = 1.2391085 Odds ratio = 0.9794136 Odds ratio = 3.1766134 Odds ratio = 0.6795017	**Social** Strengthened community cohesion = 0.78993901 Creation of temporary or permanent local jobs = 0.78855018 Improved local skills and knowledge = 0.79520802 Greater inclusion of women and youth = 0.27406912 Improved local governance = 0.08349999 **Economic** Increased household income = 0.6083803 Diversification of income sources = 0.5675517 Improved agricultural productivity = 0.437597 Access to new economic opportunities = 1 Stimulation of the local economy = 1 **Environmental** Improved forest cover = 0.07446375 Reduced soil erosion = 0.79059317 Improved soil fertility = 1 Protection of water resources = 0.05407020 Return or increase of Biodiversity = 0.76851165
Gender Comparison	Did men and women choose different benefits?	Odds ratio = 0.7029666 Odds ratio = 0.4778758 Odds ratio = 1.7379831 Odds ratio = 0.6349989 Odds ratio = 0.9764713 Odds ratio = 0.7156404 Odds ratio = 1.1691600 Odds ratio = 1.1306454 Odds ratio = 0.747694 Odds ratio = 2.1042570 Odds ratio = 1.1939050 Odds ratio = 0.63636433 Odds ratio = 0.2503439 Odds ratio = 1.6923000 Odds ratio = 2.1994091	**social** Strengthened community cohesion = 0.6243645 Creation of temporary or permanent local jobs = 0.1465940 Improved local skills and knowledge = 0.2483366 Greater inclusion of women and youth = 0.4575033 Improved local governance = 1 **Economic** Increased household income = 0.4887972 Diversification of income sources = 0.7962634 Improved agricultural productivity = 0.8143160 Access to new economic opportunities = 0.6191072 Stimulation of the local economy = 0.4332482 **Environmental** Improved forest cover = 0.81539836 Reduced soil erosion = 0.7693495 Improved soil fertility = 0.03428799* Protection of water resources = 0.38571860 Return or increase of Biodiversity = 0.18081551

Age Comparison	Did participants from different vague groups choose different benefits?	Fisher's exact: (Cramérs V) Effect strength = 0.175 Effect strength = 0.291 Effect strength = 0.127 Effect strength = 0.108 Effect strength = o.118 Effect strength = 0.108 Effect strength = 0.275 Effect strength = 0.212 Effect strength = 0.106 Effect strength = 0.078 Effect strength = 0.067 Effect strength = 0.196 Effect strength = 0.083 Effect strength = 0.116 Effect strength = 0.189	**social** Strengthened community cohesion = 0.2702 Creation of temporary or permanent local jobs = 0.0322* Improved local skills and knowledge = 0.517 Greater inclusion of women and youth = 0.641 Improved local governance = 0.566 **Economic** Increased household income = 0.6414 Diversification of income sources = 0.0343* Improved agricultural productivity = 0.1644 Access to new economic opportunities = 0.6935 Stimulation of the local economy = 0.698 **Environmental** Improved forest cover = 0.8763 Reduced soil erosion = 0.2127 Improved soil fertility = 0.8009 Protection of water resources = 0.5441 Return or increase of Biodiversity = 0.214
Income Comparison	Did participants from different income groups choose different benefits?	Effect strength = 0.347 Effect strength = 0.328 Effect strength = 0.381 Effect strength = 0.411 Effect strength = 0.413 Effect strength = 0.346 Effect strength = 0.306 Effect strength = 0.407 Effect strength = 0.426 Effect strength = 0.336 Effect strength = 0.315 Effect strength = 0.401 Effect strength = 0.363 Effect strength = 0.433 Effect strength = 0.442	**social** Strengthened community cohesion = 0.5492 Creation of temporary or permanent local jobs = 0.7896 Improved local skills and knowledge = 0.3508 Greater inclusion of women and youth = 0.2384 Improved local governance = 0.1714 **Economic** Increased household income = 0.5957 Diversification of income sources = 0.7511 Improved agricultural productivity = 0.2139 Access to new economic opportunities = 0.1514 Stimulation of the local economy = 0.3043 **Environmental** Improved forest cover = 0.6952 Reduced soil erosion = 0.2114 Improved soil fertility = 0.4048 Protection of water resources = 0.1804 Return or increase of Biodiversity = 0.0545
4a Total Comparison	Were some answer options significantly more often chosen than others? Which options were significantly more or less often chosen?	Chi2 test: X^2 = 51.277 Residuals: no clear contact: 5.577 Community level: -1.267 Municipal/regional level: -4.309	Total = 7.334e-12***
Village Comparison	Did participants from different villages choose different answer options?	Fisher's exact test: (Cramérs V) Effect strength= 0.02540205	1
Gender Comparison	Did women choose different answer options than men?	Effect strength= 0.1594979	0.3798
Age Comparison	Did participants from different age groups choose different answer options?	Effect strength= 0.1126978	0.6894
Income Comparison	Did participants with different income sources choose different answer options?	Effect strength= 0.1126978	0.9695
4b Total Comparison	Were some answer options significantly more often chosen than others? Which options were significantly more or less often chosen?	Chi2 test: X^2 = 23.687 Residuals: No communication mechanisms: 4.775 Occasionally: -0.988 Only during field activities: -0.439 Regular basis: -1.811	Total = 9.229e-05***
Village Comparison	Did participants from different villages choose different answer options?	Fisher's exact test: (Cramérs V) Effect strength= 0.1521484	0.7556
Gender Comparison	Did women choose different answer options than men?	Effect strength= 0.2571599	0.2284
Age Comparison	Did participants from different age groups choose different answer options?	Effect strength= 0.2275515	0.3898
Income Comparison	Did participants with different income sources choose different answer options?	Effect strength= 0.352527	0.7911
5a Total Comparison	Were some answer options significantly more often chosen than others?	Chi2 test: X^2 = 30.916	Total = 3.185e-06***

	Which options were significantly more or less often chosen?	Residuals: Good awareness: -2.085 Partial awareness: -1.262 Indirect: 0.109 Limited dissemination: -2.085 No knowledge: 5.324	
		Fisher's exact: (Cramérs V)	
Village Comparison	Did participants from different villages choose different answer options?	Effect strength= 0.1310683	0.8896
Gender Comparison	Did women choose different answer options than men?	Effect strength= 0.2113413	0.4618
Age Comparison	Did participants from different age groups choose different answer options?	Effect strength= 0.2256318	0.3933
Income Comparison	Did participants with different income sources choose different answer options?	Effect strength= 0.3917572	0.1004
5b		Chi2 test:	
Total Comparison	Were some answer options significantly more often chosen than others?	X^2 = 26.217	Total = 2.861e-05***
	Which options were significantly more or less often chosen?	Residuals: Disconnected: 3.128 Limited consideration: -2.360 Partial alignment: 2.305 Total alignment: 0.384	
Village Comparison	Did participants from different villages choose different answer options?	Fisher's exact: (Cramérs V) Effect strength= 0.352913	0.01049*
Gender Comparison	Did women choose different answer options than men?	Effect strength= 0.2987043	0.1259
Age Comparison	Did participants from different age groups choose different answer options?	Effect strength= 0.1402857	0.939
Income Comparison	Did participants with different income sources choose different answer options?	Effect strength= 0.3167556	0.9675
6a		Cochran's Q:	
Total Comparison	Were some answer obstacles significantly more often chosen than others?	Q= 52.4961240310078	Total = 1.48196277471868e-09***
		Mc Nemar:	
Post hoc	Which obstacles were significantly more often chosen than others?	Odds ratio = 4.8 Odds ratio = 5.25 Odds ratio = 3.17 Odds ratio = 7.67 Odds ratio = 5 Odds ratio = 2.6 Odds ratio = 0.89 Odds ratio = 0.71 Odds ratio= 3.62 Odds ratio: 1.33 Odds ratio = 0.52 Odds ratio = 0.79 Odds ratio = 3.09 Odds ratio = 1.44 Odds ratio = 0.61 Odds ratio = 4.86 Odds ratio = 1.69 Odds ratio = 0.72 Odds ratio = 0.47 Odds ratio = 0.29 Odds ratio = 0.43	1 vs. 2 = 1.74e-02* 1 vs. 3 = 2.88e-02* 1 vs. 4 = 3.44e-01 1 vs. 5 = 1.34e-06*** 1 vs. 6 = 2.65e-03** 1 vs. 7 = 1 2 vs. 3 = 1 2 vs. 4 = 1 2 vs. 5 = 2.12e-02* 2 vs. 6 = 1 2 vs. 7 = 1 3 vs. 4 = 1 3 vs. 5 = 2.18e-02* 3 vs. 6 = 1 3 vs. 7 = 1 4 vs. 5 = 1.03e-03** 4 vs. 6 = 1 4 vs. 7 = 1 5 vs. 6 = 4.98e-01 5 vs. 7 = 9.85e-04*** 6 vs. 7 = 3.72e-01
Village Comparison	Did participants from different villages choose different answer obstacles? (each obstacle analysed separately)	Fisher's exact: Odds Ratio= 2.0269694 Odds Ratio= 0.8587255 Odds Ratio= 0.7194499 Odds Ratio= 2.5313292 Odds Ratio= 1.1234117 Odds Ratio= 1.4167128 Odds Ratio= 0.6817093	Land tenure insecurity (1) = 0.3921628 Limited involvement of local communities (2) = 1 Insufficient financial resources (3) = 0.7803965 Inappropriate choice of species (4) = 0.1372384 Short-term projects without long-term follow-up (5) = 1 Lack of coordination among stakeholders (6) = 0.5998881 Fire (7) = 0.7499582
Gender Comparison	Did women choose different answer obstacles than men? (each obstacle analysed separately)	Odds Ratio= 0.6314955 Odds Ratio= 0.5870347 Odds Ratio= 0.3846326 Odds Ratio= 2.1994091 Odds Ratio= 0.6213329 Odds Ratio= 1.6321265 Odds Ratio= 1.2241656	Land tenure insecurity= 0.7110677 Limited involvement of local communities= 0.3325178 Insufficient financial resources= 0.1280798 Inappropriate choice of species= 0.1808155 Short-term projects without long-term follow-up= 0.3516444 Lack of coordination among stakeholders= 0.3441327 Fire= 0.7725664
Age Comparison	Did participants from different age groups choose different answer obstacles? (each obstacle analysed separately)	Fisher's exact: (Cramérs V) Effect strength= 0.08918248 Effect strength= 0.27293800	Land tenure insecurity= 0.80259870 Limited involvement of local communities= 0.05897051

		Effect strength= 0.13927262 Effect strength= 0.10210254 Effect strength= 0.08554109 Effect strength= 0.08843712 Effect strength= 0.20661350	Insufficient financial resources= 0.52273863 Inappropriate choice of species= 0.64367816 Short-term projects without long-term follow-up= 0.77461269 Lack of coordination among stakeholders= 0.79260370 Fire= 0.20689655
Income Comparison	Did participants with different income sources choose different answer obstacles? (each obstacle analysed separately)	Effect strength= 0.3065487 Effect strength= 0.4431744 Effect strength= 0.4984180 Effect strength= 0.4099246 Effect strength= 0.2945321 Effect strength= 0.3278714 Effect strength= 0.3327143	Land tenure insecurity= 0.71364318 Limited involvement of local communities= 0.10294853 Insufficient financial resources= 0.02248876* Inappropriate choice of species= 0.27236382 Short-term projects without long-term follow-up= 0.83808096 Lack of coordination among stakeholders= 0.70714643 Fire= 0.71414293
6b		Cochran's Q:	
Total Comparison	Were some answer options significantly more often chosen than others?	Q= 52.714	Total = 3.851e-10***
		Mc Nemar:	
Post hoc	Which recommendations were significantly more often chosen than others?	Odds ratio = 10 Odds ratio = 2.86 Odds ratio = 2.67 Odds ratio = 19 Odds ratio = 4.12 Odds ratio = 0.32 Odds ratio = 0.16 Odds ratio = 1 Odds ratio= 0.61 Odds ratio: 1.15 Odds ratio = 3.88 Odds ratio = 1.75 Odds ratio = 3.33 Odds ratio = 1.62 Odds ratio = 0.61	1 vs. 2 = 1.98e-06*** 1 vs. 3 = 3.14e-01 1 vs. 4 = 2.22e-01 1 vs. 5 = 4.70e-07*** 1 vs. 6 = 2.67e-03 ** 2 vs. 3 = 4.47e-03** 2 vs. 4 = 3.6e-03** 2 vs. 5 = 1 2 vs. 6 = 1 3 vs. 4 = 1 3 vs. 5 = 6.40e-03** 3 vs. 6 = 1 4 vs. 5 = 2.04e-02* 4 vs. 6 = 1 5 vs. 6 = 1
		Fisher's exact:	
Village Comparison	Did participants from different villages choose different answer options? (each recommendation analysed separately)	Odds Ratio= 0.4311093 Odds Ratio= 3.1586578 Odds Ratio= 0.5833555 Odds Ratio= 0.3598747 Odds Ratio= 0.4137947 Odds Ratio= 1.4267053	Strengthen land tenure security (1) = 0.50472492 Improve community participation (2) = 0.06610214 Ensure sustainable financing (3) = 0.42272087 Use adapted local species (4) = 0.11136062 Establish long-term monitoring mechanism (5) = 0.11409016 Strengthen coordination among different actors (6) = 0.60902867
Gender Comparison	Did women choose different answer options than men? (each recommendation analysed separately)	Odds Ratio= 0.4339778 Odds Ratio= 0.7644500 Odds Ratio= 0.5436009 Odds Ratio= 0.9725470 Odds Ratio= 0.3924449 Odds Ratio= 0.7260549	Strengthen land tenure security= 0.24695140 Improve community participation= 0.63642297 Ensure sustainable financing= 0.32657027 Use adapted local species= 1 Establish long-term monitoring mechanism= 0.05785794 Strengthen coordination among different actors= 0.64264500
Age Comparison	Did participants from different age groups choose different answer options? (each recommendation analysed separately)	Fisher's exact: (Cramérs V) Effect strength= 0.16850941 Effect strength= 0.08883227 Effect strength= 0.17549370 Effect strength= 0.11104608 Effect strength= 0.10508728 Effect strength= 0.17436434	Strengthen land tenure security= 0.3323338 Improve community participation= 0.7676162 Ensure sustainable financing= 0.2743628 Use adapted local species= 0.6566717 Establish long-term monitoring mechanism= 0.6576712 Strengthen coordination among different actors= 0.3238381
Income Comparison	Did participants with different income sources choose different answer options? (each recommendation analysed separately)	Effect strength= 0.3722263 Effect strength= 0.4163670 Effect strength= 0.4054595 Effect strength= 0.6391506 Effect strength= 0.4009581 Effect strength= 0.3209928	Strengthen land tenure security= 0.4267866067 Improve community participation= 0.2088955522 Ensure sustainable financing= 0.1689155422 Use adapted local species= 0.0004997501*** Establish long-term monitoring mechanism= 0.3038480760 Strengthen coordination among different actors= 0.7251374313
7a		Fisher's exact:	
Village Comparison	Did participants from different villages rate the most frequently chosen outcome differently?	Odds Ratio= 0.19 Odds Ratio= 0.56 Odds Ratio= 0.59 Odds Ratio= 0.71 Odds Ratio=0.26	Creation of sustainable local jobs= 0.00678** Restoration of degraded land= 0.278 Improved land tenure security= 0.471 Improved livelihoods for community members= 0.542 Long-term maintenance of restored areas= 0.0557
Gender Comparison	Did men and women rate the most frequently chosen outcome differently?	Odds Ratio= 1.49 Odds Ratio= 1.12 Odds Ratio= 1.02 Odds Ratio= 0.918 Odds Ratio= 2.19	Creation of sustainable local jobs= 0.764 Restoration of degraded land= 1 Improved land tenure security= 1 Improved livelihoods for community members=1 Long-term maintenance of restored areas= 0.483
		Fisher's exact: (Cramérs V)	
Age Comparison	Did participants from different age groups rate the most frequently chosen outcome differently?	Effect strength= 0.112 Effect strength= 0.180 Effect strength= 0.285 Effect strength= 0.0387	Creation of sustainable local jobs= 0.662 Restoration of degraded land= 0.265 Improved land tenure security= 0.0455* Improved livelihoods for community members= 0.937

		Effect strength= 0.154	Long-term maintenance of restored areas= 0.494
Income Comparison	Did participants from different income groups rate the most frequently chosen outcome differently?	Effect strength= 0.396 Effect strength= 0.332 Effect strength= 0.328 Effect strength= 0.392 Effect strength= 0.341	Creation of sustainable local jobs= 0.343 Restoration of degraded land= 0.823 Improved land tenure security= 0.559 Improved livelihoods for community members= 0.433 Long-term maintenance of restored areas= 0.617
7b		Cochran's Q :	
Total Comparison	Were some NCP within one group significantly more or less often chosen than others?	Q = 115 Q = 100 Q = 98	Regulating = 4.71e-20*** Material= 3.64e-18*** Non-Material= 6.59e-19***
Village Comparison	Did participants from different villages choose different NCP?	Fisher's exact: Odds Ratio= 1.75 Odds Ratio= 0.507 Odds Ratio= 1.49 Odds Ratio= 0.425 Odds Ratio= 0.365 Odds Ratio= 1.26 Odds Ratio= 1.34 Odds Ratio= 1.16 Odds Ratio= 0.836 Odds Ratio= 0.979 Odds Ratio= 0.890	**Regulating** Soil protection= 0.294 Climate regulation= 0.299 Water quantity= 0.503 Hazard regulation= 0.673 Seed dispersal= 0.680 Pest control= 0.773 Air quality= 0.789 Water quality= 0.8 Habitat creation= 1 Soil fertility= 1 Pollination= 1
		Odds Ratio= 0.359 Odds Ratio= 2.28 Odds Ratio= 0.507 Odds Ratio= 1.62 Odds Ratio= 1.71 Odds Ratio= 1.32 Odds Ratio= 0.682 Odds Ratio= 0.682 Odds Ratio= 1.04	**Material** Charcoal= 0.222 Medicinal plants= 0.273 Construction material= 0.299 Firewood= 0.441 Weaving material= 0.471 Genetic resources= 0.735 Animal Feed= 0.750 Handcraft material= 0.750 Food provision= 1
		Odds Ratio= 1.34 Odds Ratio= 1.66 Odds Ratio= 0.797 Odds Ratio= 0.774 Odds Ratio= 0.864 Odds Ratio= 1.16 Odds Ratio= 0.910	**Non-material** Learning and Inspiration= 0.587 New experiences= 0.680 Therapeutic/Peace= 0.773 Recreation= 0.781 Intergenerational benefits= 0.781 Culture & Identity= 0.790 Social cohesion= 1
Gender Comparison	Did men and women choose different NCP?	Odds Ratio= 1.05 Odds Ratio= 1.30 Odds Ratio= 3.92 Odds Ratio= 0.613 Odds Ratio= 1.66 Odds Ratio= 0.347 Odds Ratio= 0.951 Odds Ratio= 0.532 Odds Ratio= 0.753 Odds Ratio= 1.69 Odds Ratio= 0.980	**Regulating** Soil protection= 1 Climate regulation= 0.642 Water quantity= 0.0284* Hazard regulation= 0.711 Seed dispersal= 0.478 Pest control= 0.113 Air quality= 1 Water quality= 0.242 Habitat creation= 0.764 Soil fertility= 0.423 Pollination= 1
		Odds Ratio= 1.09 Odds Ratio= 0.399 Odds Ratio= 0.670 Odds Ratio= 1.29 Odds Ratio= 0.617 Odds Ratio= 0.279 Odds Ratio= 2.23 Odds Ratio= 2.23 Odds Ratio= 1.85	**Material** Charcoal= 1 Medicinal plants= 0.0819 Construction material= 0.483 Firewood= 0.645 Weaving material= 0.743 Genetic resources= 0.125 Animal Feed= 0.148 Handcraft material= 0.148 Food provision= 0.246
		Odds Ratio= 1.47 Odds Ratio= 1.66 Odds Ratio= 1.12 Odds Ratio= 0.975 Odds Ratio= 0.388 Odds Ratio= 1.24 Odds Ratio= 1.11	**Non-material** Learning and Inspiration= 0.456 New experiences= 0.478 Therapeutic/Peace= 1 Recreation= 1 Intergenerational benefits= 0.0385* Culture & Identity= 0.805 Social cohesion= 1
Age Comparison	Did participants from different age groups choose different NCP?	Fisher's exact: (Cramérs V) Effect strength= 0.220 Effect strength= 1.47	**Regulating** Soil protection= 0.138 Climate regulation= 0.408

		Effect strength= 0.208	Water quantity= 0.194
		Effect strength= 0.0725	Hazard regulation= 0.902
		Effect strength= 0.185	Seed dispersal= 0.246
		Effect strength= 0.120	Pest control= 0.576
		Effect strength= 0.257	Air quality= 0.0545
		Effect strength= 1.60	Water quality= 0.369
		Effect strength= 0.207	Habitat creation= 0.212
		Effect strength= 0.0481	Soil fertility= 0.894
		Effect strength= 0.185	Pollination= 0.241
			Material
		Effect strength= 0.0967	Charcoal= 0.772
		Effect strength= 0.0642	Medicinal plants= 0.853
		Effect strength= 0.192	Construction material= 0.224
		Effect strength= 0.118	Firewood= 0.583
		Effect strength= 0.154	Weaving material= 0.360
		Effect strength= 0.0629	Genetic resources= 0.863
		Effect strength= 0.256	Animal Feed= 0.052
		Effect strength= 0.0216	Handcraft material= 1
		Effect strength= 0.0491	Food provision= 0.914
			Non-material
		Effect strength= 0.0358	Learning and Inspiration= 0.948
		Effect strength= 0.159	New experiences= 0.374
		Effect strength= 0.0619	Therapeutic/Peace= 0.850
		Effect strength= 0.0113	Recreation= 1
		Effect strength= 0.145	Intergenerational benefits= 0.478
		Effect strength= 0.132	Culture & Identity= 0.481
		Effect strength= 0.230	Social cohesion= 0.117
			Regulating
Income Comparison	Did participants from different income groups choose different NCP?	Effect strength= 0.431	Soil protection= 0.107
		Effect strength= 0.419	Climate regulation= 0.183
		Effect strength= 0.419	Water quantity= 0.341
		Effect strength= 0.503	Hazard regulation= 0.081
		Effect strength= 0.267	Seed dispersal= 0.811
		Effect strength= 0.439	Pest control= 0.134
		Effect strength= 0.383	Air quality= 0.356
		Effect strength= 0.412	Water quality= 0.223
		Effect strength= 0.302	Habitat creation= 0.755
		Effect strength= 0.307	Soil fertility= 0.650
		Effect strength= 0.293	Pollination= 0.822
			Material
		Effect strength= 0.467	Charcoal= 0.02*
		Effect strength= 0.443	Medicinal plants= 0.107
		Effect strength= 0.453	Construction material= 0.081
		Effect strength= 0.39	Firewood= 0.305
		Effect strength= 0.427	Weaving material= 0.131
		Effect strength= 0.342	Genetic resources= 0.815
		Effect strength= 0.361	Animal Feed= 0.706
		Effect strength= 0.319	Handcraft material= 0.790
		Effect strength= 0.482	Food provision= 0.0265*
			Non-material
		Effect strength= 0.3	Learning and Inspiration= 0.841
		Effect strength= 0.237	New experiences= 0.986
		Effect strength= 0.287	Therapeutic/Peace= 0.914
		Effect strength= 0.348	Recreation= 0.541
		Effect strength= 0.335	Intergenerational benefits= 0.664
		Effect strength= 0.415	Culture & Identity= 0.232
		Effect strength= 0.421	Social cohesion= 0.182
8		Chi2 test:	
Village Comparison	Does the perception that there are no restrictions or challenges depend on the village?	X^2= 0.19717	Village= 0.657
Gender Comparison	Does the perception that there are no restrictions or challenges depend on the gender?	X^2= 4.9702e-32	Gender= 1
		Fisher's exact test: (Cramérs V)	
Age Comparison	Does the perception that there are no restrictions or challenges depend on the age group?	Effect strength= 0.104	Age= 0.7096
Income Comparison	Does the perception that there are no restrictions or challenges depend on the income source?	Effect strength= 0.286	Income= 0.8941
9		Chi2 test:	
Total Comparison	Were some options significantly more or less often chosen than others?	X^2= 12.241	Total= 0.01565*
		Fisher's exact: (Cramérs V)	
Village Comparison	Did participants from different villages choose a different option?	Effect strength= 0.137	Village= 0.8371
Gender Comparison	Did men choose a different option than women?	Effect strength= 0.077	Gender= 0.9675

Age Comparison	Did participants from different age groups choose a different option?	Effect strength= 0.305	Age= 0.05497
Income Comparison	Did participants from different income groups choose a different option?	Effect strength= 0.438	Income= 0.1109
10a		Chi2 test:	
Total Comparison	Is there a significant difference in the frequency the two answer options were selected?	X^2= 14.759	Total= 0.0001222***
		Fisher's exact:	
Village Comparison	Did participants from different villages choose different answer options?	Odds ratio= 0.5412563	Village= 0.8371
Gender Comparison	Did men choose a different answer option than women?	Odds ratio= 1.337445 Fisher's exact: (Cramérs V)	Gender= 0.6191
Age Comparison	Did participants from different age groups choose a different answer option?	Effect strength= 0.193	Age= 0.2404
Income Comparison	Did participants from different income groups choose a different answer option?	Effect strength= 0.364	Income= 0.5217
10b		Wilcoxon signed rank test:	
Total Comparison	Is there a significant difference in perceived project involvement between specific groups within one category?	V = 916 Friedman test: Chi-squared = 16.152	Gender category = 2.694e-08*** Land ownership category = 0.002822**
		Chi-squared = 53.734	Responsibility within the community category = 5.437e-08***
Gender Comparison	Did men and women perceive the project involvement of men and women differently?	ANOVA Linear-mixed model: F = 0.4416	Gender category = 0.5083
9 & 5b		Spearman's rank correlation:	
Total Comparison	Do participants who think that the priorities of local communities and other actors involved in tree-based restoration projects are mostly or totally aligned also think that their priorities are well considered in the project strategies?	S = 59694 rho = 0.2734429	Total: 0.01475*

Additional Plots of the Results

Interview Question 1

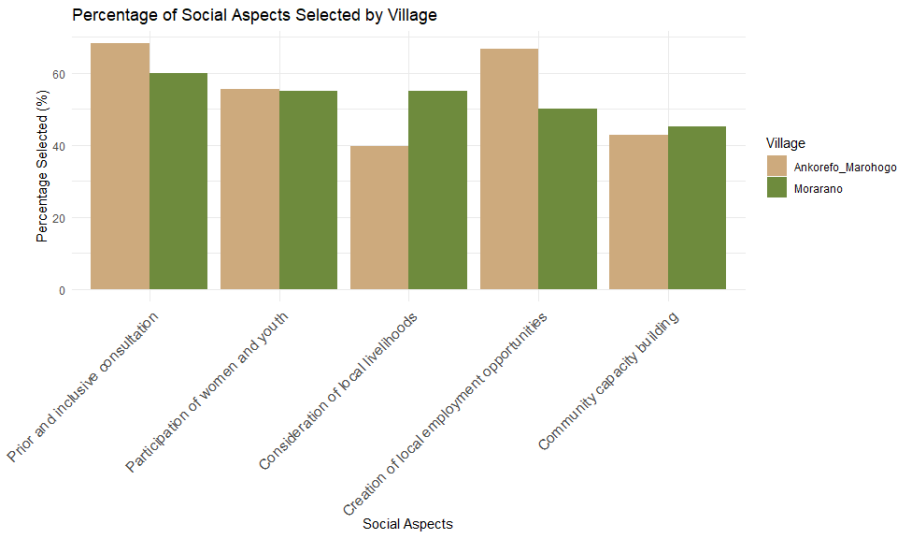


Diagram 1 Comparison of the distribution (in %) of how often various social aspects were selected by participants from the two villages.

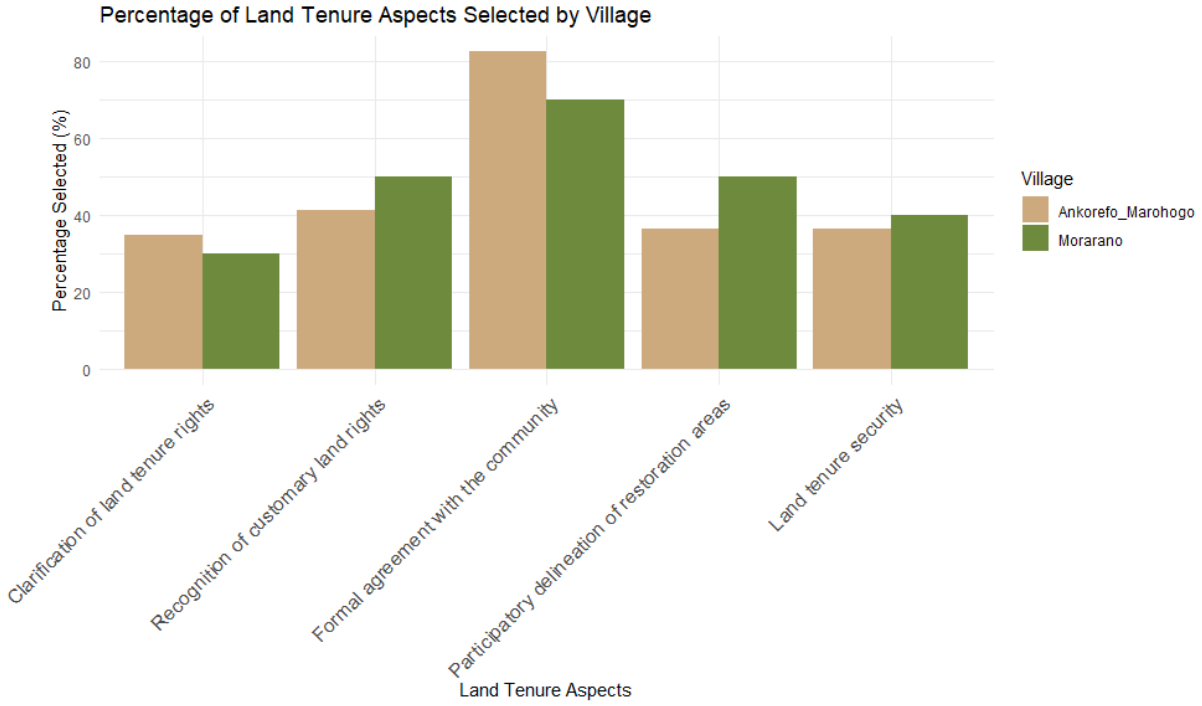


Diagram 2 Comparison of the distribution (in %) of how often various land tenure aspects were selected by participants from the two villages.

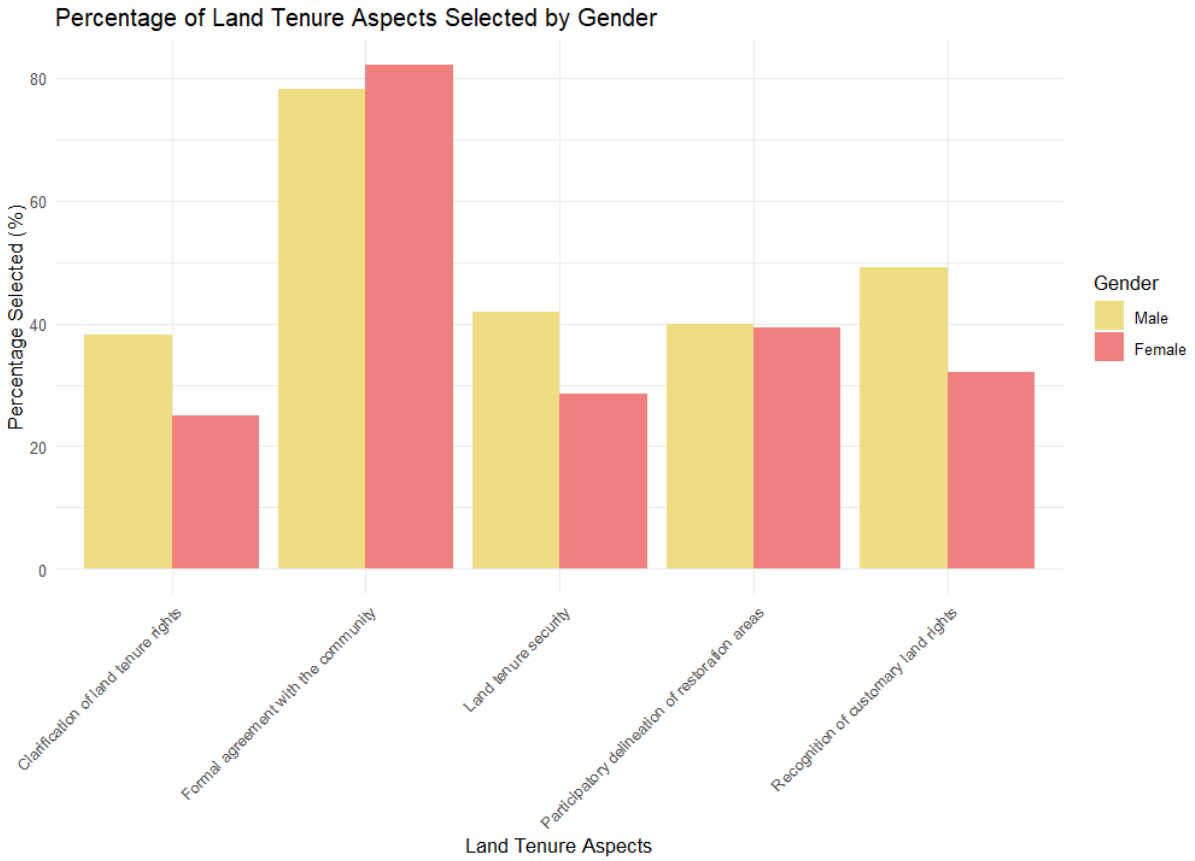


Diagram 3 Comparison of the distribution (in %) of how often various land tenure aspects were selected by men and women.

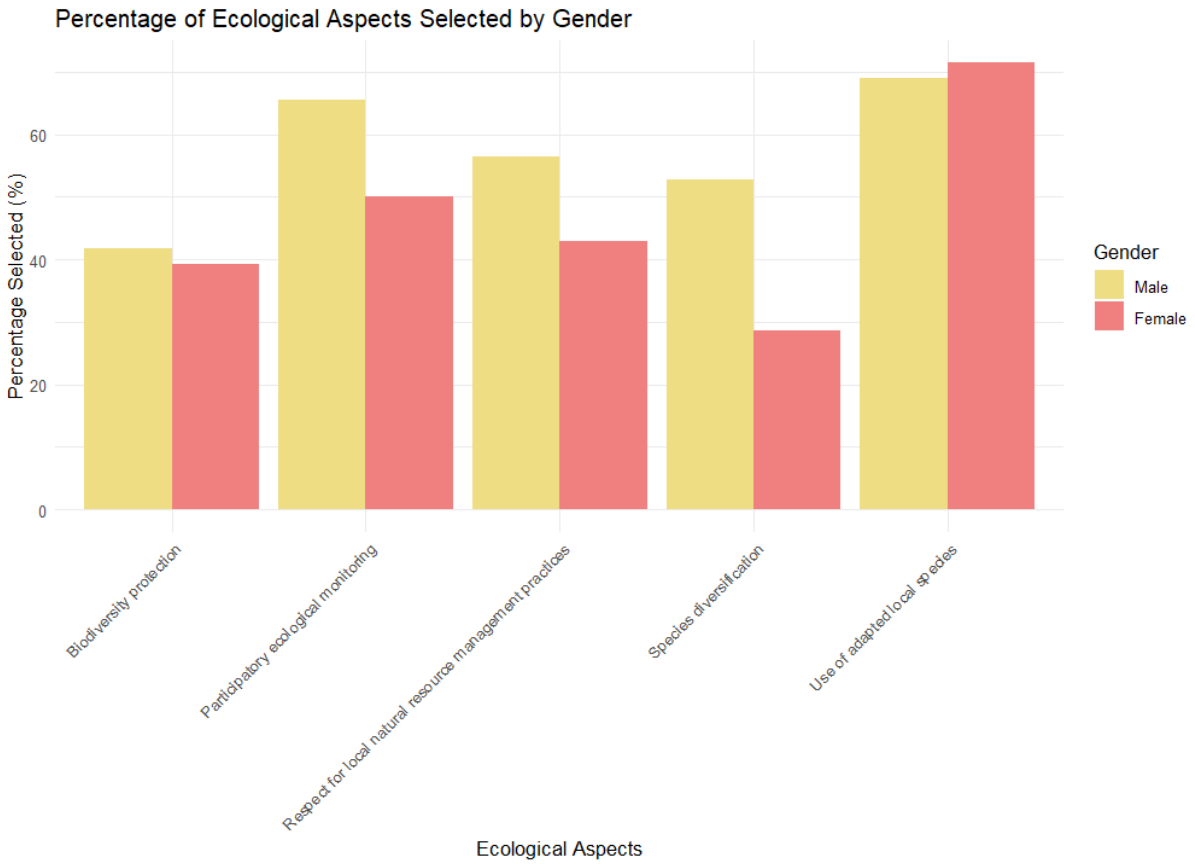


Diagram 4 Comparison of the distribution (in %) of how often various ecological aspects were selected by men and women.

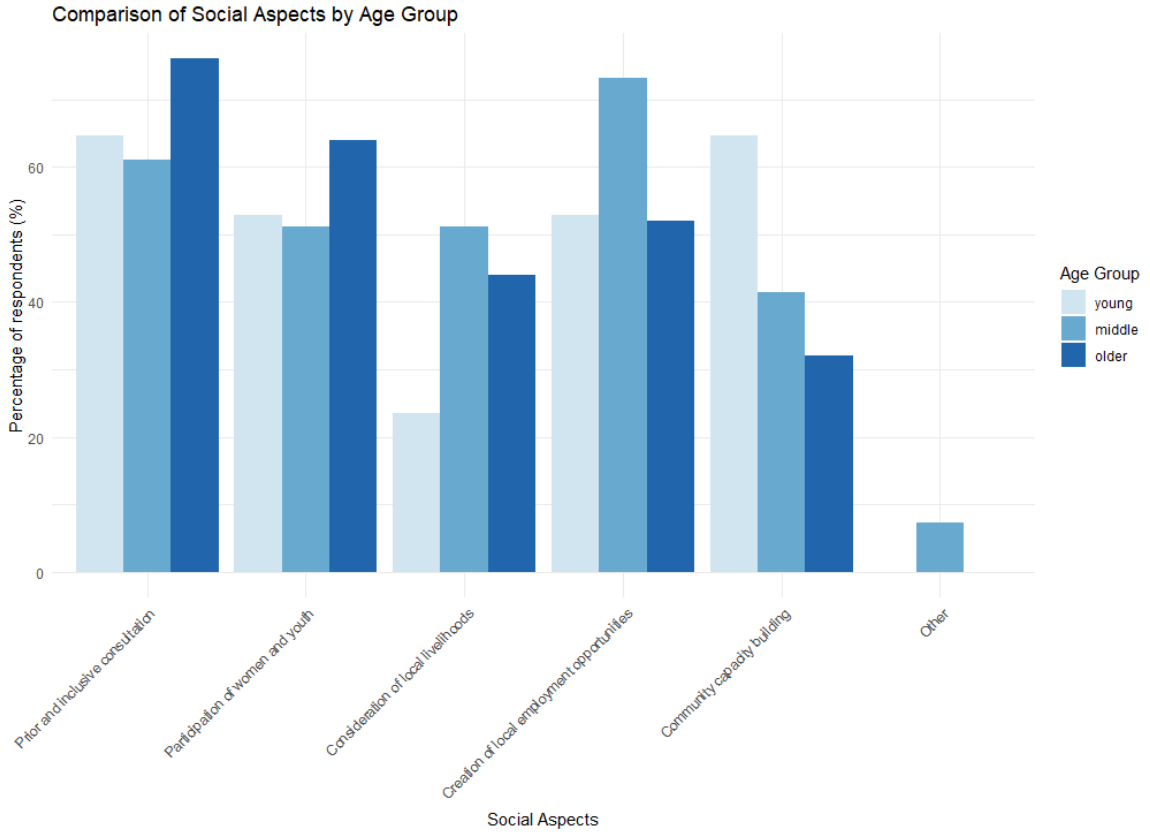


Diagram 5 Comparison of the distribution (in %) of how often various social aspects were selected by participants from different age groups.

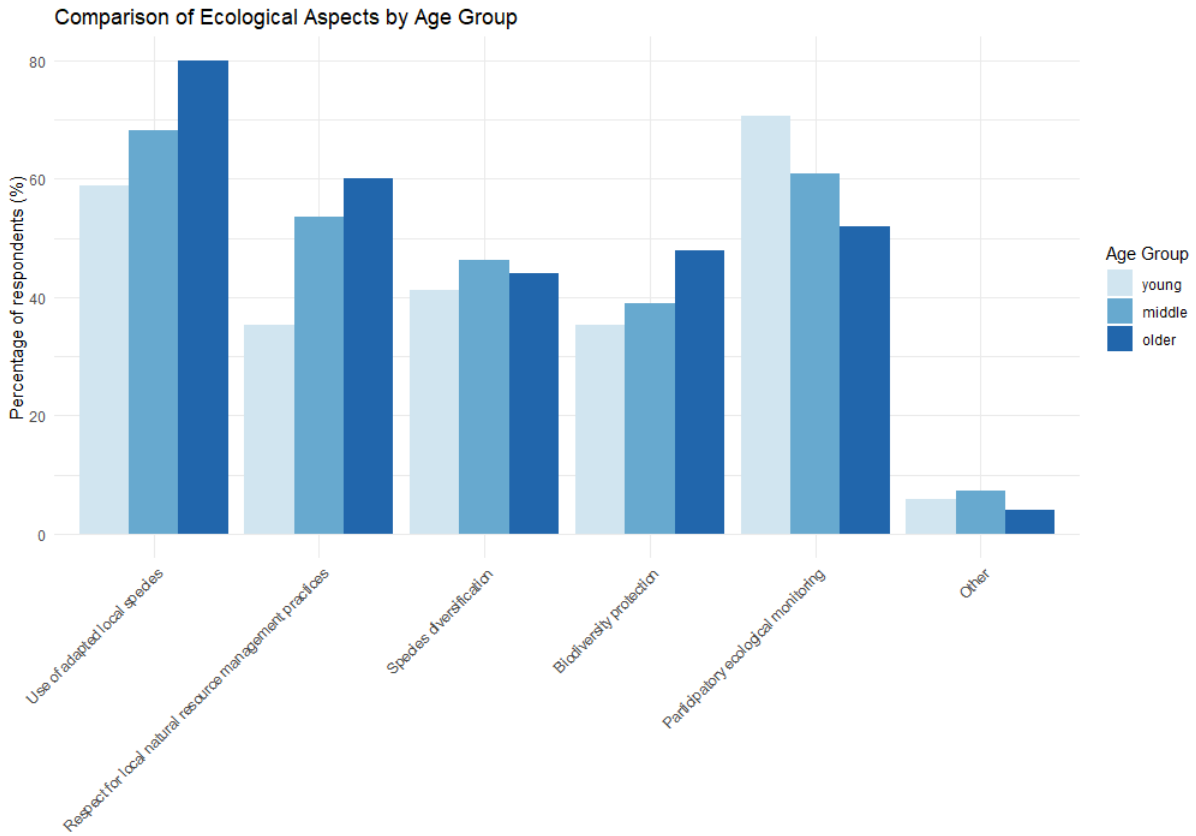


Diagram 6 Comparison of the distribution (in %) of how often various ecological aspects were selected by participants from different age groups.

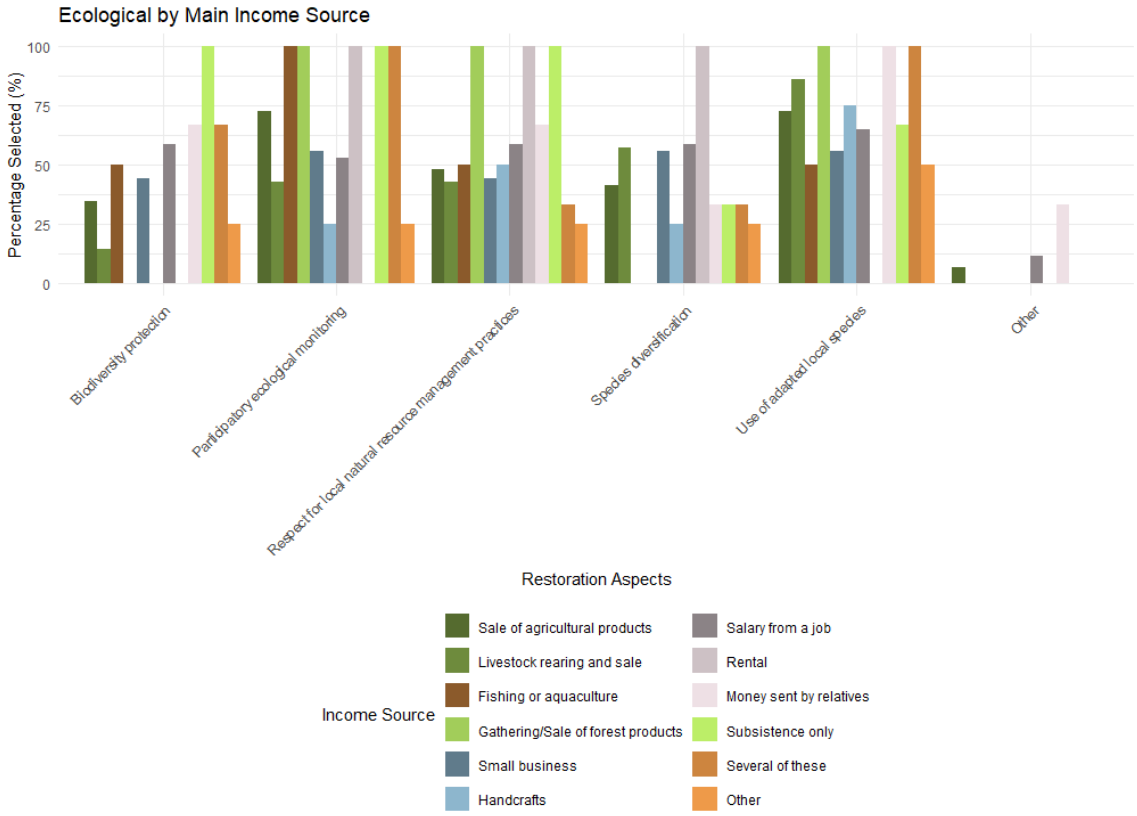


Diagram 7 Comparison of the distribution (in %) of how often various ecological aspects were selected by participants from different income source groups.

Interview Question 2

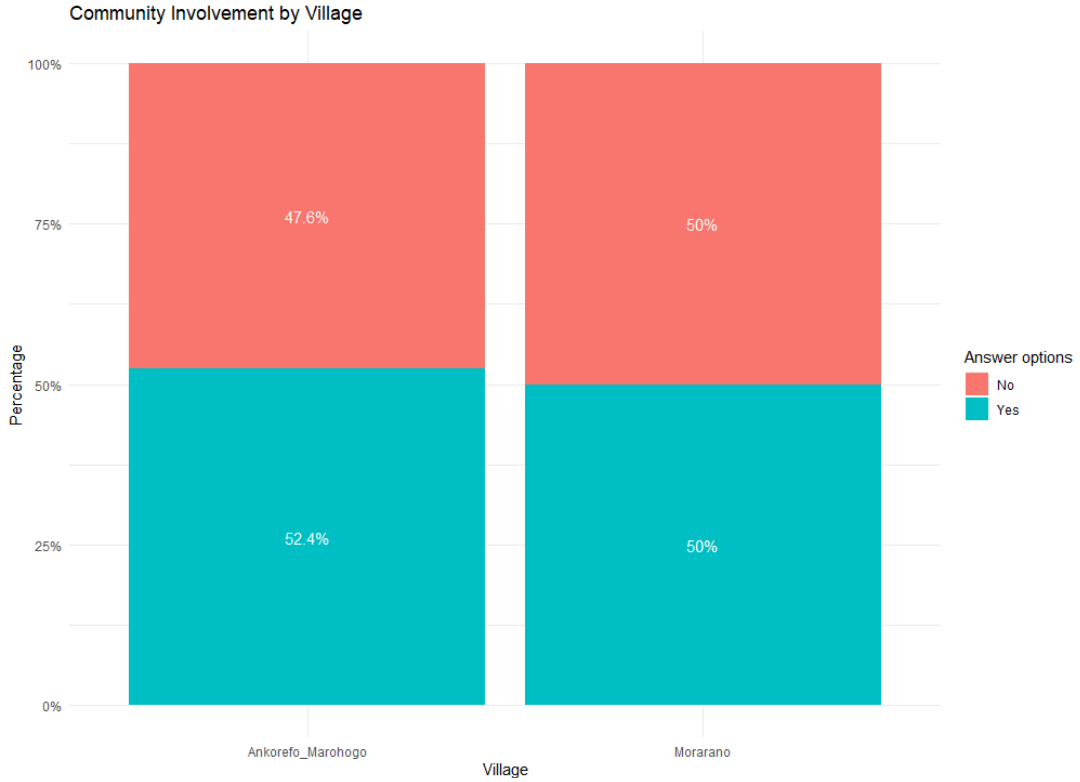


Diagram 8 Comparison of the distribution (in %) of perceived community involvement by participants from the two villages.

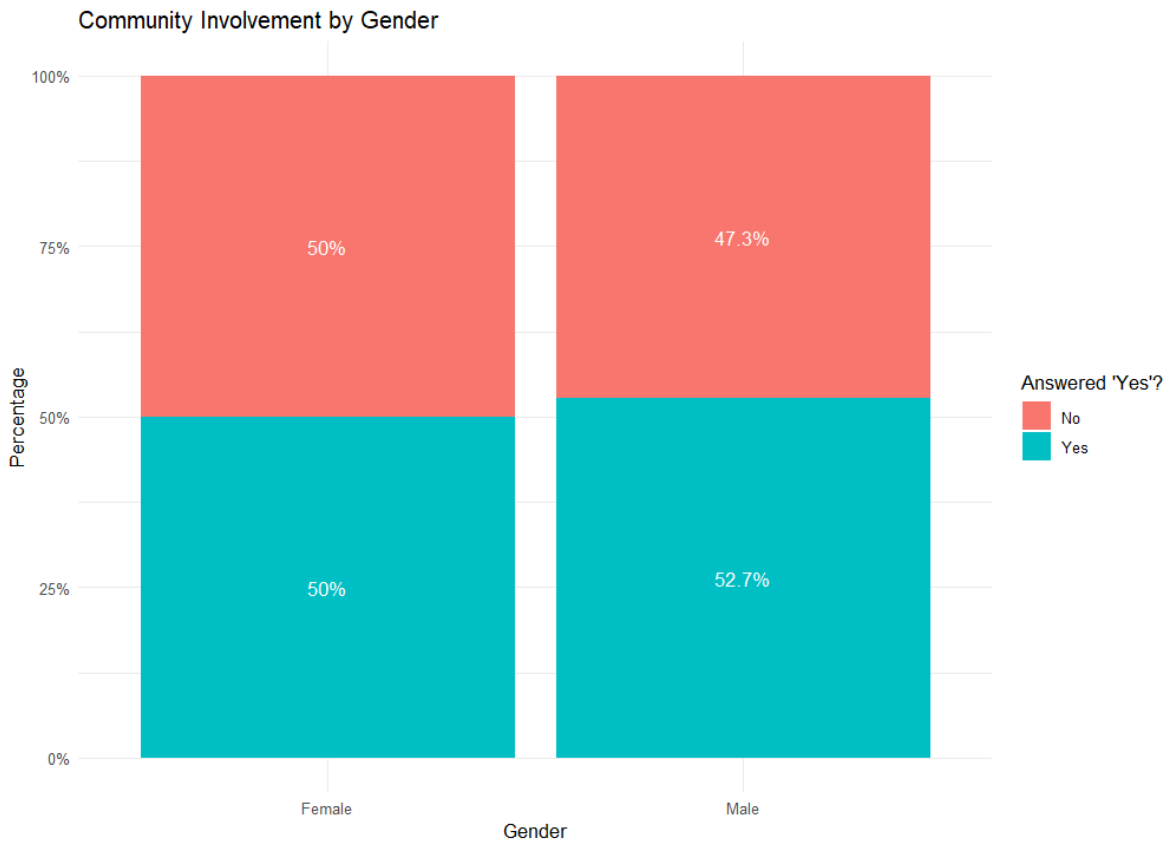


Diagram 9 Comparison of the distribution (in %) of perceived community involvement by men and women.

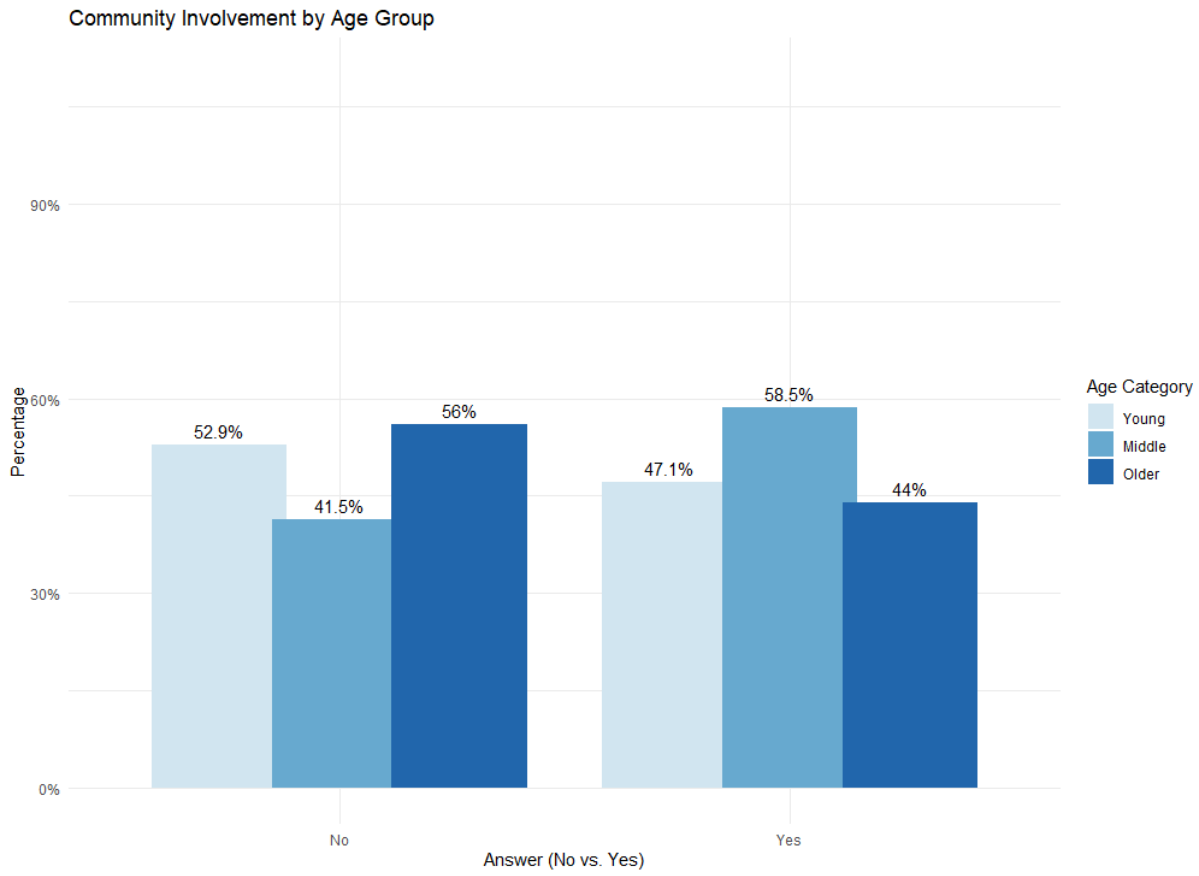


Diagram 10 Comparison of the distribution (in %) of perceived community involvement by participants from different age groups.

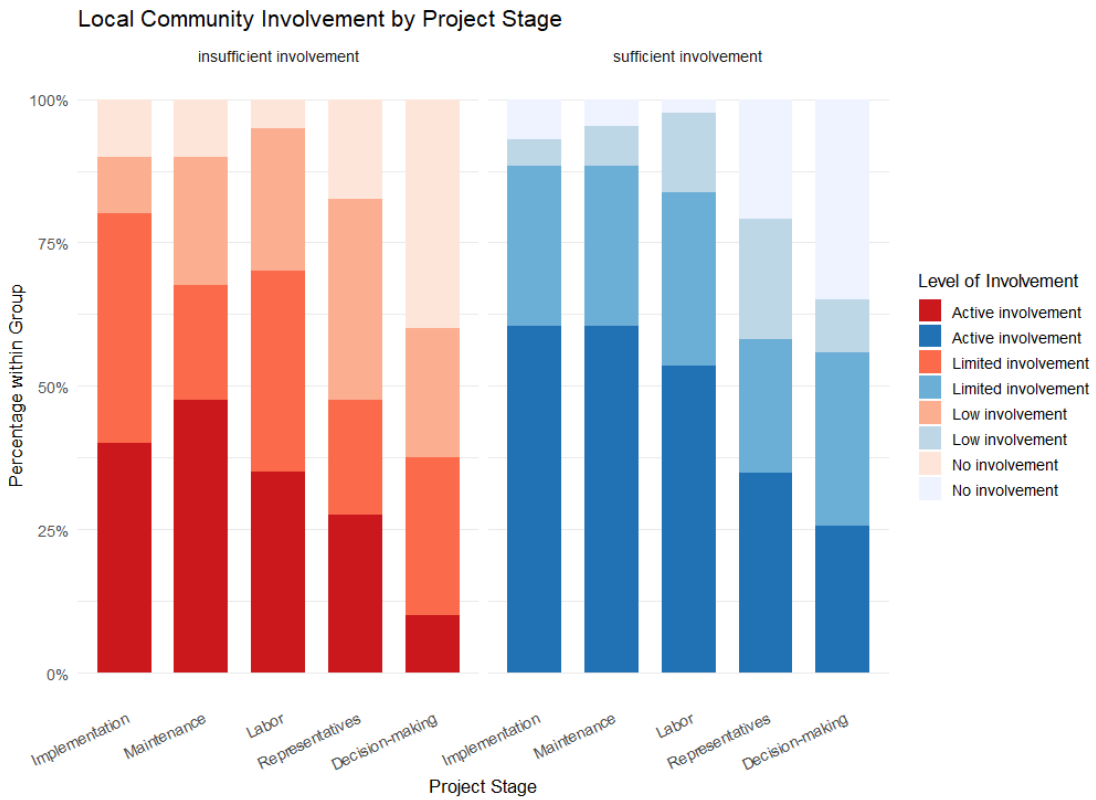


Diagram 11 Comparison of the distribution (in %) of perceived project involvement per stage by participants from the yes and no groups of Question 2a.

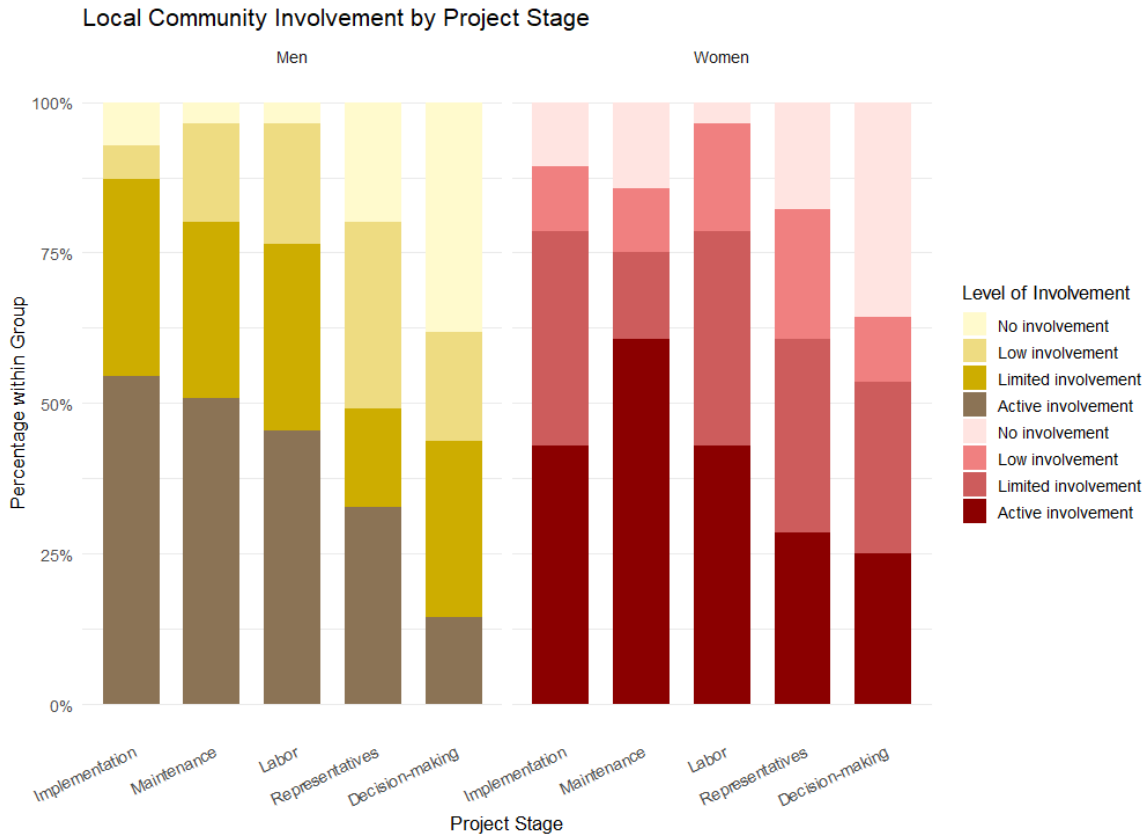


Diagram 12 Comparison of the distribution (in %) of perceived project involvement per stage by men and women.

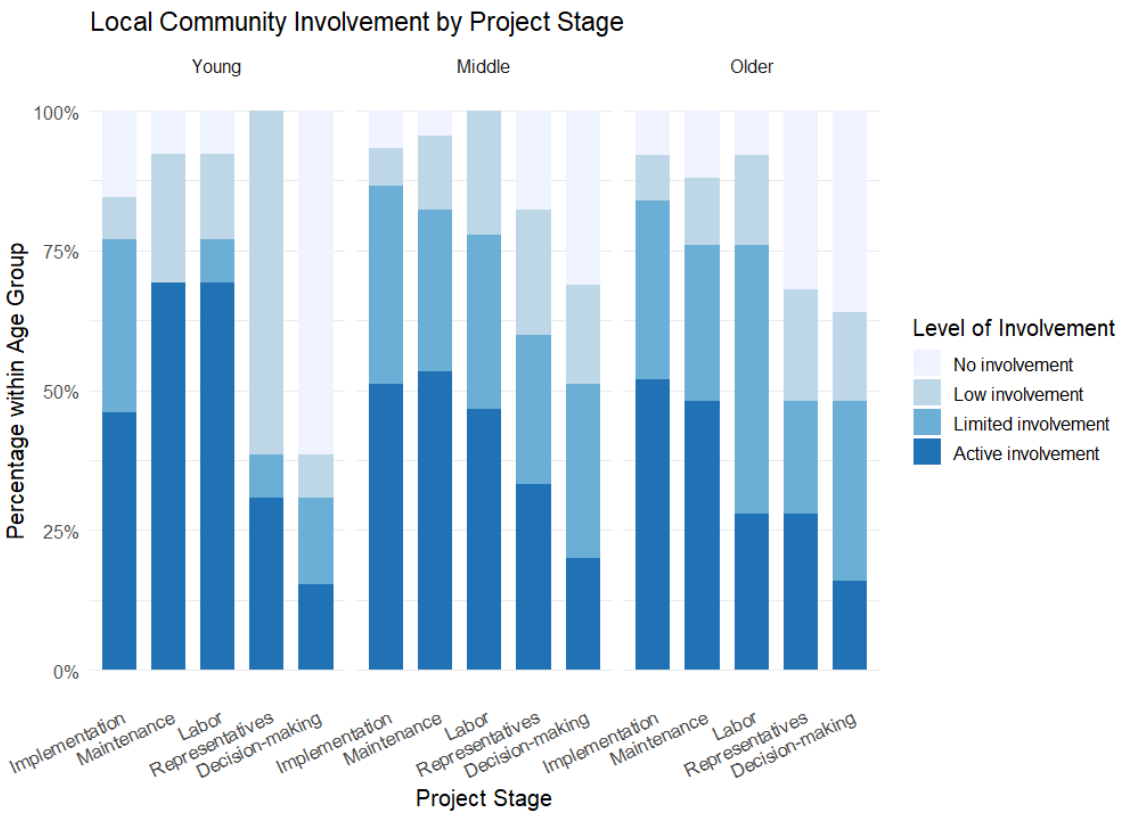


Diagram 13 Comparison of the distribution (in %) of perceived project involvement per stage by participants from different age groups.

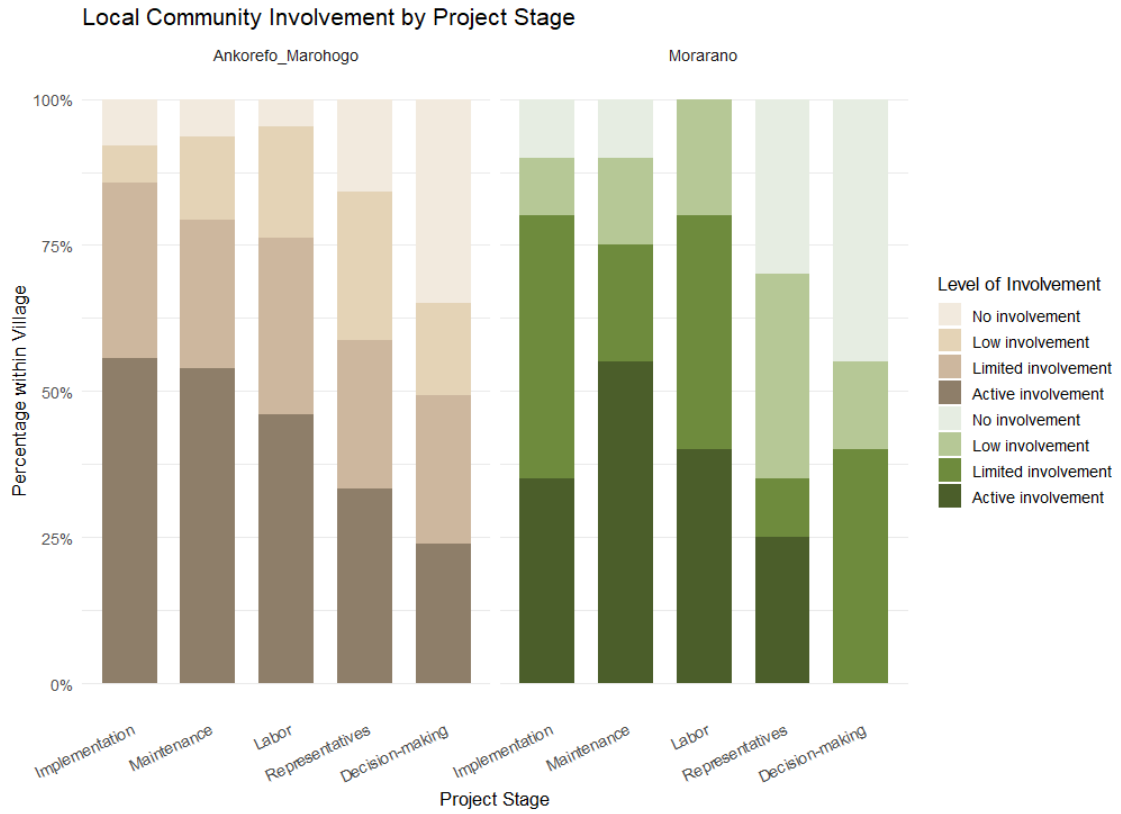


Diagram 14 Comparison of the distribution (in %) of perceived project involvement per stage by participants from different villages.

Interview Question 3

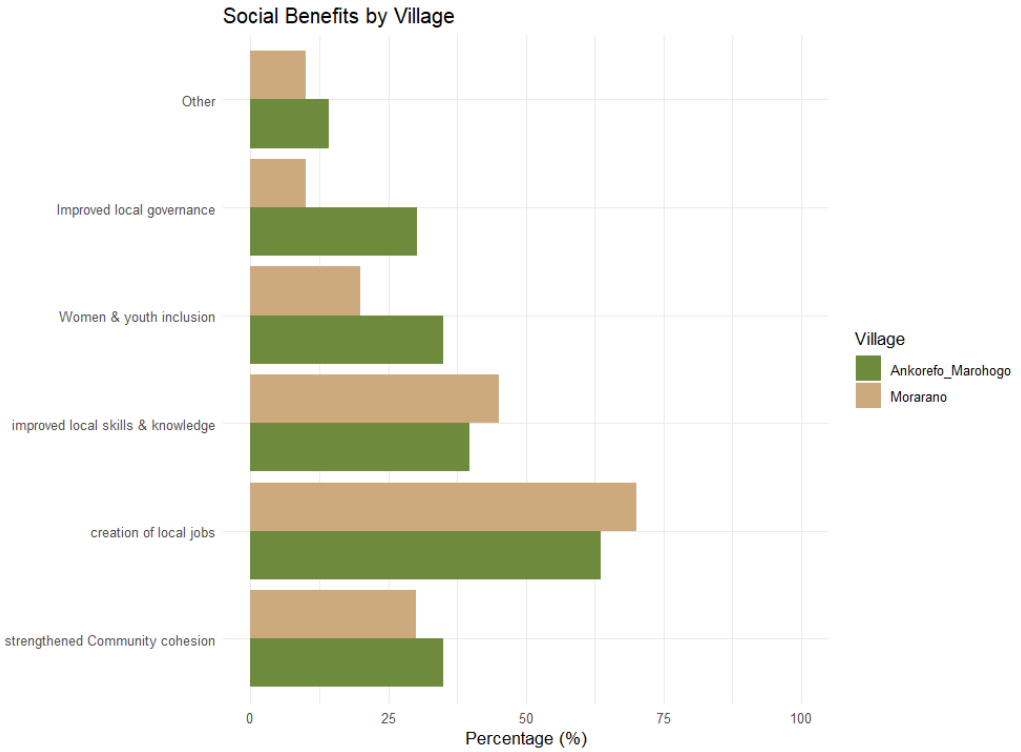


Diagram 15 Comparison of the distribution (in %) of how often various social benefits were observed by participants from the two villages.

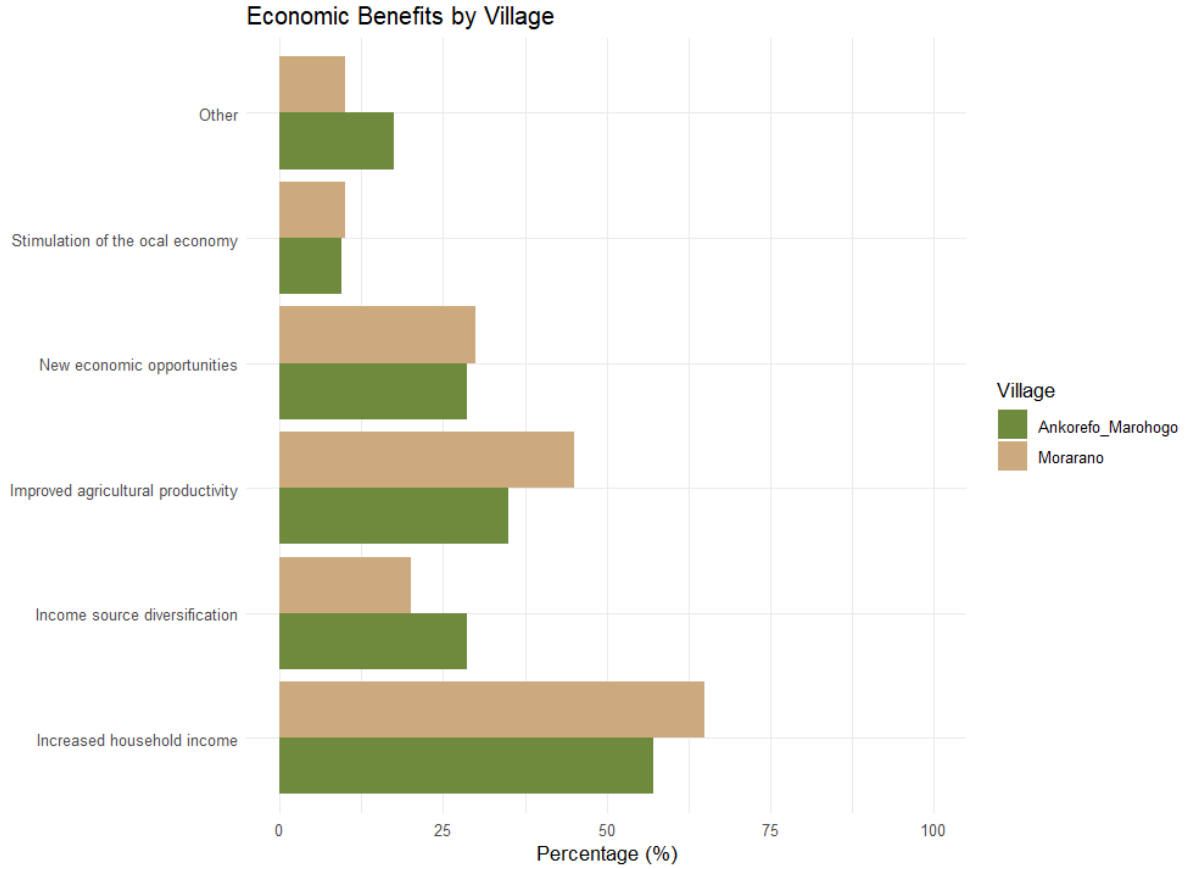


Diagram 16 Comparison of the distribution (in %) of how often various economic benefits were observed by participants from the two villages.

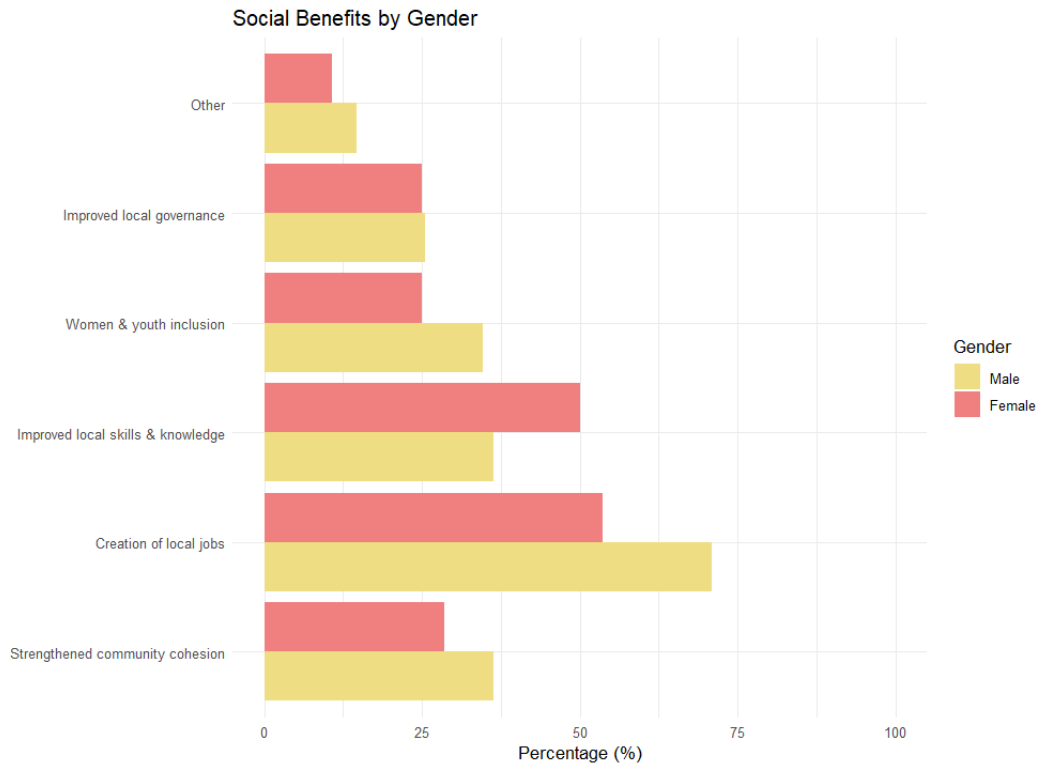


Diagram 17 Comparison of the distribution (in %) of how often various social benefits were observed by men and women.

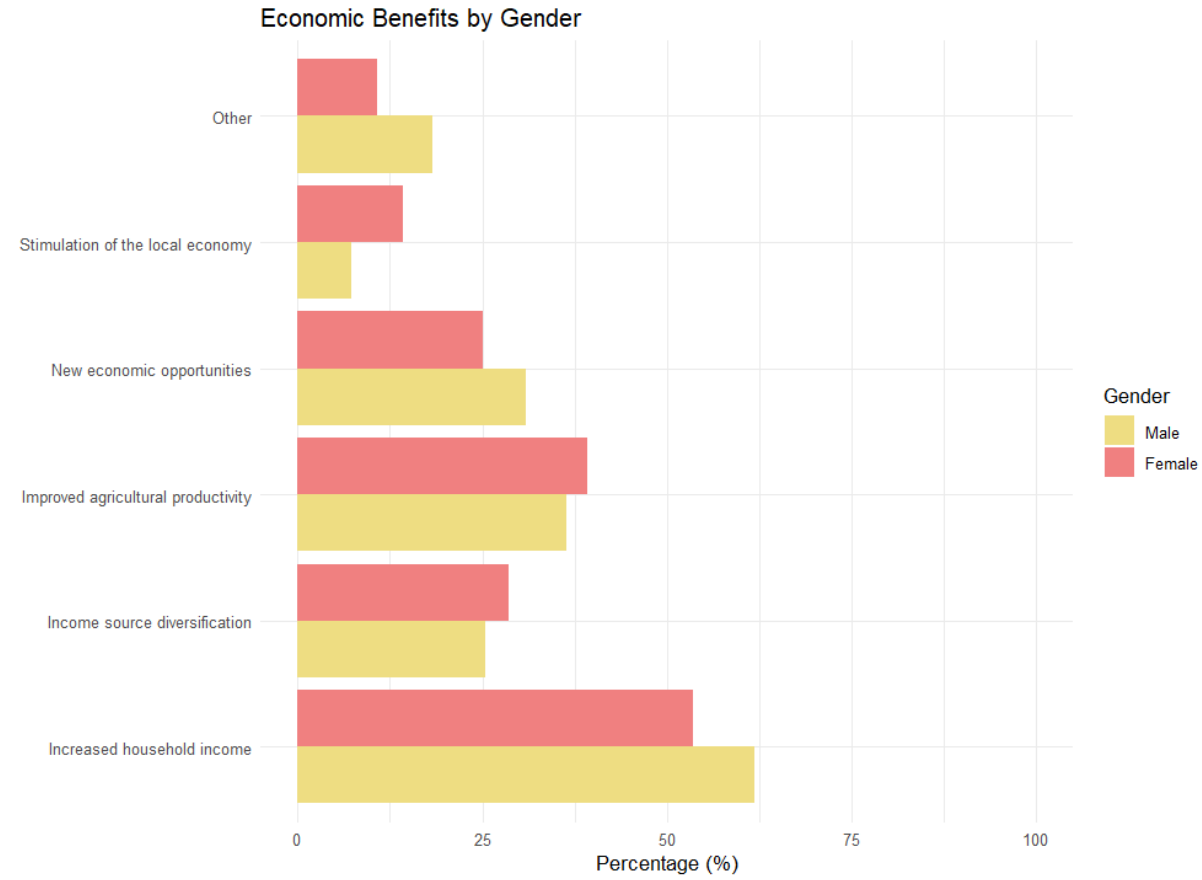


Diagram 18 Comparison of the distribution (in %) of how often various economic benefits were observed by men and women.

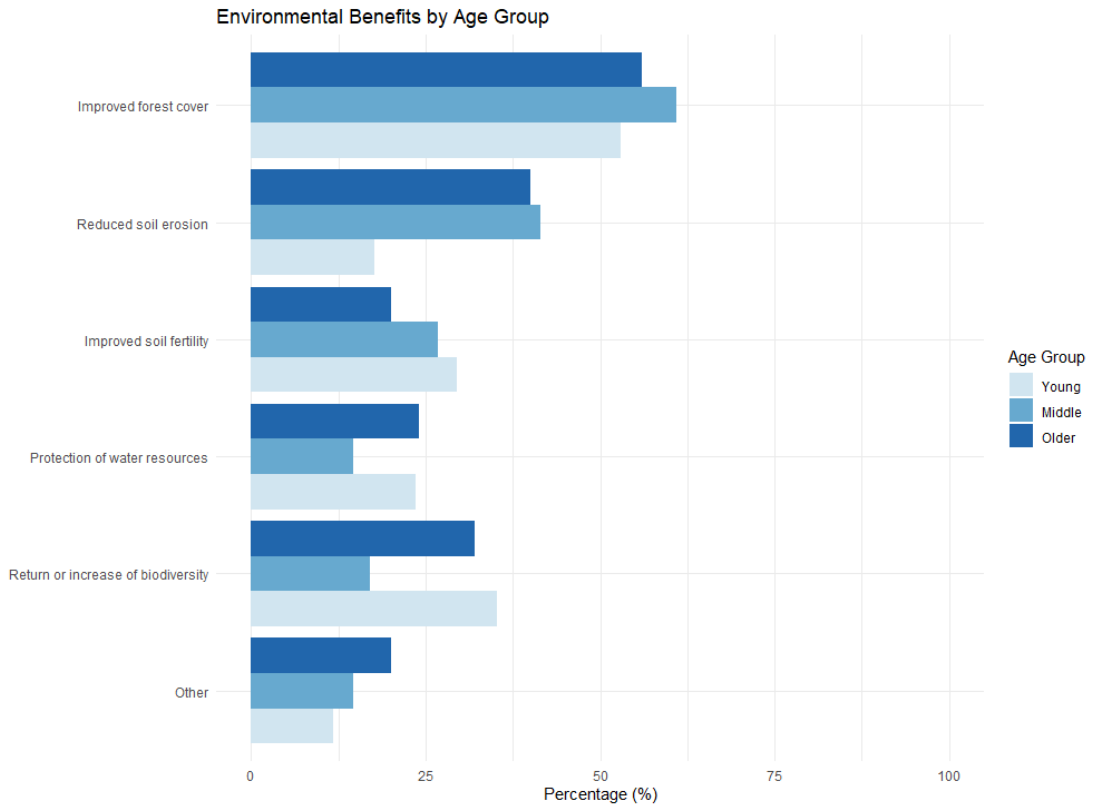


Diagram 19 Comparison of the distribution (in %) of how often various environmental benefits were observed by participants from different age groups.

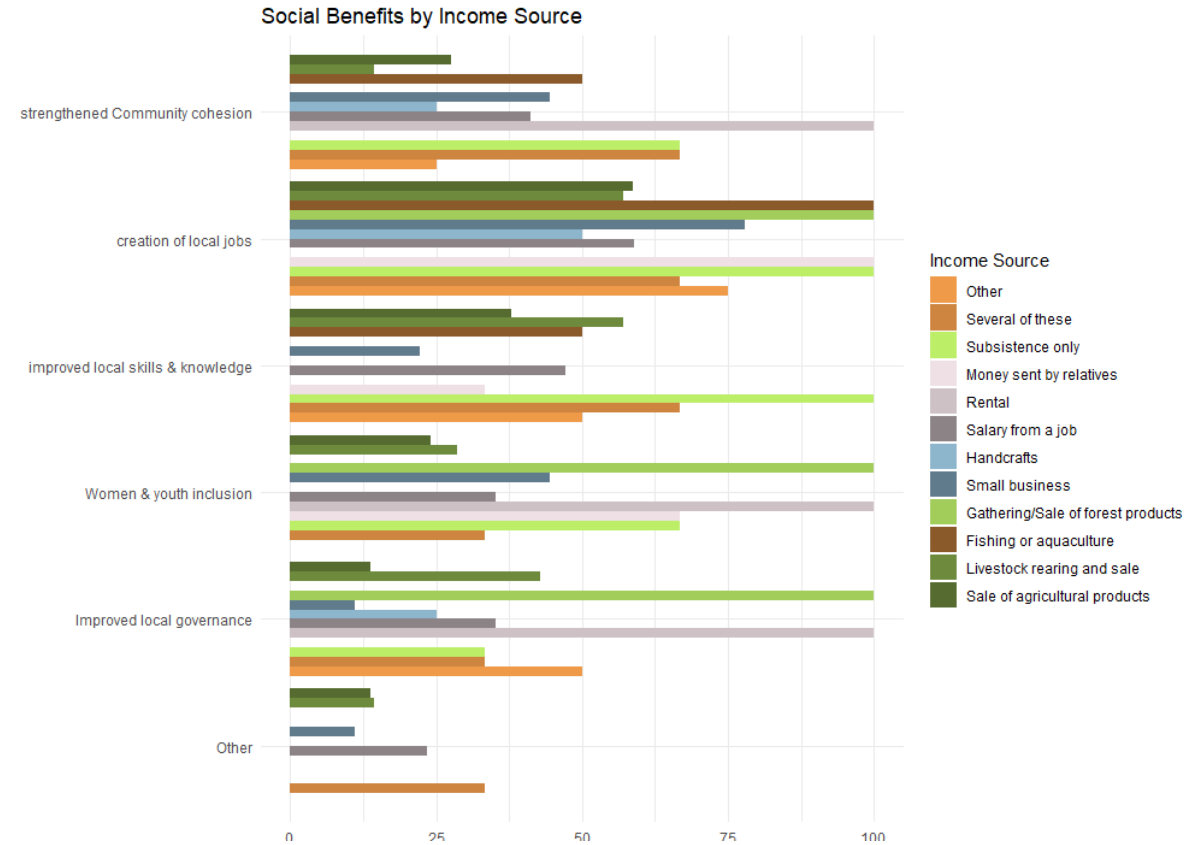


Diagram 20 Comparison of the distribution (in %) of how often various social benefits were observed by participants from different income source groups.

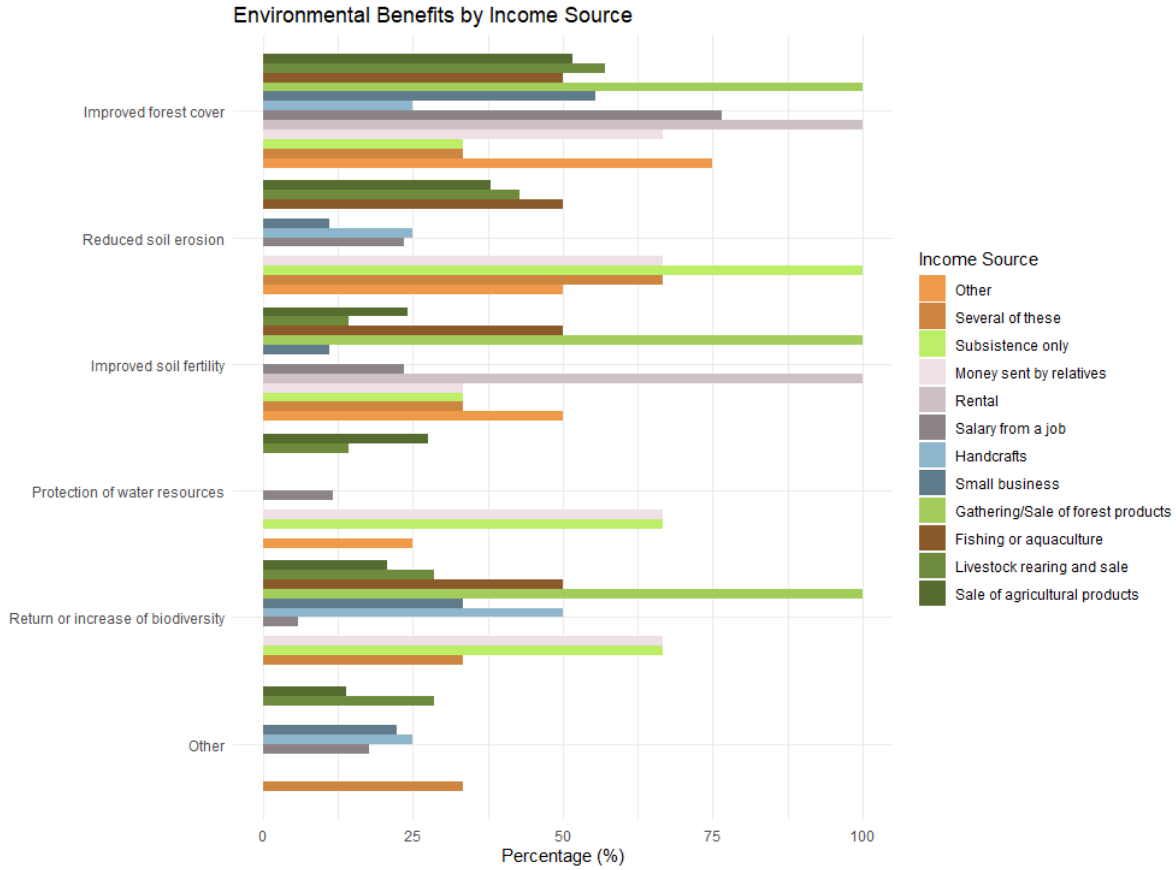


Diagram 21 Comparison of the distribution (in %) of how often various environmental benefits were observed by participants from different income source groups.

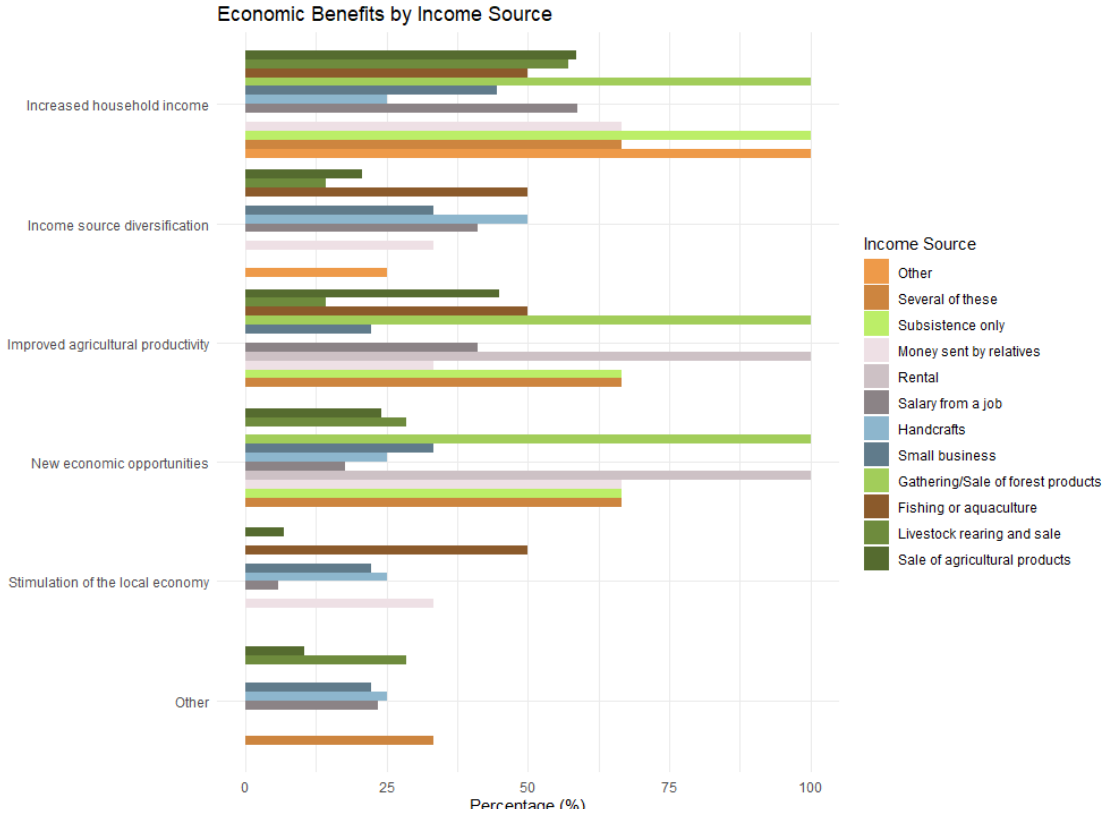


Diagram 22 Comparison of the distribution (in %) of how often various economic benefits were observed by participants from different income source groups.

Interview Question 4

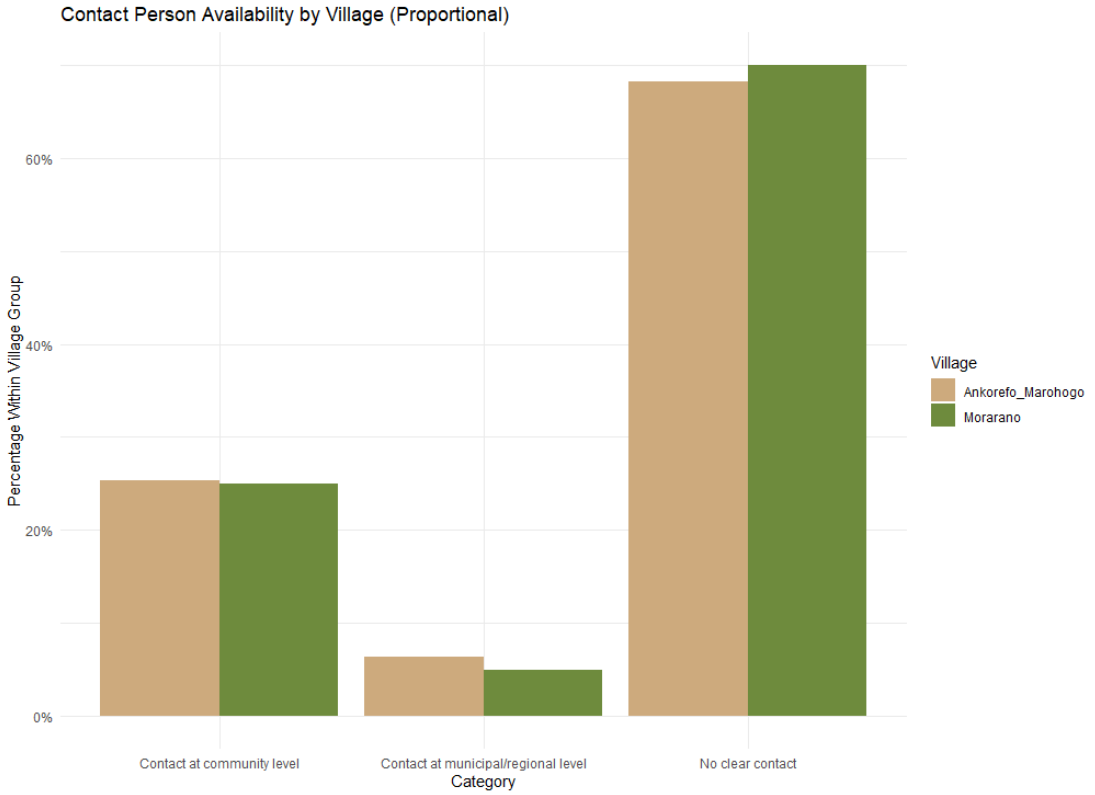


Diagram 23 Comparison of the distribution (in %) of participants from different villages' perceptions of the availability of a contact person.

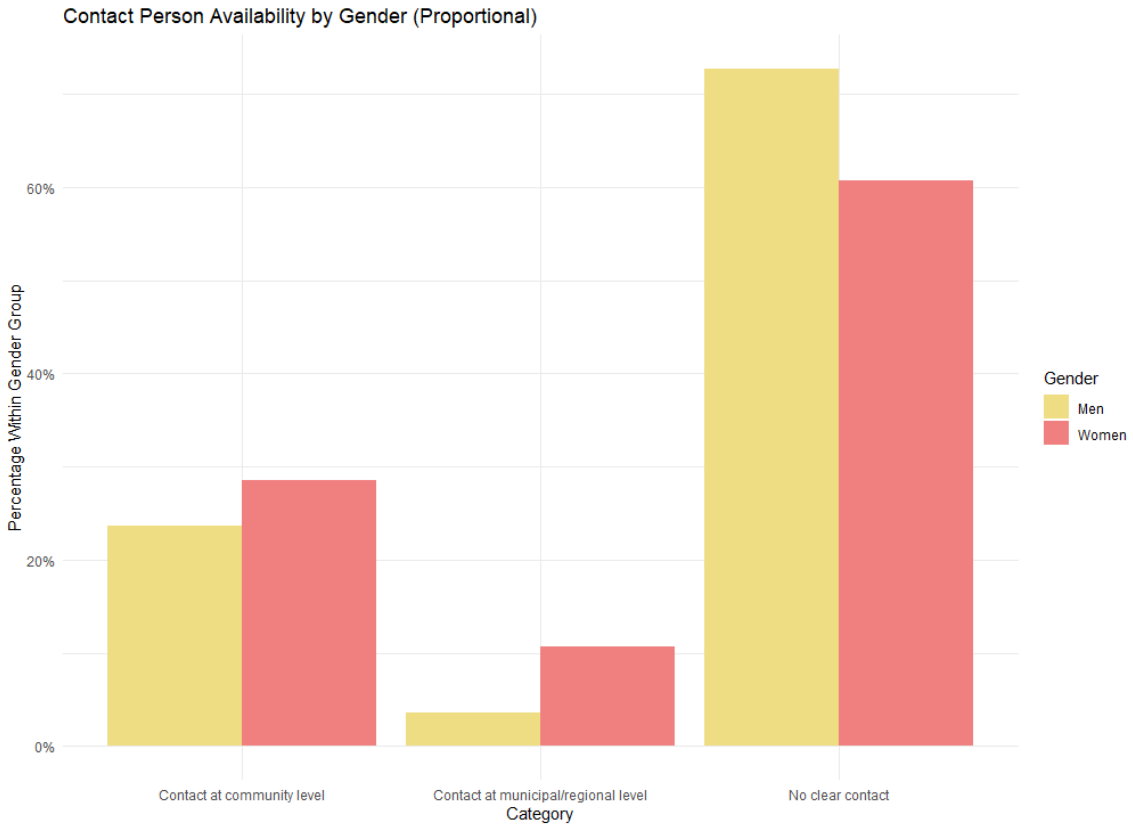


Diagram 24 Comparison of the distribution (in %) of men and women's perceptions of the availability of a contact person.

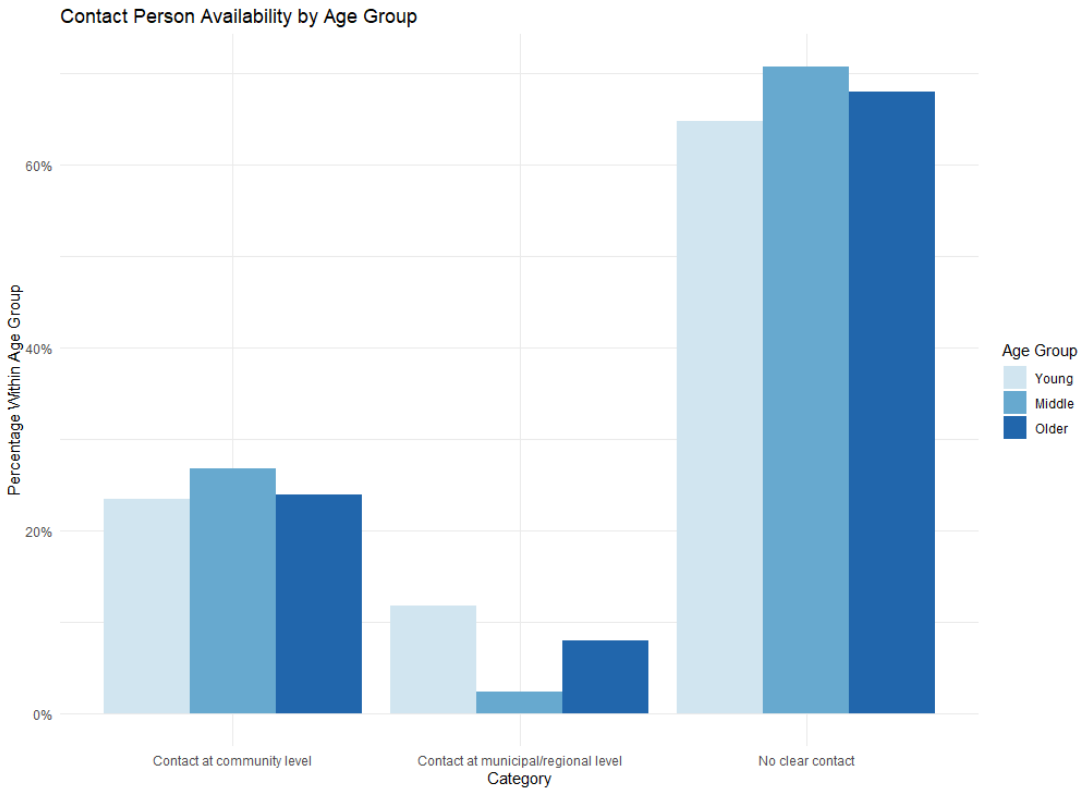


Diagram 25 Comparison of the distribution (in %) of participants from different age groups' perceptions of the availability of a contact person.

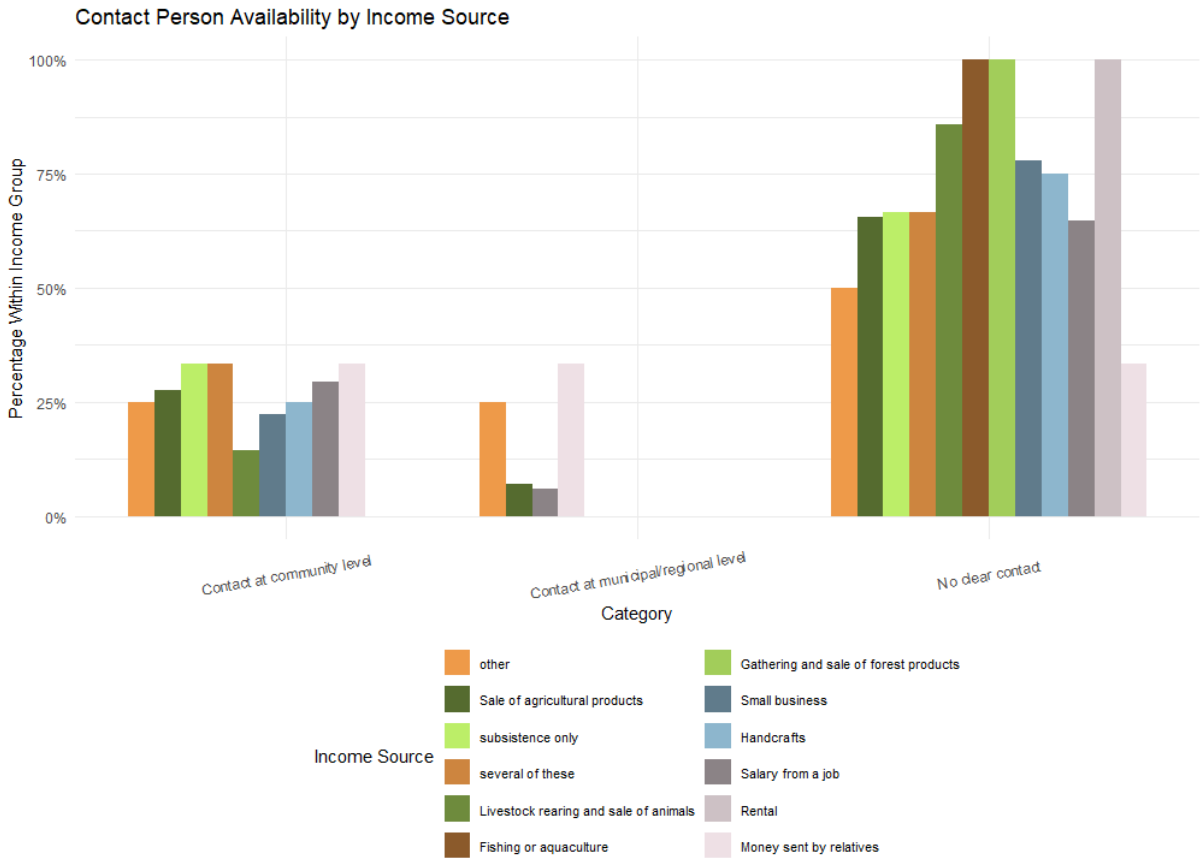


Diagram 26 Comparison of the distribution (in %) of participants from different income source groups' perceptions of the availability of a contact person.

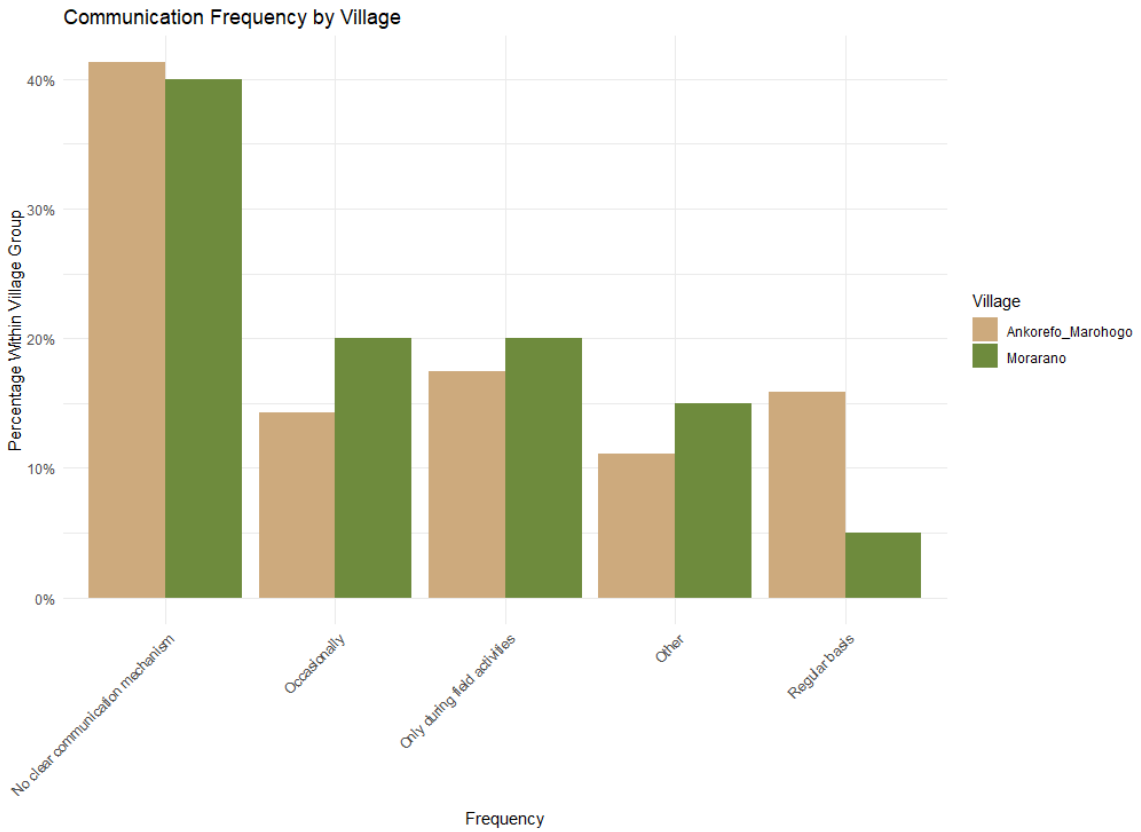


Diagram 27 Comparison of the distribution (in %) of participants from different villages' perceptions regarding how frequently they are informed about the projects.

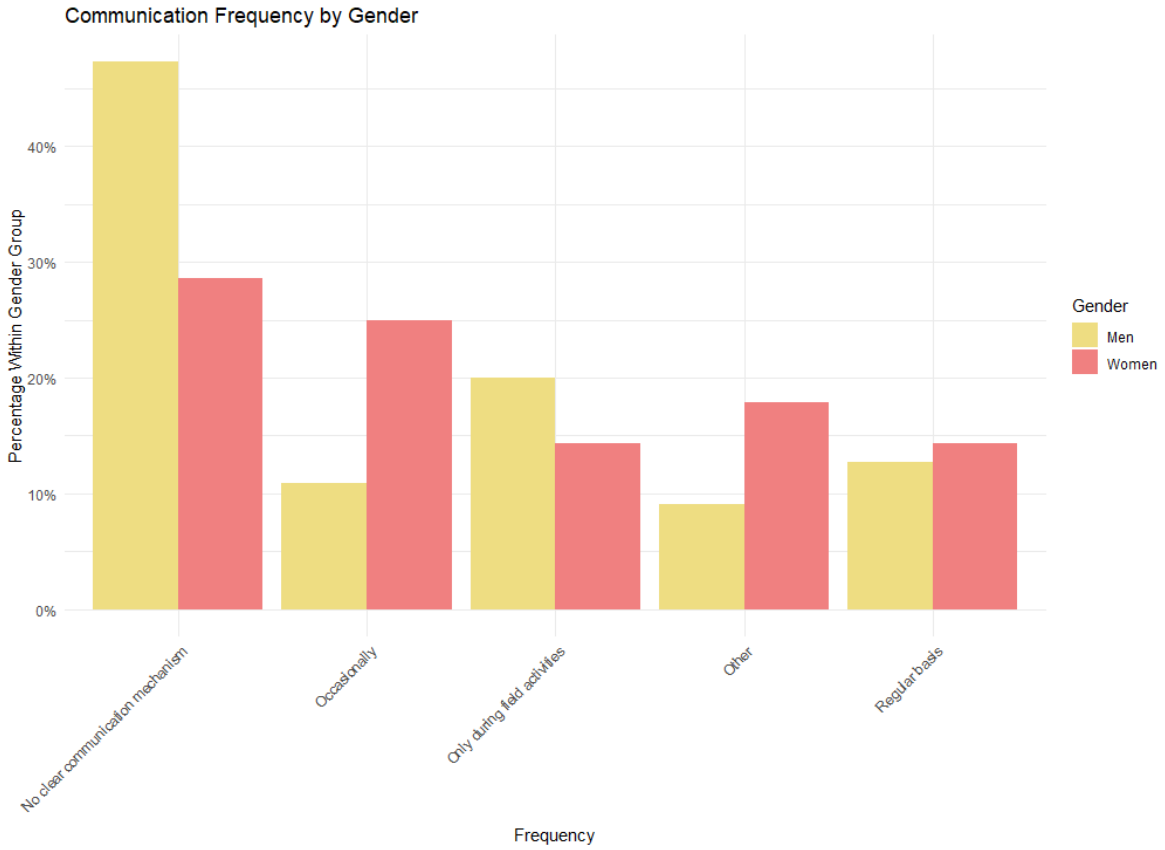


Diagram 28 Comparison of the distribution (in %) of men and women's perceptions regarding how frequently they are informed about the projects.

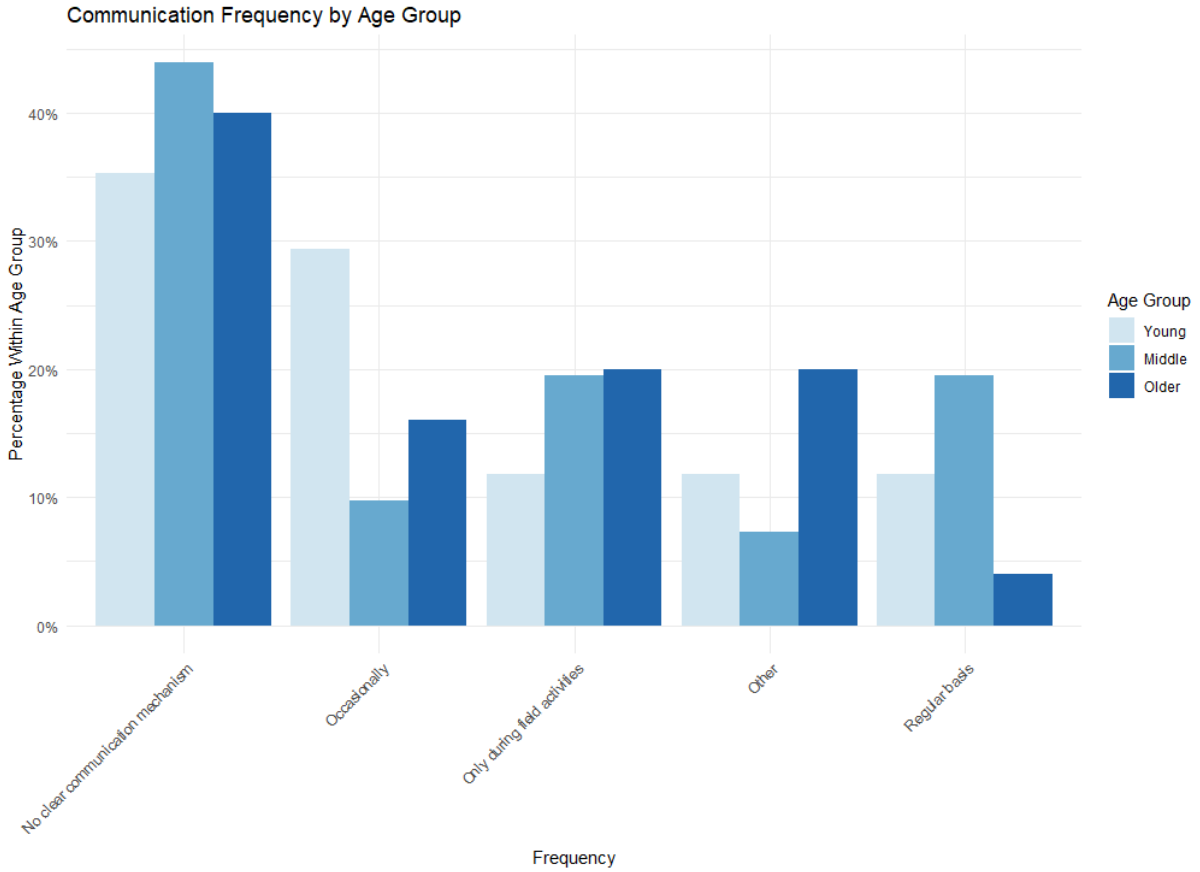


Diagram 29 Comparison of the distribution (in %) of participants from different age groups' perceptions regarding how frequently they are informed about the projects.

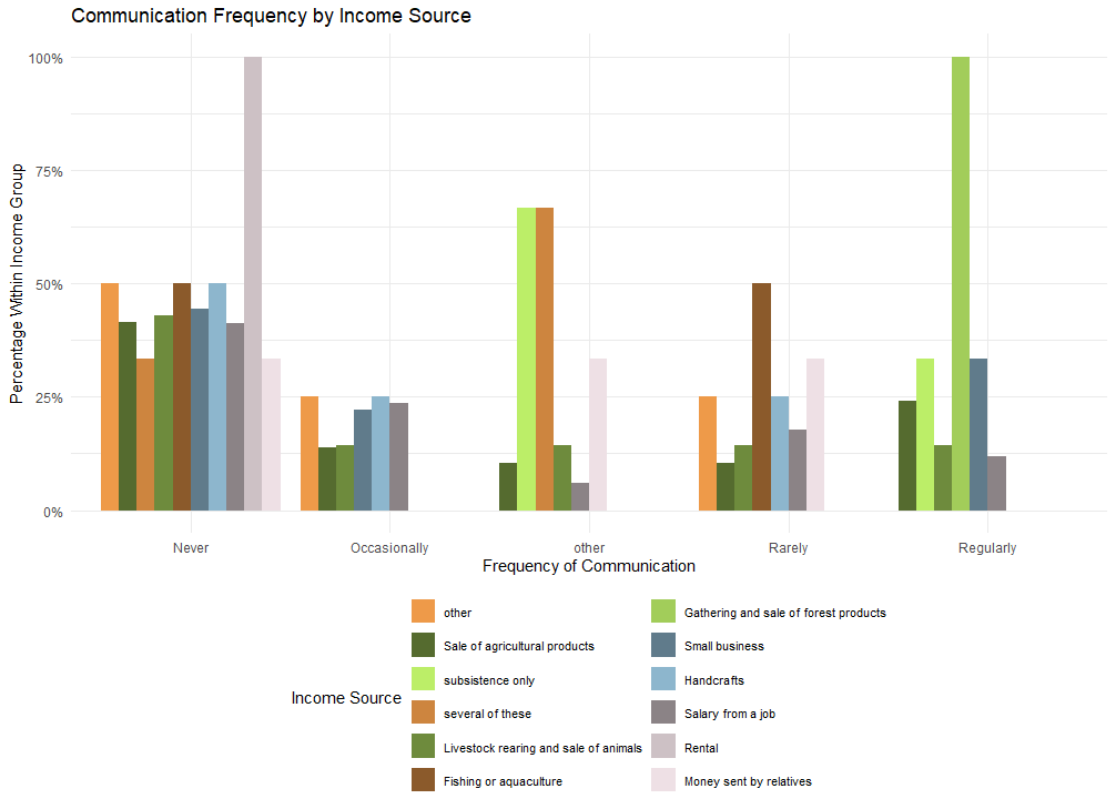


Diagram 30 Comparison of the distribution (in %) of participants from different income source groups' perceptions regarding how frequently they are informed about the projects.

Interview Question 5

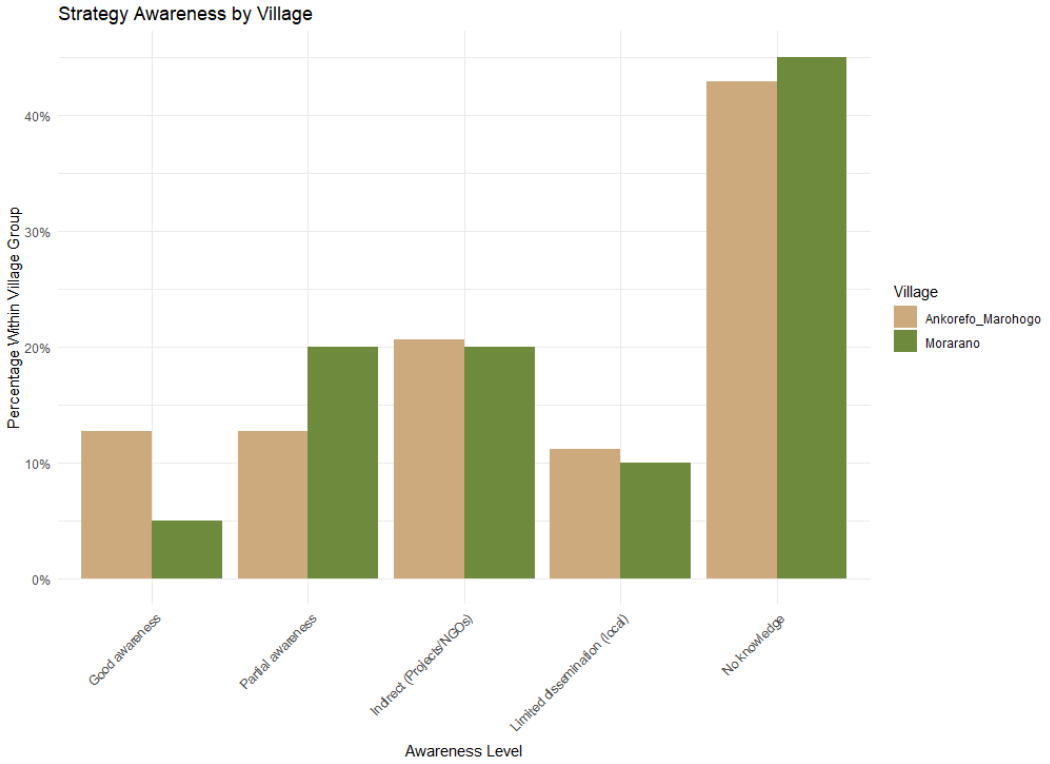


Diagram 31 Comparison of the distribution (in %) of participants from different villages' perceptions regarding their awareness of national strategies.

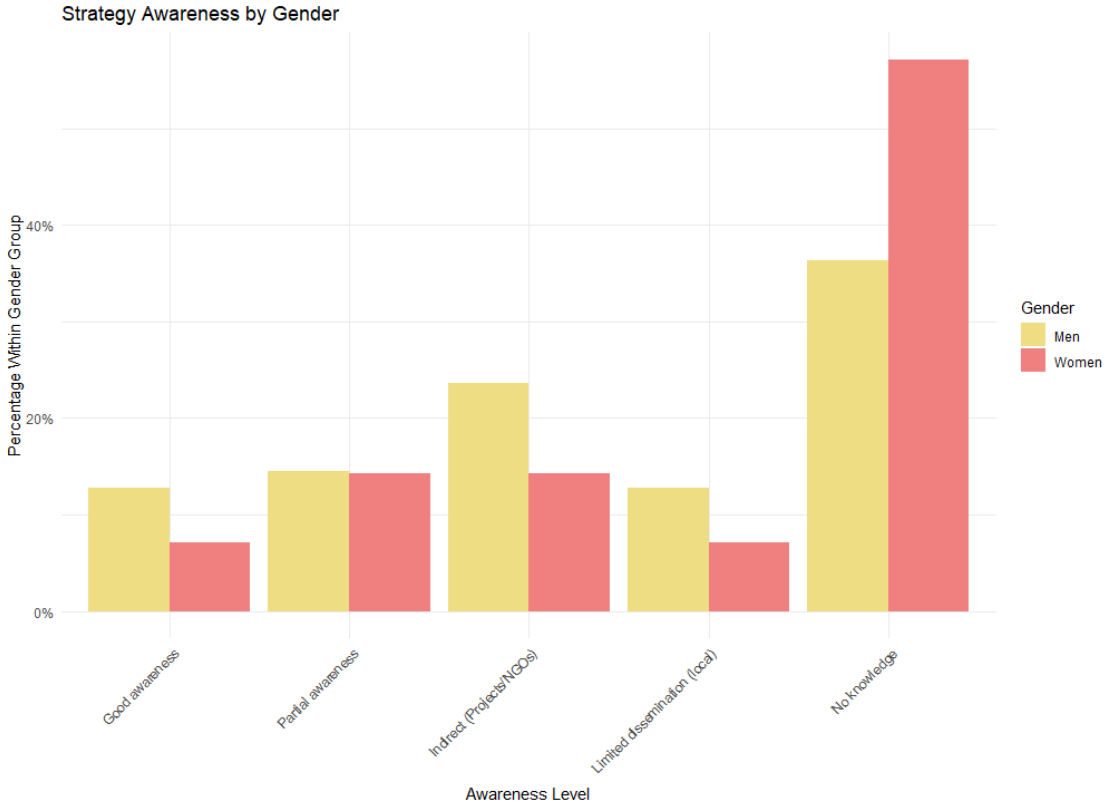


Diagram 32 Comparison of the distribution (in %) of men and women's perceptions regarding their awareness of national strategies.

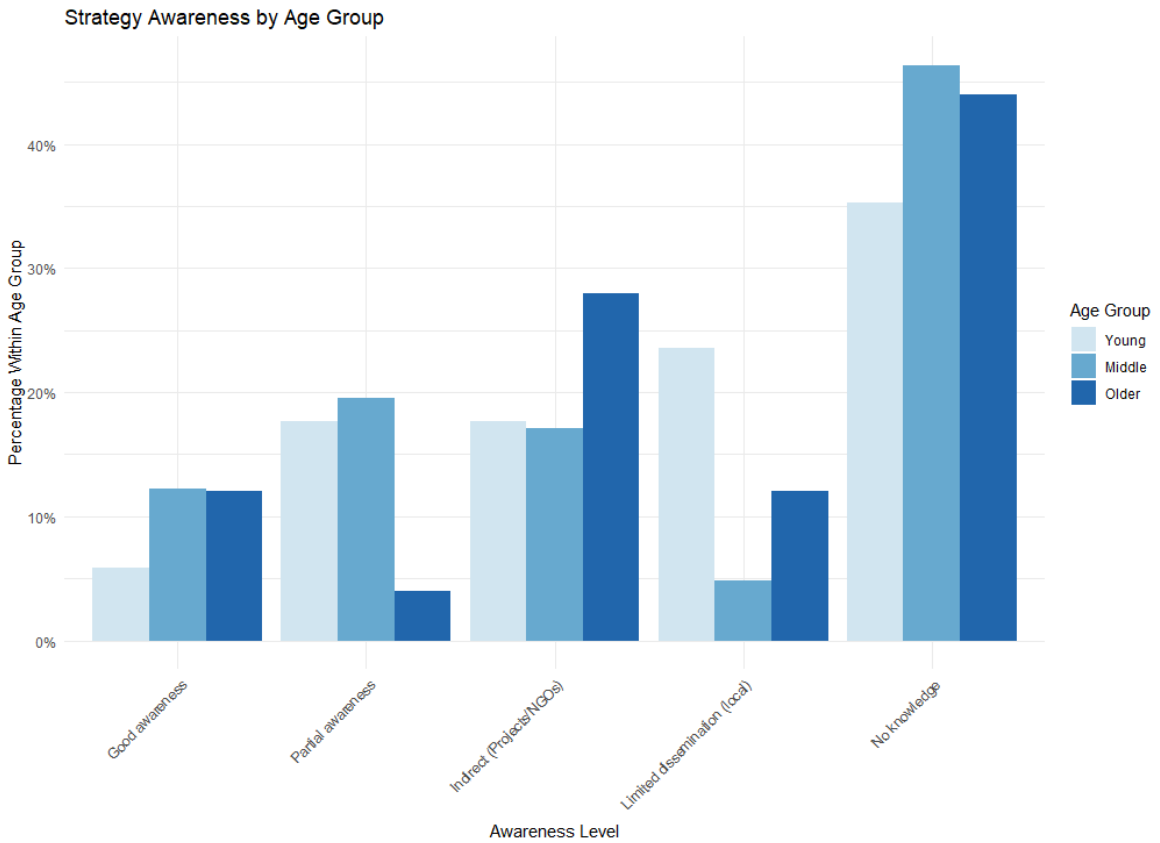


Diagram 33 Comparison of the distribution (in %) of participants from different age groups' perceptions regarding their awareness of national strategies.

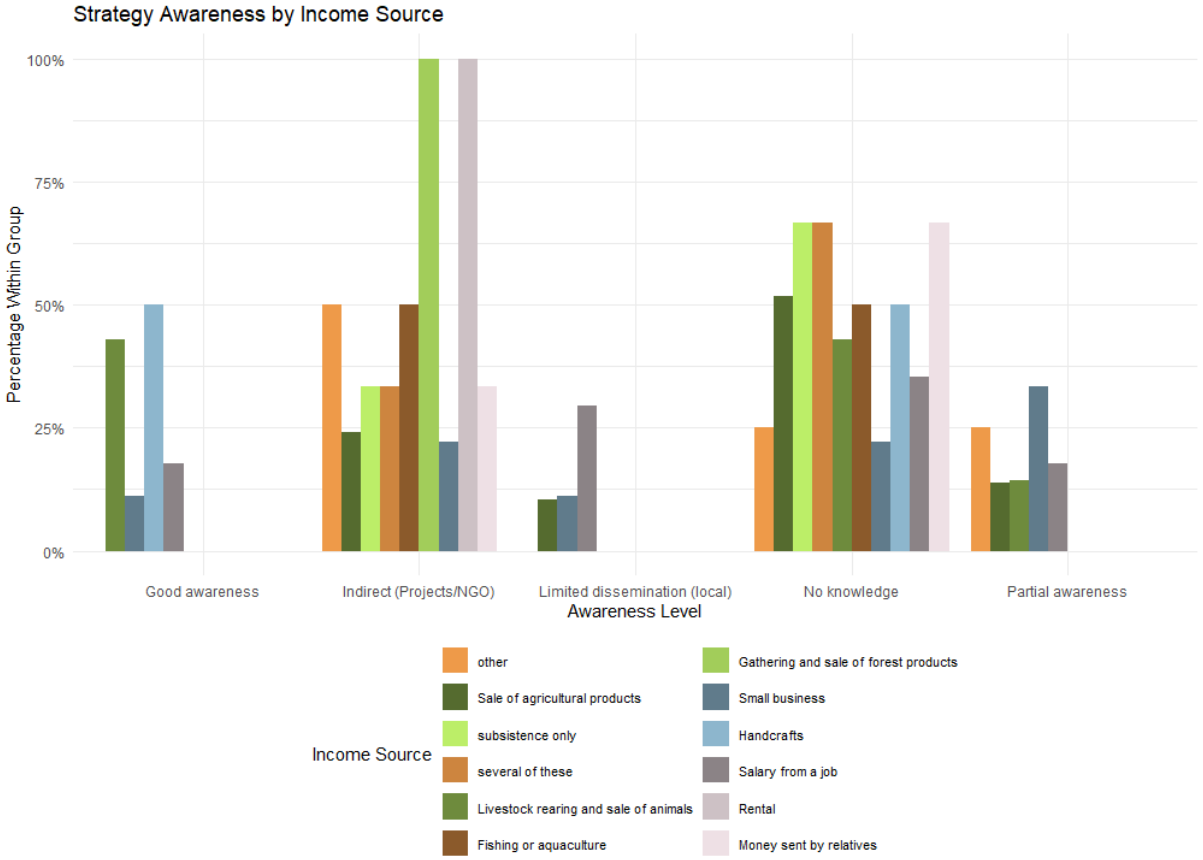


Diagram 34 Comparison of the distribution (in %) of participants from different income source groups' perceptions regarding their awareness of national strategies.

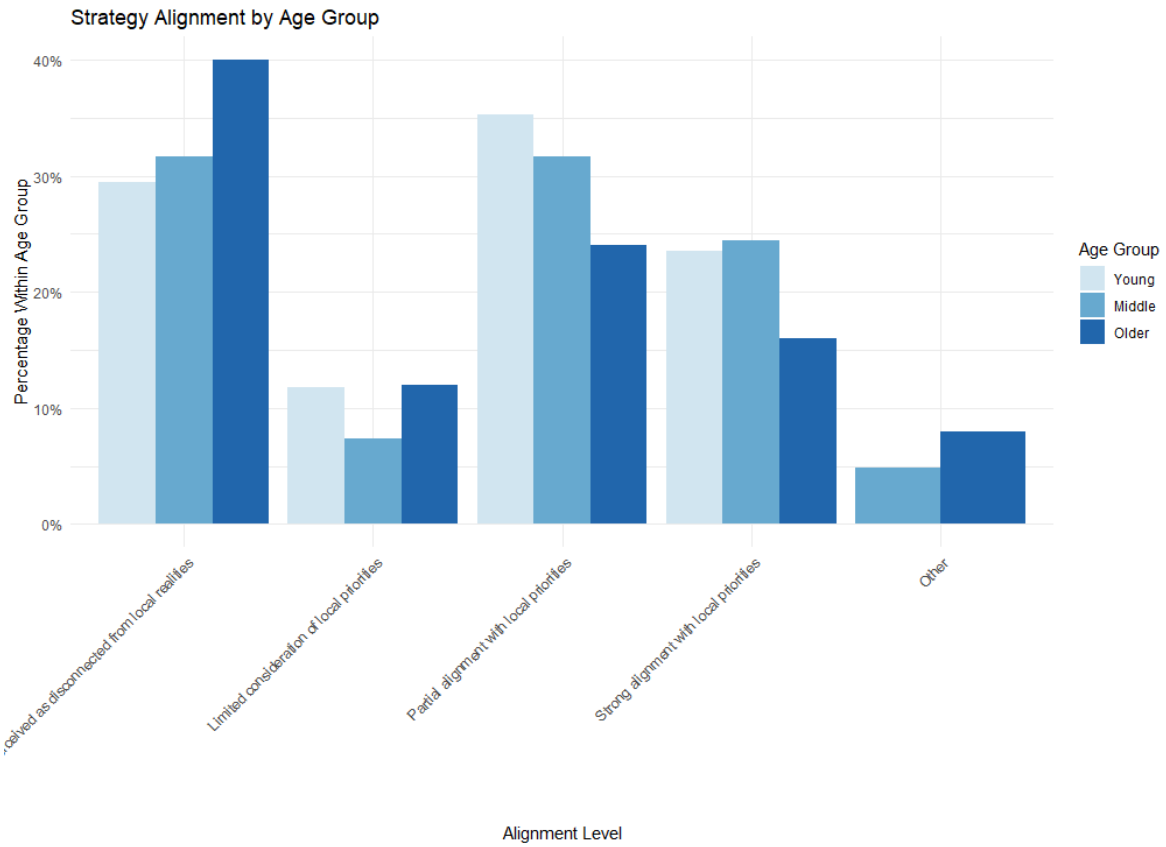


Diagram 35 Distribution (in %) of participantsfrom different age groups' perceptions of the alignment between national strategies and their own priorities.

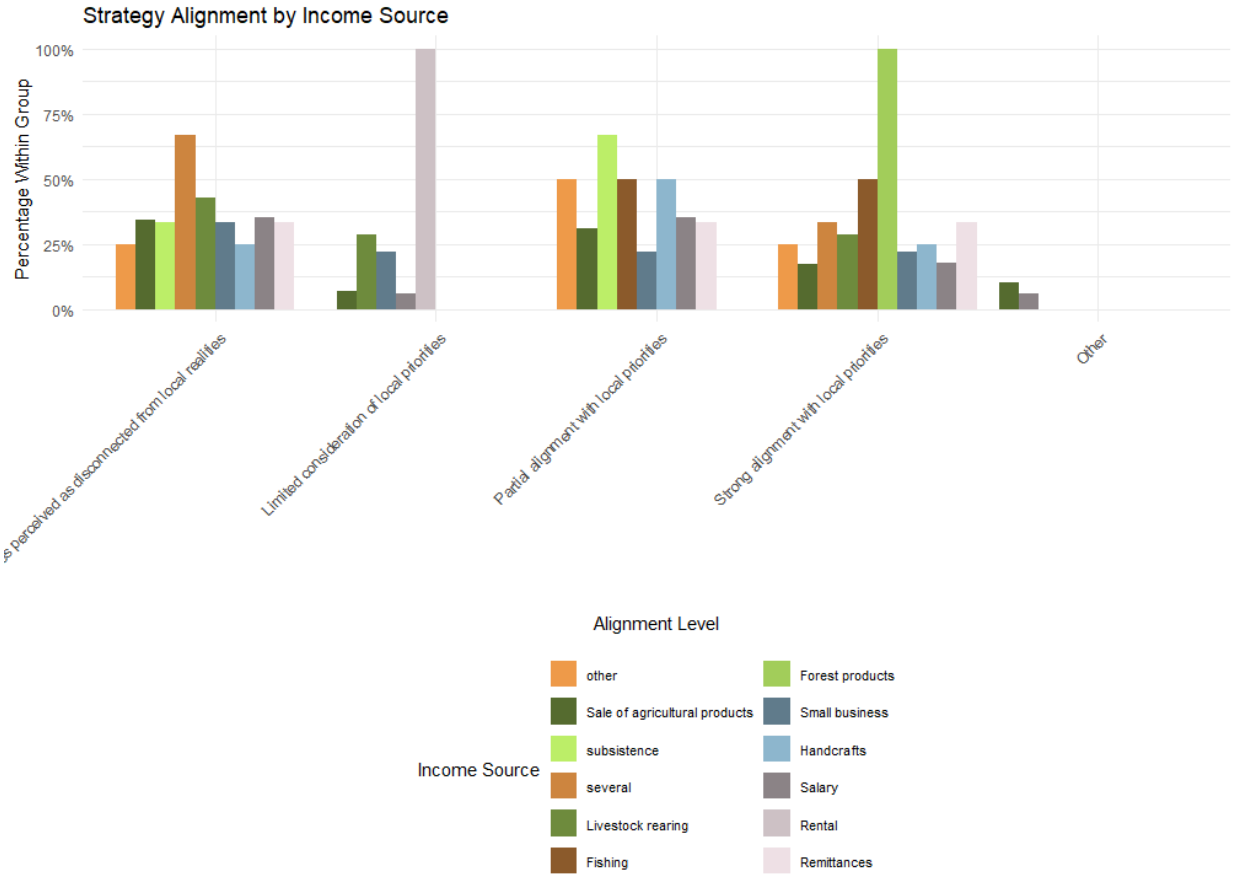


Diagram 36 Distribution (in %) of participants from different income source groups' perceptions of the alignment between national strategies and their own priorities.

Interview Question 6

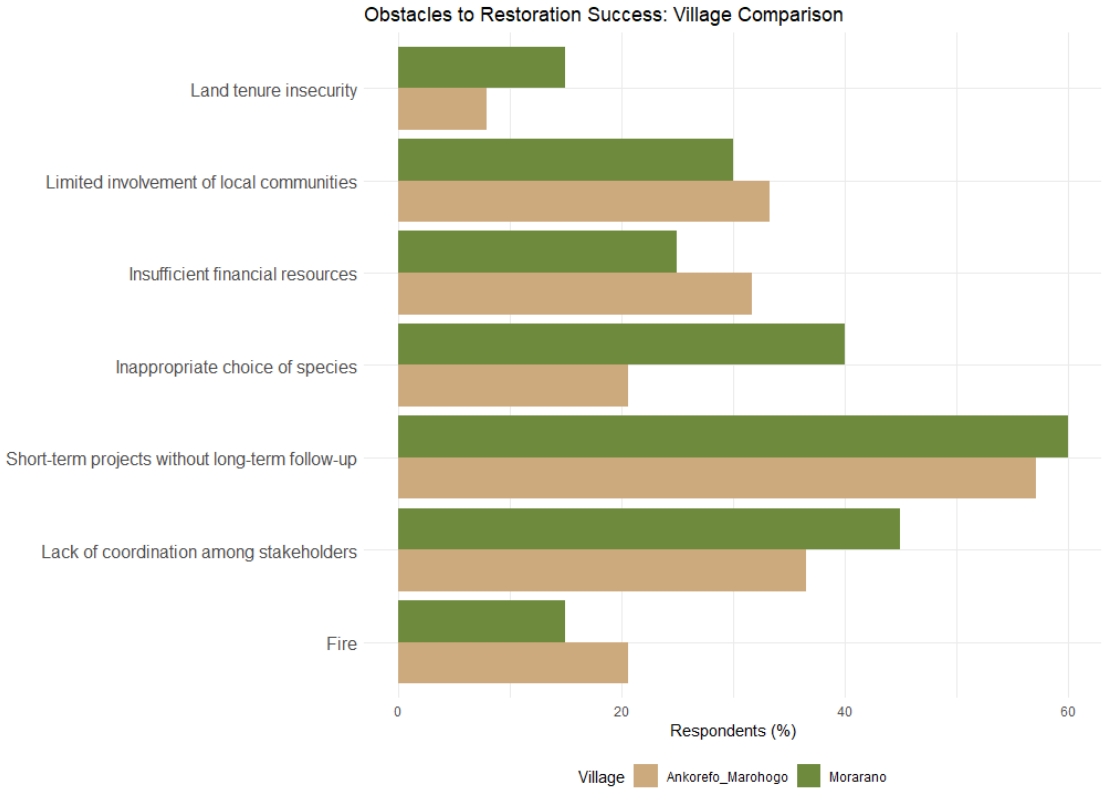


Diagram 37 Comparison of the distribution (in %) of perceived obstacles to restoration selected by participants from different villages.

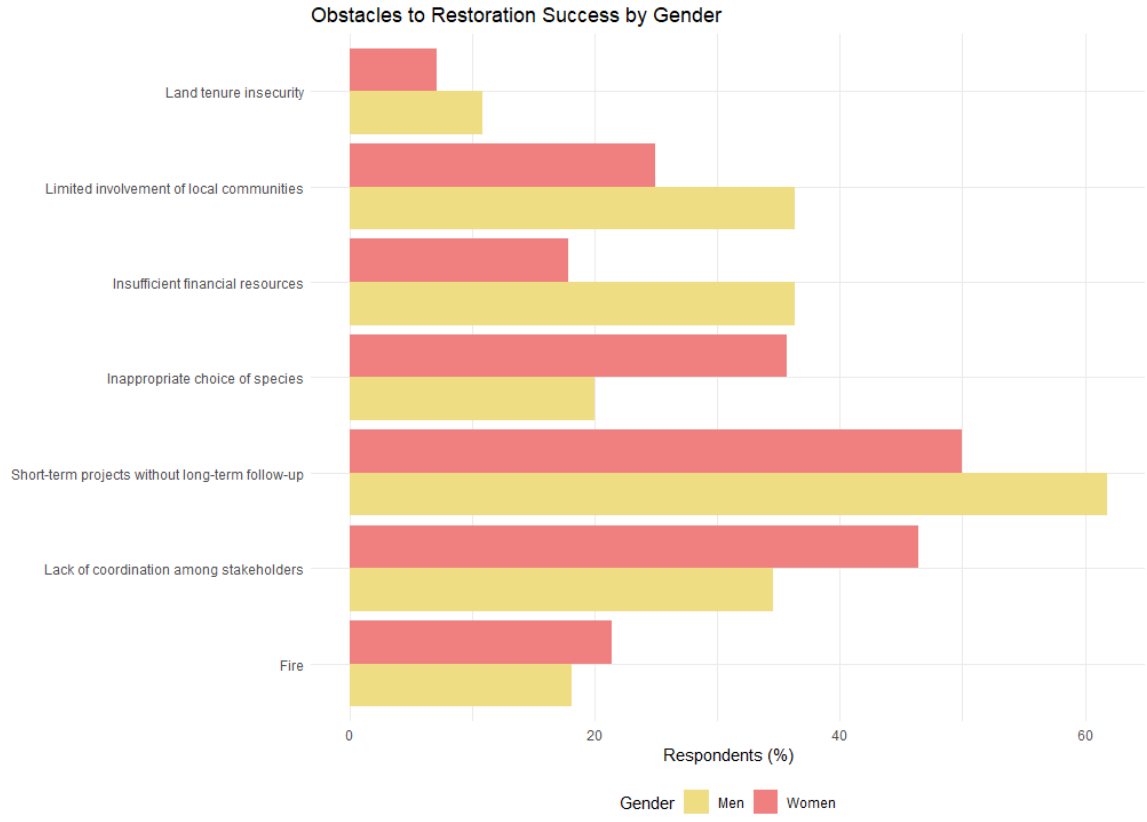


Diagram 38 Comparison of the distribution (in %) of perceived obstacles to restoration selected by men and women.

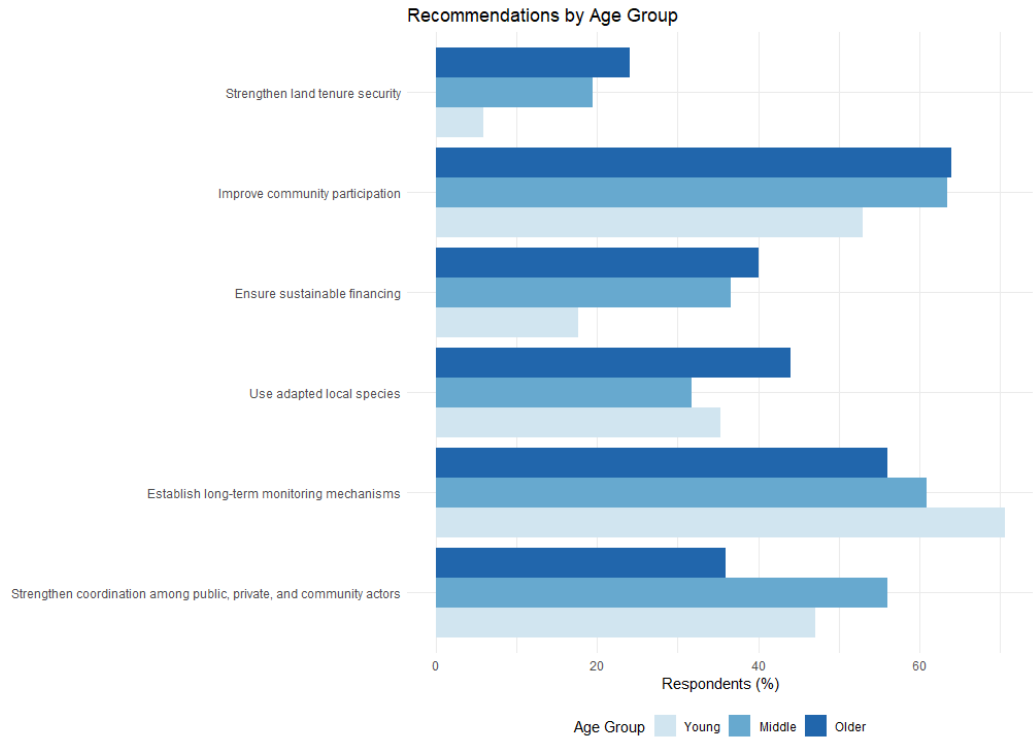


Diagram 39 Comparison of the distribution (in %) of participants from different age groups' recommendations for restoration success.

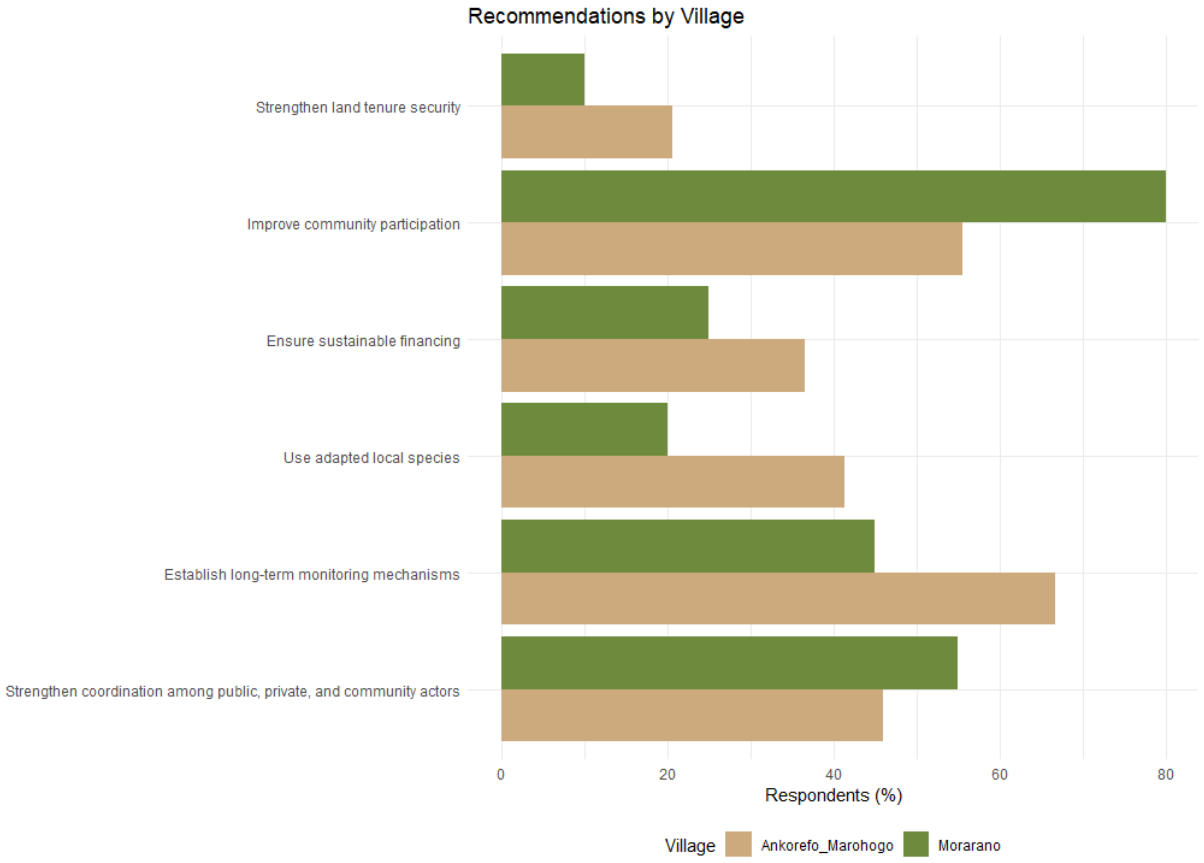


Diagram 40 Comparison of the distribution (in %) of participants from different villages' recommendations for restoration success.

Interview Question 7



Diagram 41 Comparison of the distribution (in %) of how often various restoration outcomes were selected by men and women.

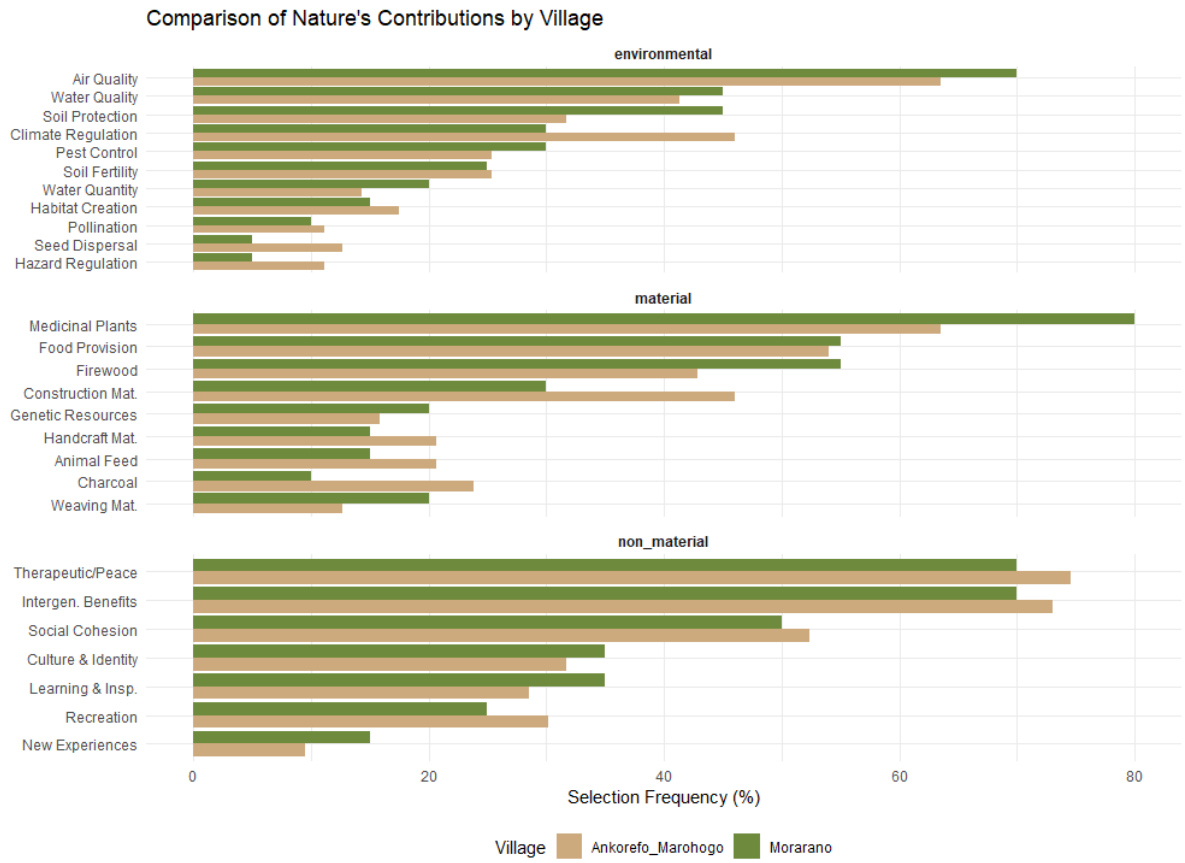


Diagram 42 Comparison of the distribution (in %) of how often various NCP were selected by participants from different villages.

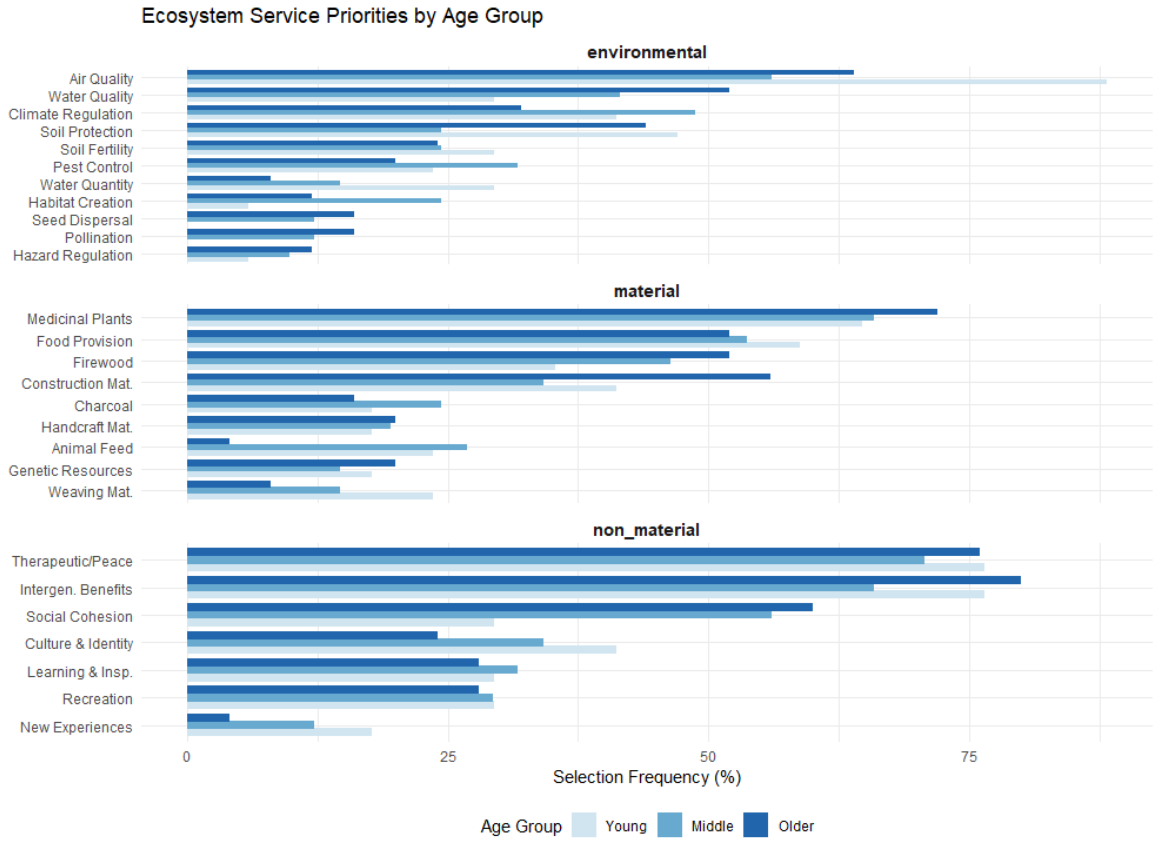


Diagram 43 Comparison of the distribution (in %) of how often various NCP were selected by participants from different age groups.

Interview Question 9

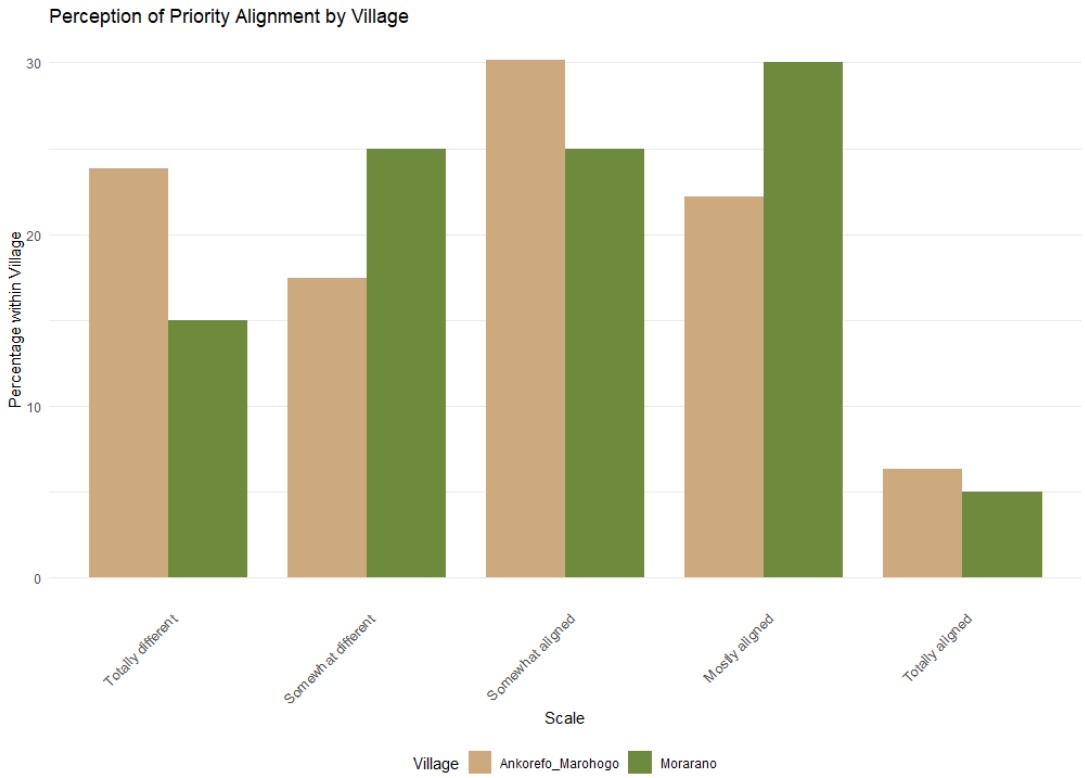


Diagram 44 Comparison of the distribution (in %) of participants from different villages' perceptions of the alignment between other actors' priorities and goals and their own.

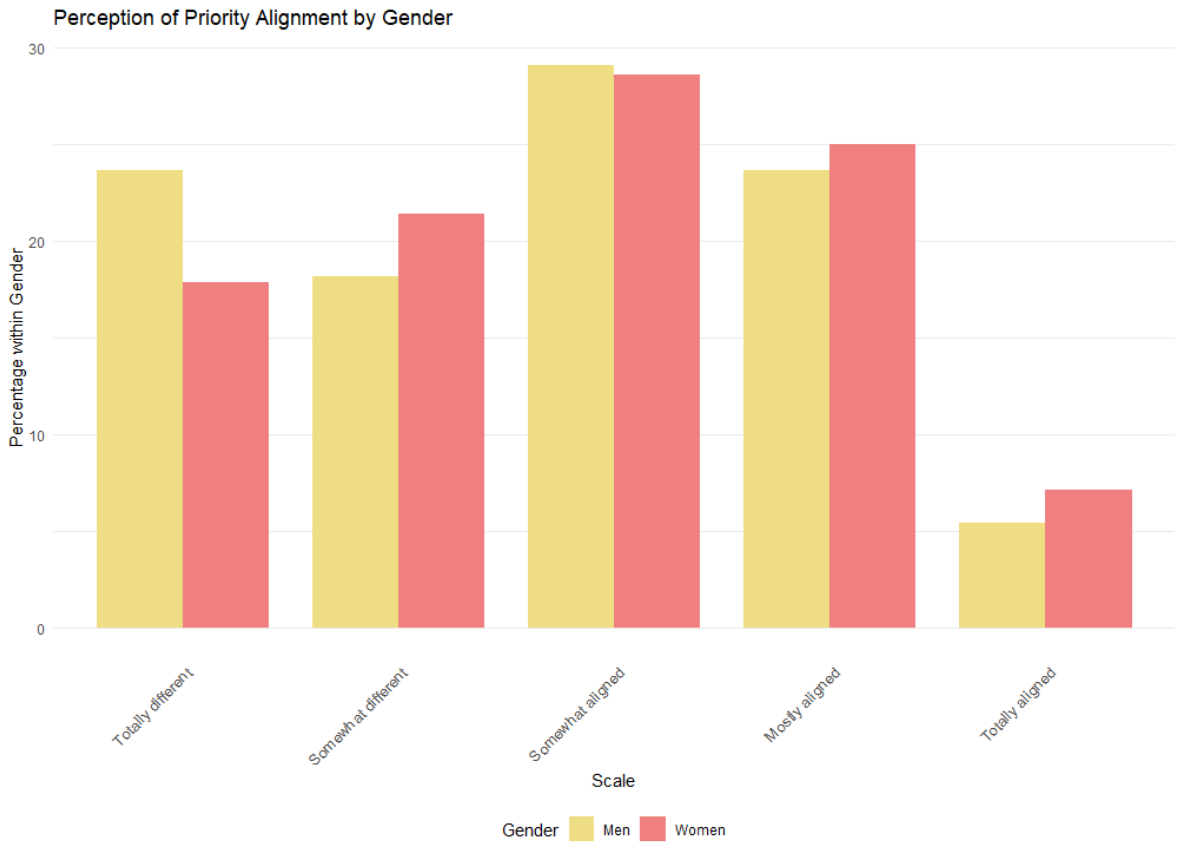


Diagram 45 Comparison of the distribution (in %) of men and women's perceptions of the alignment between other actors' priorities and goals and their own.

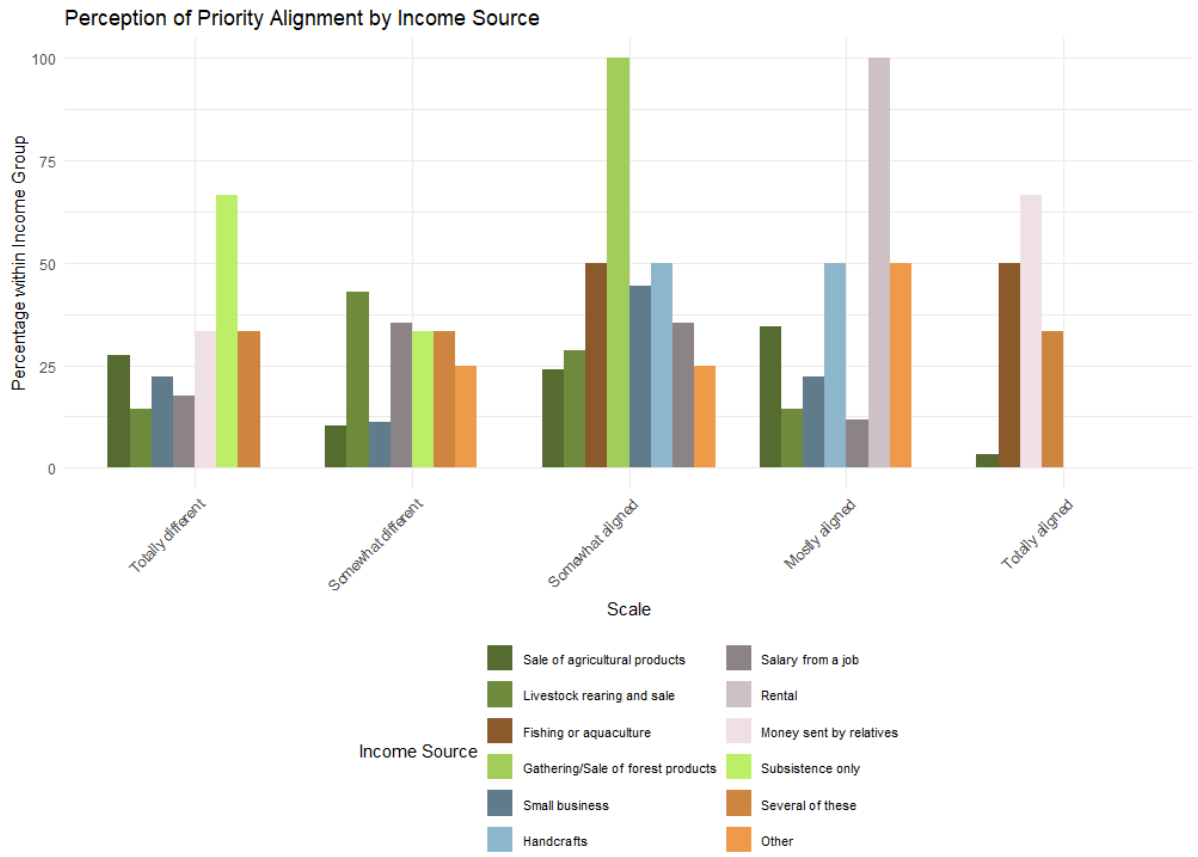


Diagram 46 Comparison of the distribution (in %) of participants from different income source groups' perceptions of the alignment between other actors' priorities and goals and their own.

Interview Question 10

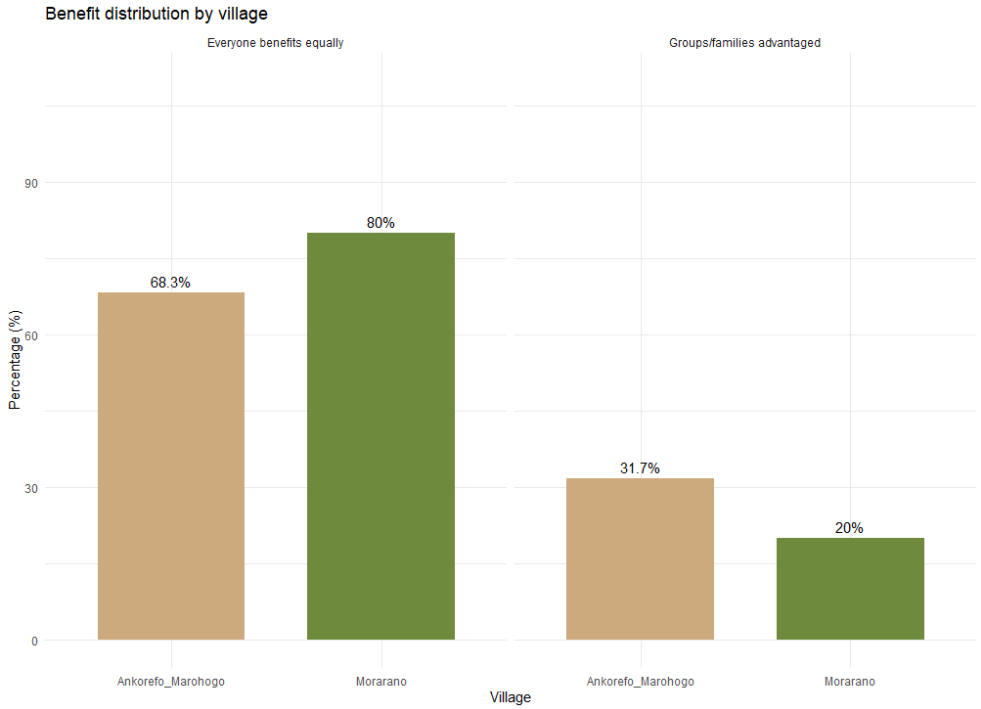


Diagram 47 Comparison of the distribution (in %) of the frequency with which the two response options were selected by participants form different villages.

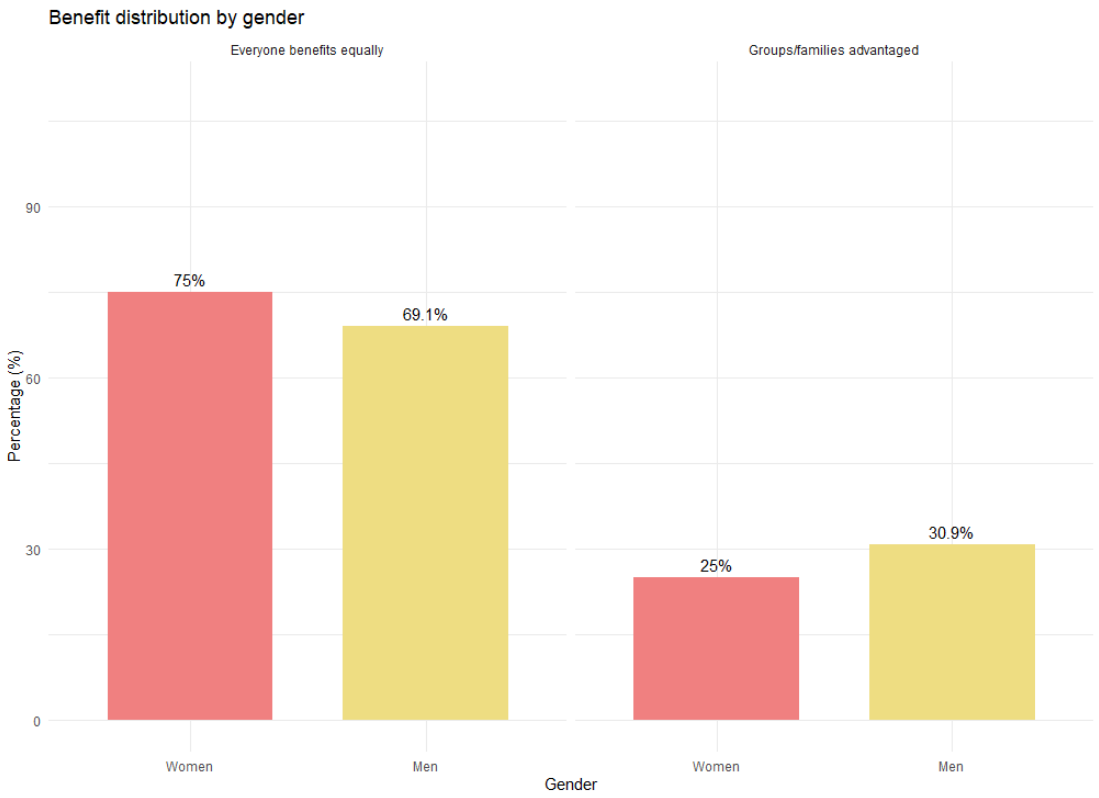


Diagram 48 Comparison of the distribution (in %) of the frequency with which the two response options were selected by men and women.

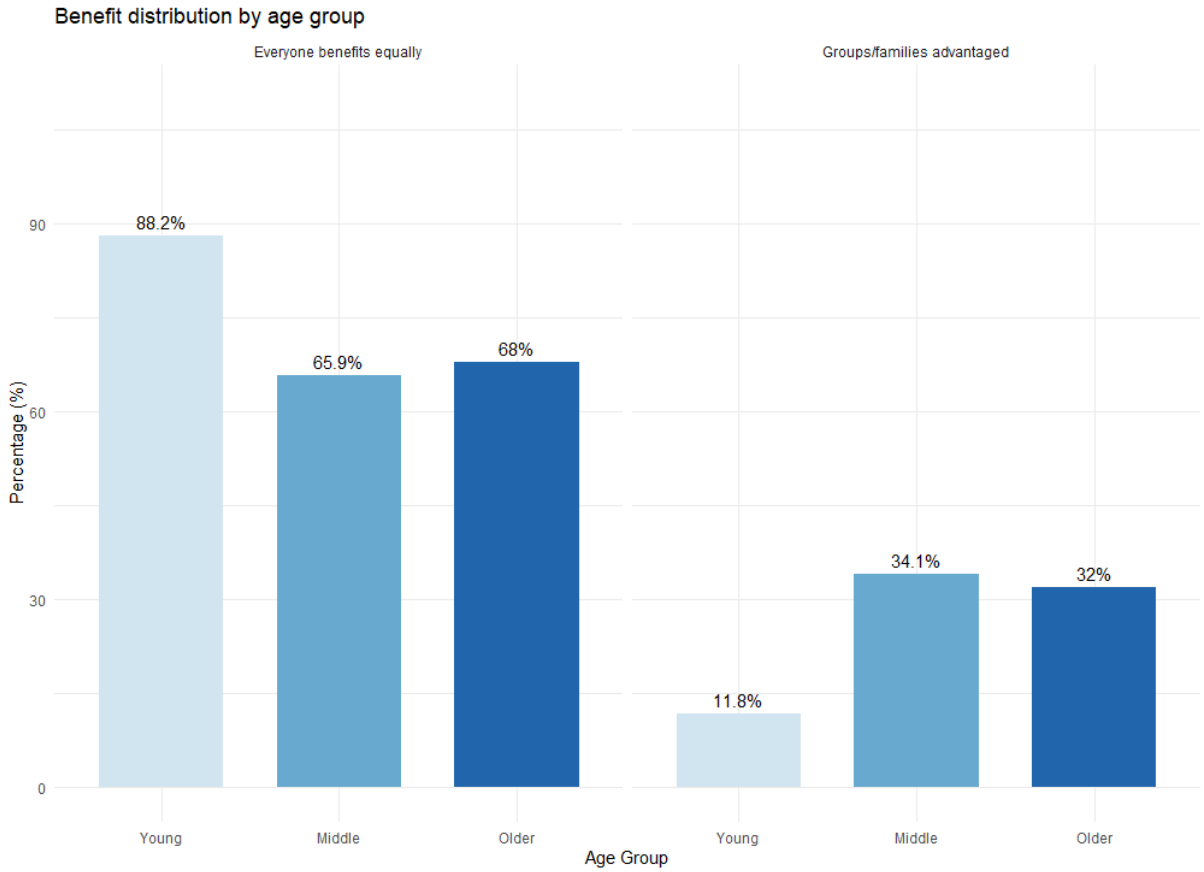


Diagram 49 Comparison of the distribution (in %) of the frequency with which the two response options were selected by participants form different age groups.

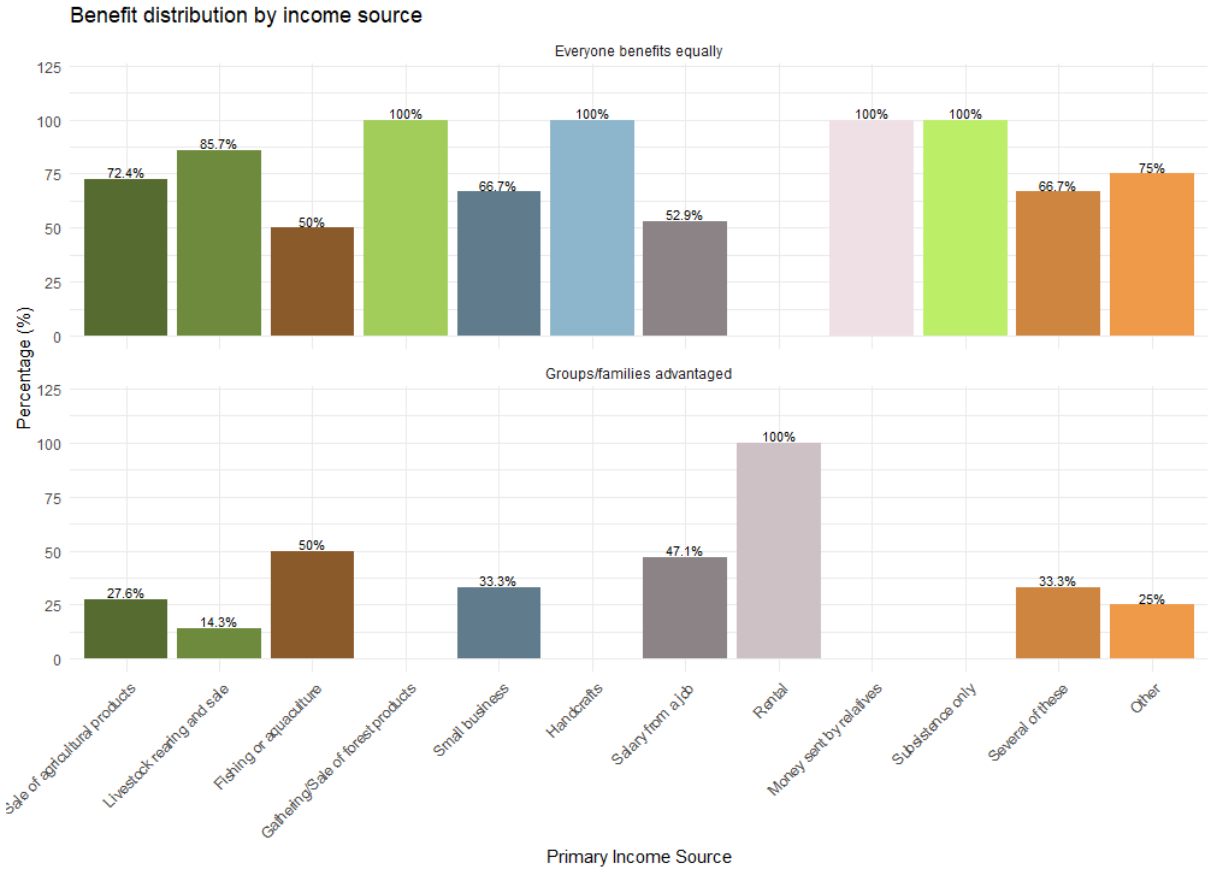


Diagram 50 Comparison of the distribution (in %) of the frequency with which the two response options were selected by participants form different income source groups.

Personal Declaration

I hereby declare that the submitted thesis is the result of my own, independent work. All external sources are explicitly acknowledged in the thesis.

AI tools have been used in this thesis for the following purposes:

- Translation: DeepL and ChatGPT 5.3 (DeepL SE, 2026; OpenAI, 2026)
- Stylistic improvements and structure suggestions: ChatGPT 5.3 (OpenAI, 2026)
- Correction of spelling: Grammarly and ChatGPT (Grammarly, 2026; OpenAI, 2026)
- Assistance in literature research: ChatGPT 5.3 (OpenAI, 2026)
- Assistance in creating and debugging R Codes for statistical analysis and plots: ChatGPT 5.3 and Gemini 2.5 (Gemini, 2026; OpenAI, 2026). All codes were independently reviewed, verified, and adapted

All text parts created by AI have been checked by me, the author of this text. I take full responsibility for the text.



Amelina Sofia Ana Wernli 25.06.2026, Zürich