Perceptions and expectations on biodiversity of three focus groups (small farmers, local personnel and scientists) at the Kafa Biosphere Reserve

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Summary

Stakeholders from different backgrounds engage and interact in UNESCO biosphere reserves (BRs), so it is essential for all parties to understand each others' views and values. We studied perceptions and expectations on biodiversity in the Kafa BR, Ethiopia. Semi-structured interviews (n = 85) were conducted with three focus groups: small farmers, local personnel and scientists. The groups displayed substantial differences in their definition of biodiversity, its perceived value and the benefit for local communities. In contrast, there was a shared understanding of the main risks (population pressure) and threats (expanding agriculture). Frequently cited necessary steps to protect biodiversity included community involvement and benefits. The need for stricter law enforcement is debated. Views on biodiversity were found to be strongly influenced by underlying value systems. Means of comparison is suggested as one major factor for varying understanding and valuing of biodiversity. When defining conservation goals, different backgrounds should be carefully considered.

1. Introduction

UNESCO biosphere reserves (BRs) are explicitly designed to reconcile people's needs with conservation pressures. Thus, the aim is to integrate ecological, social and economic goals, creating sustainable ways of living (Bridgewater 2002). To successfully manage a BR, different interests and needs must be considered. A certain level of participation from local communities is generally seen as essential. The level of participation required to create a well-functioning BR is still debated (Wallner et al. 2007). Some argue that, provided local people's interests are met, participation through consultation only (no active participation) is sufficient. Different stakeholders from diverse backgrounds usually jointly engage in the work associated with BRs; therefore, they have to find common grounds for communication to successfully collaborate. This is especially true for BRs in developing countries where external stakeholders from different cultural backgrounds are involved. To agree on common goals, it is essential to have a sound understanding of the background of each party.

In recent years, much attention has been paid to the massive loss of biodiversity worldwide. This is of human concern, as it also relates to a loss of ecosystem services which humanity profits from (Cardinale et al. 2012). However, in many cases it is difficult to quantify specific benefits and their exact impacts, and the issue is fraught with uncertainty (Balvanera et al. 2014). A major aim of BRs is to preserve a diverse environment. Biodiversity is therefore one of the key terms to be communicated. Ideally, the different actors involved should have a good understanding of their respective interpretations.

Most value systems surrounding nature and its use or protection are anthropocentric. According to Duelli et al. (2007), to understand human behaviour it is important to consider both intrinsic motivation (based on value systems) and extrinsic incentives (such as economic benefit). For example, appreciating and valuing a landscape depends on many factors, including cultural background and individual knowledge, interest and experience. Likewise, personal motivation to protect biodiversity can vary greatly, both in extent and underlying justification. Different stakeholders may also have a different understanding of the causes of dwindling biodiversity and of how biodiversity should be protected (if at all). Knowing each party's perspective and values is not only crucial for successfully implementing conservation measures – it also provides an opportunity for a process of mutual understanding, collaboration and, possibly, inspiration.

The Kafa Zone, located in southwestern Ethiopia, lies in one of the few areas of Ethiopia which still has substantial forest cover. Nationwide, Ethiopia's forest cover has been reduced to less than 2.5%, whereas within Kafa Zone around 50% of the land cover is still forest (Pratihast et al. 2014). Nonetheless, there has been a significant loss of forests in the Kafa Zone in recent decades (Tadesse et al. 2014). To preserve the remaining forest with diverse species including wild coffee, efforts were made by different governmental and non-governmental parties like NABU to establish a biosphere reserve. Finally, in 2011 UNESCO designated most of the Kafa Zone the Kafa Biosphere Reserve. Since then, NABU has been one of the major external actors in the Kafa BR, financing a NABU branch office in Bonga (administrative centre of the Kafa Zone) and ten rangers through funding from the German government. The Kafa BR is therefore an exemplary project that brings together many different stakeholders from diverse backgrounds. Through its work, NABU not only tries to enhance conservation through different activities implemented by their staff (all local personnel are originally from the area) but also brings in external actors, mainly for research activities.

UNESCO requires research and monitoring activities to be carried out in all biosphere reserves (Bridgewater 2002). Scientists therefore play an important role in evaluating the current environmental status of the area, including its biodiversity. Their value system and interpretation of biodiversity will influence the outcome of their assessment. This might possibly determine what indicators are chosen to measure biodiversity (Duelli et al. 2007). For example, there could be either a focus on high local species richness (alpha diversity) or a high regional or national diversity (beta or gamma diversity). Different researchers' perspectives on meaningful conservation methods and the overall concept of biosphere reserves are equally important. They may hope that establishing a biosphere reserve might help conserve species or preserve "wilderness" (which might be contradictory in itself, see Duelli et al. 2007). The two most common approaches to biodiversity management have been (a) the exclusion of humans and strict law enforcement and (b) a participatory and community-based approach (Stoll-Kleemann et al. 2010). The latter is strongly advocated by the ethos behind UNESCO biosphere reserves (Bridgewater 2002).

In the case of the Kafa BR, local residents, mostly small farmers, will most likely perceive the landscape quite differently. Therefore, their judgment of its quality might also differ. They might be more interested in direct-use values such as food and medicine and indirect-use values such as ecosystem functions than in non-use values. These three value categories were defined by Gaston and Spicer (2013). A study by Wallner et al. (2007) on locals' perception and evaluation of biosphere reserves showed that the main arguments in favour of establishing a biosphere reserve were economic. Local ecological knowledge is increasingly valued in wildlife conservation (Berkes et al. 2000). This knowledge is the result of a long history of interaction between local people with their environment. In the Kafa BR, there is a long tradition of using wild plants and animals for various purposes. However, traditional management techniques may no longer be sustainable due to pressure through population growth and resettlement programmes. New techniques, along with pressure and influence driven by external interests, have likewise altered land use and management. To preserve biodiversity in the long run, new concepts and methods or shifts in management strategies might be necessary.

The ideas of scientists and other external stakeholders are communicated to local residents by local personnel engaged in nature protection activities. In the Kafa BR these are mainly the rangers employed by NABU, who see raising awareness among local communities as one of their main tasks. Their interpretation of biodiversity and its value will influence locals' understanding of it, along with their perceptions of the importance of biosphere reserves. In a global survey on the effectiveness of UNESCO biosphere reserve management, Stoll-Kleemann et al. (2010) showed that community-based management is on the rise. Its success, however, largely depends on proper adaptation to the local context. Local employees know the cultural and historical background of the area well, and are informed about people's needs. Being simultaneously in close exchange with external stakeholders, they have the opportunity to bridge the gap between different perspectives.

To account for the different levels of stakeholders in the Kafa BR, three focus groups were chosen: (i) small farmers, (ii) local personnel, working in the context of the biosphere reserve, and (iii) scientists (involved in NABU's biodiversity assessment at the Kafa BR). The goal of this study is to gain a better understanding of each party's perceptions of biodiversity, its value, threats and the best ways to protect it in the context of the Kafa BR. Understanding each group's position on these issues will not only help avoid misconceptions; it can also reveal common ground on which future activities can be built.

2. Materials and Methods

2.1 Study area

According to a background study by Chernet (2008), the ethnic composition of the Kafa Zone is dominated by Kaffecho (81%), followed by Bench (6%), Amara (6%) and Oromo (2%). The remaining 5% also include marginalised groups like Manjo (Manja). The biggest religious group are Orthodox Christians (67%), followed by Protestants (20%) and Catholics (10%). There is also a small Muslim community (3%).

The overall population density of the Kafa BR is 98 inhabitants per km², ranging from 52 inhabitants per km² in the least densely populated woreda (Decha) to 210 inhabitants per km² in the most densely populated woreda (Chena).

In total, the Kafa Zone has an area of around 10,000 km² and a human population of a little over one million inhabitants. The Kafa BR itself has an area of around

7,500 km². The natural vegetation is mostly classified as moist Afromontane forest (Friis 1992). Different political and demographic factors have driven changes in land use and land cover in the Kafa Zone. In the 1970s, major land redistribution occurred, followed by large-scale resettlement in the 1980s. The 1990s were shaped by the agricultural investment policy and the promotion of cereal production, along with the Ethiopian Forestry Action Plan. Finally, the 2000s were influenced by large-scale agricultural expansion, the establishment of National Forest Priority Areas, Participatory Forest Management (PFM) projects and ultimately the UNESCO biosphere reserve (Tadesse et al. 2014).

Subsistence farming is very important for local livelihoods. The most common livestock is cattle, followed by poultry, sheep and goats. Honey production (mainly using traditional techniques) and coffee cultivation are other important sources of income (Department of Finance and Economic Development 2012).

2.2 Data collection

Semi-structured interviews were conducted with three different focus groups: Small farmers (n = 43), on-site personnel (n = 15) involved in nature conservation and scientists (n = 27) participating in a biodiversity assessment in the Kafa BR in December 2014. Most interviews were held between 3rd and 21st of December 2014 within the Kafa BR. Time constraints made it necessary to interview some scientists via telephone. Interviews with small farmers were conducted in five different kebeles (situated in three different woredas). The kebeles were chosen because of their proximity to both core zones and the study sites of other groups involved in the assessment (Table 1). Households for most interviews were chosen randomly, but with a preference for a gender-balanced sample. Interviews were held such that they only represent the opinion of a single household member. Wherever possible, the kebele leader and kebele manager of each kebele were interviewed.

Table 1: Sampled kebeles and their main features for the small farmer focus group

Kebele	Angiokolla	Boka	Michiti	Ufa	Ufudo
Woreda	Adiyo	Adiyo	Gimbo	Decha	Gimbo
Habitat of the area	Bamboo forest	Montane forest	Montane forest	Montane forests / riverine vegetation	Wetland
No. of households*	85	311	38	157	209
Walking distance to market [h]**	2.5	< 0.5	0.75	1	< 0.5
Walking distance to core zone [h]**	3	0.5	1.25	1.5	2

* As stated by the respective kebele leader or manager

** Mean value of statements by interviewees of the respective kebele

The personnel interviewed on-site were mostly NABU staff. This included most rangers employed by NABU as well as staff at the NABU branch office in Bonga. Two more people involved in nature conservation work in Bonga were also interviewed. 27 of the 34 participants of the biodiversity assessment were interviewed. Around a third of them were affiliated with Ethiopian institutions. The remaining scientists were affiliated with European universities or institutions.

2.3 Interview design

Interviews were structured in two parts. Part one tackled specific biodiversity issues, mostly directly linked to the Kafa BR. Since most farmers were not familiar with the term "biodiversity", a short explanation was provided before further biodiversity-related questions were asked. Part two consisted of more general questions about BRs and their influence. Due to time constraints, these questions were only put to two of the focus groups (scientists, local personnel). To ensure comparable results, some questions (n = 13) were asked to all focus groups, although sometimes with minor changes. To allow interviewees' specialist knowledge to be considered, some questions (n = 19) were only asked to one or two of the focus groups. Since there is no term for biodiversity in any local language, the English term "biodiversity" was used when interviewing farmers. Rangers reported that they had also used the English term when giving training sessions.

2.4 Background information on interviewees

The ethnic composition and religion of interviewed farmers roughly matched the overall mean for the Kafa Zone (Chernet 2008) being clearly dominated by Kaffechos and Orthodox Christians. One of the minorities (Manja) was overrepresented with a share of 19%, because one of the sampled kebeles (Michete) is only inhabited by Manja. The gender ratio among farmers was about equal. The educational level between sexes was significantly different, with women only attending school for three years on average (Figure 1a). 30% of interviewees were members of participatory forest

management (PFM) sites, while 56% had received training. There were no major differences between sexes in these two categories (see Table 2 and Figure 1b). The most common sources of training were NABU (28%) and the agricultural department (21%).

Table 2: Background information for interviewed farmers (overall and by kebele)

	Total	Kebele				
		Angiokolla	Boka	Michete	Ufa	Ufodo
No. of interviewees	43	5	11	7	10	10
Age [mean ± sd]*	34 ± 14.3	36 ± 9.6	28 ± 7.2	32 ± 6.6	27 ± 6	47 ± 21.8
No. of school years [mean ± sd]	5 ± 4.1	3 ± 3	7 ± 3.1	6 ± 3.2	5 ± 5	4 ± 4.9
Property size in ha [mean ± sd]**	2 ± 1.4	2 ± 1.5	2 ± 1.2	2 ± 1.7	1 ± 1	2 ± 1.8
No. of household members [mean ± sd]	5 ± 3.3	8 ± 3.3	5 ± 2.6	5 ± 3.7	4 ± 2.5	5 ± 3.2
Received training [%]	56	80	82	14	70	30
Higher education [%]	5	0	0	14	10	0
PFM member [%]	30	100	27	14	40	0

* Age values must be treated with caution, as interviewees were often unsure of their exact age

** Because of fears of taxation, stated property sizes are very likely underestimates

The gender ratio was less balanced among personnel, being clearly dominated by men (87%). The mean age (34 years) was the same as for the farmers, but the range was smaller. Mean work experience (10 years) was significantly less than for the scientists (15 years). Interviewees mostly worked as rangers employed by NABU (67%). Only personnel not working as rangers held Master's degrees.

The scientist group was older (mean = 44) and more experienced than the personnel. It was likewise dominated by men (70%), with females tending to be younger with less work experience. Just over half of the scientists said they were familiar with Ethiopia to some extent, but only 30% were Ethiopian by nationality. Scientists with experience in management and nature conservation were less likely to have doctoral degrees (19% vs. 50%) or be acquainted with Ethiopia (40% vs. 78%). In general, more Ethiopians than non-Ethiopians had worked for a governmental institution (57% vs. 8%) but the reverse was true for non-government organizations (38% vs. 73%).

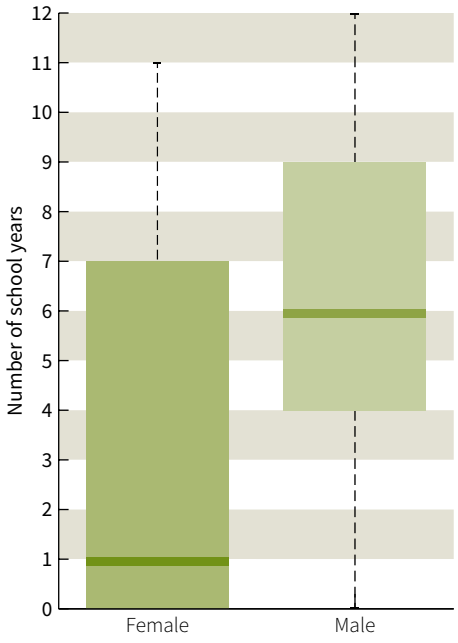

Figure 1a: Number of school years by gender

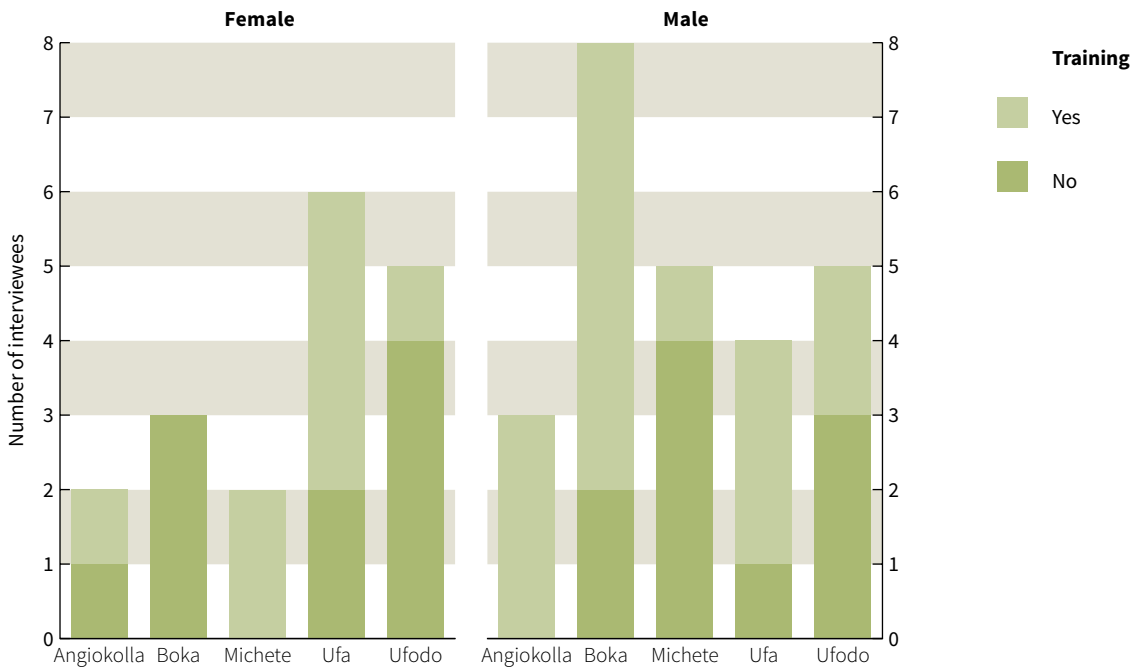

Figure 1b: Training received by kebele and gender

2.5 Data analysis

First, answers were tentatively categorised to allow for comparison and aggregation. Responses were checked to see whether they covered the most common topics. Whenever reasonable, answers to different questions were considered simultaneously. Lines of argument and general concepts were then analysed and grouped. Statistical analysis was performed using R version 3.1.2 (R core Team 2014).

3. Results

3.1 General perception of biodiversity

All three focus groups were asked to define the term "biodiversity" (see Figure 2a). The farmers' understanding matched the most common answer given by personnel, and equated biodiversity with ecosystems, and sometimes only with forests. The standard textbook definition of biodiversity, which includes three levels of diversity (genetics, species and ecosystems/landscapes) was given by 20% of the personnel and 56% of scientists. Around 25% of scientists and 7% of personnel mentioned additional qualities of biodiversity, mostly focusing on the diversity of biological relations or interactions. Around 33% of scientists reduced biodiversity to diversity at the species level. For the majority of scientists, species were the most important element of biodiversity and therefore the focus.

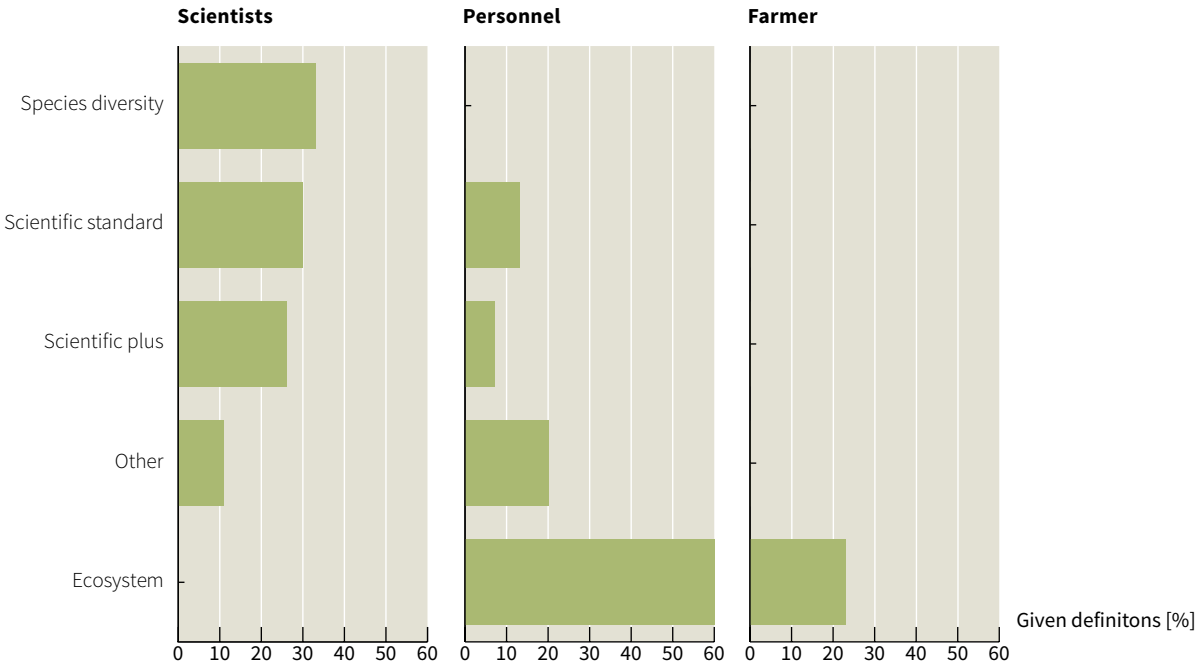

Figure 2a: Definitions of biodiversity given by all focus groups

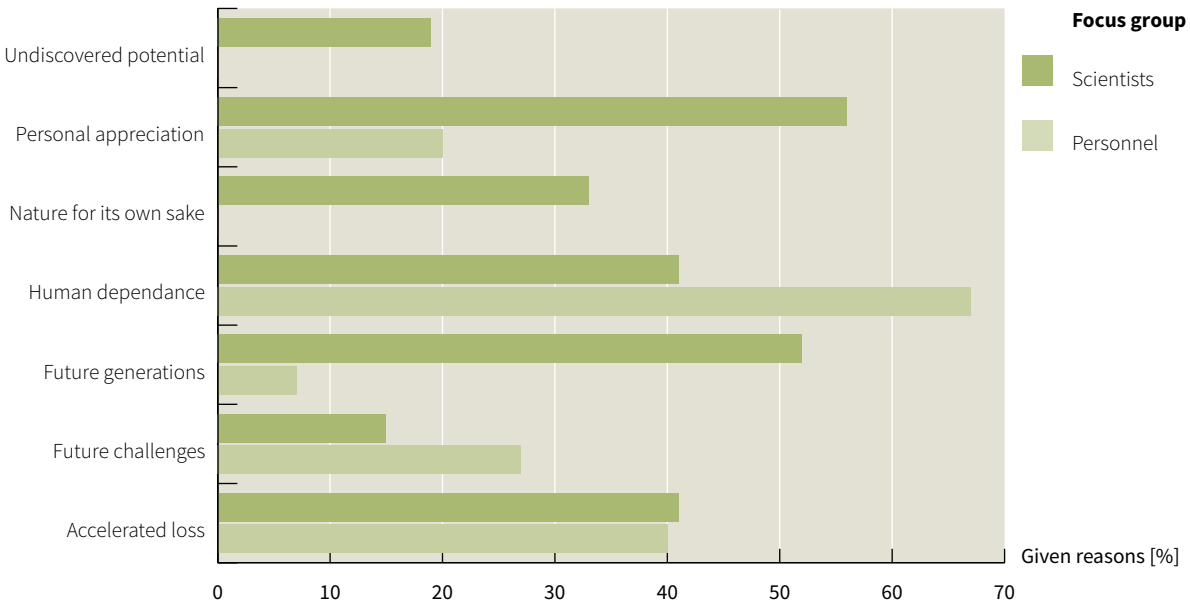

Figure 2b: Personal motivations to protect biodiversity as given by scientists and personnel

When asked about personal reasons to protect biodiversity, the most common answer for scientists was personal appreciation of the diversity of nature, followed by the wish to preserve it for future generations (Figure 2b). In contrast, human dependence was the single most important reason for personnel, followed by motivation due to recent accelerated loss of biodiversity. This reason was given by the scientists about as frequently. To be prepared for future challenges was a comparatively rare personal motivation for scientists (15%), but the third most important motivator for personnel (20%). Only scientists mentioned protecting biodiversity for its own sake, ensuring every species' right to exist independent of any human benefit. This was also true for the undiscovered potential of biodiversity, e.g., future medicinal discoveries.

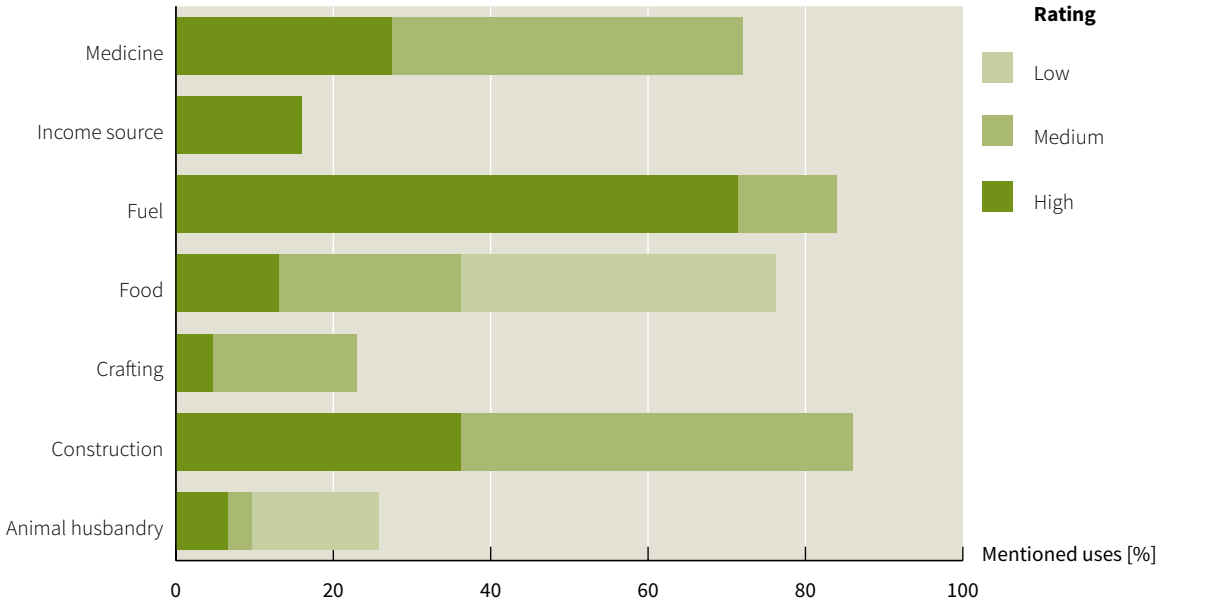

Figure 2c: Uses of wild species mentioned by farmers and their importance

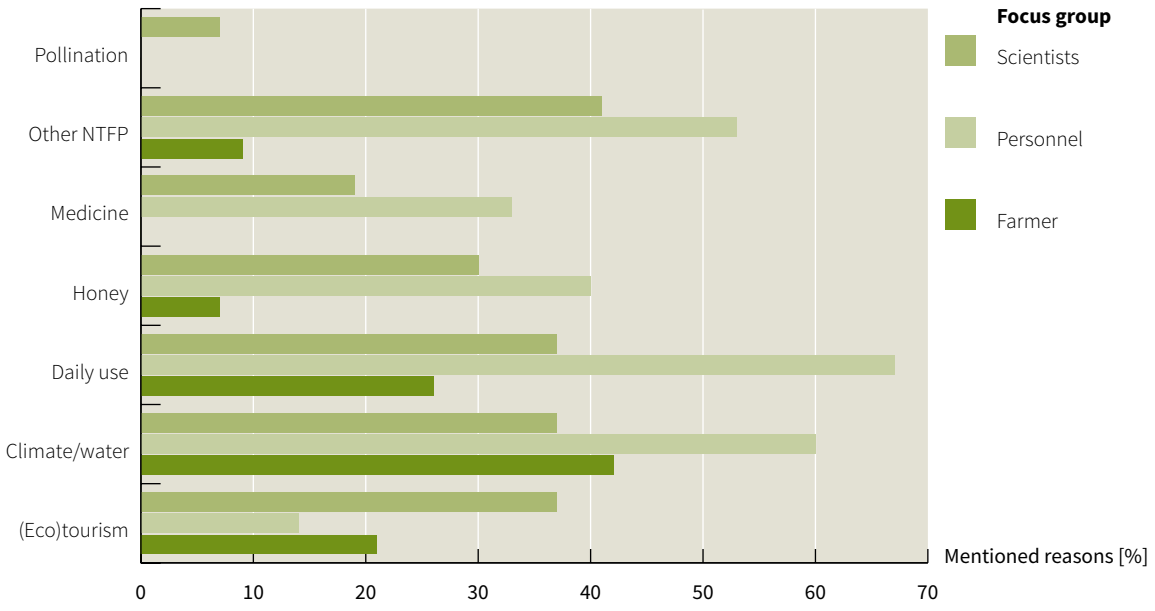

Figure 2d: Reasons to protect biodiversity for the local community, according to all groups

The most important stated use of wild species for farmers was fuel, which was rated as highly important and commonly used (Figure 2c). Using wild plants for construction and medicinal purposes were also viewed as important, but the majority of interviewees only attributed medium importance to it. Wild species are commonly used as food, but this was generally perceived as being of low importance. Some people mentioned that this might be more important after a poor harvest. Few people (16%) mentioned wild species as an important source of income, but for those who did, this was rated as highly important. Generally, only wild plants were regarded as useful. Animals, especially mammals, were often seen as competitors for crops; their only perceived use was as a tourist attraction. When specifically asked if they also valued wild species for some other reason beyond their usefulness, less than half of the interviewed farmers

agreed. For those who agreed, the most common reason given was beauty. The mantled guereza (*Colobus guereza*) was often mentioned in this context. Sacred forest sites were also mentioned. Some farmers were asked if they would be willing to protect a species that was endemic to their forest (a bird was given as an example) but which was ugly and of no use to them. Besides surprise at the question, the immediate reaction was that they would not. However, after reflection some people later stated that the species might be of future use and therefore worth protecting.

Many scientists found it difficult to name ways in which biodiversity would benefit local communities, especially when asked to specifically identify benefits from a diverse environment rather than general ecosystem services provided by forests. The most commonly cited reasons were climate and water regulation, making use of different species in daily life, especially from non-timber forest products (NTFP), and tourism as a source of income (see Figure 2d). Of the scientists who saw ecotourism as a possible way to benefit from biodiversity, some also stated associated risks and challenges, the most important being distributing profits and the limited quality of tourist infrastructure and associated services. Honey and coffee were perceived as the most important forest products. The majority of scientists (65%) rated the importance of biodiversity for the livelihood of local communities as high. Still, 13% of interviewees thought of it was of low importance to local communities. The remaining 22% assigned medium importance to it.

When asked the most important reason to protect biodiversity, the most common response from farmers involved ecosystem services such as climate regulation and water supply (Fig. 2d). Daily use, the second most common answer, was only mentioned by 26% of respondents. This is probably because, even after being provided with an explanation of the term, biodiversity was seen as related to forests and protection was seen as implying non-use. Surprisingly, none of the farmers mentioned medicinal plants as a reason to maintain a diverse environment, even though 72% mentioned using them and 38% assigned them high importance. Some farmers explained how strict protection of areas that excluded any use made no sense. Others also expressed that "biodiversity should be balanced", expressing the fear that if there were too many wild animals they would feed on their crops. 88% said that biodiversity was very important to people's wellbeing, while the rest assigned it medium importance.

In contrast, 67% of personnel cited daily use as a benefit of biodiversity for the local community, the most common answer. This was followed by climate and water regulation. NTFP, especially honey and medicinal plants, were also often mentioned. Of the three focus groups, the personnel mentioned possible benefits of tourism the least (14%). All interviewed personnel said biodiversity was very important for the well-being of local communities.

3.2 Biodiversity – What makes the Kafa BR special?

Overall, scientists rated the richness of the Kafa BR as high (Fig. 3a). However, of the three focus groups, scientists were the more likely to assign medium richness to it (22%). This was only true for non-Ethiopian participants (32%). More than a quarter of scientists (and 50% of Ethiopian scientists) emphasized Kafa's high biodiversity, especially in comparison with other parts of Ethiopia. In addition, almost half of the scientists mentioned its undiscovered potential in terms of new species.

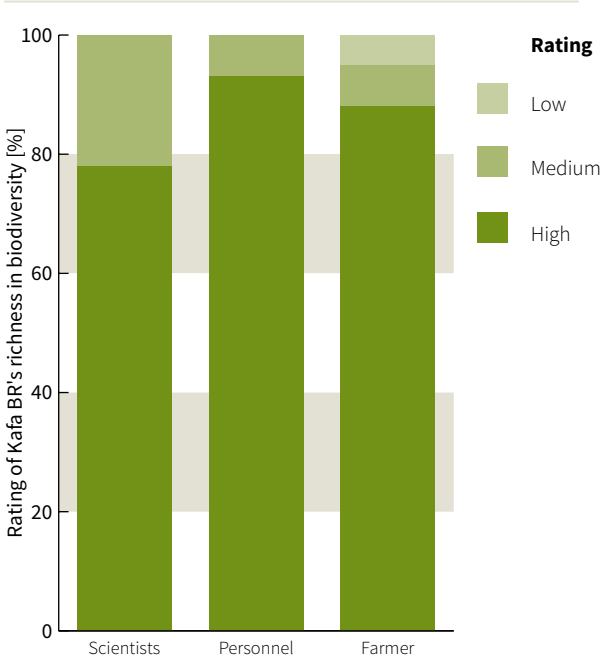

Figure 3a: Rating of the richness of Kafa BR's biodiversity by all focus groups

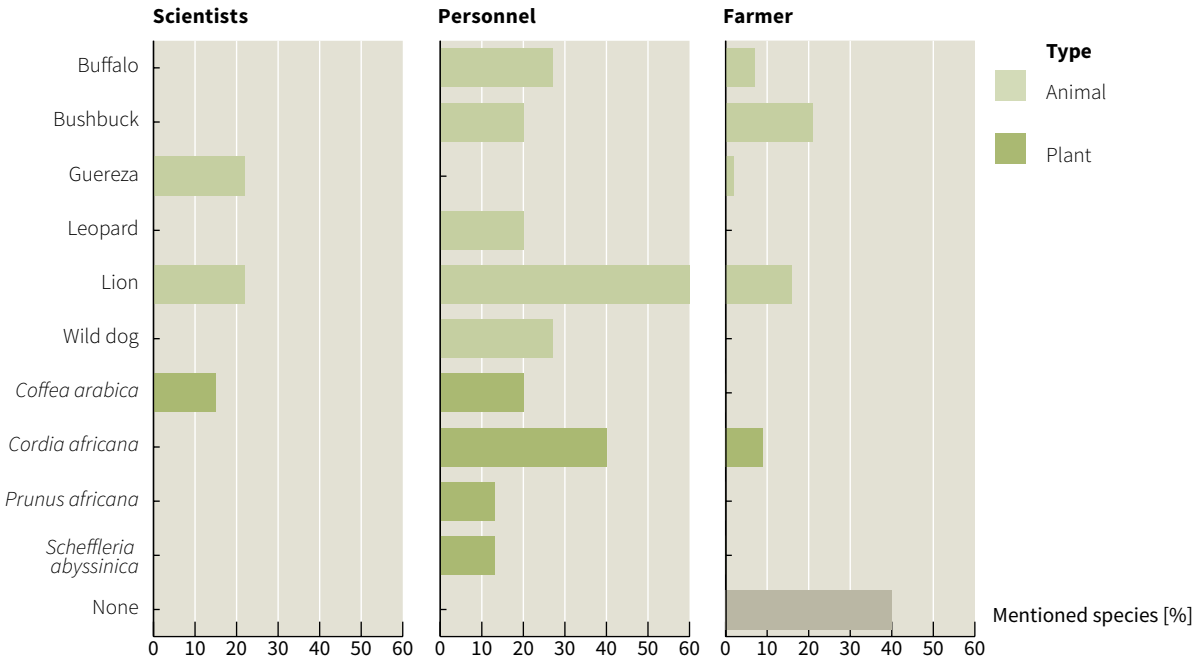

Figure 3b: Rare species most commonly mentioned by farmers and personnel and suitable flagship species according to scientists

Generally, farmers said they were very familiar with wild species (67%). Responses varied by gender and PFM membership, but not by training received, indicating that knowledge of species is indigenous knowledge than rather than taught by external actors. Some women (13%) explained their low familiarity with species by explaining how they mostly stayed within a certain radius of their property. Most interviewed farmers had never travelled outside of the Kafa Zone. Often, they were only familiar with their area within Kafa. In total, 88% of interviewed farmers saw the Kafa Zone as being highly rich in species. When asked, what they based this rating on, respondents mostly explained that they heard this from other people or through the media about other parts of the country. Some respondents also claimed that the Kafa Zone is rich because of its evergreen forest. One individual stated that the Kafa area was species poor. However, he later confessed that he gave this answer to discourage interest in protecting the Kafa area.

All three focus groups were asked to name special animals. For the scientists, the focus was on suitable flagship species, whereas for farmers and personnel the main criterion was rarity. Surprisingly, about 40% of farmers were unable to name any rare species (see Fig. 3b). The most commonly cited animal was the bushbuck (*Tragelaphus sylvaticus*) at around 20%, followed by the lion (*Panthera leo*). It was unclear whether by "bushbuck" people were referring to *Tragelaphus sylvaticus* or a "deer-like" animal in general. The personnel mentioned lions most often as rare species (60%), followed by *Cordia africana* (40%). The existing flagship species of the Kafa BR, the mantled guereza (*Colobus guereza*) and coffee (*Coffea arabica*), were generally supported by scientists. More than 20% also suggested adding the lion as an additional flagship species. Scientists also named possible flagship species from their own disciplines.

3.3 Risks and threats to the Kafa BR's biodiversity

Changes in species abundance had been noticed by 87% of personnel and 70% of farmers, respectively. Increases and decreases were cited about equally, and around a third of each focus group had noticed changes in both directions. Personnel most frequently cited the increase in the monkey population (36%) and decreasing number of lions (29%). They also reported that secondary and understorey species are benefiting from selective logging of large hardwood trees. The general feedback from personnel was that the biggest losses had already happened in the past, mainly due to the resettlement program in the 1980s. The development of forest cover and animal populations in past years was seen predominantly positive. According to one respondent, the increase in monkeys is due to changes in law. Between 1970 and 1990, hunting monkeys was regulated. According to some personnel, this led to increased conflict with farmers, who then tried to kill monkeys to avoid crop loss. This is supported by the feedback from farmers on which species had the biggest negative impact on their farming activities,

with 86% of respondents mentioning monkeys (Figure 4b). However, most people, being aware of the government regulation, said they would only try and chase them away, not kill them. The mantled guereza was an exception to this negative view, due to its different feeding habits (mostly leaves). Other animals often seen as a problem included wild pigs (65%) and rats (37%) eating from food storage. Carnivores attacking livestock were only mentioned by 16% of farmers.

Biodiversity loss was seen as a severe problem by most people in all three focus groups (see Figure 4a). Personnel were the most likely (20%) to ascribe low importance to the problem. This is because they saw recent developments as being positive, as mentioned above. Personnel and farmers saw the pressure on wetlands as predominantly low (only farmers living near to wetlands were asked this question). Overall, scientists rated the pressure as medium (Figure 4a). Both underlying risks (e.g., population pressure, climate change, investors) and actual threats (e.g., agricultural expansion, hunting) were mentioned as drivers of biodiversity loss (Figure 4c). The threats of expanding agriculture and (illegal) logging were most frequently mentioned by farmers and scientists. Personnel ascribed higher priority to (illegal) hunting over logging. Every focus group saw population pressure as the biggest risk. Investors were mentioned as a risk by about 20% of both scientists and personnel. Only scientists mentioned the risk of increased biodiversity loss through increasing wealth, bringing with it new technologies and lifestyles with higher environmental impact. When asked about drivers in general, only personnel mentioned climate change. However, when scientists were asked specifically to rate the possible impact of climate change on biodiversity, 28% said they saw it as a current driver (see Figure 4e). Nonetheless, the majority did not rate it as a current driver, and only possibly as a future driver. Many scientists felt that the local effects of climate change are too complex to allow for predictions.

Both farmers and personnel were asked whether they had experienced changes in weather in recent years. Changed or unclear seasonality (unseasonal rain) was the most frequently cited trend in weather conditions. This was reported by 28% of farmers, but results were sometimes contradictory, even within the same village. 64% of personnel mentioned shifts in seasonality and 43% mentioned increased rain intensity. Signs of increasing temperature were mentioned by less than 10% of interviewees in both focus groups.

Interviewees were also asked to name plant species which are vulnerable to changing weather conditions. Increased rain intensity, long dry spells and shifts in seasonality were given as examples to help explain the question. Only a little more than 20% of farmers and 50% of personnel were able to name such a species. This was most commonly associated with prolonged dry conditions.

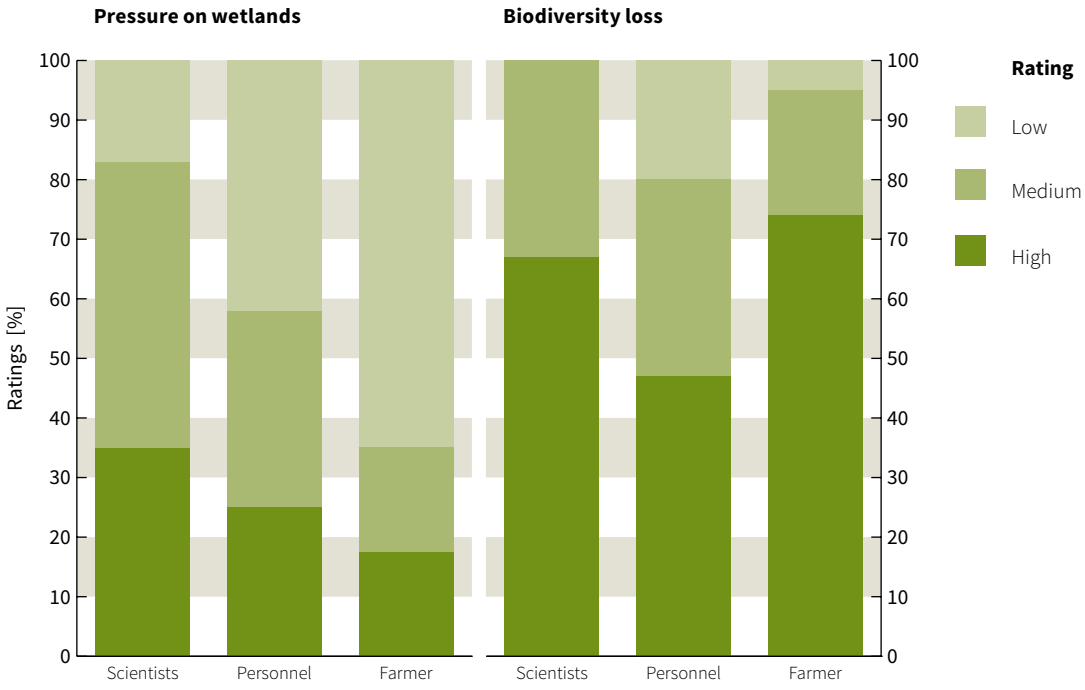

Figure 4a: Ratings by all three focus groups on the pressure on wetlands and the problem of biodiversity loss

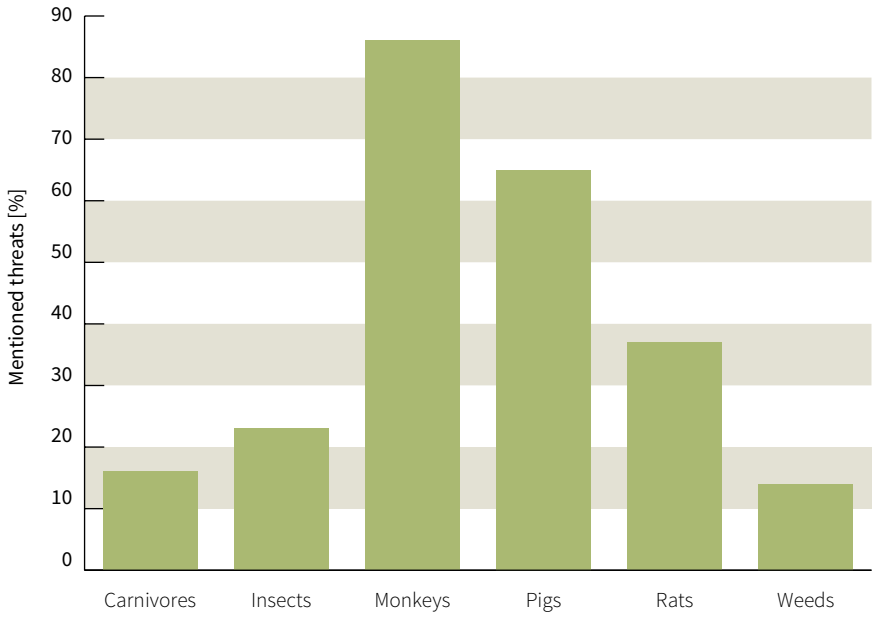

Figure 4b: Wild species commonly perceived as threats by farmers to their farming activities

Figure 4c: Most commonly mentioned drivers of biodiversity loss for all focus groups

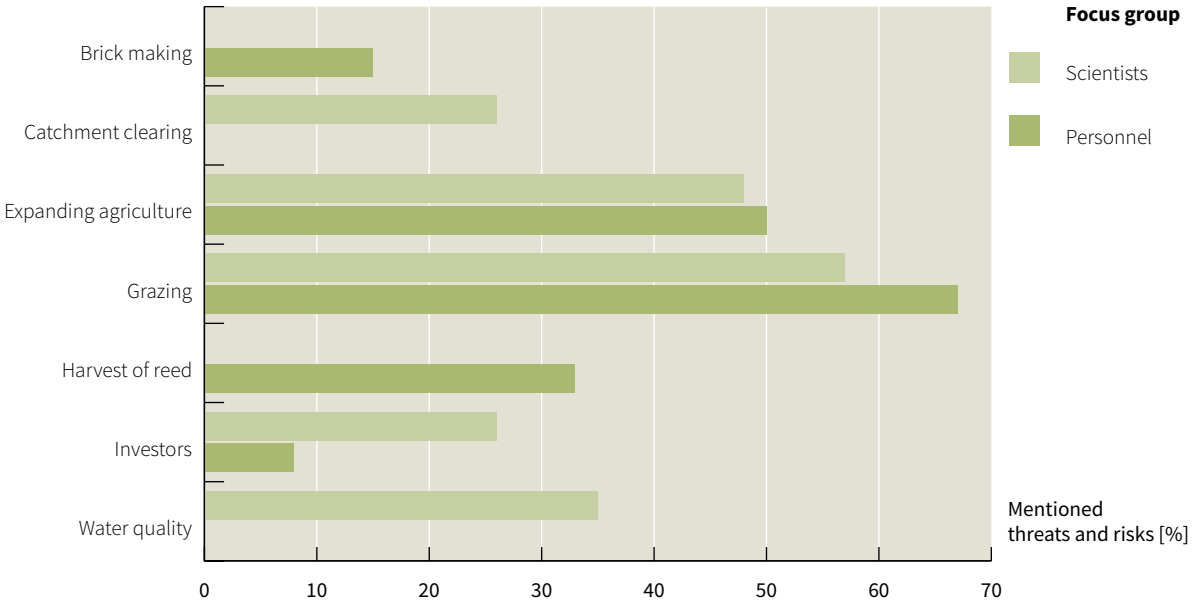

Figure 4d: Commonly mentioned risk and threats to wetlands by scientists and personnel

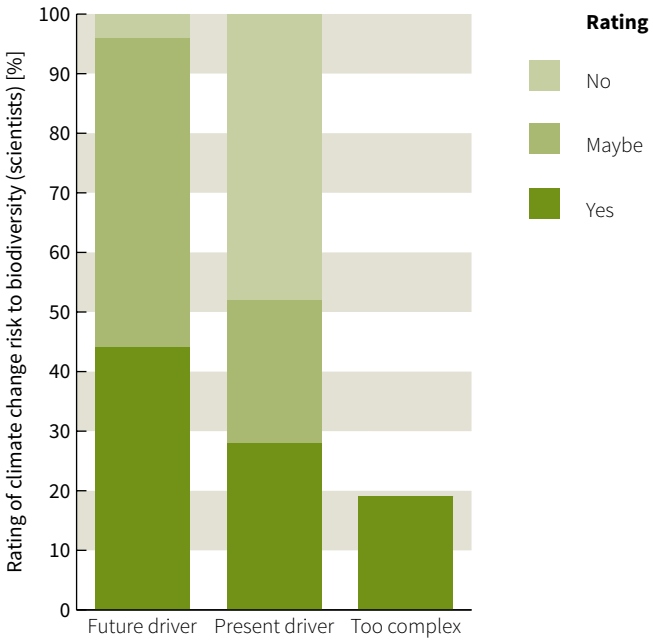

Figure 4e: Ratings for the risk of climate change affecting biodiversity by scientists

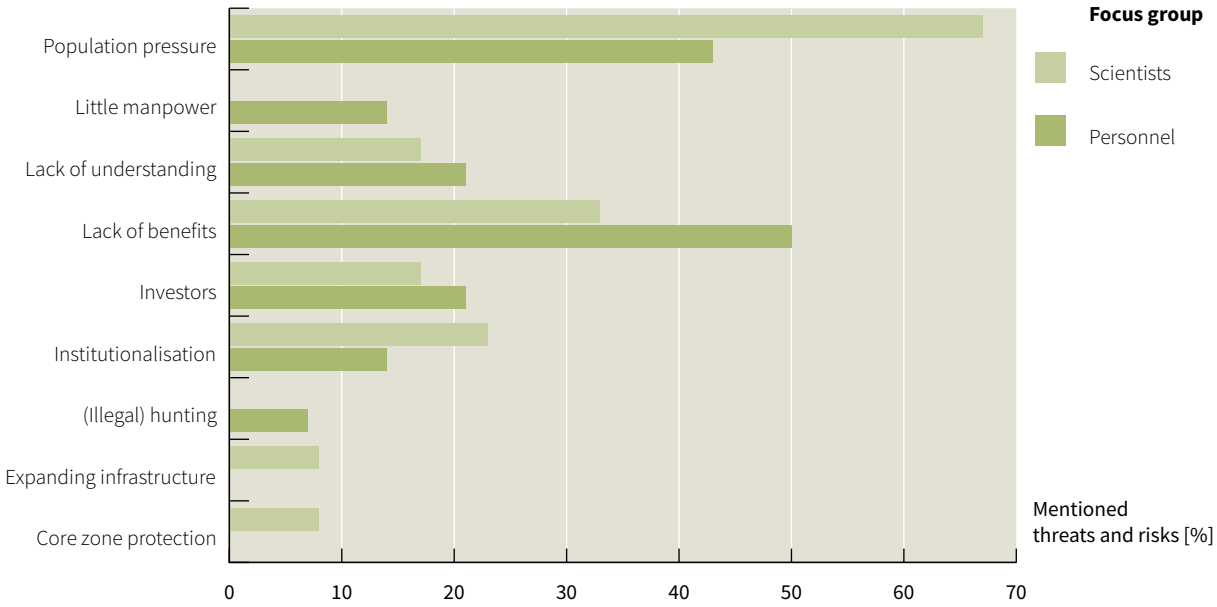

Figure 4f: Commonly mentioned risk and threats for the future of the Kafa BR by scientists and personnel

Wetlands are traditionally used for grazing, especially during dry season, and to harvest reed for roofs and as decoration for celebrations. Farmers saw grazing as the most important use of wetlands by far, followed by the collection of reed for roofs. When scientists were asked about the importance of wetlands to achieving conservation goals, the main reason given was the provision of habitats to wetland species (65%). Regulation of water and microclimate were also mentioned. Wetlands were seen as being very important for conservation (96%). Grazing and expanding agriculture were seen as the biggest pressures on wetlands, both by personnel and scientists (Figure 4d). Harvesting reeds and brickmaking were only mentioned by personnel. Scientists also worried about threats such as water pollution (sediments, chemical), catchment clearing and the risk of large-scale impact by investors.

Scientists generally viewed the relationship between development goals and nature conservation as problematic. Still, 20% thought that they were compatible, since long-term development is only possible by considering environmental issues. This perspective was only supported by non-Ethiopians (26%). Likewise, only non-Ethiopians (28%) stated that conservation should be prioritised over development (28%). The idea of balanced use, with some areas set aside for development (e.g., intensive agriculture) and others for environmental protection was mainly proposed by Ethiopians and interviewees who had no stated background in management.

The biggest challenges seen for the future of the Kafa BR exhibited significant overlap with the mentioned drivers of biodiversity loss (see Figure 4f). The risk of population pressure and its associated threats was once again mentioned frequently by both scientists and personnel. However, the challenge most frequently mentioned by personnel (50%) was the lack of benefit to local communities from the Kafa BR. This argument was also supported by 33% of scientists. Both focus groups mentioned risks due to a lack of understanding by different communities and risks due to investors about equally. Challenges associated with the institutionalisation process which require the government to take over responsibility for managing the BR were pointed out by more scientists (23%) than personnel (14%). Only personnel mentioned the lack of manpower and resources in BR management.

3.4. Proposed measures to protect the biodiversity of the Kafa BR

Around half of the farmers saw their activities as contributing to conserving biodiversity. Specific reasons included diverse home gardens, planting or maintaining of trees on their properties and, occasionally, planting flowering plants for beekeeping (Figure 5a). Scientists and personnel both mentioned that Kafa's inhabitants have a unique culture based around protecting nature. Some proposed measures to protect biodiversity were similar to the contributions mentioned by farmers, e.g., planting or maintaining of trees. Education about ways to protect resources and their proper use was also seen as important (26%).

Almost all farmers said they were interested in the results of the study and the biodiversity assessment. Scientists explicitly mentioned education (58%) and general development of the area, including infrastructure (21%). Most farmers (70%) saw the community as responsible for protecting biodiversity, while a little over half thought this lies with the government (see Figure 5b). Generally, male farmers mentioned both bodies more often. Interviewees who had received training or were PFM members tended to see the community as more strongly in charge of protecting biodiversity. About 60% of scientists were aware of at least some of NABU's activities since establishing the Kafa BR. Measures aiming to raise awareness among local communities, PFM sites and the distribution of stoves were the most commonly known. The majority of scientists saw communities as playing a central role in the success of future biodiversity conservation (Figure 5c). Around 50% of scientists suggested raising community awareness, ways to allow communities to profit from biodiversity through benefits or compensation and community involvement. A little under half of scientists saw government involvement as crucial. This was also mentioned by the personnel, with the biggest difference being the frequency of mentioning raising community awareness (93%). External financial or personal input was suggested more frequently by scientists (22%) than personnel (14%). This was also true for family planning. Only scientists mentioned improving management strategies, sustainably increasing agriculture and implementing waste and sewage management. Only personnel mentioned product marketing and better protection through increased ranger capacity, especially for transportation. Scientists and personnel were both broadly against enforcing punishments in the region, e.g., to protect the core zones (see Figure 5d). However, more scientists (33%) were in favour of this measure than personnel (25%). Most scientists saw the need for future research in further biodiversity assessments (81%). Research into improved management or agricultural techniques were mentioned by around 40% of scientists.

While describing the general concept of BRs, 60% of personnel and 81% of scientists emphasised the aim of combining human use with protecting nature. Around 30% of scientists saw zonation as helpful in this regard. Scientists saw loss of sovereignty and specifically land access rights as the biggest disadvantages for local communities associated with establishing a BR (56%). The long-term preservation of a basis for livelihoods was seen as the biggest advantage (64%). Adding value to an area by promoting it as a tourist destination, especially while competing with other places, was also mentioned (40%). Around 10% supported the view that the positive and negative effects would balance out. Overall, scientists rated the effects of BRs on local communities as positive (84%).

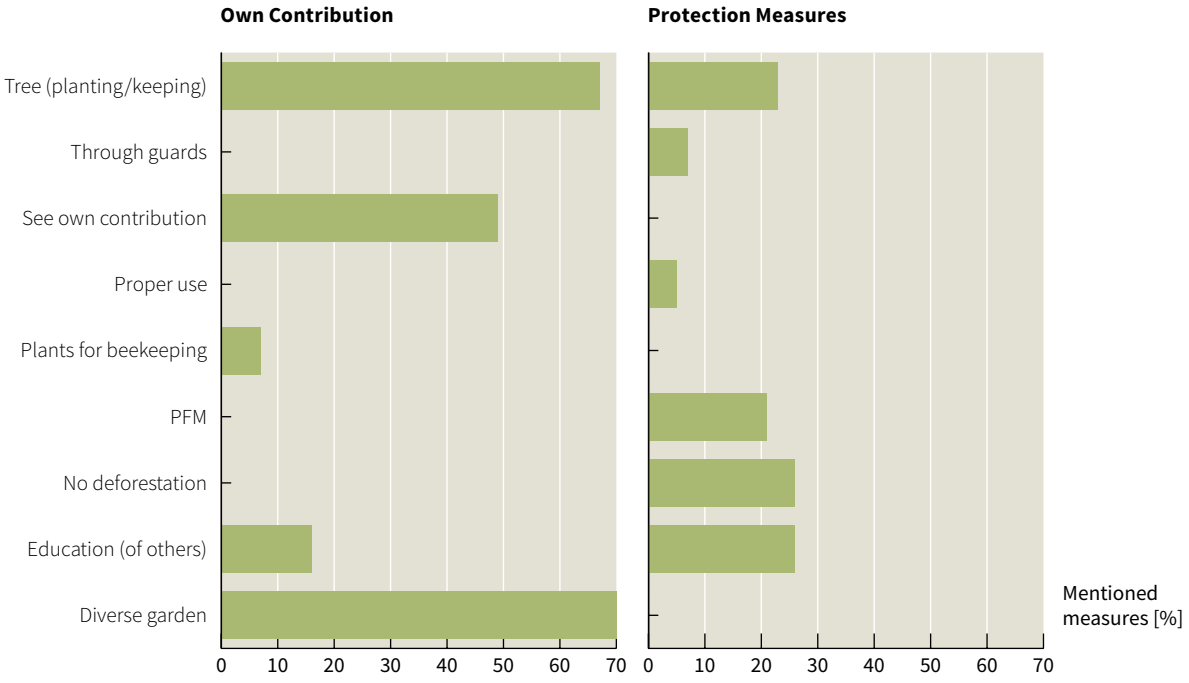

Figure 5a: Farmers' perceived contributions to biodiversity and suggested measures to protect biodiversity

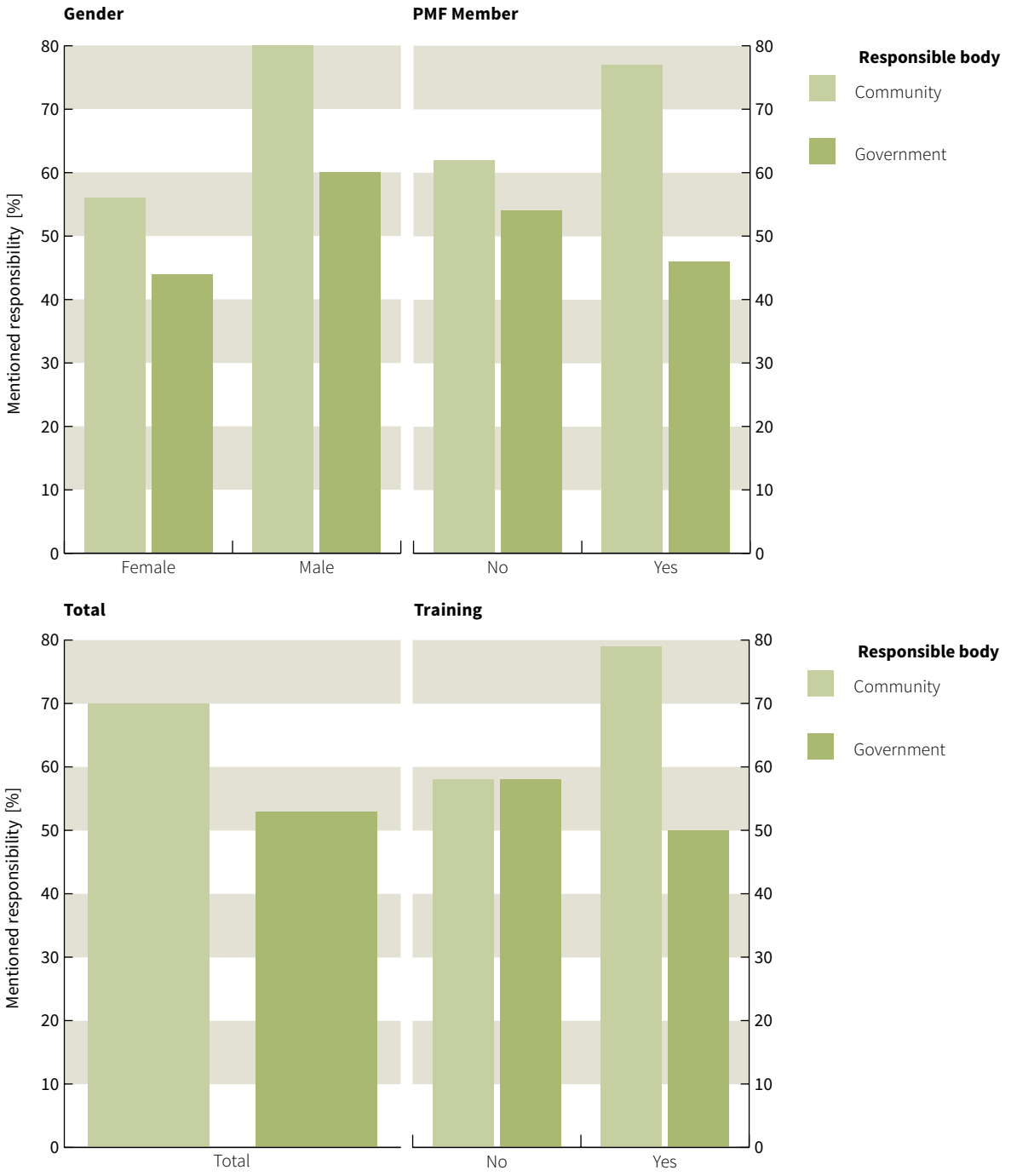

Figure 5b: Bodies seen as responsible for biodiversity conservations by farmers (also grouped by gender, PFM membership and level of training)

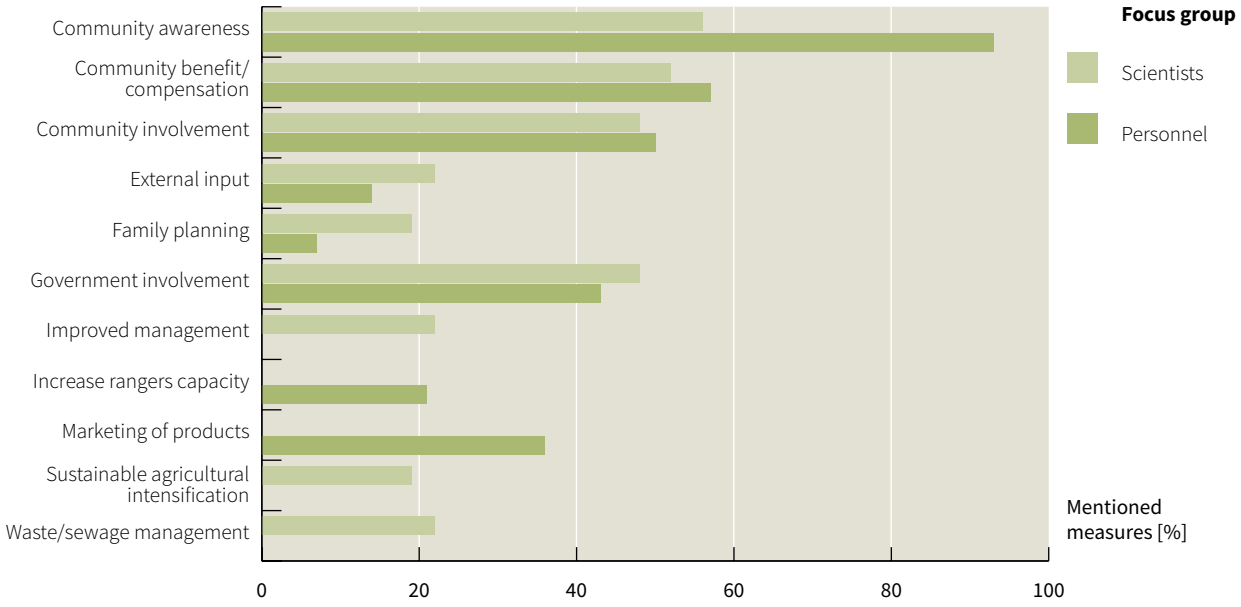

Figure 5c: Measures for biodiversity conservation in Kafa, as suggested by scientists and personnel

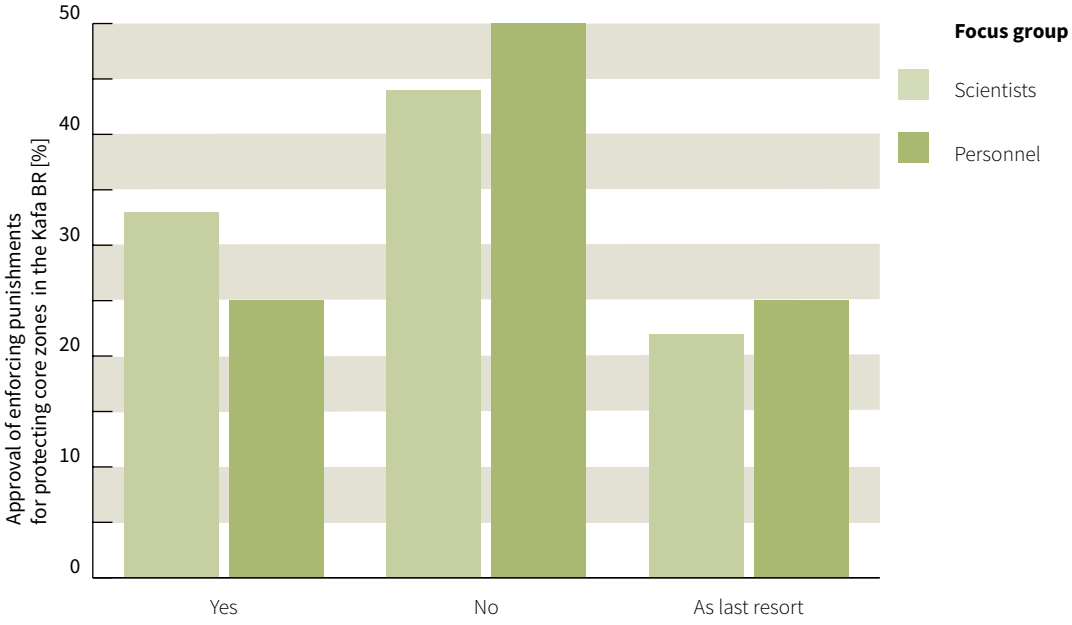

Figure 5d: Opinion on the necessity of enforcing punishments to protect core zones in Kafa, as given by scientists and personnel

4. Discussion

4.1 Biodiversity – a concept understood in diverse ways

The three different focus groups had substantially different understandings of biodiversity. This is due to both education and individual interests. Even the definition of biodiversity is influenced by value systems, which can be both cultural and individual. The term is used with diverging understanding even within scientific contexts (Duelli et al. 2007). This was also true for the focus group of scientists in this study, who provided varying definitions of the term. The clearest overall difference in the definitions was in terms of level of abstraction. When equated with ecosystems or even more simplistically with forests (farmers, personnel), biodiversity becomes a very tangible concept, at the expense of the relevant of diversity. Reducing biodiversity to the species level (personnel, scientists) still simplifies variety to the level that is the most accessible to humans. The standard textbook definition reduces "diversity of life" into three defined categories. The extended scientific definition, given mostly by scientists but also occasionally by personnel, also mentions a diversity of relations and interactions related to the concept of a "balance of nature". This concept of ecological resilience, put forward by Pimm (1991), stresses that the more species there are, the more diverse their roles within an ecosystem. This, in addition to intraspecies diversity, promotes "ecological stability", because adaptation is more likely without major shifts.

Semi-structured interviews are not sufficient to explore the relationship between farmers and their environment in any great depth. The main focus was on understanding predefined (scientific) concepts. Methods like participatory rural appraisal are better suited to allowing people to develop appropriate concepts to describe their views (Chambers 1994). Due to time constraints, it was unfortunately not possible to use these methods for this study. Thus, the meaning of biodiversity for people in local communities may have not been properly assessed. Even so, this study demonstrated that, although farmers mostly focus on practical uses of wild species, a significant number also assigned them non-use importance.

Similarly, personal motivations to maintain a diverse environment varied considerably across the different focus groups. There was a generally good shared understanding of the importance of natural resources to local livelihoods. But the extent to which this can be directly related to biodiversity was again subject to debate. In principle, the value of biodiversity can be grouped into three basic categories: (a) direct-use values such as food, medicine and biological control, (b) indirect-use values such as ecosystem functions and (c) non-use values (Gaston & Spicer 2004). When asked about personal motives to protect biodiversity, each focus group mentioned a different category most frequently. Personnel most frequently cited direct-use values, farmers indirect-use values and scientists non-use values.

4.2 What is needed to value distinctiveness?

Systems of value are influenced by many factors. This is also true when it comes to judging the value of biodiversity. What is regarded as special depends on points of comparison, either through personal experience or other sources of information. In judging Kafa's richness of biodiversity, the interviewed scientists usually cited two different underlying criteria: rarity (e.g., endemic species) and contrast (e.g., to the amount of forest remaining in the rest of Ethiopia). The farmers have not travelled outside of their immediate environment, and thus have no points of direct comparison from their own experience. They are thus completely reliant on external reports. Unlike the scientists, the farmers did not seem to view rarity as having distinct value. Around 40% of farmers were unable to name even a single rare species. Assuming this was not due to methodological limitations (e.g., farmers' fear of acknowledging something possibly unwanted), this supports the argument that recognising (and valuing) rarity is related to points of comparison.

Scientists sometimes argue that non-use qualities of nature can only be appreciated after experiencing their loss. The farmers were most in proximity to relatively "intact" ecosystems, since most chosen kebeles were close to core zones. Still, some had noticed changes in species abundance. This recent accelerated loss of species was an important argument for protecting biodiversity for both the scientists and the personnel. Most personnel had at least travelled to some extent within Ethiopia and had access to information through their education and work.

Still, there was a consensus across all three groups that the Kafa BR is a diverse place (for farmers, this was simplified to rich in species). Farmers often expressed themselves via superlatives, e.g., "Kafa is the richest in the world." Scientists, the group with the best means to compare Kafa with other places, where the most likely (22%) to view the Kafa BR as exhibiting medium species richness. This was especially true

for the non-Ethiopians (32%), who are presumably the most likely to be able to contrast Kafa with other environments. Interestingly, the underlying reason for rating the biodiversity as medium was often the level of human disturbance. This indicates that biodiversity was being linked to "wilderness" or "naturalness". Objectively, however, these need not correlate with measures of biodiversity such as high alpha diversity (Duelli et al. 2007).

There are various underlying motivations to maintain a diverse environment. To illustrate this, biodiversity in the Kafa BR can be seen in two different contexts: Its contribution to (i) national or global diversity, e.g., through a high diversity of *Coffea arabica* varieties or endemic species and (ii) a high local or regional diversity (alpha or gamma diversity). Here, according to the medium disturbance hypothesis, agricultural activity can even increase diversity (Kershaw & Mallik 2013). The first context relates to species conservation and involves valuing rarity, as discussed above. The second relates to ecological resilience of diverse systems (see above) and the provision of ecosystem services (Duelli & Obrist 2003). According to Duelli et al. (2007), these two contexts can be in conflict when choosing indicators for biodiversity conservation.

One of the flagship species of the Kafa BR, *Coffea arabica*, was well-chosen in that it is linked with both concepts discussed above. It is a distinct feature of the region, but contributes to global diversity with its diverse gene pool, which can also be seen as possible insurance for the future. If diverse varieties exist, successful adaptation to changing environmental factors is more likely. Farmers additionally value the species, since they directly profit from it.

4.3 Common ground on risk and threats to biodiversity

There was generally a good common understanding of the most important drivers of loss of biodiversity across all three focus groups. This was true despite biodiversity being defined in different ways. The biggest threat was generally seen from agriculture, predominantly small-scale farming (expanding agriculture). The second most important threat category was the use of biological resources, mainly through small-scale logging (logging). Population pressure was unanimously seen as the biggest underlying risk for the loss of biodiversity and for the future of the Kafa BR. This agreement is probably at least partly due to available information, which was in this case provided by NABU to both local personnel and scientists participating in the biodiversity assessment.

There were diverse views on the effects of climate change. Perception of risks and threats depends on both knowledge and experience. When it comes to judging the extent of changes in climate, there are a lot of constraining factors (Eguavoen & zur Heide 2012). First, it is often difficult to differentiate the effects of climate change from other effects such as changes in land use, for example deforestation. Interviewees who already saw climate change as a driving force in biodiversity loss in the Kafa BR mainly made arguments based on availability of water. However, the loss of forests also alters water retention and local climate conditions. For farmers in particular, the perception of climatic events is strongly linked to relevance to their daily lives. For example, a drought leading to a major crop failure is more likely to be remembered and rated as severe. A study by Meze-Hausken (2004) comparing measured precipitation data and weather conditions as perceived by farmers in northern Ethiopia showed no correlation between the two. This could explain the inconsistency in farmers' responses about changing weather conditions in this study. Nonetheless, locally reported changes can provide valuable information, especially as a supplement to measured meteorological data. A study by Schliep et al. (2008) evaluated the perceived risk of climate change among biosphere reserve managers. One of the results of this worldwide study was that risk perceptions of climate change are lower in countries with lower gross national income. In contrast, in Kafa the personnel focus group was the only one to mention climate change as a current driver of biodiversity loss without being specifically asked about it. The personnel involved in the Kafa BR at the management level particularly viewed climate change as a severe risk to biodiversity.

A remarkably small percentage of interviewees saw investors as a potential risk to biodiversity. Ethiopia has a recent history of large-scale agricultural investment, often leading to vast monoculture fields (Lavers 2012). This was not mentioned at all by farmers, and in the other two groups on a little over 20% mentioned this as either a threat or driver of loss. Those who did mention investors as a risk were mainly personnel involved at the management level and Ethiopian scientists (and those who claimed good familiarity with Ethiopia). This suggests that a certain level of education and access to information influences the perception of investments as a risk. According to a study by Tadesse et al. (2014), investment areas were seen as a driver for deforestation by 75% of focus group participants in Decha woreda in Kafa. Some scientists mentioned that the area's BR status might prevent major investments of this kind.

4.4 Partial agreement on best measures to protect biodiversity

The three focus groups were in partial agreement over the best measures to protect biodiversity. Many participants stated involvement, creation of benefits and knowledge transfer for the local communities as important. Both personnel and scientists also saw government involvement as essential. There was disagreement over the need for strict enforcement of protection measures (punishments). A study by Stoll-Kleemann and Welp (2008) showed that, according to a global survey, biosphere reserve managers see environmental education as the most important factor for the success of BRs. Collaboration with local authorities was the second most important factor in this context, while community participation was ranked sixth. Stoll-Kleemann and Welp (2008) propose that BRs can become sites for participatory and integrated management approaches, thus becoming a place for mutual learning including bureaucratic institutions.

Other studies showed a positive relationship between level of education and support for biodiversity conservation (Vodouhê et al. 2010). Of the farmers interviewed in this study, female participants were significantly less educated. Their overall input and comprehension of questions was also lower. Participants (of both genders) who had received training had an increased feeling of responsibility towards protecting nature. Remarkably, even farmers who contribute very little to other questions usually suggested some measures to protect biodiversity (e.g., tree planting).

According to a study by Durand and Lazos (2008) in a Mexican BR, attitudes towards conservation were negative as it was understood as a top-down enforcement process. Participants in the current study cited the need for a sense of responsibility and inclusion. This was especially true for participants who strongly opposed punitive measures, which they felt would alienate local communities in the long run.

Wallner et al. (2007) identified economic benefits as the main positive outcome local residents are hoping for when a BR is established. In contrast, the scientists interviewed for this study saw the preservation of a foundation for their livelihoods as the biggest advantage for local communities. Interestingly, even though population pressure was unanimously seen as the biggest risk across all three focus groups, very few people suggested family planning as a measure to prevent further biodiversity loss.

5. Conclusion

Biodiversity was defined in various ways both within and between the different focus groups. If biodiversity is to be used to promote environmental protection, it is therefore necessary to be clear about the different perspectives of involved parties. Concentrating on the benefits of biodiversity seems advisable in encouraging nature conservation. Pinning down the concrete use of (a) species conservation or (b) a diverse environment can be quite difficult. Conservation goals related to biodiversity should be carefully defined with a good understanding of underlying value systems. One of the most important factors in being able to appreciate the unique features of a place is available points of comparison. These are very limited for the farmers living in the Kafa BR.

Generally, there was a strong shared conception of risk and threats to biodiversity in the Kafa BR. The threats perceived as most important were small-scale interventions in agriculture and the use of biological resources. There was less agreement surrounding the effects of climate change and large-scale investment areas.

Suggested measures to protect biodiversity were partly agreed on, especially regarding the important role of local communities. However, the need for punishments to reach conservation goals was strongly contested.

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7. Appendix

7.1 Interview questions: Scientists

1. Interviewee details

Profession/educational background:
Expertise in their field/work experience:
Acquainted with Ethiopia?
Familiar with BR concept?
Experience in nature conservation (Mgmt.):

Part I – Biodiversity

2.1 How would you define biodiversity?

2.2 Why would you personally try to prevent biodiversity loss (personal motivation)?

2.3 How would you rate the natural richness of the Kafa BR?

2.4 What are your suggestions for flagship species in the Kafa BR?

2.5 What are the main reasons for biodiversity loss in the Kafa BR? How severe would you rate the biodiversity loss?

2.6 Do you believe that climate change is a driving force of biodiversity loss? If yes, how?

2.7 Do you see wetland zones as being at risk in the Kafa BR? If yes, what are the main drivers?

2.8 How important are the wetland areas to achieving conservation goals in the Kafa BR?

2.9 Do you know what measures to enhance nature conservation have been implemented in the Kafa BR?

2.10 Is preserving or increasing biodiversity important for the Kafa BR and the wellbeing of the people who live there? Why?

2.11 What measures do you believe are necessary to protect biodiversity in the Kafa BR?

2.12 Do you have any other suggestions for further development/projects in the Kafa BR (besides biodiversity-related issues)?

2.13 What is the relationship between development goals and nature/biodiversity conservation in Ethiopia?

2.14 Where do you see the need for further research?

Part II – Biosphere Reserves

3.1 What do BRs mean to you? What is your general opinion about them?

3.2 What potential benefits/negative effects for the local community do you see by establishing BRs and what has been the case for the Kafa BR?

3.3 What do you see as the most challenging issues for the Kafa BR?

3.4 Do you have any suggestions what Ethiopia can learn from the experiences of the Kafa BR and its projects?

3.5 What potential do you see for BRs in Ethiopia (including wish lists for BRs)?

7.2 Interview questions: Local personnel

1. Interviewee details

Education level:
Profession/Main activity:
Training/Education in BR context:
Location of workplace:
Familiar BR parts:

Part I – Biodiversity

2.1 How would you define biodiversity?

2.2 For what reason would you try to prevent biodiversity loss (personal motivation)?

2.3 How would you rate the natural richness of the Kafa BR?

2.4 What is the most rare/unusual species occurring in the Kafa BR (flora and fauna)? Discuss this question highlighting the importance of these species as a flagship species.

2.5 Have you noticed any changes in the presence/availability of certain species? (If yes: how? In your opinion, what are the reasons for this?)

2.6 Is the loss of biodiversity a major problem in the Kafa BR? Why? What are the main reasons?

2.7 Do you know about the climate vulnerability of certain species? Have you noticed any recent changes?

2.8 Have there been any climatic extreme events? Have the frequency and intensity of events changed?

2.9 Do you see wetland zones at risk in the Kafa BR? If yes, what are the main drivers of this risk? Have there been recent land-use changes/increased pressure on wetlands?

2.10 Is preserving or increasing biodiversity important for the Kafa BR and the wellbeing of the people who live there? Why?

2.11 What measures do you believe are necessary to protect biodiversity?

2.12 What have been your experiences in conveying the importance of biodiversity/nature conservation to the local community?

2.13 Do you see conflicts with the local community in establishing certain wetland areas as core zones? If yes: why and where? What could be possible solutions?

Part II – Biosphere Reserves (optional)

3.1 Can you describe what the concept of BRs means to you? What is your general opinion about it?

3.2 What measures to enhance nature conservation or local livelihood in the Kafa BR have had the best results? Why? What has been the effect for the local community?

3.3 Do you have any suggestions what Ethiopia can learn from the experiences of Kafa BR and its projects?

3.4 What do you see as the most challenging issues for the Kafa BR?

3.5 What are your suggestions for further development /projects in the Kafa BR?

7.3 Interview questions: Small farmers

1. Interviewee details

Age; Gender; Ethnic group; Religious belief; Education level (No. of school years); Size and type of property; No. of household members; Main activity/Livelihood strategies

2. Location
Size of village:
Distance to core zone:
Infrastructure / distance to market:

Part I - Biodiversity

3.1 How would you define biodiversity (if you are familiar with the term biodiversity)?

3.2 How familiar are you with the natural richness of the Kafa BR? Is the reserve poor or rich in term of species?

3.3 Do you use wild plants? If yes, for what purpose (e.g., food, medicine)? To what extent?

3.4 Do certain species have a meaning to you beyond being useful (e.g., religious beliefs, beauty)?

3.5 Do certain species have a negative effect on you or your farming activities? Do you apply certain measures to get rid of them?

3.6 Do you use wetland areas? If so, how? What use is essential for you? (Question only asked close to wetlands.)

3.7 What is rarest / most unique species occurring in the Kafa BR (flora and fauna)?

3.8 Have you noticed any changes in the availability of certain species? If yes, does this change matter to you?

3.9 Is the loss of biodiversity a major problem in the Kafa BR? Why? What are the main reasons?

3.10 Do you think the wetland zones in the Kafa BR are at risk? If yes, what are the main drivers or this risk? (Question only asked close to wetlands.)

3.11 Do you know about climate vulnerability of certain species? Have you noticed recent changes?

3.12 Have there been any climatic extreme events? Have the frequency and intensity of events changed?

3.13 Is preserving or increasing biodiversity important for the Kafa BR and the wellbeing of the people who live there? Why? For what reason would you try and prevent biodiversity loss?

3.14 What measures do you believe are necessary to protect biodiversity?

3.15 How does your farm/household contribute to biodiversity?

3.16 What is your opinion on scientists coming to the Kafa BR to do research?

3.17 Have you been informed about the results of previous studies? (If no: are you interested?)