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

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SUMMARY

UNESCO biosphere reserves (BR) are places where stakeholders with different backgrounds engage and interact, making a good understanding of each party's views and values necessary. As a contribution, this study was conducted on perceptions and expectations on biodiversity in Kafa BR, Ethiopia. Semi-structured interviews (n = 85) were conducted with three focus groups: small farmers, local personnel and scientists. The groups showed substantial differences regarding the definition of biodiversity, its perceived value and benefit for local communities. In contrast, there was a shared understanding of the main risks (population pressure) and threats (expanding agriculture). Commonly mentioned necessary steps for protection of biodiversity were community involvement and benefits. Controversially discussed was the necessity of stricter law enforcement. 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 therefore be carefully taken into account.

1. INTRODUCTION

UNESCO Biosphere reserves have the explicit purpose of reconciling people's needs with nature conservation. Thus, the aim is to bring together ecological, social and economic purposes, demonstrating sustainable ways of living (Bridgewater, 2002). To successfully manage a biosphere reserve, different interests and needs have to be taken into account. Especially a certain level of participation of the local communities is generally seen as crucial. The level of participation required to create a well-functioning biosphere reserve is still controversially discussed (Wallner et al., 2007). Sometimes it is argued that as long as local people's interests are met, participation through consultation only (no active participation), is sufficient. Usually different stakeholders with diverse backgrounds jointly engage in the work associated with biosphere reserves and therefore have to find a common ground for communication to achieve a successful collaboration. This is especially true for biosphere reserves in developing countries if external stakeholders with different cultural backgrounds are involved. In order to be able to agree on common goals it is therefore essential to have a sound understanding of the background of each concerned 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 humanity is profiting from (Cardinale et al., 2012). To quantify specific benefits and their exact impacts, however, has been difficult in many cases and still is often subject to high uncertainty (Balvanera et al., 2014). To preserve a diverse environment is one of the important aims of biosphere reserves. Biodiversity is therefore one of the

key terms in communication. Ideally, the different actors involved should have a good understanding of their respective interpretations.

Most value systems regarding nature and its use or protection are anthropocentric. According to Duelli et al. (2007) it is important to both consider intrinsic motivation (based on value systems) and extrinsic incentives (like economic benefit) to understand human behaviour. For instance, the appreciation and valuation of a landscape depends on many factors including the cultural background as well as individual knowledge, interest and experience. Likewise, the personal motivation to protect biodiversity can greatly vary both in extent and underlying justification. Different stakeholders may also have a different understanding of the causes of a loss of biodiversity and of how biodiversity (if at all) should be protected. Knowing each party's perception and values is not only crucial for the successful implementation of measures. It also offers chances for a process of mutual understanding, collaboration and, possibly, inspiration.

The Kafa zone, located in South-Western Ethiopia, lies in one of the few areas of Ethiopia which still has substantial forest cover. In total, 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 over the past decades (Tadesse et al., 2014). To preserve the remaining forest with diverse species including wild coffee, an effort by different governmental and non-governmental parties has been made to establish a biosphere reserve. Eventually, in 2011 the biosphere reserve Kafa was designated by UNESCO comprising most of Kafa zone. Until today NABU is one of the main external actors, financing a NABU branch office in Bonga (administrative centre of Kafa Zone) and ten rangers through funding by the German government. The Kafa biosphere reserve (Kafa BR) is therefore one of the exemplary places 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 externals, mainly for research activities.

UNESCO requires that research and monitoring activities are to be carried out (Bridgewater, 2002) in all biosphere reserves. 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. It possibly might 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' perspective on meaningful conservation methods and the concept of biosphere reserves as a whole are most likely of equal importance. Their hope of the desired effects through the establishment of a biosphere reserve might be connected to species conservation or preservation of "wilderness" (which might be contradicting intentions in itself, see Duelli et al., 2007) The two main concurring approaches of 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 concept of 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 differ, too. They might be more interested in direct-use values like food and medicine and indirect-use values like ecosystem functions than in non-use values. The three mentioned categories of values have been defined by Gaston and Spicer (2013). A study by Wallner et al. (2007) on the perception and evaluation of biosphere reserves by local residents showed, that the main argument in favour of the establishment of a biosphere reserve was a potential economic benefit. Local ecological knowledge is increasingly valued in wildlife conservation (Berkes et al., 2000). This knowledge is the result of a history of interaction of local people with their environment. In the Kafa BR there has been a long tradition of using wild plants and animals for various purposes. However, traditional management techniques that were sustainable in the past may no longer be sustainable due to pressure through population

growth and resettlement programs. New techniques as well as pressure and influence driven by external interest have likewise altered land-use and management. To allow for the continuous use of biodiversity in the future, 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 Kafa BR these are mainly the rangers employed by NABU, who see awareness creation among local communities as one of their main tasks. Their interpretation of biodiversity and its value will influence locals' understanding of it as well as their perceptions of the importance of biosphere reserves. Stoll-Kleemann et al. (2010) have shown in a global survey on the effectiveness of UNESCO biosphere reserve management that community-based management tends to grow. Its success, however, largely depends on the 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 at the same time in close exchange with external stakeholders, they have the chance to bridge the gap between different points of views.

To account for the different levels of stakeholders in Kafa BR, three focus groups have been chosen: (i) small farmers (ii) local personnel, working in the context of the biosphere reserve (iii) scientists (involved in a biodiversity assessment in Kafa BR). The purpose of this study is to gain a better understanding of each party's perception of biodiversity, its value, threats and the best ways of protection in relation to the biosphere reserve. To understand each group's position on the stated issues does not only help to avoid misconceptions but can also show the common grounds on which future activities can be built.

2. MATERIALS AND METHODS

4.1 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 groups are Orthodox Christians (67%), Protestants (20%) and Catholics (10%). There is also a small Muslim community (3%). The overall population density of Kafa zone 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 km^2 and a human population of a little over one million inhabitants. The Kafa BR itself has an area of around 7500 km^2. The natural vegetation is mostly classified as moist afromontane forest (Friis, 1992). In the past, there have been different political and demographic factors driving changes in land use and land cover change in the Kafa zone. In the 1970s major land redistribution took place, followed by large-scale resettlement in the 1980s. The 1990s were shaped by the agricultural investment policy and the promotion of cereal production as well as the Ethiopian Forestry Action Plan. Finally the 2000s were influenced by large-scale agricultural expansion, the set-up of National Forest Priority Areas, participatory forest management projects and finally by the establishment process of the UNESCO biosphere reserve (Tadesse et al., 2014). For local livelihoods subsistence farming is very important. The most common livestock is cattle, followed by poultry, sheep and goats. Honey production (mainly using traditional techniques) and coffee cultivation are other important income sources (SNNPR Kafa state statistical data, 2012/2013).

4.2 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 Kafa BR in December 2014. Most interviews were held between 3rd and 21st of December 2014 within the Kafa BR. Lack of time made some interviews of scientists via telephone necessary. Interviews with small farmers were conducted in five different Kebeles (situated in three different Woredas). The Kebeles were chosen because of their proximity to core zones and to the study sites of other groups involved in the assessment (Table 1). Households for most interviews were chosen randomly, but as to preferably represent a gender balanced selection. Interviews were held in a way to only represent the opinion of one household member. Wherever possible, the Kebele leader and the Kebele manager of each Kebele were interviewed.

Table 1: Sampled Kebeles and their main features for the focus group of small farmers.

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 consisted mainly of NABU staff. This included most rangers employed by NABU as well as staff of the NABU branch office in Bonga. Additionally two more people involved in nature conservation work in Bonga were questioned. Out of 34 participants of the biodiversity assessment, a total of 27 scientists were interviewed. Around one third of them were affiliated to Ethiopian institutions. The remaining scientists were affiliated to European universities or institutions.

4.3 Interview design

Interviews were structured in two parts. Part one was tackling specific issues concerning biodiversity, mostly directly linked to the Kafa BR. Since most farmers were not familiar with the term biodiversity a short explanation was given to them, before further biodiversity related questions were asked. Part two consisted of more general questions on the concept of BRs and their impacts. Due to time limitations these questions were only put to two of the focus groups (scientists, local personnel). In order to get comparable results, some questions (n = 13) were asked to all focus groups, sometimes with minor changes. To allow for the consideration of special knowledge depending on the interviewees background, 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 for interviewed farmers. Rangers stated that they had also used the English term when giving trainings.

4.4 Background information on interviewees

The ethnic composition and religion of interviewed farmers roughly represented the overall mean for the Kafa zone (Chernet, 2008) being clearly dominated by Kafa and Orthodox Christians. One of the minorities (Manja) was overrepresented with a share of 19% because one of the sampled Kebeles (Michete) was only inhabited by Manja. The gender ratio of interviewed farmers was about equal. The educational level between sexes was significantly different, on average women only went to school for three years (Figure 1a). Out of the total percentage of 30% of interviewees being members of participatory forest management (PFM) or having received training (56%), there were no major differences between sexes (see table 2 and figure 1b). The highest percentage of training was reported to be given by NABU with 28% and the agricultural department with 21%.

Table 2: Background information on interviewed farmers in total and per 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

* Statements of age have to be considered with caution, as interviewees were often unsure of their exact age
** Because of fears of taxation, stated property sizes are very likely underestimated

The gender ratio of interviewed personnel was less balanced and clearly dominated by men (87%). The mean age (34 years) was the same for the interviewed farmers, but with a smaller range. Mean working experience being 10 years, was clearly less than for the interviewed scientists (15 years). Interviewees mostly worked as rangers employed by NABU (67%). Master degrees were only held by personnel not working as a ranger.

The group of interviewed scientists was older (mean = 44) and more experienced compared to the interviewed personnel. It was likewise dominated by men (70%), with females tending to be younger and having less years of working experience. Roughly more than half of the interviewed scientists stated to be familiar with Ethiopia to some extent, but only 30% were Ethiopian by nationality. Those declaring experience in management and nature conservation had a lower proportion of doctoral degrees (19% vs. 50%) and were less acquainted with Ethiopia (40% vs. 78%). In general, more Ethiopians had worked for a governmental institution (57% vs. 8%) but less for non-government organizations (38% vs. 73%).

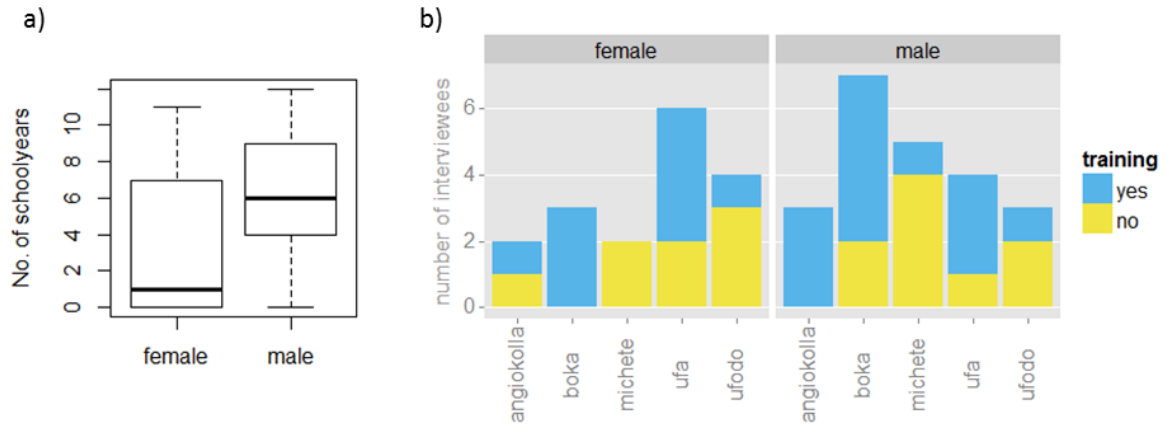

Figure 1 (a) Number of school years by gender (b) Received training by Kebele and gender

4.5 Data analysis

In a first step, answers were categorized to some extent, to allow for comparison and aggregation. Responses were checked, whether they covered the most commonly given aspects. Whenever reasonable, answers to different questions were considered at the same time. In a second step, line of arguments and general concepts were analysed and grouped. Statistical analysis was done using R version 3.1.2 (R core Team, 2014).

3. RESULTS

General perception of biodiversity

All focus groups were asked to give a definition of the term biodiversity (see figure 2a). The understanding of the term by farmers corresponded with the most common answer of personnel. Biodiversity was here put equal with ecosystems, sometimes directly with forests only. The standard textbook definition of biodiversity, mentioning three levels of diversity (genetics, species and ecosystems/landscapes) was given by 20% of the personnel and 56% of scientists respectively. In total, about one quarter of the scientists and 7% of the personnel mentioned additional qualities of biodiversity, mostly focusing on the diversity of biological relations or interactions. About one third of the scientists reduced biodiversity to diversity at the species level. For many scientists, species were the most important entity of biodiversity and therefore the base to focus on.

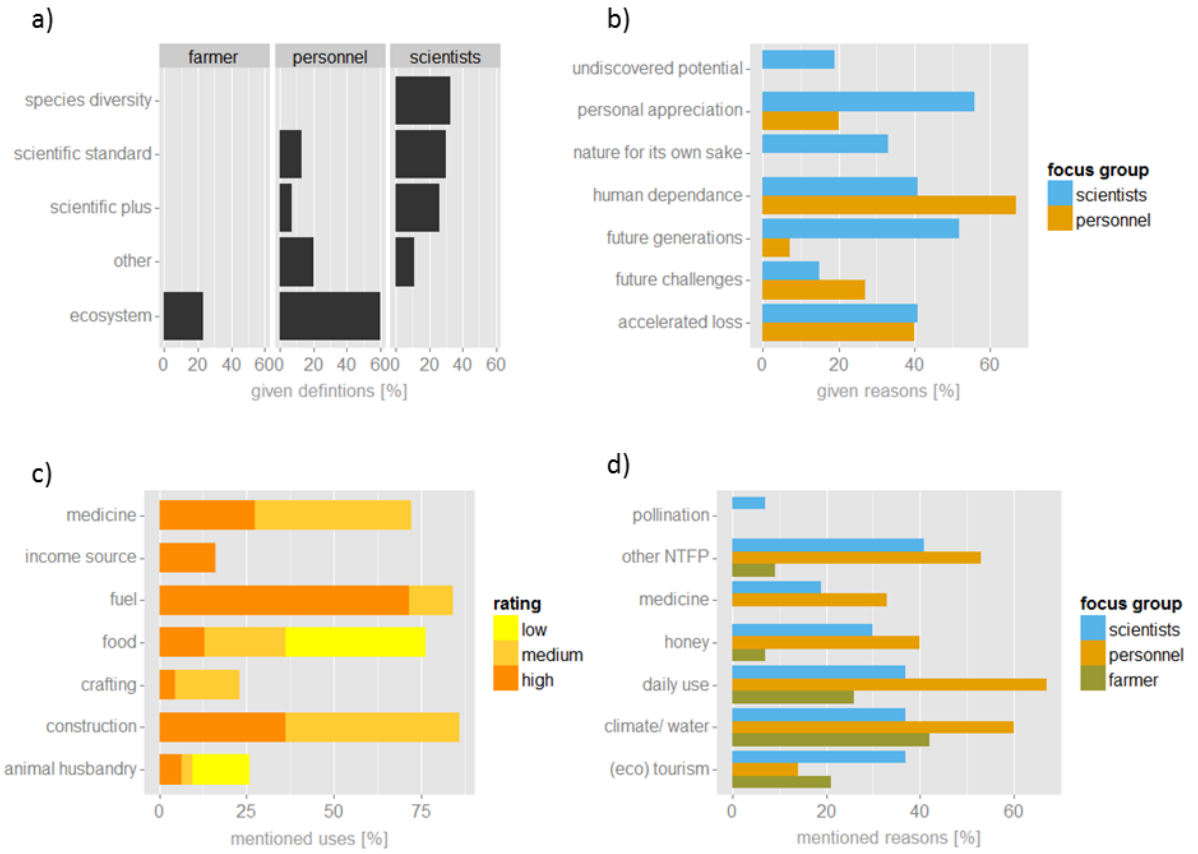

Figure 2 (a) Given definitions of biodiversity by all focus groups (b) Reported personal motivation to protect biodiversity by scientists and personnel (c) Mentioned uses of wild species by farmers and their importance (d) Mentioned importance of biodiversity for local communities by scientists and personnel and given reasons why protecting biodiversity is important by farmers

When asked about personal reasons to protect biodiversity, the most common answer for scientists was personal appreciation of a diverse nature, followed by the wish to keep if for future generations (see figure 2b). In contrast, human dependence was the clear single most important reason for personnel, followed by the motivation through recent accelerated loss of biodiversity. This reason was about equally often mentioned by scientists as well. To be prepared for future challenges was a comparatively rarely stated personal motivation for scientists (15%), but the third most important for personnel (20%). To protect biodiversity for its own sake, entitling every species the right to exist, independent of any human benefit was only mentioned by scientists. This was also true for the undiscovered potential of biodiversity, for example for medicinal purposes.

Fuel was stated the most important use of wild species for farmers. It was rated of high importance and is commonly used (Figure 2c). Using wild plants for construction and medicinal purposes were also thought to be important, but the majority of interviewees only attributed medium importance to it. Wild species as a food is a common use, but its importance was generally perceived as being low. Some people stated that it could be of higher importance in the case of a bad harvest. Only few people (16%) mentioned wild species as an important income source, but for those who did, it was rated as being highly important. Generally only wild plants were regarded as being useful. Animals, especially mammals, were often seen as a competition over crops and their only use seen in relation to being a tourist attraction. When specifically asked if they also valued wild species for some other reason than being of use, this was true for a little less than half of the interviewed farmers. The most common given reason was beauty. This was often mentioned in context the mantled guereza (*Colobus guereza*). Secondly sacred forest sites were mentioned. Some farmers were asked if they were willing to protect a species that was an endemic to their forest (a bird was given as an example)

that was ugly and not useful to them. Besides surprise about the question, the first spontaneous reaction was no. After reflecting sometimes people stated afterwards, that maybe it would be of use for the future and therefore worth protecting.

To name benefits of biodiversity for local communities was perceived difficult by quite a proportion of scientists, especially when asked not to identify general ecosystem services of forests but specifically benefits from a diverse environment. Climate and water regulation, making use of different species in daily life especially from non-timber forest products (NTFP) and tourism as an income source were named most commonly (see figure 2d). Out of the ones seeing ecotourism as a possible chance to benefit from biodiversity, more than 40% also stated some associated risks and challenges. Out of this, the most important being a widespread distribution of profits and lacking quality of touristic infrastructure and associated services. Forest products that were thought to be of most importance were honey and coffee. The majority of scientists rated the importance of biodiversity for the livelihood of local communities as being high (65%). Still 13% of interviewees thought of it having low importance only. The remaining 22% assigned medium importance to it.

The most frequent response of farmers regarding the importance to protect biodiversity were ecosystem services like climate regulation and water supply (figure 2d). Daily use, although the second most common answer, was only mentioned by 26%. This is probably due to the fact that even after a given explanation, biodiversity was more or less put equal with forests and protection equal to non-use. Surprisingly, no farmer mentioned medicinal plants as a reason to keep a diverse environment, even though 72% mentioned they would use them and 38% assigned them high importance. Some farmers stated that in their understanding strict protection of areas that excluded any use would not make any 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. The overall rating of the importance of biodiversity for peoples well-being was high (88%), the rest assigning medium importance to it.

In contrast personnel mentioned daily uses most frequently as a benefit for the local community from biodiversity (67%), followed by climate and water regulation. NTFP, especially honey and medicinal plants were also often named. Possible benefits through tourism were mentioned least often of all focus groups (14%). All interviewed personnel rated the importance of biodiversity for the well-being of the local communities as being high.

Biodiversity - What makes the Kafa BR special?

Overall, scientists rated the richness of the Kafa BR as being high (Figure 3a). However, compared to the other focus groups, scientists were the interviewees more often assigning only medium richness to it (22%). This was only true for non-Ethiopian participants (32%). More than a quarter of scientists emphasized Kafa’s high biodiversity, especially in comparison with other parts of Ethiopia, out of the interviewed Ethiopians it was even 50%. Additionally, its undiscovered potential regarding new species was mentioned by almost half of the interviewees. Another reason, why scientists commonly thought (19%) the region was special, was due to its relative isolation and therefore high rate of endemic species.

Figure 3 (a) Rating of the richness of Kafa BR's biodiversity by all focus groups (b) Most commonly mentioned rare species by farmer and personnel and species being suitable as flagship species by scientists

Generally, farmers stated a high familiarity with wild species (67%). Given responses varied with gender and PFM-membership, but not with received training, indicating that knowledge of species is rather indigenous knowledge than taught by externals. Women mentioned their main radius of action being around their property, as an explanation for their low familiarity (13%). Most interviewed farmers had not travelled out of the Kafa zone. Often, they were even only familiar with their area within Kafa. In total 88% of interviewed farmers regarded the Kafa zone as highly rich in species. When asked, on what they based their rating of richness, it was mostly explained, that they heard from other people or through the media about other parts of the country. Some people also pointed out, that Kafa zone is rich because of its evergreen forest. One individual stated that Kafa was poor in species. He later confessed that he gave this answer to prevent interest in protecting the Kafa area.

All focus groups were asked to name special animals. For the scientists the focus was on species being suitable flagship species, whereas for farmers and personnel the main criterion was rarity. Surprisingly about 40% of farmers weren't able to name any rare species (see figure 3b). The most commonly cited animal was the bushbuck (*Tragelaphus sylvaticus*) with around 20% followed by the lion (*Panthera leo*). It was not clarified whether by bushbuck people referred to *Tragelaphus sylvaticus* or a "deer-like" animal in general. As rare species, personnel mentioned the lion most often (60%) and *Cordia africana* (40%). The existing flagship species of the Kafa BR, the mantled guereza and coffee (*Coffea arabica* L.), were generally supported by scientists. More than 20% also suggested to having the lion as an additional flagship species. In addition to that, scientists named possible flagship species from their own discipline.

Risks and threats to the Kafa BR's biodiversity

Changes in species abundance had been noticed by 87% of the personnel and 70% of interviewed farmers, respectively. Increases and decreases were about equally often encountered, around one third of each focus group noticed changes in both ways. The most frequent reported shifts by personnel were the increase in the monkey population (36%) and decreasing number of lions (29%). It was also stated, that because of selective logging of large hardwood trees, secondary and understory species are benefiting. The general feedback by 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 over the past years was seen predominantly positive. According to one informant the increase of monkeys is due to changes in law. Between 1970 and 1990 there used to be regulated hunting of monkeys. According to some personnel this leads to increased conflict with farmers, who then try to kill those wild animals to avoid crop loss. This is supported by the given feedback by farmers on those species with the biggest negative impact on their farming activities (Figure 4b). With 86%, monkeys were the most frequently mentioned. Although most people, being aware of the government regulation, stated, that they would only try and chase them away, not kill them. Exempted from having a negative impact was the mantled guereza, due to its different feeding habit (mostly leaves). Other animals often seen as a problem were wild pigs (65%) and rats (37%) eating from the storage. Carnivores attacking livestock were only reported by 16% of interviewed farmers.

Biodiversity loss was seen as a severe problem by the majority of all focus groups (see figure 4a). Personnel were the group with the highest proportion (20%) of assigning only low importance to the problem of biodiversity loss. This is associated to the fact that recent development was seen rather positive, as mentioned above. Pressures on wetlands were perceived as predominantly low by personnel and farmers (only farmers living in proximity of wetlands were asked this question). Overall, scientists rated it as medium (Figure 4a). As drivers for biodiversity loss both underlying risks (e.g. population pressure, climate change, investors) and actual threats (e.g. agricultural expansion, hunting) were mentioned (Figure 4c). The threats of expanding agriculture and (illegal) logging were most frequently mentioned by farmers and scientists. Personnel gave higher priority to (illegal) hunting over logging. Population pressure was seen as the biggest risk by all focus groups. Investors were mentioned as a risk by about 20% of both scientists and personnel. The risk of enhanced biodiversity loss through increasing wealth, bringing with it new technologies and lifestyles with higher environmental impact, was only mentioned by scientists. Climate change was then again only mentioned by personnel, while asked about drivers in general. However, when scientists were asked specifically to rate the possible impact of climate change on biodiversity, 28% did see it as a present driver (see figure 4e). Nonetheless the majority didn't rate it as a present 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 about experienced changes in weather conditions in the past years. Associated with this, interviewees could also name known plant species vulnerable to changing weather conditions. Higher intensity of rain, a long dry spell or shifts in seasonality were given as examples. Only a little more than 20% of farmers and 50% of personnel respectively could name species with such a vulnerability. This was most commonly associated to prolonged dry conditions. Changed or unclear seasonality (unseasonal rain) was mentioned most frequently as a trend regarding weather conditions. This was reported by a total of 28% of farmers, but results were sometimes contradicting, even within one village. A share of 64% of the personnel mentioned shifts in seasonality and 43% a higher rain intensity. Signs of increasing temperature were mentioned by less than 10% of interviewees in both focus groups.

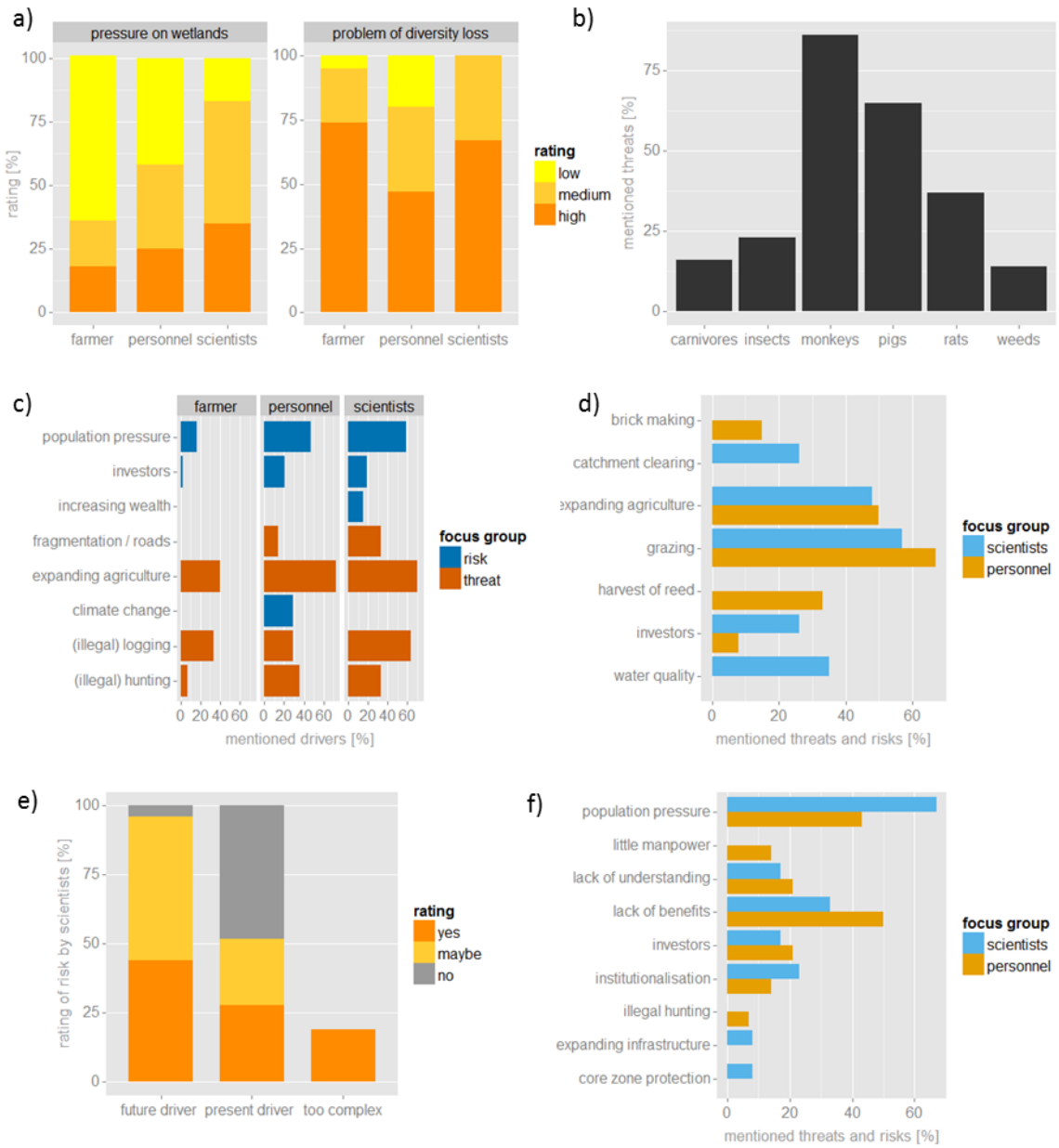

Figure 4 (a) Rating of the severeness of pressures on wetlands and the problem of biodiversity loss by all focus groups (b) Wild species commonly perceived as threats by farmers related to their farming activities (c) Most commonly mentioned drivers of biodiversity loss by all focus groups (d) Commonly mentioned risk and threats to wetlands by scientists and personnel (e) Rating of the risk of climate change affecting biodiversity by scientists (f) 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 house roofing and as decoration for celebrations. Grazing was by far seen as the most important use by interviewed farmers, followed by the collection of reed for roofs. When scientists were asked about the importance of wetlands to achieve conservation goals the main reason was the provision of habitats to wetland species (65%). Additionally, regulation services of wetlands for water and the micro climate were mentioned. Generally wetlands were seen to be of high importance for conservation (96%). Grazing and expanding agriculture were seen as the biggest pressures on wetlands, both by personnel and scientists (Figure 4d). The harvest of reed and brick-making were only mentioned by personnel. Scientists additionally worried about threats like water pollution (sediments, chemical), clearing of the catchments as well as the risk of large-scale impact by investors.

The relation of development goals and nature conservation was generally seen as a dilemma by scientists. Still 20% thought that they were compatible, since development in the long term is only possible if environmental issues are considered. This point of view was only supported by non-Ethiopians (26%). Likewise the statement that priority should be given to nature conservation over development was only given by non-Ethiopians (28%). The idea of a balanced use, in the sense that some areas are set aside for development (e.g. intense agriculture) and other for environmental protection was mainly brought forward by Ethiopians and interviewees who had stated not to have a background in management.

The biggest challenges seen for the future of the Kafa BR had quite some overlap with the mentioned drivers of biodiversity loss (see figure 4f). The risk of population pressure, with its associated threats, was again often named by both scientists and personnel. Yet, the most frequently mentioned challenge for the future by personnel (50%) was the lack of benefit for local communities though the Kafa BR. This argument was also supported by 33% of the scientists. Risks, due to a lack of understanding by the respective communities, as well as due to investors were named about equally often in both focus groups. Challenges associated to the institutionalisation process, requiring the government to take over the responsibility of managing the BR were more often pointed out by scientists (23%) than by personnel (14%). The lack of manpower and resources in the BR management was only mentioned by personnel.

Proposed measures to protect the Kafa BR's biodiversity

Around half of the interviewed farmers saw their activities as a contribution to biodiversity conservation. Specifically mentioned reasons were diverse home gardens, the planting or maintaining of trees on their properties and occasionally, the planting of flowering plants for bee keeping (Figure 5a). Scientists and personnel both mentioned that Kafa's inhabitants have a special culture of protecting nature. In parts, the proposed measures to protect biodiversity were similar to the mentioned contributions. For example, this was true for the focus on the planting or maintaining of trees. Education about ways to protect and the proper use of resources was also seen as important (26%). Almost all farmers stated an interest in the result of the study and the biodiversity assessment.

Explicitly mentioned hopes from scientists were education (58%) and general development of the area, including infrastructure (21%). The community was seen as the responsible body for protecting biodiversity by most farmers (70%), the government by a little more than half (see figure 5b). Generally, male farmers mentioned both bodies more often. Interviewees who had received training or where PFM members tended to see the community as more strongly in charge of biodiversity protection. About 60% of the interviewed scientists were aware of at least some of the activities by NABU since the establishment of the Kafa BR. Measures aiming at the creation of awareness among local communities, PFM-sites and the distribution of stoves were the ones known to the most. The majority of scientists saw communities playing a central role in the success of future biodiversity conservation (Figure 5c). Community awareness, ways of allowing communities to profit from biodiversity through benefits or compensation as well as community involvement were respectively suggested by around 50% of participants. Additionally government involvement was seen as crucial by a little less than half of interviewed scientists. This was similarly stated by personnel as well, the biggest difference being the frequency of mentioning community awareness (93%). External input in terms of finances or actual involvement was pointed out more often by scientists (22%) than by personnel (14%). This was also true for family planning. Improved management strategies,

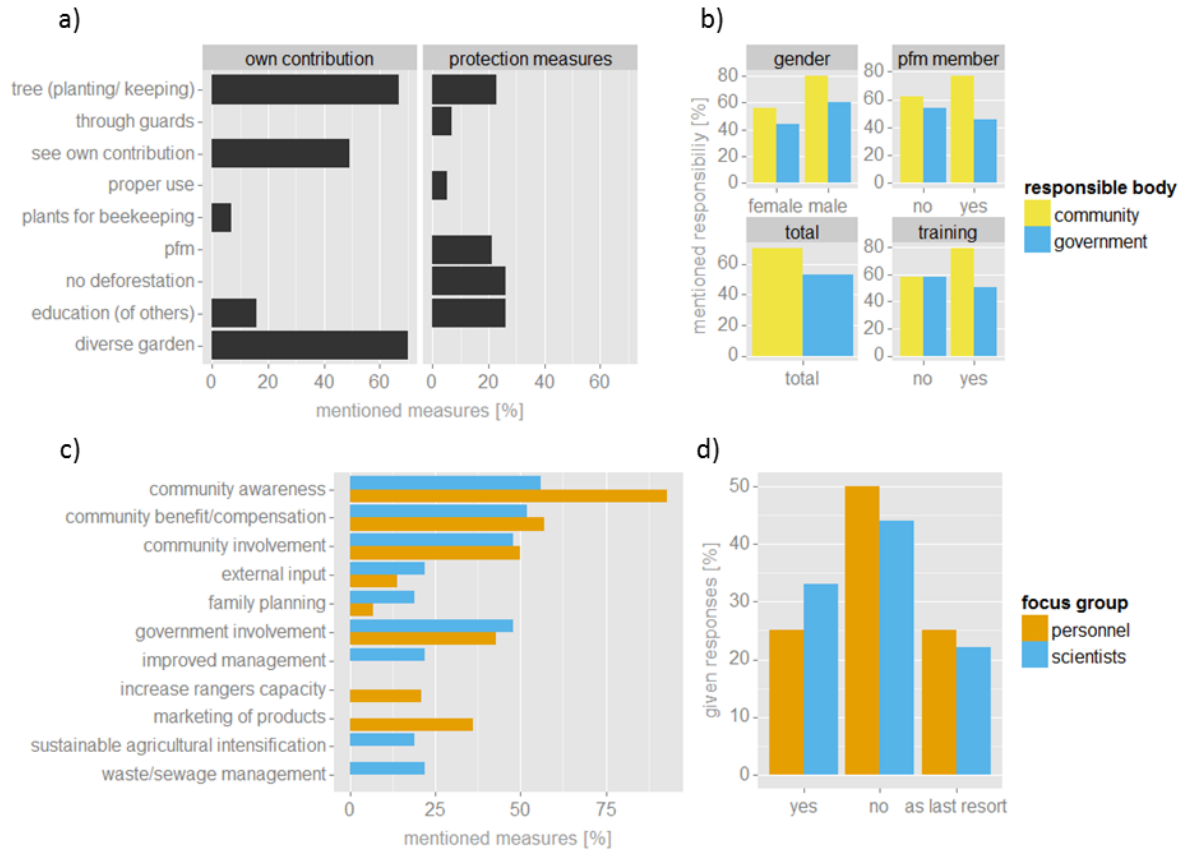

Figure 5 (a) Mentioned measures by farmers they see as their own contribution to biodiversity and suggested measures to protect biodiversity (b) Mentioned responsible bodies for biodiversity conservations by farmers additionally grouped by gender, PFM-membership and if training was received (c) Suggested measures for biodiversity conservation in Kafa by scientists and personnel (d) Rating of the necessity of enforcement of punishments to protect core zones in Kafa by scientists and personnel

sustainable agricultural intensification as well as waste and sewage management was only mentioned by scientists. Marketing of products was in this context only mentioned by personnel, likewise better protection through increased capacities of rangers especially in terms of means of transportation. The most common response whether there should be punishments enforcing for example the protection of the core zones was negative, both by personnel and scientists (see figure 5d). Yet, compared with personnel (25%) a higher proportion of scientists (33%) were in support of it. Most scientists saw the need for future research in further biodiversity assessments (81%). Research about 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 respectively, emphasized the aim of combining human use and nature protection. Around 30% of scientists mentioned the zonation as being supportive in this regard. For local communities, scientists saw the loss of sovereignty as such and specifically access rights to land, as the biggest disadvantage associated to the establishment of a BR (56%). The long-term preservation of the base of the livelihood on the other hand was seen as the biggest advantage (64%). Adding value to an area in terms of promoting it as a tourist destination, especially while competing with other places, was also mentioned (40%). Around 10% supported the view, that positive and negative effects would equal each other out. Overall scientists rated the effects of a BR for local communities as being positive (84%).

4. DISCUSSION

Biodiversity – a concept understood in diverse ways

The understanding of biodiversity by the three different focus groups showed substantial differences. This is connected to education as well as individual interests. Additionally, even the definition of biodiversity is influenced by value systems, which might be both cultural and individual. It is a term that 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 gave various definitions of it. Overall, biodiversity was defined in different levels of abstraction. If put equal with ecosystems or even more simplistic with forests (farmers, personnel), it is a very tangible concept, that however misses the reference to diversity. Reducing biodiversity to the species level (personnel, scientists) is still simplifying variety to the level that is the most accessible to humans. The standard textbook definition is reducing the "diversity of life" into three defined categories. The extended scientific definition, given mostly by scientists but also personnel, additionally mentioning a diversity of relations and interactions relates to the concept of a "balance of nature". This concept of ecological resilience, put forward by Pimm (1991), stresses the point that the more species there are, the more diverse are their roles within an ecosystem. This, in addition to intra-species diversity, is then also linked to "ecological stability", because adaptation to changes is more likely to happen without major shifts.

The selected method of semi-structured interviews was not suitable to explore the relationship of farmers to their environment in greater depth. The main focus was on their understanding of already predefined (scientific) concepts. Methods like participatory rural appraisal are better suited to allow people to develop appropriate concepts to describe their views (Chambers, 1994). Due to time constraints, it was unfortunately not possible to make use of these methods for this study. Thus, the meaning of biodiversity for people of local communities might have not been properly assessed. Even so, the conclusion of this study was that besides the major focus of farmers might be on practical uses, still quite a proportion of interviewed farmer also assigned non-use importance to wild species.

Likewise, the personal motivation to keep a diverse environment varied considerably for the different focus groups. A good common understanding was held about the importance of natural resources for local livelihoods. To what extent this can be directly related to biodiversity was again subject to discussion. In principle the value of biodiversity can be grouped in three basic categories (a) direct-use values like food, medicine, biological control (b) indirect-use values like ecosystem functions (c) non-use values (Gaston and Spicer, 2004). Each focus group mentioned a different category most frequently, when asked about personal motives to protect biodiversity. Direct-use values were the most commonly named by personnel, indirect-use values by farmers and non-use values by scientists respectively.

What is needed to value distinctiveness?

Systems of value are influenced by a lot of factors. This is also true when it comes to judging the value of biodiversity. What is regarded as special depends on means of comparison, either through personal experience or other sources of information. In judging Kafa's richness in biodiversity, interviewed scientists usually gave two different underlying justifications. Those were rarity (e.g. endemic species) and contrast (e.g. little forest left in the rest of Ethiopia). Farmers having not travelled outside of their immediate environment have no means of direct comparison from their own experience. To judge the distinctiveness of their surroundings they therefore completely rely on reports by others. In contrast to scientists, farmers seemingly didn't see rarity as a value in itself. Around 40% of farmers couldn't even name any rare species. If this was not due to methodical limitations (e.g. farmers fear of acknowledging something possibly unwanted), this would support the argument that recognizing (and valuing) rarity is related to means of comparison.

It was sometimes argued by scientists that non-use qualities of nature can only be appreciated if losses have already been experienced. The interviewed farmers have mainly been in proximity of still relatively “intact” ecosystems, since most chosen Kebeles were close to core zones. Still changes in species abundance had been noticed by farmers. For both the group of scientists and personnel the recent accelerated loss of species was an important argument, why biodiversity should be protected. Most personnel had at least travelled to some extent within Ethiopia and access to information through their education and work.

Still, between all focus groups, there was a general consensus, that the Kafa BR is a diverse place (for farmers simplified to: rich in species). Farmers statements were quite often put in superlatives: “Kafa is the richest in the world”. Scientists, the group with the best means of being able to compare Kafa with other places, where the ones assigning most often (22%) only medium richness. This was especially true for the group of non-Ethiopians (32%), possibly having even higher chance of contrasting Kafa with other environments. Interestingly, the underlying argument why biodiversity was only rated medium often was the level of human disturbance. This indicates that here biodiversity was linked to “wilderness” or “naturalness”. Objectively however, this doesn't need to correlate with measures of biodiversity like a high alpha-diversity (Duelli et al., 2007). There are various underlying motivations to keep 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 in the case of Kafa 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 agricultural activities can even lead to a higher diversity, according to the medium disturbance hypotheses (Kershaw and Mallik, 2013). The first relates to the concept of species conservation and has the notion of valuing rarity, as discussed above. The second is connected with the conception of ecological resilience of diverse systems (see above) and the providence of ecosystem services (Duelli and Obrist, 2003). According to Duelli et al. (2007) those two main concurring ideas can be the most conflicting, when it comes to choosing indicators for biodiversity conservation.

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

Common grounds on risk and threats to biodiversity

Generally there was a good common understanding of the most important drivers of loss of biodiversity within all three focus groups. This was the case, even though biodiversity might have been defined in different ways. The biggest threat was generally seen in agriculture, predominantly small-scale farming (expending agriculture). The second important category of area-based threats 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 as well as for the future of the Kafa BR. Partly this agreement is probably due to available information, which was in this case provided by NABU to both local personnel and scientists participating in the biodiversity assessment.

One issue that was diversely debated was the effect of climate change. What is perceived as a risk and a threat depends on knowledge as well as experience. When it comes to judging the extent of changes in climate, there are a lot of confining factors (Eguavoen and zur Heide, 2012). For one, it is often difficult to discriminate the effects of climate change from other effects like land-use changes, for example deforestation. The arguments of those interviewees, who already saw climate change as a driving force in biodiversity loss in the Kafa BR, were mainly related to water availability. However, with the loss of forests, water retention and local climate conditions are also altered. Especially for

farmers, the perception of climatic events is highly related to the relevance for their daily life. 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 perceived weather conditions by farmers in northern Ethiopia, showed no correlation between the two. This could explain the inconsistency of responses, regarding changing weather conditions, by farmers in this study. Nonetheless, locally reported changes can constitute valuable information, especially as a supplement to measured meteorological data. A study by Schliep et al. (2008) evaluated the risk perception of climate change by biosphere reserve managers. One of the results of this worldwide study was that the risk perception of climate change is lower in countries with a low gross national income. In contrast to this, in Kafa the focus group of personnel was the sole one mentioning climate change as a current driver of biodiversity loss, without being specifically asked about it. Especially by the personnel involved in the management level of the BR Kafa, climate change was perceived 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 areas, often leading to vast monoculture fields (Lavers, 2012). It was not mentioned at all by farmers and by a little more than 20% either as a driver of loss or a future risk by the two other focus groups. Those who did mention investors as a risk were mainly personnel involved in the management level and Ethiopian scientists (and those who stated a good familiarity with Ethiopia). This suggest that a certain level of education and access to necessary information where influencing 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 groups participants in Decha Woreda in Kafa. Some scientists mentioned that the BR might ensure to a certain extent that no big investment would take place in the future.

Partial agreement on best measures to protect biodiversity

In parts there was a good agreement of best measures to protect biodiversity between the different focus groups. Involvement, ways of benefitting and knowledge transfer for the local communities were commonly seen as important steps. Both personnel and scientists also saw government involvement as essential. Controversly discussed was the need of strict enforcement of protection measures (punishments). A study by Stoll-Kleemann and Welp (2008) showed, that according to a global survey, biosphere reserve managers thought that environmental education was the most important factor for the success of BRs. Collaboration with local authorities was seen as the second most important factor, community participation was ranked six in this context. Stoll-Kleemann and Welp (2008) propose that BRs can become sites for participatory and integrated management approaches. Thus being a place for mutual learning including bureaucratic institutions.

Other studies showed a positive relation between the level of education and a supportive attitude towards 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. The impact of received trainings (for both gender) resulted in an increased feeling of responsibility towards nature protection for instance. Remarkably, even farmers who could contribute very little to other questions did usually mention some measures to protect biodiversity (e.g. tree planting).

According to a study by Durand and Lazos (2008) in a Mexican BR, the attitude towards conservation was negative as it was understood as a top-down enforcement process. The necessity of a feeling of responsibility and belongingness was also put forward by interviewees of this study. This was especially true for those ones strongly opposing punishments, since they would in the long run lead to a rejecting attitude of local communities.

Wallner et al. (2007) identified economic benefits with the establishment of BRs as the main positive outcome local residents are hoping for. In contrast to this, interviewed scientists of the study in Kafa, saw the preservation of the base of their livelihoods as the biggest advantage for local communities. Interestingly, even though population pressure was unanimously seen as the biggest risk by all focus groups, very few people suggested family planning as a measure of preventing 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 of the respective perceptions of involved parties. Concentrating on the benefits of biodiversity seems therefore 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 regarding biodiversity should be carefully defined with a good understanding of underlying value systems. One of the seemingly important factors in the appreciation of the special features of a place, are the means of comparison. Those are very limited for the farmers living in the Kafa BR.

Generally, there was a good common 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. A little more controversially discussed were the effects of climate change and large-scale investment areas.

Suggested measures to protect biodiversity were partly commonly agreed on, especially regarding the important role of local communities. Hotly discussed was the need of punishments to reach conservation goals.

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7. APPENDIX

Interview questions: Scientists

1. Interviewee details

Profession/ educational background:

Expertise in their field/ working 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 For what reason would you try to prevent biodiversity loss (personal motivation)?

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

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

2.5 What are main reasons for biodiversity loss in Kafa BR? How severe would you rate 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 at risk in Kafa BR? If yes, what are the main drivers?

2.8 What importance have the wetland areas to achieve conservation goals in BR Kafa?

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

2.10 Is biodiversity preserving/enhancing important for Kafa BR and the wellbeing of people living inside? Why?

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

2.12 What are other suggestions for further development/ projects in BR Kafa (besides biodiversity related issues)?

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

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

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

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

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

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

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

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 climate vulnerability of certain species? Have you noticed recent changes?

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

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

2.10 Is biodiversity preserving/enhancing important for the Kafa BR and the wellbeing of people living inside? 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 BR Kafa had 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 BR Kafa?

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

Interview questions: Small farmers

1. Interviewee details

Age; Gender; Ethnic group; Religious belief; Education level (No. of school years) Size and type 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 with term familiar)?

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

3.3 For what purpose, do you use wild plants (e.g. food, medicine)? If yes, to what extent?

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

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

3.5 Do you/ How do you use wetland areas? If yes: What use is essential for you? (Question asked close to wetlands only!)

3.6 Cite the most rare/particular species occurring in the Kafa BR (flora and fauna species)?

3.7 Have you noticed any changes in availability of certain species? (If yes: does it matter to you?)

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

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

(Question asked close to wetlands only!)

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

3.11 Have there been climatic extreme events? Have frequency and intensity of events changed?

3.12 Is biodiversity preserving/enhancing important for the Kafa BR and the wellbeing of people living inside? Why? For what reason would you try to prevent biodiversity loss?

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

3.14 How does your farm/ household contribute to biodiversity?

3.15 What is your opinion on scientist coming to Kafa to do research?

3.16 Have you been informed about results of former studies? (If no: are you interested?)