What makes Community-Based Forest Managed Areas (CBFMAs) work?

A meta-analysis of the impact of tenure regimes and institutional and legal settings on the ecological effectiveness of CBFMAs in Africa

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„There can be no end to forest destruction without securing forest peoples' land and territorial rights in line with the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) and in accordance with State obligations under related human rights instruments ratified by forest nations. Measures must also be taken at all levels to ensure full participation of forest peoples as key rights holders at the heart of decision-making."

Joji Cariño & Franky Samperante (2014)

Abstract

Community-based conservation (CBC) is nowadays widely accepted as an approach to conservation. However, success is not always present and there is a debate on which factors make CBC work. Tenure devolution on the one hand and a strong legal and institutional framework are thought to enable conservation outcomes, however, empirical proof is missing. In this study, I did a quantitative statistical analysis to compare the annual deforestation rate of various tenure regimes of community-based forest managed areas (CBFMAs) in Africa, to see, whether a devolved tenure system is related to successful conservation. Moreover, I did a qualitative comparative analysis (QCA) to see, whether a strong legal and institutional framework enables the success of CBFMAs. The non-significant results of the quantitative analysis support the view that tenure devolution on itself is not enough to enable successful conservation outcomes. The results of the QCA support the fact that devolved tenure is not necessary, but rather that the combination of strong environmental and human rights legislations, low corruption, an at least medium human development and national policies supporting CBC enable ecologically effective CBFMAs. Even though methodological constraints cause the results to only giving a limited evidence base of the examined relations, and further research is needed to strengthen the findings, this study represents a basis for understanding how tenure and institutional settings are related to the ecological effectiveness of CBFMAs.

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List of Abbreviations & Synonyms

AIC	Akaike's Information Criterion
BIC	Bayesian Information Criterion
CBC	Community-based conservation
CBFMA	Community-based forest managed area
CBD	Convention on Biological Diversity
CBNRM	Community-based natural resource management
FAO	Food and Agriculture Organization of the United Nations
FPP	Forest Peoples Programme
FRA	Global Forest Resources Assessment
fsQCA	Fuzzy-set qualitative comparative analysis
GLM	Generalized linear model
ICDP	Integrated conservation and development projects
IPLC	Indigenous peoples and local communities
IUCN	International Union for Conservation of Nature
MA	Millennium Ecosystem Assessment
NGO	Non-governmental organization
NCoM	CBFMA not owned by community and co-managed by community and state
NMan	CBFMA not owned by community and managed by community
NTFP	Non-timber forest products
OCoM	CBFMA owned by community and co-managed by community and state
OMan	CBFMA owned by community and managed by community
PA	Protected areas
PES	Payments for Ecosystem Services
QCA	Qualitative comparative analysis
REDD	United Nations REDD Programme on "Reducing emissions from deforestation and forest degradation"
RRI	Rights and Resources Initiative
SD	Standard deviation
UNDRIP	United Nations Declaration on the Rights of Indigenous Peoples
UNEP	United Nations Environment Programme
UNEP WCMC	United Nations Environment Programme's World Conservation Monitoring Centre
VLFR	Village land forest reserve
WDPA	World Database on Protected Areas

WPC	World Parks Congress
WRI	World Resources Institute

1) Introduction

1.1) Paradigm shift in protected areas

> *"In the past [protected areas] have been seen as islands of protection in an ocean of destruction. We need to learn to look on them as the building blocks of biodiversity in an ocean of sustainable human development, with their benefits extending far beyond their physical boundaries."*
>
> *Achim Steiner* (in Adams, 2013)

With the European colonial expansion and industrialization around two hundred years ago the first environmental impacts due to human influence became apparent in many parts of the world (Anderson & Grove, 1987). This process brought forth the establishment of the first modern protected areas (PAs) (Chape et al., 2005). Though the concept of setting aside certain areas to protect their intrinsic value is thousands of years old (Chape et al., 2008), the first officially assigned PA was established in 1872. "Yellowstone National Park" marks the beginning of the over the following decades rapidly increasing designation of PAs as a response to the continuing destruction of ecosystems and species they contain (Chape et al., 2005). Back then, the dominant paradigm of PAs was to preserve beautiful natural places and to eliminate human exploitation and occupation (Elliott, 1974). Only state regulated activities, such as tourism, were allowed, and little attention was paid to local peoples and their interests (Elliott, 1974; Phillips, 2003), which led to the exclusion and displacement of countless (Brockington & Igoe, 2006).

Starting in the 1970s, people got a broader understanding of the inter-linkages of humankind and their impacts on nature, and simultaneously criticism of the traditional model of PAs arose: Until now, people, especially from the Western world, had perceived humans as a threat to nature. They considered them as being independent from each other and therefore, conservation was focused on preserving "pristine" places (McNeely, 1994) and residents were being displaced as well as human impact minimized. This so called "fortress conservation" or negatively named "fences and fines approach" (Hutton et al., 2005) was being questioned, when people realised that almost no place on earth had not been impacted by humans (Western, 2001). Safely-assumed untouched places such as the Amazon basin were found to be affected by substantial prehistoric human activity (Mc Neely, 1994; Heckenberger et al., 2003; Kareiva et al., 2007) and current biodiversity was created partly by human manipulation itself (Clement & Junqueira, 2010).

For being the model best suited to counteract the harm that was done upon nature, about a hundred years after the first establishment of traditional national parks this model no longer occupied the moral high grounds (Brockington and Igoe, 2006); especially in the tropics, where in many cultures people had always been seen as a part of nature (McNeely, 1994), the approach failed, and in turn

caused resistance; here, where people were living from the land and its resources (Kirby, 2014), the creation of PAs deprived them of their livelihood, as they were being excluded and displaced from the land (Colchester, 1994; Brockington & Igoe, 2006). Even though many parks were officially declared people-free places, locals entered because it had always been their home and they felt the right to use the resources (Rehman, 2006). The IUCN estimated that in 1985 around 70% of the world's PAs were inhabited (Colchester, 1994). By residing in or using resources of PAs, formerly lawfully activities of IPLCs' livelihoods (indigenous peoples and local communities) were illegalized (Campese et al., 2009). This marginalization and discrimination did not remain without consequences. IPLC started protesting. With public demonstrations, blockages, campaigns, boycotts, as well as passive resistance they were fighting for their human rights and claimed back their ancestral land and the resource rights to it (Escobar, 1998; Dowie, 2006). They went in front of courts and addressed petitions to the government (Dowie, 2006). In many parts of the world social movements arose simultaneously and groups started to join forces. Supported by human rights organizations and other NGOs, an international network was forming calling for legal and institutional reforms and justice (Brosius et al., 1998).

Their voices were not unheard as academics had been noticing these negative social externalities for decades, as well (Colchester, 1994; Adams et al., 2004; Brockington & Igoe, 2006). It was recognized that despite the global benefits PAs provide, the costs are often borne disproportionately by local peoples (Clements et al., 2014). Moreover, it was more and more realized that nature and humans are interconnected (Pretty et al., 2009) and at the third IUCN World Parks Congress (WPC) in 1982 it was acknowledged that local support is vital for the success of PAs (Adams et al., 2004). For those reasons more participatory approaches were promoted (Colchester, 1994), such as 'community-based natural resource management' (CBNRM) and 'integrated conservation and development projects' (ICDPs), just to name two of the various approaches (Hutton et al., 2005).

However, negative social impacts and their consequences were not the only forces altering the paradigm of PAs. At the same time, changing scientific understandings and worldviews modified conservation efforts (Phillips, 2003); since the first establishment of PAs, biodiversity loss had grown and not enough land could possibly be set aside from human use to halt the loss. Inconsequence, calls grew for protecting biodiversity on places under human influence, wherein a negative impact on biodiversity should be kept low (Kareiva, 2014). Furthermore, it was being increasingly recognized that biodiversity within a PA is being influenced by the surroundings (De Fries et al., 2010) and PAs function better, if they are connected to other sustainably used areas (Persha et al., 2010). Furthermore, realizing that nearly all places on earth are being influenced and degraded by human kind (MA, 2005; Kareiva et al., 2007) "ecological restoration" (Dobson et al., 1997) was identified as a complementary approach of protection. Lastly, future climatic changes will alter species distribution patterns (Hannah et

al., 2002; Parmesan & Yohe, 2003) and together with the occurring phenomenon of fragmentation an adaptable and flexible "landscape approach" (Selman, 2008) / "habitat conservation" (UNEP, 2012) is needed. These changing worldviews, in combination with international agreements, gave rise to the notions of "biodiversity" and "sustainability" (Chape et al., 2008).

All these changes were the result of a protracted process, however, they were profound; Phillips (2003) mentions that the decisions made at the fourth WPC in 1992 produced a "paradigm shift" in conservation efforts, and Hulme & Murphree (1999) are talking about the "new conservation" movement; while the traditional approach was state-centered (Hulme & Murphree, 1999) and about national concerns and assets (Phillips, 2003), this new participatory approach is on the one hand society-centered (Hulme & Murphree, 1999) and about local concerns (Phillips, 2003), and on the other hand about global concerns and states taking international responsibility (Phillips, 2003). In this way, conservation developed into a multi-disciplinary pursuit (Larsen & Oviedo, 2006). While the old approach focuses on environmental aspects to preserve nature, community-based conservation tries to combine environmental as well as social and economic aspects to aim for sustainable development (Phillips, 2003). In the new conservation approach, terms like "participatory", "bottom-up" or "grass-root" are used to describe the emphasis that is put on both, the physical and the political inclusion of local people. With this, power is decentralizing, democratizing, devolving, and given to local stakeholders such as municipalities or local communities. Additional players such as NGOs and privates get a saying, too, shifting the management type from a solely government and experts management to a multi-skilled network of stakeholder management (Philips, 2003; Hutton et al., 2005). This paradigm shift is reflected in forest ownership; while a few decades ago most of the land was owned by the state (Sunderlin et al., 2008), in recent decades more and more land rights were transferred to local communities (Colchester, 2004; RRI, 2012). Correspondingly, the necessary legislation to officially recognize tenure rights was passed in many countries (RRI, 2012). Also, new policies involving devolution and local participation emerged, which link conservation and development (Larson et al., 2010; FAO, 2012). The main idea here is that local communities are not being labeled as trespassers anymore, and instead of making them refugees, they are acknowledged as legal custodians of their ancestral lands. By reducing before mentioned threats, conflicts are being averted, and local communities are given the opportunity to live a more secure and stable life. Thus, community-based conservation assumes that local communities are more willing to invest into their land in the long term, which in turn, creates a sound basis for sustainable development and conservation (Sunderlin et al., 2008).

Initially the "new conservation" had a lot of support (Hutton et al., 2005). Especially in the tropics many projects were implemented. New PAs were created or even some existing ones were downgraded from strictly protected areas to sustainably used areas (Mascia & Pailler 2011). At the fifth WPC in Durban in 2003,

social protest and criticism of fortress conservation was quite strong (Brosius, 2004) and at the same time community-based conservation had entered mainstream thinking (Sunderlin et al., 2008). However, not all scientists supported this paradigm shift; some conservationists criticized the "new conservation" and claimed that social issues – without denying their importance – are over-shading the actual issue (at the conference) of biodiversity conservation (Terborgh, 2004 in Brockington & Igoe, 2006). In this context, a counter movement, called "back to the barriers" was forming advocating the return to strict conservation approaches (Hutton et al., 2005). This resulted in a harsh debate between both sides (Adams et al., 2004), known under various titles (parks vs. people, new conservation debate, biodiversity conservation vs. poverty alleviation debate, nature protectionists vs. social conservationists (Miller et al., 2011) or pro-poor conservation debate (Adams et al., 2004)).

Nature protectionists mention that biodiversity is annihilated by men (Soule, 2014), and thus that human beings pose a threat to biodiversity (Miller et al., 2011). This is why environmental and developmental goals are incompatible and trade-offs to substantial. Either one of the goals (conservation/social issues) are only reached by significant costs to the other one (Adams et al., 2004). By integrating both into one approach, the primary goal of conservation cannot be fulfilled (Soule, 2013). One of the main points they make is that success of before mentioned new approaches is elusive (Adams et al., 2004) and empirical evidence is virtually absent (Soule, 2014). They therefore point out that participatory approaches are overambitious (Adams et al., 2004) and claim that strict PAs are most effective in conserving biodiversity (Miller et al., 2011). On the other hand, there are some scientist, who believe that it is possible (Sachs et al., 2009; Roe et al., 2013; Kirby, 2014).

On the other hand, social conservationists point out that strictly protected PAs, despite their achievements, are not sufficient, as they have not been able to halter the loss of biodiversity (Pimm & Raven, 2000 in Marvier, 2014). They point out that a conservation strategy, which limits itself to strictly PA approaches, utilizes only a fraction of all available tools (Persha et al., 2010). They agree, that humans can pose a threat to biodiversity, however they say that man does not have to be in all cases. For example, some indigenous tribes have lived for thousands of years alongside nature (Colchester, 1994), and nowadays the majority of highly biodiverse areas can be found on indigenous peoples territories (Toledo, 2001), where nature has been managed and controlled by those tribes (Sobrevila, 2008). People have to be integrated into a conservation approach, as they are interconnected with nature and cannot be separated, like one tried to do in the past (Pretty et al., 2009). This is why local support is vital for the success of PAs (Adams et al., 2004; Sachs et al., 2009; Kareiva, 2014) and one needs to understand the underlying drivers/root causes of environmental and cultural loss (Pretty et al., 2009; Sachs et al., 2009). Some go even so far as to say that conservation, as a cultural response (McNeely, 1998 in Chape et al., 2008), is primarily about human beings and their decisions (Balmford & Cowling, 2006). In

this manner, some studies show that social conflict, created by the establishment of a PA, can be worse than the resources uses in the area before (Ferraro et al., 2013). Others mention that local communities, as they are often dependent on natural resources of PA, have a stronger interest in a sustainable resource use than off-site stakeholders such as the state (Brosius et al., 1998).

1.2) CBC is not one homogeneous approach

> *"Ideas that were inconceivable to mainstream foresters 30 years ago are become commonplace topics of discussion today," with foresters asking questions like, "To what extent should forests be devolved to local control, and owned and managed by local communities?"*
>
> Colchester et al. (2003) in Larson (2010a)

As the science community seems to be divided, it becomes apparent that there is actually no conclusive prove for either one of the sides positions (Davies et al., 2014). This is why some say that decisions for choosing a side are more based on belief than evidence (Davies et al., 2014; Doak et al., 2014). Thus, on the one hand, some scientists are asking for empirical evidence on the matter (Bowler et al., 2010; Ferraro et al., 2011; UNEP, 2012; Wunder et al., 2014) and literature on whether or not different types of PAs are conserving biodiversity is growing fast (Gaston et al., 2008). Results of such studies give ambiguous results. While Porter-Bolland et al. (2012) found that CBC projects have a lower deforestation rate, Joppa & Pfaff (2011) state that more strictly protected areas function better (see also Ferraro et al. (2013) for an overview of evidence comparing the two groups).

While some ask for more evidence on the matter, others say that the debate, on whether strictly PAs or CBC is better, is hindering progress towards effective conservation approaches (Casse & Milhoj, 2013; Roe et al., 2013; Davies et al., 2014). They claim that we are asking the wrong questions. Instead of looking at PAs from a binary point of view, we should evaluate conservation projects along multiple criteria to get a sophisticated result (Miller et al., 2011; Casse & Milhoj, 2013; Kirby, 2014). Bowler et al. (2011) speculate that this narrow viewpoint might be the reason for why results are ambiguous, as CBC is not one homogeneous method, but represents a variety of approaches, and as such, some fail, while others do not. And Davies et al. (2014) hypothesize that there is no evidence of success of integrated approaches, because we do not use the right methods, not because it is failing.

So, what does this mean for CBC? Considering the past of PAs, it is a moral imperative to many conservationists to recognize human rights in conservation efforts (Kirby, 2014). And nowadays, it is universally recognized (e.g. by the CBD) that conservation efforts should at least not detriment local people, and if feasible, aim for social goals (Clements et al., 2014). For all those reasons, the majority of the science community agrees that a common approach to conservation is needed,

integrating environmental and developmental goals (Adams et al., 2004; Pretty et al., 2009; Sachs et al., 2009; Miller et al., 2011). Considering that CBC is people-centered and about stable livelihoods, research should evaluate projects along measures, which create secure livelihoods (Davies et al., 2014).

Such a measure and, at the same time, key of CBC is decentralization (or devolution; both terms are often used interchangeably) of power from the central government to other stakeholders. While this term often described the transfer of power to local government levels, recently and in the context of natural resources, it is used in the context of resource tenure (Bartley et al., 2008; Yin et al., 2014). In this way, Larson et al. (2010b) use the term "democratic decentralization" to describe the transfer of power and resources from the central government "to authorities representative of and accountable to local populations", which does not only include the local government as power recipient, but also local communities themselves (see also Ribot, 2002). They introduce the notion of forest tenure as being "concerned with who owns forestland and who uses, manages and makes decisions about forest resources" (Larson et al., 2010a; Yin et al., 2014). Forest tenure consists of two variables: type of ownership and tenure regime (FAO, 2008; Larson, 2010b).

The first part of resource tenure is the "type of ownership". This term refers to who legally holds the land title. It is to be distinguished from customary ownership, which is established and maintained by the community itself, and is often weakly or not at all protected and acknowledged by the state (Wily, 2012). Sunderlin et al. (2008) distinguishes between two main types of statutory ownership: public and private. Public land is owned by the state and can be managed by the state itself (including protected areas) or it can be designated for the use of communities. Private ownership means that the land is owned privately, either by a community or by individuals or companies. In the past, most land was held by the state. However, in recent decades, a tenure reform has taken place (connected to before mentioned changes such as social movements of local communities claiming their land rights) and customary ownership is being legally recognized (Colchester, 2004; Sunderlin et al., 2008; RRI, 2012). This validation of a land title is a fundamental for the success of CBC, as it counteracts potential eviction and displacement of local communities and at the same time grants use rights exclusively to the community, which in turn makes them more willing to invest into their land and use it in a more sustainable way (Wily, 2004; Barrett, 2005; FAO, 2008; Sunderlin et al., 2008; Larson et al., 2010a; FAO, 2012).

The second part of resource tenure is the "tenure regime" describing "who is allowed to use which resources, in what way, for how long and under what conditions, as well as who is entitled to transfer rights to others and how different elements of the bundle of rights may be shared or divided in a number of ways and among stakeholders" (Larson et al., 2010a). Schlager & Ostrom (1992) define tenure as a bundle of rights with operational-level and decision-making rights (see Table 1). This model uses a bundle of rights, because not always all rights are given to local communities and devolution can occur on various levels (Larson et

al., 2010a; Robinson et al., 2014; Yin et al., 2014). For this reason it is a useful framework to describe the complex and dynamic reality of tenure rights (Coleman, 2009; RRI, 2012; Naughton-Treves & Wendland, 2014). In the case of Village Land Forest Reserves (VLFRs) in Tanzania, communities can acquire ownership rights and can use and manage the land independently (Blomley & Iddi 2009; Lund et al. 2014). The role of the government is only minimal (FAO, 2008). In other CBC models such as co-, joint-, or participatory management arrangements, the state often maintains ownership and only transfers parts of the tenure right bundle (Yin et al., 2014). In last mentioned approaches, operational-level rights (access and use rights) are given to communities, whereas so-called decision-making rights (management, exclusion and alienation rights) are only partly granted (Schlager & Ostrom, 1992). Here, the state ensures that it maintains a strong influence on the decision-making process (Larson et al., 2010a).

Table 1. *Description of the five individual rights of the tenure regime.*

Tenure right	**Description**
Operational-level rights:	
Access rights	right to enter
Use rights	right to use and extract resources
Decision-making rights:	
Management rights	right to regulate internal use patterns and to transform resources
Exclusion rights	right to regulate who can use resources
Alienation rights	right to sale/lease land and rights

(Changed after Larson et al. 2010a & RRI, 2012)

Therefore, many researchers agree that a distinction between operational-level rights and decision-making rights granted is crucial (Schlager & Ostrom, 1992; Wily, 2004; Larson et al., 2010a, Larson et al., 2010b; RRI, 2012). Operational-level rights allow stakeholders only to exercise rights, whereas decision-making rights give local communities the power to change the rights in the future (Schlager & Ostrom, 1992). Ostrom and Nagendra (2006) note that local communities, being involved in decision-making, are more likely to comply with the rules, and the Rights and Resource Initiative (2012) states that management rights are considered to empower communities, as communities can decide goals and ways to reach these themselves. In this way, secure tenure rights positively influence the ecological effectiveness of CBC. However, even though secure tenure rights are generally perceived to positively influence the success of community based management – secure rights, such as access and use rights alone, do not necessarily lead to positive outcomes (Larson et al., 2010a).

The model of tenure as a bundle of rights is a useful tool for demonstrating tenure devolution. However, it is difficult to prove this model empirically. While the model makes a distinction between operational-level and decision-making rights, in practice, it is difficult to do so, as access and use rights are rarely granted alone, and are usually being devolved in combination with decision-making rights (RRI, 2012). Similar issues occur, when looking at the distinctions made within decision-making rights themselves. While the model makes a distinction between management, exclusion, and alienation rights, empirically, it is difficult to compare community-based conservation projects with different levels of decision-making rights devolution, as alienation rights are nearly always retained by the state. For African countries, the same is even true for exclusion rights (RRI, 2012) and while management rights are often given to communities, sometimes they granted only partially and sometimes they are given fully (Yin et al., 2014). Regarding devolved management rights, Wily (2004) states that evidence suggests that shared management rights have negative environmental effects, because rights and responsibilities might be diffusing and unclear, and Larson et al. (2010a) agree, noting that competition for resources and control might hinder projects of shared decision-making rights. On the other hand, in cases, where communities were given full management rights, before mentioned problems were rendered void (Wily, 2004).

In summary, devolved ownership and tenure rights are often thought of as eminently important and key to a successful community-based approach (Wily, 2004; Barrett et al., 2005; Padgee et al., 2006; Chhatre & Agrawal, 2009; FAO, 2008; Sunderlin et al., 2008; Roe et al., 2009; Larson et al., 2010a). However, tenure rights can be granted in several magnitudes, which is described by the concept of tenure as a bundle of rights (Schlager & Ostrom, 1992; Larson et al., 2010b). However, it is difficult to empirically prove this model. In practice, not all degrees of the bundle of rights are given to communities. However, it on the ground, there are various levels of devolution being practiced, so a comparison could be made.

However, until now, research comparing the ecological effectiveness of these different tenure regimes is missing. Pagdee et al., (2006) did a meta-analysis of 69 case studies, to see which factors make them work. They found that tenure security, clear ownership, and other factors are significantly related to the success of CBC projects. However, they did not compare the ecological effectiveness of different tenure groups of CBFMAs types quantitatively. One study, which compared forest outcomes of various tenure regimes is the meta-analysis from Robinson et al. (2014). They compared communal, customary, private and protected lands and found no significant differences between their ecological effectiveness. However, similar to Larson et al. (2010a), they mention that tenure is composed of a bundle of rights, which of all affect forest outcomes in a different ways. However, research comparing the ecological effectiveness of these individual rights of the tenure bundle in a meta-analysis is missing.

1.3) Multi-layered context of CBC projects

> *"As conservation projects do not take place in a vacuum, the only way for these projects to operate effectively in their complex social and political settings is to acknowledge, understand and openly address these conditions."*
>
> *Robinson et al., 2011 (in Aziz et al.,2013)*

While scientists agree that there is a strong relationship between the tenure regime and the ecological effectiveness of CBC areas, and that tenure is crucial for the success of community-based conservation (see also Yin et al., 2014), some researcher say, that a devolved tenure regime is not sufficient (FAO, 2012). Yin et al. (2014) mention that devolution of tenure should be looked at from a broader point of view, as tenure devolution is embedded in a broader context of tenure reforms and Bartley et al. (2008) agree, saying that decentralization is institutionally mediated. Throughout the literature the institutional and legal framework are mentioned as being crucial for enabling successful CBC (Barrett et al.,2005; Pagdee et al., 2006; Bartley et al., 2008; Sunderlin et al., 2008; Larson et al., 2010a; Doherty and Schroeder, 2011; FAO, 2012; Robinson et al., 2014; Yin et al., 2014).

They argue that an adequate institutional framework can support communities insofar as it gives them legal support for defending their rights towards outsiders and offenders (Larson et al., 2010a) This framework unfolds vertically on multiple levels from a global to a local level (FAO, 2008; Doherty & Schroeder, 2011; Rantala et al., 2012; Yin et al., 2014). Especially important is the function of the state to create and enact an effective framework for natural resource management (Lynch, 1998; Casse & Milhoj, 2013). Unexpectedly, only few studies have looked at the influence of the national settings on the effectiveness of community-based conservation (Brooks et al., 2012).

Some researchers go even so far as to say that these institutional and legal settings can even be hindering for the success of devolved tenure regimes and CBC, and that only under certain favorable conditions decentralization of tenure regimes functions (Bartley et al., 2008; Doherty & Schroeder, 2011; Aziz et al., 2013; Robinson et al., 2014; Yin et al., 2014).

However, Yin et al. (2014), mention that linkages of these complex processes are not fully understood, and Bartley et al. (2008) state that the question, which conditions as are really necessary, and whether some factors would be sufficient, is still unanswered. They ask for comparative research on the matter at hand. And while many studies have looked at these relations, most of them have been done on local or regional scale, or they were done as a qualitative comparative review, which makes it difficult to draw conclusions (Larson et al, 2010a; Larson, 2010b).

1.4) Aim of the study

There is a clear need to integrate social aspects into a conservation approach. However, evidence is elusive, whether or not it is possible to integrate social aspects into a conservation approach. The reason might be, that until now, research has often been done in a too simplistic way. To evaluate the effectiveness of community-based conservation, other aspects, which secure the livelihood of local communities, should be included into research. Often thought of as important, is the devolution of tenure at various levels. However, until now, nobody has compared the ecological effectiveness of various degrees of tenure devolution. This is why, in this study, I quantitatively compared the ecological effectiveness of various tenure regimes with each other, to see, whether or not, a more devolved tenure regime is related to a more successful conservation outcome than is a less devolved tenure regime.

However, some researchers say that granting tenure rights to local communities is necessary, but not sufficient. They mention, that a conservation project does not take place in a vacuum, but is enabled by a sound legal and institutional framework. Research in this field has often been done on a regional scale or, if done on a broader scale, it has been done as a review, so that linkages are still poorly understood. Thus, I am going to qualitatively look at the relation of several institutional factors and the effectiveness of community-based forest management, to see, which factors enable a successful community-conservation approach.

As research in this field has been done over-proportionately in Latin America and Asia I will focus in this research on selected countries in Africa.

I expect that a fully devolved tenure regime will increase the ecological effectiveness of community-based conservation projects more than a less devolved tenure regime does.

I expect, that a strong institutional and legal framework has a positive influence on the ecological effectiveness of community-based forest managed areas (CBFMAs), while weak institutional and legal settings influence CBFMAs negatively.

2) Methods

In my research, I examined how the tenure regime and various legal and institutional factors related to the ecological effectiveness of community-based forest managed areas (CBFMA) in Africa.

To do this, I collected data on the tenure regime, spatial information, and the local institutional framework of CBFMAs in the following eight countries in Africa: Cameroon, Ethiopia, Ghana, Kenya, Mozambique, Namibia, South Africa and Tanzania. I assumed that it would be difficult to find a representative number of case studies. Therefore, I consulted experts, who identified countries, of whom they anticipated that most information would be available.

After having collected case studies, I calculated the ecological effectiveness of the collected CBFMAs. This was done in two ways: Firstly, I did a quantitative statistical comparison of the ecological effectiveness of different tenure regime groups of CBFMAs. Secondly, I performed a qualitative comparative analysis (QCA) to identify combinations of legal and institutional factors on various levels, which support CBFMAs to function in an ecological effective way (see Figure 1).

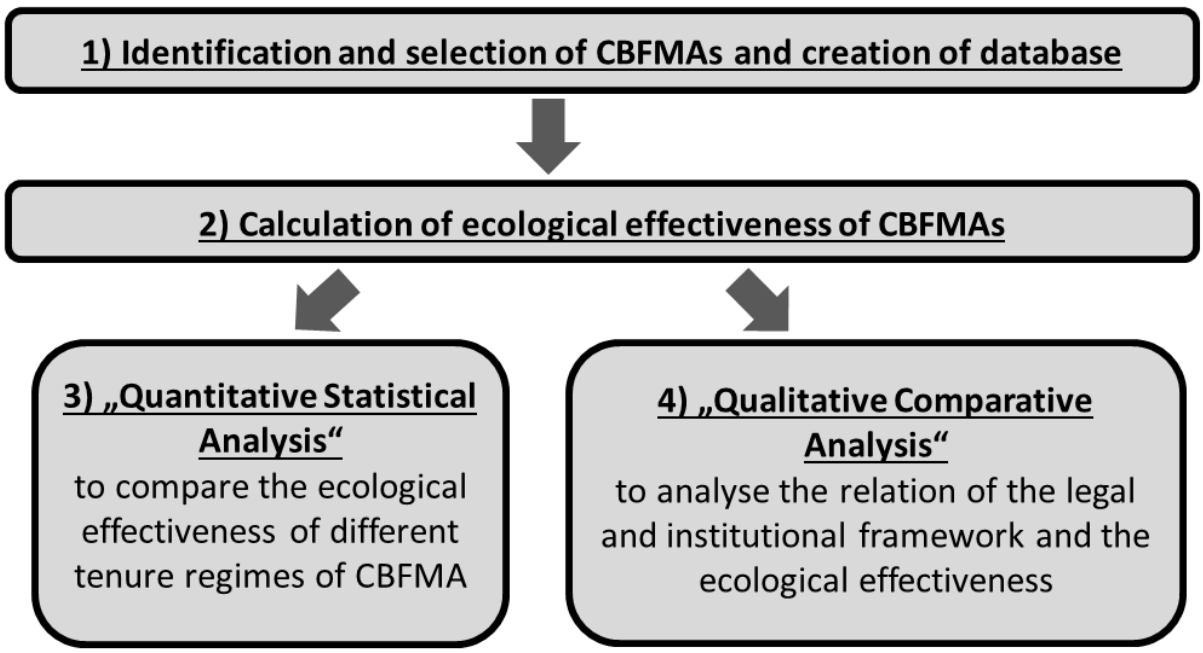

***Figure 1**. Flow-chart of the main working steps of the methods used in the study.*

2.1) Identification of case studies

2.1.1) Literature research

First, I performed a literature research to find case studies. Many researchers until now have limited their information sources to peer-reviewed publications. In this field of study, however, grey literature is recently being recognized as an additional useful source (Hulme, 1999; Brockington & Igoe, 2006; Boakes et al. 2010; CBD, 2010; Geldmann et al., 2013; Macura et al., 2013; Ojanen et al. 2014; Seymour et al. 2014), because peer-reviewed literature offers only a few case studies (Porter-Bolland et al., 2012). One reason for this is that a big part of research in this field is unreported, inaccessible or reported as grey literature (Veríssimo, 2013). Therefore, I included grey literature as well.

Especially underrepresented and scarce are case studies from Africa (Naughton-Treves et al., 2005 in Porter-Bolland et al., 2012; Oldekop et al. 2010). I skimmed the literature to find case studies, where the deforestation rate of CBFMAs had already been calculated. However, there were not enough case studies from Africa available to create a representative database. Thus, I decided to calculate the ecological effectiveness myself. This methodological approach has the advantage that the variation for the ecological indicator is reduced. In other studies, researchers quantitatively compared the ecological effectiveness of CBFMAs categorically (e.g. conservation outcome: high, low, no; see Oldekop et al., 2010). And yet other researcher quantitatively compare deforestation rates being calculated in case studies themselves. Though this approach evaluates the deforestation rate along a continuous scale, its results are being distorted, as there is no unified definition of a deforestation rate, and methods obtaining it vary. Therefore, comparability is lacking (Puyravaud, 2003). For these reasons, the method used in this study enhanced the ability of comparing deforestation rates from various CBFMAs via a statistical approach.

I used the following information sources:

1) Online databases of peer-reviewed papers (Web of Science)
2) Web search engines (Google scholar, Google search)
3) Organizational websites (global and local NGOs)
4) Sources identified by experts

For each country, I looked for information sources, which described the tenure regime and management of certain projects. Initial search terms included general CBC terms, such as community-based conservation, community-based natural resource management, joint forest management or participatory conservation. After being familiar with specific CBC approaches in a country, the search was adapted to each country individually, so that specific CBC approaches, such as community conservation area, community forestry's, Kayas or Village Land Forest Reserves were added.

2.1.2) Selection criteria for case studies

From a pool of case studies identified, I selected those that met the following criteria:

- Research done in CBFMA (*"A by the state officially acknowledged multiple-use (ecological, social, economic) forested area with defined boundaries (no open access), that is managed in a more or less sustainable way (restricted use) with participation of the local community (ownership/ management) and clear enforcement rules."* [modified after Bowler et al. (2011), and Casse & Milhoj (2013)]
- Spatial information of location, in which the project is taking place to evaluate ecological effectiveness (either polygon from the World database on Protected areas (WDPA) or other source or map to geo-reference)
- Clear information on tenure regime of CBFMA (information on "ownership" saying who owns the land, and information on "tenure rights" determining how rights to use and manage an area are administered)
- Potential information on local institutional framework:
  - management plan
  - monitoring
  - establishment/existence of body organizing local NGO or committee
  - involvement international (funding) NGO
  - integration customary laws and knowledge
  - capacity building (technical training, etc.)
  - monetary income
- CBFMA area criteria to standardize CBFMA characteristics for calculation of deforestation rate:
  - be forested (minimum forest cover of at least 10% and minimal tree height of at least 5 m (modified definition after FAO (2010))
  - minimal area size of 100 ha
  - year of establishment before 2007
- Where more than one source for one case study was found, information on the tenure regime had to be identical; additional sources were only used to fill in missing information (esp. on local institutions)
- Rights are perceived as *de jure* rights, because officially recognized rights shape policies (RRI, 2012)

2.1.3) Creation of database

I created a database with general, spatial, tenure regime, and local institutions information on every case study (see Table 2).

Table 2. *Information on CBFMAs in database.*

Category	Variables
General	Name, Self-created ID, Year of establishment, Size, Percentage of forest cover of total area in 2009
Spatial	Whether in WDPA: if it is: WDPA ID, if it is not: Other source for spatial information
Tenure regime	Whether community has the following rights: ownership, access & use, joint decision-making, full decision-making
Local institutions	Management plan, Monitoring, Clear boundaries, Local NGO or committee, International (funding) NGO, Customary laws, Capacity building, Income

2.2) Calculation of ecological effectiveness of CBFMAs

As an indicators for ecological effectiveness of each CBFMA the "average annual deforestation rate from 2009-2013" was used, as the preservation of forest cover is accepted as a robust measurement of biodiversity conservation on various scales (Porter-Bolland et al., 2012; Casse & Milhoj, 2013).

Spatial information on the location of CBFMAs was taken from the WDPA (May, 2014). If a CBFMA was not in this database, a map image was geo-referenced with ArcGIS 10.3. For the CBFMAs in Cameroon, spatial information was extracted from the "Forest Atlas of Cameroon" (WRI, 2012). The deforestation data from 2009-2013 was derived from Hansen et al. (2013) and transformed into an annual deforestation rate $r=1/(t_2-t_1)*\ln(A_2/A_1)$, where A_1 and A_2 are the forest cover of the CBFMA at times t_1 and t_2 (here: A_1, $t_1=2009$ and A_2, $t_2=2013$) (Puyravaud, 2003).

Many researchers used the annual deforestation rate to evaluate conservation success. However, this indicator can be biased due to non-random location (Nelson & Chomitz, 2009), so that low deforestation rates are overestimated (Joppa & Pfaff, 2010). To account for this, I added a control group, which is considered of not having any protection scheme in place. I calculated the deforestation rate of a 5km wide buffer zone around the analyzed CBFMAs. This is a commonly used method, as the geographical proximity implies similar environmental characteristics (Andam et al., 2008). To see, whether the treatment (of CBFMAs) has a significant lower deforestation rate than the control group, I did a Wilcoxon matched-pair signed-rank test, as the data was non-normally distributed and the two groups are auto-correlated (due to spatial adjacency).

2.3) Quantitative statistical analysis

2.3.1) Creation of tenure regimes groups

I did a quantitative statistical analysis to find out, how different levels of tenure devolution relate to the ecological effectiveness of CBFMAs.

Firstly, I compared the ecological effectiveness of CBFMAs, where local communities own the land, and CBFMAs, where statutory ownership rights are maintained by the state. Secondly, I compared CBFMAs, where communities having full management rights, with those, where local communities have shared management-rights. Finally, I compared these different factors of devolved tenure in combination. Thus, I created four CBFMA tenure categories (see Table 3).

Table 3. *Created tenure regime groups for quantitative analysis.*

Abbreviation	Description
OMan	Local community owns area and manages it
OCoM	Local community owns area and co-manages it
NMan	State owns area and local community manage it
NCoM	State owns area and co-manages it with local community

Regarding the tenure regime, I tried to collect information on CBFMAs, where communities were given access and use rights only, and those, where exclusion and alienation rights were devolved. As already suspected in the introduction (see 1.2. CBC is not one homogeneous approach), only a small number of case studies could be collected, which made a comparison with other CBFMAs impossible.

2.3.2) Statistical analysis

To analyze, whether there is a significant difference between the effectiveness of CBFMAs, where the local community has the statutory land title, and those, where the community does not own the land, I used a one-tailed Mann-Whitney U test, because the data was not normally distributed. In addition, I used 10000 Monte Carlo simulations to calculate an unbiased significance level due to the small dataset. I used the same test to compare, whether there is a significant difference between the annual deforestation rate of CBFMAs, where local communities solely manage the area and those, where they only have joint management rights. To analyze the relation between deforestation rate and tenure regimes I did a Kruskal-Wallis test to account for non-normality and

heteroscedasticity. In addition, I used 10000 Monte Carlo simulations to account for the small sample size per group to calculate unbiased significance levels.

To test whether the random factors year of establishment, forest cover, and size would confound the data, I controlled for them by adding them to my basic model. For this analysis, I ran a non-parametric ANCOVA model, by using a generalized linear model with identity link. In this model, these 3 variables were added to the basic model as covariates. To perform this analysis, the statistical program SPSS was used.

2.4) Qualitative comparative analysis (QCA)

I did a **qualitative comparative analysis (QCA)** to identify which underlying legal and institutional factors can lead to ecological effective CBFMAs.

In the last decades, QCA has gained popularity among social scientists interested in alternative ways to analyze and compare a small or medium number of cases (> 5 cases) and multi-level data (Rohlfing, 2012) and has recently been discovered by conservationists, too (e.g. Oestreicher et al., 2009; Oldekop et al., 2010; Porter-Bolland et al., 2012; Sehring et al. 2013; Korhonen-Kurki et al., 2014;). QCA combines characteristics of both, quantitative and qualitative research methods, maintaining the individual identity of case-studies, while still allowing for generalizations (Ragin, 2014). The term "qualitative" is used to make a clear distinction between this method and common quantitative methods, which draw on statistical logic (Sehring et al. 2013). Instead of using statistical probability, the QCA uses Boolean algebra.

QCA assumes "multiple conjunctural causation", consisting of three premises: Firstly, QCA supposes "conjunctual causation", meaning that a desired outcome is usually not caused by one, but by a combination of several factors (called configuration). Secondly, The QCA assumes "multiple causation", that is, several configurations can cause the same outcome. Finally, a causal condition can enable or disable the desired outcome, depending on the combination with other conditions (Korhonen-Kurki et al., 2014).

Before described causal conditions and configurations mirror the complex reality of institutional and legal settings around CBFMAs. Thus, the QCA is a useful tool to get a deeper understanding of such multifaceted causal relations, where classical statistical and comparative methods might be inadequate and unable to disentangle factors (Sehring et al. 2013).

2.4.1) Two-step crisp QCA

I used a crisp QCA. Here, a case study (here: a CBFMA) is represented as a composition of causal conditions (are analog to independent variables in statistics) and a response variable (analog to outcome). Both, causal conditions and response variable are transformed into binary data (0=absence, 1=presence). The QCA compares the case study combinations in a so-called "truth table", where cases showing similar conditions are grouped together. Next to this, it gives for these grouped case studies a consistency value, which says, how consistent the underlying conditions are with the desired outcome (values from 0 to 1; here: 1 means no deforestation in any of the grouped case studies, 0 means deforestation in all grouped case studies). In the next step, a subset of those combinations, which support the desired outcome is created (here: consistency of higher than 0.8; equals generally accepted minimum for consistency to generate desired outcome) (Ragin, 2008). Then, from the pool of selected combinations, the software reduces the causal conditions to a subset, which enable the desired outcome (Porter-Bolland et al., 2012).

Institutional and legal settings influence CBFMAs on multiple levels ranging from the national to the local level. The influence of institutional factors from different levels is of varying nature. Thus, Schneider & Wagemann (2006) distinguish between remote and proximate conditions. Remote conditions are stable structural factors, often on a national level. They are more distant to the outcome than proximate factors and cannot directly be influenced by actors. Proximate conditions are closer in space and time. They can be influenced by actors and are therefore more variable than remote factors.

Because I include both, conditions on a country level and conditions on a case study level, I decided to do a two-step QCA (Schneider & Wagemann (2006)). Firstly, only remote conditions (here national level) are included into the QCA. The QCA minimizes all of those conditions to only those that are necessary. In the second step, these output remote factors are combined with the proximate conditions (local level) and the QCA is run again. Only case studies, which show this successful combination of remote conditions, are included in this second step.

In this research I used the fuzzy-set QCA (fsQCA) software from Charles Ragin (Ragin et al., 2006). I decided to use the commonly used Quine-McCluskey algorism (most commonly used algorism) with a frequency cutoff of two (minimum number of case studies with same configuration) and a consistency cutoff of 0.80.

2.4.2) QCA variables

I did a literature research, to find out, which institutional and legal factors are thought of as being important for the success of CBFMAs. I also consulted experts, to determine whether they agree with the factors that are identified as important.

In the first step of the QCA I included the following 6 remote conditions:

1) Environmental institutions (ENV)
2) Human rights institutions (HR)
3) Property rights (PROPR)
4) Level of Corruption (CPI)
5) Human development Index (HDI)
6) National policies strengthening CBNRM (NAPOL)

Thresholds for the above factors were set is several ways (see Annex X for details): Firstly, I tried to create individual, sophisticated thresholds for all variables. If that was not possible, the global average was taken as a threshold. If that was not possible, neither, because none of the countries reached that value, the average value of the examined countries was used as a threshold (approach similar to Korhonen-Kurki et al., 2013; see Annex A1-A8 for details).

In the second step of the QCA I included, next to the output combination of remote conditions, the following 8 proximate conditions:

1) Management plan (MAN): coded as (1) if any management plan exists.
2) Monitoring (MON): coded as (1) if an environmental monitoring scheme exists.
3) Clear boundaries (CLE): coded as (1) if area has demarcated and clear boundaries.
4) Local organization (LOC): coded as (1) if the local community has a representative organ (such as committee or local NGO created by community members)
5) International organization (INT): coded as (1) if a national or international organization is giving support (e.g. financial, technical).
6) Local regulations (REG): coded at (1) if LC established local by-laws or included traditional knowledge into management of area
7) Capacity Building (CAP): coded as (1) if any capacity building activity has been done (such as technical training, establishment of school or sanitation facilities, literacy training, environmental education)
8) Income (INC): coded as (1) if LC obtains revenue from area (from activities such as tourism, timber, NTFP, REDD, PES)

If the literature, used to create the database, did not mention, whether a condition was present or absent, it was assumed that the condition is absent.

In both steps, one outcome variable was used:

1) Annual deforestation rate (DEFOR): coded as (1) if the annual deforestation rate was lower than 0.085. Land cover change literature often considers an annual deforestation rates of -0.25 as deforestation. However, the distribution of the data used in this study did not allow for this threshold. This corresponds with national annual change rates from examined countries found by the FAO (FRA, 2010; see also Annex B). As this

beforehand mentioned value could not lead the way, the threshold was based on the distribution of the data and represents the median (not mean because of non-normality).

2.4.3) Supporting quantitative analysis

Although the QCA is a useful tool to analyze complex multi-level data, a lot of variation is taken out of the model by categorizing the response variable (annual deforestation rate) into binary data. Therefore, I performed an additional statistical analysis to compare the deforestation rates for the countries examined in the QCA. For this analysis I used a Kruskal-Wallis test with 10000 Monte Carlo simulations. I did this to account for the non-normality and the heteroscedasticity found in the data.

3) Results

3.1) Case studies evaluation

From 148 potential studies found, 75 case studies were selected, which fulfilled the criteria, see (Annex C1-C3). The originally found case studies varied very much in their characteristics. For example, some pre-selected case studies from Namibia had less than one percent of forest cover in 2009. After selecting case studies with a forest cover of at least 10%, only 6 from originally 13 case studies from Namibia were left. From Ethiopia, only 3 case studies remained, as many were established in 2008 and 2009. From Kenya, many case studies were represented by Kayas (holy forests), which were rejected, as their size was less than 100ha. From Tanzania, a lot of CBFMAs were found (more than 70). However, after the selection criteria were applied, only 11 remained.
In this way, 10 studies were selected from Cameroon, 3 from Ethiopia, 8 from Ghana, 17 from Kenia, 11 from Mozambique, 6 from Namibia, 11 from Tanzania and 9 from South Africa (see Figure 2 for overview map of case studies, and Annex D1-D8 for maps with case studies in each country individually).

17 case studies were found for each, community owned and managed areas (OMan), and for state owned and community managed areas (NMan). For areas owned by communities and co-managed with the state (OCoM) 5 case studies were included and for areas, owned by the state and co-managed by the state and communities, 36 case studies fulfilled the selection criteria.

The NCoM CBFMAs were found in several countries, with many in Mozambique and Kenya. The NMan areas are represented by 6 studies from Namibia, 10 from Cameroun and 1 from Kenya. The 5 OCoM areas are from Ghana (4 case studies) and South Africa (1 case study). OMan-CBFMAs were found from many different countries.

The database contains CBFMAs from 104 ha (Kaya Kauma, Kenya) to 2285987 ha (Niassa Wildlife Reserve, Mozambique), where 8 of the 9 smallest areas are Kayas in Kenya. 6 of the 7 biggest areas are in Mozambique (see graphically also in Annex C1). The forest cover in 2009 (percentage of total area), of these CBFMAs ranged from 13% (Olare-Motorogi Community Conservancy, Kenia) to 100% (Kaya Dzombo, Kenya). The oldest CBFMA in the database was established in 1967 (Mukogodo Forest Reserve, Kenya) and the youngest are 8 CBFMAs, which were founded in 2006. From these 8 areas, 6 are from Namibia.

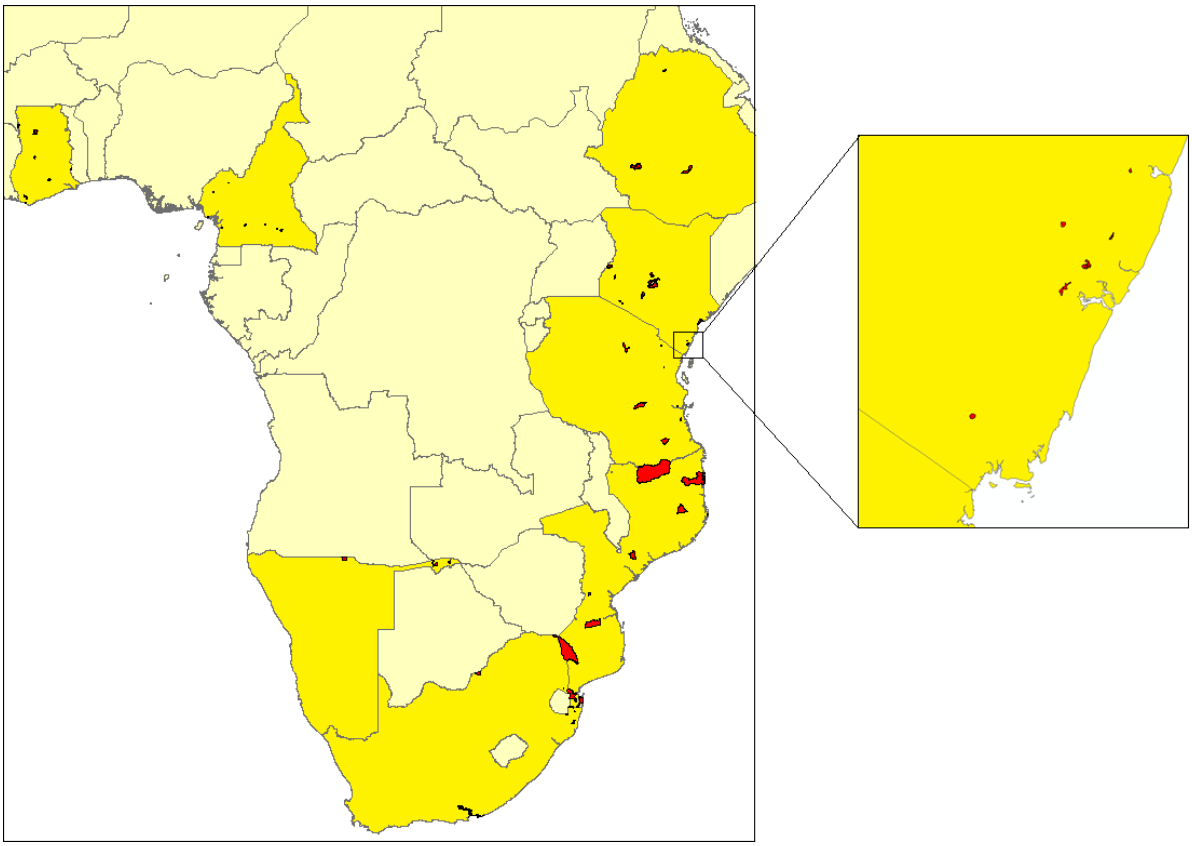

Figure 2. *Overview map of all 75 case studies in the 8 examined countries with close up of Kaya CBFMAs in Kenya; yellow = examined countries; red = case studies.*

3.2) Deforestation rate

The mean annual deforestation rate of all the case studies is -0.248. The distribution of the data is skewed (towards low deforestation rates), so that the median is -0.085. The highest deforestation rate has been calculated in Kisangi Village Land Forest Reserve (r=-2.302) in Tanzania, and in Handeni Hill Forest Reserve (Tanzania) and Tinto Community Forestry (Cameroon) no deforestation was detected (r=0.000). The standard deviation is 0.438.

The comparison of the deforestation rates of the CBFMAs and their buffer zones (as control group) shows that the deforestation rates differ significantly (see Annex E1-E2, Wilcoxon matched-pair signed-rank test; N=75, Z=-1.975, P=0.047 (0.043-0.051), with a mean rank of 37.54 for CBFMA areas and 38.28 for Buffer zones, meaning that CBFMAs have a significantly lower deforestation rate than the control group.

3.3) Ecological effectiveness of tenure regimes

The Kruskal-Wallis test revealed that the deforestation rate does not differ significantly between tenure groups (see Figure 3; Kruskal-Wallis with Monte Carlo

simulation; X^2=4.984, *df*=3, *P*=0.183 (0.173-0.193), η^2=0.077), with a mean rank of 36.35 for OMan (N=17), 19.4 for OCoM (N=5), 17 for NMan (N=17) and 36 for NCoM (N=36). Figure 3 shows that the groups are not similarly distributed and that there are a lot of outliers. All groups show a high variation in deforestation. OCoM has a higher variation than the other tenure groups. However, it has a much smaller sample size (N=5) than the other groups, which could have caused this high variation.

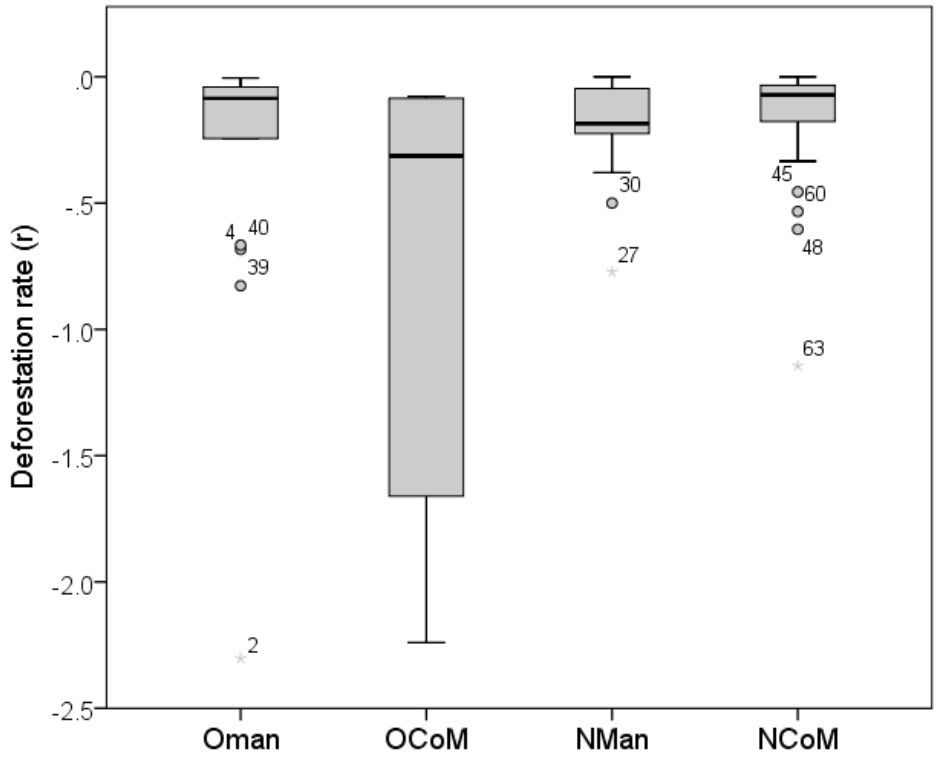

Figure 3. *Relation of annual deforestation rate r and tenure regimes (boxplot with mean rank) tenure rights of community: OMan = ownership and decision-making rights; OCoM = ownership and joint decision-making rights; NMan = no ownership and decision-making rights; NCoM = no ownership and joint decision-making rights.*

The comparison of the deforestation rates of ownership types shows that both groups do not differ significantly (see Figure 4 (a), Mann-Whitney U test, *U*=462, *Z*=-1.408, *P*=0.160 (0.151-0.170), *r*=-0.162), with a mean rank of 40.28 for Ownership (N=53) and 32.50 for No Ownership (N=22).

The same accounts for the comparison of the deforestation rates of the two decision-making groups. The two groups do not differ significantly (see Figure 4 (b), Mann-Whitney U test, *U*=647, *Z*=-0.527, *P*=0.605 (0.592-0.617) *r*=-0.061), with a mean rank of 39.21 for CBFMAs with joint-decision-making rights (N=41) and 36.54 for CBFMAs, where communities have full decision-making rights (N=34).

Similar to the tenure regime comparison, in all groups there are several outliers and the variation is high.

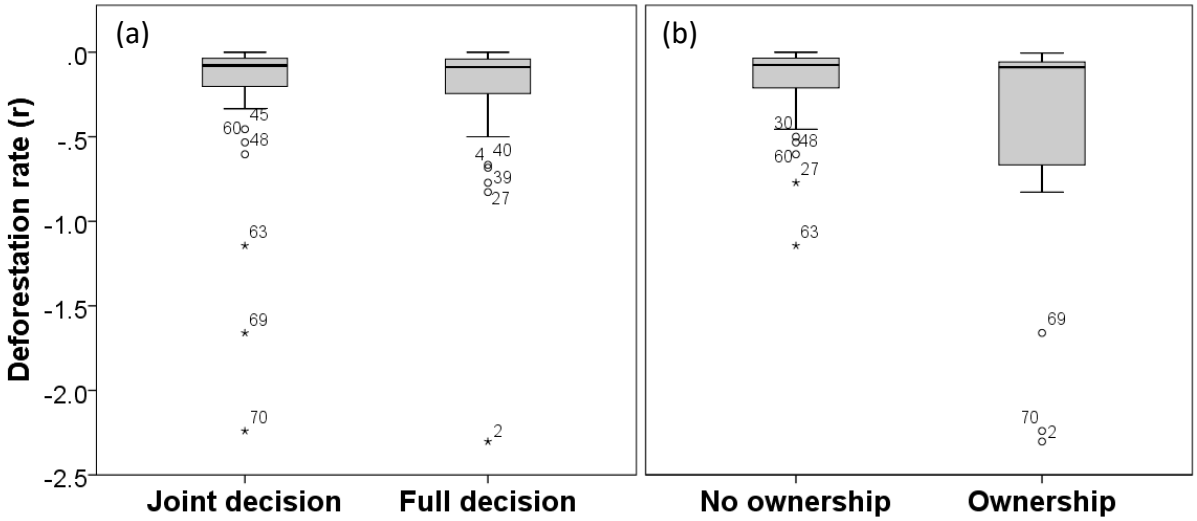

Figure 4. *Relation of annual deforestation rate r and (a) ownership rights of local community, and (b) decision-making rights of the local community (boxplot with mean rank).*

There was no significant difference between deforestation rate per tenure group after controlling for the effects of year of establishment, forest cover in 2009 and size (GLM with identity link; N=75, Wald X^2=4.811, df=3, P=0.186). After adjusting for year of establishment, forest cover, and size, the adjusted means and confidence intervals remained very comparable with the basic model of deforestation rate and tenure groups. Because the results remained quite similar and no significant p-value was found, no post-hoc test was considered. The analysis shows that even by controlling for expected confounding factors, tenure groups still did not have any influence on the deforestation rate.

3.4) Institutional settings of CBFMAs

The truth table reveals that only two combinations of causal conditions led to the desired outcome (see Table 4). The first row represents the case studies from Namibia. Here all causal conditions are marked with (1), except for property rights. This configuration led to a consistency of 1. The second row represents the case studies from South Africa, where all causal conditions are marked with (1). This configuration led to a consistency of 0.889. These two configurations of causal factors were the only ones leading to a consistency of higher than 0.8, and are thus the only ones, which lead to the desired outcome. The configuration representing case studies from each, Ghana (row 3, 8 case studies), Mozambique (row 4, 11 case studies), and Tanzania (row 5, 11 case studies) led to a consistency of around 0.5, which implies, that half of the cases led to a deforestation, that is higher than the set threshold. The causal conditions configurations, which represent the case studies from Kenya (row 6, 17 case studies) and Ethiopia (row

7, 3 case studies) led in around one third of the cases to no deforestation. And the configuration of case studies from Cameroon (last row, 10 case studies) led in 80% of all cases to deforestation.

Table 4. Truth table for first step of QCA for outcome= no deforestation.

ENV	HR	PROPR	CPI	HDI	NAPOL	number	raw consist.	PRI consist.	SYM consist
1	1	0	1	1	1	6	1.000	1.000	1.000
1	1	1	1	1	1	9	0.889	0.889	0.889
1	1	1	1	1	0	8	0.500	0.500	0.500
0	1	0	0	0	0	11	0.455	0.455	0.455
0	1	0	0	0	1	11	0.455	0.455	0.455
1	0	0	0	1	1	17	0.353	0.353	0.353
0	0	0	0	0	0	3	0.333	0.333	0.333
0	0	0	0	1	0	10	0.200	0.200	0.200

ENV= International environmental institutions; HR= International human rights institutions; PROP= Property rights; CPI= Level of Corruption; HDI= Human development Index; NAPOL= National policies strengthening CBNRM; consist.= consistency.

After reducing the casual condition, the QCA gave only one solution (see Table 5). It reduced the causal condition from six to five, where property rights were seen as unnecessary for creating the desired outcome. The solution combination of conditions covers 37.8% of all case studies, of which 93.3% lead to the desired outcome of no deforestation. The case studies covered by this combination of factors are those from Namibia and South Africa.

Table 5. Output 1st step of QCA analysis with Quine-McCluskey algorism (frequency cutoff: 2.00; consistency cutoff: 0.80).

Condition combi-nation	Raw cover-age	Unique cover-age	Consist-ency	Cases with greater than 0.5 membership
ENV*HR* CPI*HDI* NAPOL	0. 378	0. 378	0. 933	ADD (1,1), BUK (1,1), KWA (1,1), LUB (1,1), MAD (1,1), MAH (1,1), MAS (1,1), NDU (1,1), OKO (1,1), PAR (1,0), PHI (1,1), PHO (1,1), SIK (1,1), TSH (1,1), USU (1,1)

Solution coverage: 0.378; solution consistency: 0. 933; upper-case letters mark presence of conditions; lower-case letters mark the absence of conditions; ENV= International environmental institutions; HR= International human rights institutions; PROP= Property rights; CPI= Level of Corruption; HDI= Human development Index; NAPOL= National policies strengthening CBNRM; for abbreviations of case studies see Annex C1.

In the first step of the QCA one configuration (ENV*HR*CPI*HDI*NAPOL) was identified as providing enabling conditions for the desired outcome of no deforestation. Thus, in the second step of the QCA, the by the solution covered cases (from Namibia and South Africa) were run with the five as enabling identified

conditions and the local conditions. The QCA gave several potential solutions. However, only three solutions covered more than two case studies and were, thus, included into the minimization process. The QCA was not able to further reduce the conditions, and thus generated three solution combinations of causal conditions (see Table 6). The first solution covers two case studies from South Africa (MAD and NDU), where only capacity building is present and all other conditions are absent. The second solution covers four case studies from Namibia (BUK, LUB, OKO and SIK), where an international NGO and income is absent and all other conditions are present. The third solution covers two case studies from Namibia (KWA and MAS), where all local causal conditions are present.

Table 6. Output 2nd step of QCA analysis with Quine-McCluskey algorism (frequency cutoff: 2.00; consistency cutoff: 0.80).

Condition combination	Raw cover-age	Unique cover-age	Consist-ency	Cases with greater than 0.5 membership
ENV*HR*CPI*HDI*NAPOL + man*mon* cle*loc*int* reg*CAP*inc	0.143	0.143	1.000	MAD (1,1), NDU (1,1)
ENV*HR*CPI*HDI*NAPOL + MAN*MON*CLE* LOC*int* REG* CAP*inc	0.285	0.143	1.000	BUK (1,1), LUB (1,1), OKO (1,1), SIK (1,1)
ENV*HR*CPI*HDI*NAPOL + MAN*MON*CLE*LOC*INT* REG*CAP*INC	0.143	0.143	1.000	KWA (1,1), MAS (1,1)

Solution coverage: 0.571, solution consistency: 1.000; upper-case letters mark presence of conditions, lower-case letters mark the absence of conditions. ENV= International environmental institutions; HR= International human rights institutions; PROP= Property rights; CPI= Level of Corruption; HDI= Human development Index; NAPOL= National policies strengthening CBNRM; MAN= Management plan; MON= Monitoring; CLE= Clear boundaries; LOC= Local organization; INT= International organization; REG= Local regulations; CAP= capacity building; INC= income.

The Kruskal-Wallis test showed that there is a significant difference between the mean rank of the deforestation rates of the countries (see Figure 5; Kruskal-Wallis with Monte Carlo simulation; X^2=19.676, *df*=7, *P*=0.002 (0.001-0.003), h^2=0.266)), with a mean rank of 61.67 for ZAF (N=9), 54.17 for NAM (N=6), 40.05 for TZA (N=11), 37.67 for ETH (N=3), 35.00 for MOZ (N=11), 30.65 for KEN (N=17), 28.38 for GHA (N=8), and 28.35 for CMR (N=10).

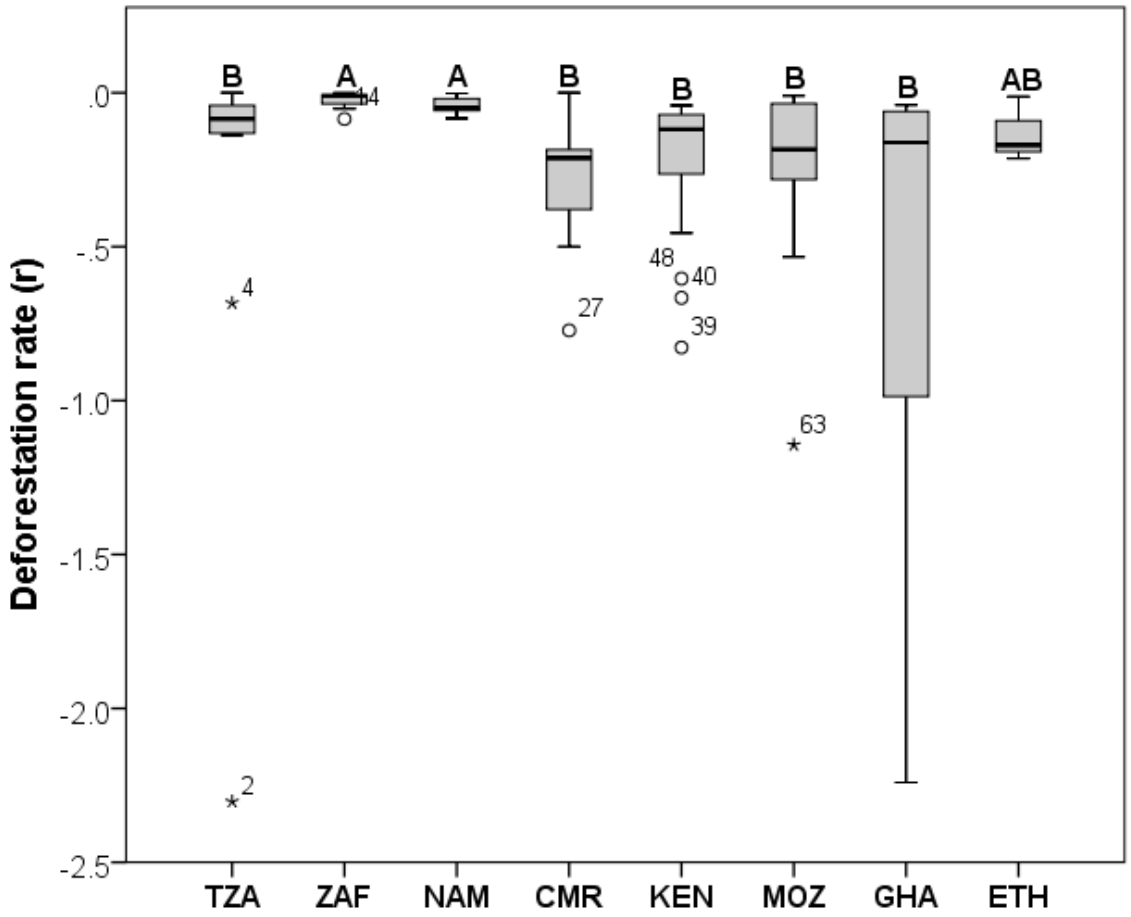

Figure 5. Relation of annual deforestation rate r and countries (boxplot with mean rank); CMR= Cameroon, ETH= Ethiopia, GHA= Ghana, KEN= Kenya, MOZ= Mozambique, NAM= Namibia, TZA= Tanzania, ZAF= South Africa.

Because of the overall test significance, a pairwise Mann-Whitney U test among the 9 groups was done. The pairwise comparisons of countries showed that there is a significant difference between some countries. Table 7 gives an overview of the country pairs, where the deforestation rate is significantly different. Namibia has a significantly lower average deforestation rate than 3 other countries (Cameroon, Ghana & Kenya). South Africa, too, has a significantly lower deforestation rate then the three before mentioned countries. In addition it has a significantly lower average deforestation compared to Mozambique and Tanzania. The only country, the deforestation rates of both, South Africa and Namibia, do not differ significantly from, is Ethiopia. Both, Namibia and South Africa, have a lower variation in deforestation than all the other countries. Especially high is the variation in data for Ghana. South Africa and Namibia have the smallest variance (ZAF: SD=0.028, NAM: SD=0.029), followed by Ethiopia (SD=0.106), whereas Ghana (SD=0.861) and Tanzania (σ^2=0.682) have the biggest variation in the deforestation rate (see also Annex F).

Table 7. Country pairs with significantly different deforestation rates.

N	compared groups	p-value	X^2	h^2
16	Cameroon - Namibia	0.042	4.247	0.283
19	Cameroon - South Africa	0.019	5.607	0.311
14	Ghana - Namibia	0.032	4.817	0.344
17	Ghana - South Africa	0.001	8.898	0.523
23	Kenya - Namibia	0.003	8.240	0.375
26	Kenya – South Africa	0.000	14.031	0.561
19	Mozambique - South Africa	0.018	5.607	0.312
20	Tanzania - South Africa	0.026	5.023	0.264

4) Discussion

It was very difficult to find a representative number of case studies from each country, even though I had decided to include grey literature as a source. As there is no unified definition for CBFMAs in the literature, characteristics of CBFMAs (size, year of establishment, forest cover in 2009) varied a lot throughout case studies. By applying the established selection criteria, case studies with extreme characteristics were eliminated, however, only 75 case studies remained, were characteristics were still unevenly distributed among countries (e.g., many small CBFMAs from Namibia, many big ones form Mozambique).

The variation (SD=0.438) in the afterwards calculated deforestation rate was relatively low, compared to other meta-analyses (e.g. see Porter-Bolland et al. (2012), where SD=3.46). While the selection criteria could have contributed, the main reason for this is probably that I calculated the deforestation rate myself. By doing so, the deforestation rates of the different CBFMAs were all calculated in the same way, thus, reducing variation that was caused by sampling bias, which is normally found in meta-analysis or studies that compare several studies with different methodologies (see Porter-Bolland et al. 2012).

4.1) Insufficiency of tenure devolution

The findings do not support the hypothesis that CBFMAs with devolved tenure rights are ecologically more effective than those without devolved tenure. The results did not show any significant difference between various tenure regime groups. This contradicts the common belief that tenure rights are the key of a successful CBC approach (Wily, 2004; Barrett et al., 2005; Padgee et al., 2006; Chhatre & Agrawal, 2009; FAO, 2008; Sunderlin et al., 2008; Roe et al., 2009; Larson et al., 2010a). While many researchers belief that the granting of legal land titles gives local communities the incentive to invest into their lands, as it counteracts potential eviction and displacement (Wily, 2004; Barrett, 2005; FAO, 2008; Sunderlin et al., 2008; Larson et al., 2010a; FAO, 2012), the results of this study cannot confirm this view as the comparison of the ecological effectiveness of CBFMAs, where the local community owns the land, and those, where the state maintains statutory land rights, did not result in significant difference. Similarly, the findings of this research cannot confirm that case studies, where decision-making rights were granted, lead to positive conservation outcomes, while projects with shared management rights were hindering, like Wily (2004) and Larson (2010a) state. This is not to say, that tenure devolution is not important to enable successful conservation. Rather, even though tenure devolution might be eminently important, on itself, is not enough. This conclusion is similar to conclusions made by Robinson et al. (2014). They compared the ecological effectiveness of different tenure regimes (communal, customary, private and protected) in a meta-analysis, and found no significant difference. Robinson et al.

(2014) concluded that land tenure is inseparably linked to various socio-economic and institutional factors, and thus, that no tenure form is immune from deforestation.

However, Robinson et al. (2014) found that the majority of communal lands in Africa, examined in their study, are linked to negative forest outcomes. These findings cannot be confirmed by results found in this study, because the Wilcoxon test showed a significant difference between the conservation outcomes of CBFMAs and their buffer zones. However, Robinson et al. (2014) compared forest outcomes, which were calculated for case studies individually. They mention that they only found seven studies, that included a counterfactual (a control group), so their analysis was done with mostly case studies, where no counterfactual analysis was integrated, thus biasing the results. Moreover, they mention that their results might be biased by the small sample size and a publication bias.

In this study, the deforestation rate was calculated by using one technique, so to control for a non-random location bias. However, an aspect, which could have biased the results, is the small number of case studies found (selection and publication bias). In this way, the NMan-CBFMAs (community has no ownership, and full management rights) were nearly exclusively made up by all case studies from two countries (Namibia (N=6) & Cameroun (N=10), except for 1 case study from Kenya). The average deforestation rates of these two countries differ significantly, which could have created the variation and outliers in this tenure regime group. Especially striking is the influence of the low number of case studies in the tenure regime group OCoM (communities own the land, and co-manage it). This group is only represented by five case studies, where four are from Ghana, and one is from South Africa. The group has a much higher variation than the other groups (see Figure 3), which is caused by the high variation in the case studies from Ghana (see Figure 5). However, when comparing groups with a reasonable number of case studies, no significant results were found, neither. For example, when comparing the ecological effectiveness of CBFMAs, where local communities owned the land, and where they did not, the sample size was sufficient (Ownership (N=22), No Ownership (N=53)). The same is true for the comparison of the decision-making rights groups (Man (N=34), CoM (N=41)). In both analyses no significant difference was found.

A second factor, which could have biased the results is that the CBFMAs, which were included in the analysis vary in many characteristics, such as size, year of establishment and forest cover in 2009. Thus, these differences could have influenced the results. However, I critically reduced the number of CBFMAs, which might have increased uncertainty (CBFMA area criteria to standardize CBFMA characteristics for calculation of deforestation rate). And also, the results of the GLM counteract this assumption of a bias, because there was no significant difference between deforestation rate per tenure group after controlling for the effects of year of establishment, forest cover in 2009 and size.

Thirdly, important to mention is also, that no comparison could be made between the deforestation rates of CBFMAs, where local communities only have

operational-level rights (access & use rights), and those, where they, additionally, have decision-making rights (management, exclusion, alienation rights). This is one of the most important distinctions that can be made between various levels of devolution (e.g. Schlager & Ostrom, 1992; Wily, 2004; RRI, 2012). Furthermore, alienation rights and exclusion rights (in the case of Africa) are mostly retained by the government (RRI, 2012), so no distinction could be made between CBFMAs, where communities had these rights, and those, where they did not.

In summary, the results do not support the hypothesis that a more devolved tenure regime increases the conservation effectiveness of CBC. Even though the data quality and sample size could have biased the results, the influence of these limitations was minimized, firstly, by critically reducing the number of CBFMAs, which might have increased uncertainty, secondly, by controlling for variation in deforestation rates of CBFMAs by calculating them with one unified approach, and thirdly, by controlling for a non-random location bias.

4.2) Enabling conditions for successful CBFMAs

4.2.1) National level

The results of the QCA support the hypothesis that a strong institutional and legal framework increases the effectiveness of CBFMAs. These findings of the QCA are, in general, supported by the outcomes of the quantitative comparison of the deforestation rates of the examined countries.

The two countries with the significantly lower quantitative deforestation rates are Namibia and South Africa. The configuration of the causal conditions of those two countries is also given as the only solution enabling the desired outcome of no deforestation. In the minimization process of the QCA, the condition "property rights" was the only variable thought of as unnecessary. This supports the results from the quantitative comparison of ecological effectiveness of various tenure regimes, where no significant difference between the deforestation rates of various tenure regimes was found. While in Namibia the government owns all communal land (Jones, 2012), in South Africa, communities can acquire statutory ownership rights under the "Communal Land Rights Act" (Cousins et al., 2007).

While South Africa has the lowest average deforestation rate in the quantitative analysis, followed by Namibia, with the second lowest average deforestation rate, in the qualitative analysis, Namibia has the highest consistency (=1). Here, South Africa had a consistency of 0.889. The reason for this switchover is the low sample size in combination with the data simplification of the QCA (to binary data). One of the CBFMAs from South Africa has a slightly higher deforestation rate than the set threshold for the outcome variable in the QCA (CBFMA PAR, r=-0.09, see Annex C1, see also Figure 5, outlier of the boxplot from South Africa). This is why the consistency value from South Africa is lowered. Even

though these methodological shortcomings compromise the results, the main outcome does not change.

Next to Namibia, Ghana is the second country, where all causal conditions, except for one, are present in the QCA. However, in this case, it is the national policies and not property rights, which are missing. This is a condition, which is given as necessary by the QCA and even though all other causal conditions are present, it seems that due to this one variable, the consistency drops drastically to 0.500. In both, Namibia and South Africa, all national legislations are present, which clearly recognize CBFMAs under statutory law. Moreover they have clear guidelines for communities on how to establish a community forest (see Annex A6). In Ghana, on the other hand, not all national legislations impacting CBC exist. They do not have any laws supporting community-based conservation (Boakye & Baffoe, 2008), and though the "Local Government Act" from 1993 exists, the statutory system is not enforced properly, so that the customary system often dominates due unawareness of the statutory system (Roe, 2014). So, this insecure und unclear legislation could be the reason for why the variation in deforestation rates in the quantitative analysis in Ghana is so high.

Both, Mozambique and Tanzania, had an only slightly lower consistency than Ghana. Still around 50% of all case studies in these two countries led to the desired outcome. However, nearly all causal conditions were not present. The only condition, which all three countries have as a present condition in common, are human rights. As the consistency for these three countries is quite similar, it seems that human rights are quite important. This assumption is being reinforced, by the fact, that all until now mentioned countries (with the highest consistency, see Table 4) have only the presence of this one causal condition in common, in contrast to all other countries (with the lowest consistencies). Thus, even though human rights are not sufficient on themselves, the pattern emerges that human rights are very important for enabling the desired outcome.

The three remaining countries (Kenya, Ethiopia and Cameroun) have the lowest consistencies, where only around a third of the CBFMAs led to the desired outcome. In general, these patterns match with those of the quantitative analysis, except for Ethiopia. In the quantitative comparison Ethiopia is the only country, where the average deforestation rate is not significantly different from neither South Africa, nor Namibia. However, this implausible result is probably caused by the low sample size (N=3) of case studies from Ethiopia.

4.3.2) Local level

The second step of the QCA gave three configurations of causal conditions as the solution. Two of the three solutions are represented by all six case studies from Namibia. In both condition configurations, nearly all local factors are present.

The third solution, which is represented by two case studies from South Africa, has no condition present, except for capacity building.

The main explanation for this dubious result is that the local causal conditions are mainly based on presence data only. The consulted sources mainly mentioned that a certain institution was "present". Rarely, they mentioned that it was "absent". However, the QCA needs for all conditions a value, or it does not consider the case in the analysis (see Porter-Bolland et al., 2012). In order to being able to do an analysis, I assumed, that local institutions, which were not mentioned, were not present. Most of the sources from Namibia are documents published by the government and are very thorough mentioning a lot of local institutions (see Annex C1-3). On the other hand, most of the data from South Africa was retrieved from NGOs, who do not mention local institutions in such detail. This, the data quality of the information used to create local causal condition for the QCA, was not good enough to allow for reliable conclusions. In addition to this methodological issue, it is possible that, on the local level, too many causal conditions were used. Schneider & Wagemann (2006) mention that, similarly to statistical analyses, too many variables 'destroy' the result. Moreover, they mention that a disadvantage of the two-step QCA is that for the second step of the analysis only the subset of cases is used, which represents the solution configurations. Thus, it is possible that not enough cases were left to run the second step.

4.3.3) Methodological shortcomings and comparability

The results from the QCA coincide with the common belief that a strong institutional and legal framework is crucial for enabling successful CBC (Barrett et al.,2005; Pagdee et al., 2006; Bartley et al., 2008; Sunderlin et al., 2008; Larson et al., 2010a; Doherty and Schroeder, 2011; FAO, 2012; Robinson et al., 2014; Yin et al., 2014). However, it is difficult to compare the results in detail to results found in other studies for several reasons. Firstly, most studies used statistical methods, such as correlations and regressions to look at all factors of influence separately (Rohlfing, 2012). However, I used a QCA, which assumes multiple-conjunctual causation, meaning that an outcome is caused by a combination of factors and that several combination can lead to one outcome (Korhonen-Kurki et al., 2014). Even though, Hayes (2006) used statistical methods and concluded from those that for different governance regimes (PAs and non-park community-based areas) different institutional arrangements can lead to successful conversation projects.

Secondly, it is difficult to compare my results to other studies, because other studies using a QCA to evaluate, which institutional settings enable successful conservation, were all done in different ways. For example, Oldekop et al. (2010) found that strong institutional arrangements lead to ecologically effective projects. However, only one variable represents all institutional arrangements, and this

variable is not well defined. On the other hand, Porter-Bolland et al. (2012) used 18 variables from various institutional levels in a one-step QCA, and got very complex results, which make general conclusions difficult.

A third factor, which reduces comparability, is the limited data availability. It is difficult to find comprehensive information on the institutional settings of case studies. However, in order for including a case study into the QCA, all causal conditions need to have values. Oldekop et al. (2010) decided to discard all studies, which did not have information on all causal conditions. They mention that by doing so, their database was drastically reduced from 116 to 36 case studies, which probably increased the sampling bias immensely. On the other hand, both, Porter-Bolland et al. (2012), and I, assumed that every condition, which is not being mentioned is non-existent. As the results from the second step of the QCA show, this approach does not always work. However, the data availability did not allow to proceed like Oldekop et al. (2010).

In summary1 z, despite these shortcomings, the results of the QCA support the hypothesis that a strong legal and institutional framework enables successful CBC. Furthermore, the results underpin the non-significant results from the quantitative statistical comparison of the ecological effectiveness of various tenure regimes, because property rights is the only causal condition, which is excluded in the minimization process of the QCA. This supports the opinion that a devolved tenure regime is not enough to enable successful CBC. Rather a well-rounded institutional framework, including strong environmental and human rights legislations, low corruption, an at least medium HDI and national legislation supporting CBNRM. Moreover, even though the presence of human rights seems to be eminently important for enabling successful conservation, the results show, that only the presence of all these factors enable ecologically effective CBFMAs.

5) Conclusion

Community-based conservation is widely being accepted as an alternative to strictly protected areas. However, success is not always present and it is not fully understood, what makes it work. Tenure devolution and strong institutional settings are thought of as enabling condition, however empirical prove is limited. This study addressed these questions and found out that tenure devolution alone is not enough to enable successful conservation. Tenure is rather embedded in a complex institutional framework. The findings of this study support this view that a strong institutional framework enables successful CBC. By using a qualitative comparative analysis, I was able to look at combinations of institutional factors and not just at individual factors separately. The results show, that it is indeed the combination of many factors, which make CBFM work. And even though methodological constraints only allow for a limited understanding of these complex and nested relations, they give new insights into which factors make CBFM work. The quantitative comparison is the first to ever compare CBC tenure regimes in this detail and more studies should be done to confirm the findings, as the small sample size in this study could have biased the results. The QCA has proven to be a useful additional tool to commonly used statistical analyses. The results support the view that evidence of successful CBC is missing, not because it is failing, but because we do not use the right methods, and do not ask the right questions (Davies et al., 2014). This study can serve as a starting point for more comprehensive research in the future to evaluate conservation projects along multiple criteria in order to getting a better understanding of how CBC projects are embedded into complex institutional settings and bringing us closer to understanding what makes them work.

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APPENDICES

ANNEX A Detailed description of creation of national conditions for QCA.

Annex A1. Description causal conditions for QCA.

Condition	Full name	Description	Threshold	Reasoning threshold	Source
ENVTR	International Environmental Treaties Ratifications	self-created analog index to HRTR for environmental treaties (see HRTR)	Ratification of at least 11 of 12 treaties;	Environmental treaties are often signed, so countries are all similar (10 and 11 are only values).	See Annex A4 and Annex A5
EPI	The Environmental Performance Index 2014	State performance of protecting human and ecosystem health regarding environmental issues	Score of at least 50 (= global average)	Difficult to make sophisticated cut, as index consists of 16 indicators; thus, global average	Yale University (2015)
ENV	Environmental Institutions	Combination of ENVTR and EPI	Fulfillment of either one of ENVTR or EPI	(only values of 0 and 1, no country had 2)	-
HRTR	International Human Rights Treaties Ratifications	Consent of country to comply to human rights treaties (18 treaties) under international law	Ratification of at least 10 of 18 treaties; (>50%)	Half of treaties signed, given as cut by UN;	OHCHR (2014)
HRRI	Human Rights Risk Index 2014	Risk of human rights violations in states	At least category of medium risk	high or extreme human rights excluded	Verisk Maplecroft (2014)
HR	Human Rights Institutions	Combination of HRTR and HRRI	Fulfillment of either one of HRTR or HRRI	1 of 2 (similar to ENV)	-
PROPR	Property Rights Index 2015	Ability of individuals to get property and security by clear laws and enforcement by state	Score higher than 42.4 (=global average)	Countries with values higher than threshold have low expropriation risk; countries with values lower have property rights poorly protected	Heritage Foundation (2015)
CPI	Corruption Perception Index 2014	Perceived corruptness of public sector/state	Score higher than 43 (=global average)	(same as EPI)	Transparency International (2015)
HDI	Human Development Index 2013	Combination of Life expectancy, education and income indices	Score higher than 0,52 (=average of examined countries)	Difficult to make sophisticated cut, as global average difficult, country average chosen	UNDP (2015)
NAPOL	National CBC Institutions	Existence of Environmental, Land, Forest and CBNRM Policies	All four policies existent	All policies researched are important, so all should be present	See Annex A6 and Annex A7

Annex A2. Causal conditions for QCA on a national level.

Country	ENV	HR	PROP	CPI	HDI	NAPOL
Cameroon	0	0	0	0	1	0
Ethiopia	0	0	0	0	0	0
Ghana	1	1	1	1	1	0
Kenya	1	0	0	0	1	1
Mozambique	0	1	0	0	0	0
Namibia	1	1	0	1	1	1
South Africa	1	1	1	1	1	1
Tanzania	0	1	0	0	0	1

Annex A3. Original values of causal factors before transformation into binary data. Last line shows threshold for presence or absence. Values present (shaded in grey) or absence (shaded in white) of condition.

Country	ENVTR	EPI	ENV	HRTR	HRRI	HR	Property rights	CPI	HDI	NAPOL
Cameroon	10	36,7	0	9	high	0	25	27	0,504	3
Ethiopia	10	39,3	0	9	extreme	0	30	33	0,435	2
Ghana	11	32,1	1	12	high	1	50	48	0,573	1
Kenya	11	37	1	8	high	0	30	25	0,535	4
Mozambique	10	30	0	13	high	1	30	31	0,393	3
Namibia	11	43,7	1	13	med	2	30	44	0,624	4
South Africa	10	53,5	1	13	high	1	50	44	0,658	4
Tanzania	10	36,2	0	10	high	1	30	31	0,488	4
Threshold	11	50	1	10	med	0	42.4	43	0,520	4

Annex A4. Information on environmental treaties used for ENVTR.

Environmental treaty	Full name	Source
CBD	Convention on Biological Diversity	CBD (2015a)
Nagoya	Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the CBD	CBD (2015b)
Cartagena	Cartagena Protocol on Biosafety to the CBD	CBD (2015c)
UNFCCC	United Nations Framework Convention on Climate Change	UNFCCC (2014a)
Kyoto	Kyoto Protocol to the UNFCCC	UNFCCC (2014b)
UNCCD	Convention to Combat Desertification	UNCCD (2014)
UNECSO	Convention Concerning the Protection of the World Cultural and Natural Heritage	UNESCO (2014)
ITTA	International Tropical Timber Agreement	ITTA (2015)
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora	CITES (n.d.)
CMS	Convention on the Conservation of Migratory Species of Wild Animals	CMS (2014)
RAMSAR	Convention on Wetlands of International Importance	RAMSAR (2014)
ITPGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture	FAO (n.d.)

Annex A5. Ratifications of international environmental treaties by examined countries; used for QCA causal condition “ENVTR”.

Country	CBD	Nagoya	Cartagena	UNFCCC	Kyoto	UNCCD	UNECSO	ITTA	CITES	CMS	RAMSAR	ITPGRFA
Cameroon	1	0	1	1	1	1	1	0	1	1	1	1
Ethiopia	1	1	1	1	1	1	1	0	1	1	0	1
Ghana	1	0	1	1	1	1	1	1	1	1	1	1
Kenya	1	1	1	1	1	1	1	0	1	1	1	1
Mozambique	1	1	1	1	1	1	1	0	1	1	1	0
Namibia	1	1	1	1	1	1	1	0	1	1	1	1
South Africa	1	1	1	1	1	1	1	0	1	1	1	0
Tanzania	1	0	1	1	1	1	1	0	1	1	1	1

Annex A6. Description national legislation of examined countries.

	Environmental policies	**Land policies**	**Forest policies**	**CBNRM policies**
Cameroon:	Existent: Framework law on the environment (1996) • National Environmental Management Plan (NEMP) • participation as one principle • substitution as one principle (if no statuary law, customary law rules) (Herakles Farms, 2011)	Non-existent: All land under state ownership see Forestry law (1994) • People may manage and exploit 5,000 ha under 15 year contract (rights to forest, not land) (Nelson & Lomax, 2013; Wily, 2011)	Existent: Forestry Law (1994) • usage rights to everybody for personal use • LC can acquire exclusive rights to manage and use forest up to 5,000 ha under a 15-year contract; LC need to create cooperative in order to apply for CF contract; need annual management plan; Wildlife Decree (1995) • participative management: any approach of management (Nelson & Lomax, 2013; Roe, 2014)	Existent: Forestry law regulates CF (community forests) (see Forestry law (1994))
Ethiopia:	Existent: National Environmental Policy (1997) • so to prevent environmental degradation • principles of community participation and decision-making, equity Institute of Biodiversity Conservation by Proclamation (2004) Access to Genetic Resources and Community Knowledge, and Community Rights Proclamation (2006) (Getu, 2013; USAID, 2011a)	Non-existent: no post-colonial land policies (Crewett et al. 2008; USAID, 2011a)	Existent: Forest Development, Conservation, and Utilization Policy (2007) • two types of forest ownership: - State forests held by state - Private forests outside state control; include those held & managed by individuals or groups (such as community forest associations) • participatory forest management not explicitly addressed • need for assessing policies & enabling circumstances for CFM; need for clarification of land and forest-use rights in forest area (IUFRO, USAID, 2011a)	Non-existent: no policies supporting participatory forest management (CEPF, 2012; USAID, 2011a)
Ghana:	Non-existent: Nothing found	Non-existent : Not enforced and thus, unclear situation:	Existent: Forest and Wildlife Policy (1994) • Government has control over	Non-existent: No laws supporting participatory resource management

		Local Government Act (1993) • Pluralistic lend tenure system (customary and statutory) • Customary system dominant, due to lack of knowledge about statutory system and due to lack of enforcement of state tenure system - Customary land: trustee (authority in community) is titular holder; - Customary freehold: secure and inheritable) - Communal land: undeveloped land subject to common rights (Roe, 2014)	forest sector • Co-management between timber companies and communities • LC can obtain rights to use forest either through occupancy, or authorization • Exploitation requires license - except for personal consumption • Community participation in wildlife management is endorsed (Roe, 2014)	(Boakye & Baffoe, 2008)
Kenya:	Existent: Environmental Management and Coordination Act (1999) • broad legal and institutional framework for environmental protection and regulation • introduced EIAs • generic and simple regulations for ABS (Access and Benefit sharing), including FPIC (Free, Prior and Informed Consent) (Kenya, 2010)	Existent: National Land Policy (2009) • conversion of trust lands to community lands, vested in communities holding customary rights areas, Community Resource Board as key tenure governance body • Kenya's new constitution has enshrined this reform and planned conversion of trust lands to community land (Nelson, 2012a) Constitution of Kenya (2010) • "Principles of land policy: Land in Kenya shall be held, used and managed in a manner that is equitable, efficient, productive and sustainable" (Kenya, 2010) Land Act (2012) • to consolidate land policy in	Existent: Forest Act (2005) • three categories of forests: state, local authority and private • Local authority forests comprise forests on trust land, which the County Council has established as such • all forests other than private and local authority forests are under state jurisdiction (general exemption to local communities to continue subsistence-based (non-commercial) customary uses) • encouragement PFM, however, limits role of communities in forest governance to co-management (joint forest management) --> community-owned forests not provided for --> (reason: followed old land tenure categories) (Nelson, 2012a)	Existent: Similar regulations to Tanzania, where the Forest Act empowers local communities to participate in the management of state forests as community forest associations (CFAs). (CEPF, 2012)

		constitution ! However policies have to be implemented and if not, land is still governed according to Trust Land Act: <u>Trust Land Act</u> • trust land can be alienated without consulting communities • communities has no exclusion rights -> old laws major constraints! (Kenya, 2010; Nelson, 2012a)		
<u>Mozambique:</u>	Existent: <u>Environmental Act (1997)</u> • "legal basis for the proper use and management of the environment and its elements in order to establish a system of sustainable development in Mozambique." (Lexadin)	Existent: <u>Land Act (1997)</u> • officially all land owned by state; **LC can acquire use rights indefinitely; has equivalent legal status to "private land rights"** • called DUAT (direito de uso e aproveitamento dos terras), two types: 1) obtained by occupancy: according to customary norms and practices communities can get their traditional territory (or only for 10 years)(no registration necessary); if want to register and delimitate: need plan; LC individual can get own plot within communal land; LC can give company use rights 2) obtained by grant: for 50 years; need exploitation plan; first provisional grant; investments on land are private property (FAOLEX; Roe, 2014; USAID, 2011b)	Existent: <u>Forest and Wildlife Act (1999)</u> • Forests are property of state; • can obtain rights to use and benefit from forest through occupancy or authorization • exploitation requires license - except for personal consumption; (FAOLEX; USAID, 2011b)	Non-existent: no overarching policy (Roe, 2014)
<u>Namibia:</u>	Existent:	Existent:	Existent: <u>Forest Act (2001)</u>	Existent: <u>Communal Land Act (2002)</u>

	Nature Conservation Ordinance (1975, amended in 1996) • LC conservation on communal land (called conservancies); ***communal land is owned by state on behalf of community*** (Jones, 2012) Environmental Management Act (2007) • sustainable management of environment and use of natural resources • to provide for a process of assessment & control of activities, which might affect environment (Ecolex)	The Constitution of the Republic of Namibia (1991) • all people have right to own, acquire, or dispose of property, individually or with others, bequeath property to heirs and legatees (USAID, 2010) Land Policy (1998) • land rights (freehold titles, leaseholds, customary grants, licenses, certificates and permits, and state ownership) (USAID, 2010) Communal Land Act (2002) • see CBNRM legislation • All communal land is owned by state on behalf of community (Jones, 2012)	• allows for community forests and forestry councils • Use and management regulations of forests and their resources • establishment of community forest: formal application; elect committee, which manages; demarcate boundaries; develop constitution; create by-laws; ensure revenue for all communities members; approval of traditional authority • Report to ministry of forestry, which supports LC with monitoring and management plan if needed • Minister may revoke title, if community does not comply with agreement (Jones, 2012)	• Allocation of rights on communal land (regulates power of traditional authority/chief) • Establishment of Communal Land Board allocating leases to use • Communal land is owned by state, held in trust for local community; -> difficult to prevent others from usage • Communal land registry (Jones, 2012; USAID, 2010)
South Africa:	**1) Environmental policies** Existent: National Environmental Management Act (1998) • guidelines for actions affecting environment, principle of sustainable management • recognizes rights of LCs to access & benefit sharing (ABS) Biodiversity Act (2004) • Framework for management, sustainable use & conservation of biodiversity Protected Areas Act (2003) • regulates management of PAs for protection of environment	Existent: Communal Land Rights Act (2004) • LC can obtain land title and manage • need to register communal rules and boundaries of community land • existing rights and rights conflicts are investigated and rights are secured (e.g. gender equality) • increase tenure security by transferring land • recognized traditional practices (Roe, 2015; Cousins, 2009; Cousins et al., 2007) Communal Property Association Act (1996)	Existent: National Forest Act (1998) • LC can create agreement with government for community forestry • joint management with state -> can lodge if comply with sustainable forest management plan (Holden et al., 2008)	Existent: Communal Property Association Act (1996) • overarching framework • allows communities to establish legal common property institutions (Roe, 2015) See moreover: Protected areas act (-> environmental policies) Traditional Leadership & Governance Framework Amendment Act (2003) • national framework for traditional leadership • recognition of traditional leadership

	• Communities (privates) can have government declare their lands as PA • both, co-management with state, and LC management only • Creation of management plan; • Management authority can be local community • public register: "Protected Areas Register" • communal tenure rights clearly regulated with agreement • comprehensive formalities costly and time-intensive (Conservation at Work, 2009; Holden et al., 2008; Paterson, 2010)	• communities can acquire, hold and manage land (Nelson, 2012) <u>Land Restitution Act (1994)</u> • dispossessed local communities are being compensated either by actual land or alternative (Nelson, 2012b)		• establishment of traditional councils to represent communities: owners of communal land, and to manage and allocate rights on communal land • to clarify community boundaries to create institutional clarity (Cousins et al., 2007)
<u>Tanzania:</u>	Existent: <u>National Environmental Policy (1997)</u> • Decentralization of environmental management • to prevent environmental degradation (Hausser et al., 2006) <u>Environmental Management Act (2004)</u> • management and protection of environment (Mattee & Shem, 2006; TNPNPC, 1994) • Tanzania National Parks (TANAPA) in charge; • In 90s "Community Conservation Scheme" regulating that part of tourism revenue goes to neighbouring communities through furniture of public services)	Existent: <u>Land Act (1999)</u> • Recognition of village land as legal category of land (other categories: general land and conservation land) • Community and private ownership possible • Legal provision for common property rights to be registered (Customary tenure systems) • Strong role of villages in management and conservation: financial revenue from tourism (Hausser et al., 2006) <u>Village Land Act (1999)/ Land Use Planning Act (2007)</u> • Village Land Act often disregarded for interests of external players; land tenure insecurity for rural communities with a high dependence on natural resources	Existent: <u>National Forest Policy (1998)</u> • to strengthen legal framework for promotion of private and CB ownership of forests and trees (Roe, 2014) • participation and rights clearly recognized • various types: 1) JFM of LC and state; 2) CBFM: through Village Land Forest Reserves (VLFRs) (Nelson, 2012b) • clearly defined user rights (Hausser et al., 2006) • implemented through: <u>Forest Act (2002)</u> • framework for forest management at lowest level of government possible • LC are granted secure rights to	Existent: <u>Local Government Act (1982)</u> • Local institutional framework for CBNRM/CBNRC: - Villages can make own by-laws, legally binding - Local by-laws: use of natural resources; sanctions and fines (Roe, 2014) • Ministry of Regional Administration and Local Government (MRALG) for devolution • security and autonomy to drive development for communities and privates (Hausser et al., 2006) <u>Community-Based Forest Management Guidelines (2001)</u> • LC can own and manage forest • exclusive property rights with

	(Hausser et al., 2006) <u>National Tourism Policy (1999)</u> • Communities next to tourist attractions to be involved in management, get share of income generated from tourism; joint ventures possible; • Allows ecotourism and benefit sharing • Money can be invested in management (village scouts, land use plan) or social services (education, health) • Village can pass by-laws to regulate the use and management of natural resources in village (Hausser et al., 2006; MNRT, 1999)	(Mattee & Shem, 2006, Roe, 2014; Pedersen, 2010) • village can draft & enforce by-laws • creation of Certificates of Village Land and the Right of Occupancy to Forest Land for both communities and individuals • establishment of management institutions for CBNRM at village level (such as village council, village assembly; Village Environment Committee (VEC) or Village NRM Committee (VNRC) and village scouts or guards) (Hausser et al., 2006)	own, use and manage forests on village lands, can collect fines; • PFM possible (Government Survey) • establishment of VLFR: formation of environmental committee under Village Council, demarcate boundaries, draft local by-laws, set up management plan • flexible institutional arrangements for local forest management and ownership (VLFRs): village management OR - Community Forest Reserves (CFRs): sub-group of village (Roe, 2014; Nelson, 2012b) • partly in conflict with Village Land Act regarding establishment of (VLFR) (Hausser et al., 2006)	appropriate legal support from government • distinction between 1) JFM: - involvement of local communities or NGO in management and conservation of forests, appropriate user rights as incentive - on state owned reserves with forest adjacent communities - main tool: LFM Agreement 2) CBFM: ownership of LC of general land - main tool: Village Forest Reserve (VLFR) (Hausser et al., 2006) <u>Beekeeping Policy (1998)</u> • main tool: - Village Bee Reserves (VBR) - JFM with Beekeeping zone in National Forest Reserve (NFR) (Hausser et al., 2006)

Annex A7. Existence of national policies in examined countries; used for causal condition “NAPOL”.

Country	environmental policies	land policies	forest policies	CBNRM policies
Cameroon	1	0	1	1
Ethiopia	1	0	1	0
Ghana	0	0	1	0
Kenya	1	1	1	1
Mozambique	1	1	1	0
Namibia	1	1	1	1
South Africa	1	1	1	1
Tanzania	1	1	1	1

Annex A8. References causal conditions

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Annex B. National annual change rates *q* ($q=((A_2/A_1)^{(1/(t2-t1))})-1$) of examined countries (derived from FRA, 2010).

	annual change rate q		
Country	**1990-2000**	**2000-2005**	**2005-2010**
Cameroon	-0.94	-1.02	-1.07
Ethiopia	-0.97	-1.05	-1.11
Ghana	-1.99	-1.97	-2.19
Kenya	-0.35	-0.34	-0.31
Mozambique	-0.52	-0.54	-0.53
Namibia	-0.87	-0.94	-0.99
Tanzania	-1.02	-1.1	-1.16
South Africa	-0.1	-0.13	-0.05

ANNEX C. Information on case studies included in database.

Annex C1. Database with all case studies used for analysis in this study; Year= Year of establishment. FC 2009 [%] = Forest cover of total area in 2009 in percentage; MAN= Management plan; MON=Monitoring; CLE= Clear boundaries; LOC=Local organization, INT= International Organization, REG= local regulations; CAP= Capacity building; INC= Income; r= annual deforestation rate.

ID	Name CBFMA	Year	Area [ha]	FC 2009 [%]	Country	Tenure regime	MAN	MON	CLE	LOC	INT	REG	CAP	INC	r
BIM	Bimbia-Bonadikombo CF	2002	3760	99.20	CMR	NMan	0	1	0	1	1	0	0	0	-0.22
COD	Codevir CF	2002	4330	98.23	CMR	NMan	1	0	0	1	1	0	0	0	-0.50
COV	Covimof CF	2004	6071	97.59	CMR	NMan	0	0	0	1	1	0	1	1	-0.21
KON	Kongo CF	2000	3317	98.55	CMR	NMan	1	1	0	1	1	0	0	1	-0.21
MBO	Mboké CF	2001	3883	98.80	CMR	NMan	1	1	0	1	1	0	1	1	-0.19
MOA	Moangué-le-Bosque CF	2000	1677	97.32	CMR	NMan	0	0	0	1	0	0	0	1	-0.77
MKI	Mount Kilum-Ijim CF	1998	397	98.51	CMR	NMan	0	1	1	1	0	0	1	0	0.00
NGO	Ngola-Achip CF	2001	4150	98.07	CMR	NMan	1	0	0	1	1	0	0	1	-0.38
NZI	Nzienga-Mileme CF	2001	1442	99.42	CMR	NMan	1	1	0	1	0	0	0	0	-0.20
TIN	Tinto CF	2002	1256	99.44	CMR	NMan	1	0	0	1	1	0	0	0	0.00
BON	Bonga NFPA	1995	165948	98.70	ETH	NCoM	1	0	0	1	1	1	0	1	-0.17
DOD	Dodola-Adaba-Lajo NFPA	1995	136046	66.87	ETH	NCoM	0	0	0	1	1	1	1	0	-0.21
SIM	Simien NP World Heritage Site PFM	1997	13262	27.17	ETH	NCoM	1	0	0	0	1	0	0	1	-0.01
AFA	Afadjato Agumatsa Community NR	1999	2957	98.31	GHA	OMan	0	1	0	1	1	1	1	1	-0.24

ID	Name CBFMA	Year	Area [ha]	FC 2009 [%]	Country	Tenure regime	MAN	MON	CLE	LOC	INT	REG	CAP	INC	r
AMA	Amamsuri Conservation Area	2000	3461	94.96	GHA	OCoM	0	0	0	0	0	1	1	1	-2.24
BOA	Boabeng-Fiema Sanctuary	1990	15313	98.60	GHA	OCoM	0	0	0	1	1	1	1	1	-0.08
ESU	Esukawkaw FR (Anweam Sacred Grove)	1996	12471	99.07	GHA	OCoM	0	0	0	0	1	0	0	0	-0.31
GWI	Gwira-Banso JFM	1996	22166	72.49	GHA	OCoM	1	0	0	1	1	1	1	1	-1.66
MUR	Murugu-Mognori CREMA	2005	20832	98.89	GHA	OMan	1	1	1	1	1	1	1	1	-0.06
WEC	Wechiau Community Hippo Sanctuary	1998	18255	44.28	GHA	OMan	1	1	0	1	1	1	1	1	-0.06
YAZ	Yazori-Kaden CREMA	2005	40803	97.22	GHA	OMan	1	1	1	1	1	1	1	1	-0.04
ILN	Il Ngwesi Community Trust	1995	9497	24.88	KEN	OMan	1	1	0	0	0	0	1	1	-0.83
KAK	Kakamega FR	1999	18138	96.16	KEN	NCoM	1	1	0	1	1	0	1	1	-0.13
KBO	Kaya Bomu/Fimboni (Rabai Kayas)	1999	281	99.05	KEN	NCoM	1	0	1	1	1	1	0	0	-0.10
KDZ	Kaya Dzombo	1992	314	99.98	KEN	NCoM	0	1	0	0	1	0	0	0	-0.06
KGA	Kaya Gandini (Duruma Kayas)	1992	246	94.07	KEN	NCoM	1	0	1	1	1	1	0	0	-0.08
KGI	Kaya Giriama (Fungo)	1997	273	87.29	KEN	NCoM	1	0	1	1	1	1	0	0	-0.04
KJI	Kaya Jibana (FR)	1994	115	95.05	KEN	NCoM	1	0	1	1	1	1	0	0	-0.60

ID	Name CBFMA	Year	Area [ha]	FC 2009 [%]	Country	Tenure regime	MAN	MON	CLE	LOC	INT	REG	CAP	INC	r
KKA	Kaya Kauma	1997	104	87.84	KEN	NCoM	1	0	1	1	1	1	0	0	-0.06
KMT	Kaya Mtswakara (Duruma Kayas)	1997	257	85.80	KEN	NCoM	1	0	1	1	1	1	0	0	-0.07
KMU	Kaya Mudzimuvya (Rabai Kayas)	1998	214	97.49	KEN	NCoM	1	0	1	1	1	1	0	0	-0.15
KIE	Kikuyu Escarpment FR	1996	41578	94.58	KEN	NCoM	1	1	0	1	1	0	1	1	-0.12
LOW	Lower Tana Delta Conservation Trust	2004	52118	80.72	KEN	OMan	0	1	0	1	1	0	1	1	-0.67
MEL	Mount Elgon JFM	1999	60893	92.00	KEN	NCoM	1	0	0	0	0	0	1	1	-0.46
MKE	Mount Kenya JFM	1998	213642	95.58	KEN	NCoM	1	1	0	0	1	0	1	1	-0.12
MUK	Mukogodo FR	1967	31124	71.26	KEN	NMan	1	1	0	1	1	1	0	1	-0.26
OLK	Ol Kinyei CC	2005	3055	17.43	KEN	OMan	0	0	0	0	0	0	0	1	-0.09
OLA	Olare-Motorogi CC	2006	6388	13.35	KEN	OMan	0	0	0	0	0	0	0	1	-0.07
DER	Derre FR CoM	2001	158879	92.25	MOZ	NCoM	1	1	0	1	0	1	0	0	-0.53
GOB	Goba Conservancy	2000	202806	88.63	MOZ	OMan	0	0	0	1	0	0	0	0	-0.03
LIC	Licuati FR CoM	2001	14160	99.34	MOZ	NCoM	0	0	0	1	0	0	1	1	-0.18
LIM	Limpopo NP CoM	2001	1054356	79.23	MOZ	NCoM	1	0	0	1	1	0	1	1	-0.01
MAP	Maputo Special Reserve CoM	2006	104392	86.37	MOZ	NCoM	1	0	0	0	0	0	0	1	-0.07

ID	Name CBFMA	Year	Area [ha]	FC 2009 [%]	Country	Tenure regime	MAN	MON	CLE	LOC	INT	REG	CAP	INC	r
MAT	Matibane FR CoM	2000	10991	84.07	MOZ	NCoM	1	1	0	1	1	0	1	1	-0.20
MEC	Mecuburi JFM	1997	239460	94.48	MOZ	NCoM	1	1	0	1	0	0	0	0	-0.33
MOR	Moribane JFM	1997	16231	97.36	MOZ	NCoM	1	1	0	1	0	0	0	0	-1.14
NIA	Niassa Wildlife Reserve	2003	2285987	95.97	MOZ	NCoM	0	1	0	0	1	0	1	1	-0.04
QUI	Quirimbas NP CoM	2002	814660	91.69	MOZ	NCoM	1	1	0	1	1	1	1	1	-0.23
ZIN	Zinave NP	2001	391030	91.19	MOZ	NCoM	1	1	0	1	1	1	1	1	-0.03
BUK	Bukalo CF	2006	5249	25.65	NAM	NMan	1	1	1	1	0	1	1	0	-0.06
KWA	Kwandu CF	2006	21285	67.96	NAM	NMan	1	1	1	1	1	1	1	1	-0.08
LUB	Lubuta CF	2006	17205	63.94	NAM	NMan	1	1	1	1	0	1	1	0	-0.05
MAS	Masida CF	2006	19780	60.69	NAM	NMan	1	1	1	1	1	1	1	1	-0.02
OKO	Okongo CF	2006	76935	37.92	NAM	NMan	1	1	1	1	0	1	1	0	0.00
SIK	Sikanjabuka CF	2006	4200	19.03	NAM	NMan	1	1	1	1	0	1	1	0	-0.05
ADD	Addo-Elephant National Park	2005	125210	99.31	ZAF	NCoM	0	0	0	1	1	0	1	1	-0.01
MAD	Madikwe Game Reserve	1991	54535	37.88	ZAF	NCoM	0	0	0	0	0	0	1	0	0.00
MAH	Mahushe Shongwe Game Reserve	1996	1144	98.65	ZAF	NCoM	0	0	0	1	0	0	1	1	-0.01
NDU	Ndumo Game Reserve	2000	11917	99.38	ZAF	NCoM	0	0	0	0	0	0	1	0	-0.05
PAR	Parfuri Triangle in Kruger NP	1998	22522	99.71	ZAF	OCoM	1	0	1	1	1	0	0	1	-0.09

ID	Name CBFMA	Year	Area [ha]	FC 2009 [%]	Country	Tenure regime	MAN	MON	CLE	LOC	INT	REG	CAP	INC	r
PHI	Phinda Private Game Reserve	1993	16741	97.83	ZAF	NCoM	0	1	0	0	0	1	1	1	-0.01
PHO	Phongola Nature Reserve	2000	5351	93.67	ZAF	NCoM	1	0	0	0	0	0	1	0	-0.04
TSH	Tshanini CCA	1992	2759	99.23	ZAF	OMan	0	0	0	1	1	0	0	1	-0.03
USU	Usuthu Gorge CCA	2006	6217	98.48	ZAF	OMan	0	0	1	0	0	0	1	1	0.00
ANG	Angai VLFR	2001	142538	94.59	TZA	OMan	1	1	1	1	1	1	1	0	-0.04
DUR	Duru Haitemba Forest (VLFRs)	1994	33787	98.44	TZA	OMan	1	1	1	1	1	1	1	0	-0.14
HAN	Handei VLFR	1996	174	59.04	TZA	OMan	0	1	0	1	0	1	1	0	-0.11
HAH	Handeni Hill JFM	1999	562	15.42	TZA	NCoM	1	1	0	0	0	1	1	0	0.00
KIK	Kikole VLFR	2005	457	97.31	TZA	OMan	1	1	1	1	1	1	1	1	-0.08
KIS	Kisangi VLFR	1997	4070	93.83	TZA	OMan	1	1	1	1	1	1	1	1	-2.30
KWI	Kwizu JFM	1998	3002	51.50	TZA	NCoM	0	0	0	1	0	1	0	0	-0.05
MBU	Mbunju-Mvuleni VLFR	2003	2730	99.24	TZA	OMan	1	0	1	1	1	1	0	0	-0.68
NOU	Nou JFM	2001	30519	53.53	TZA	NCoM	1	1	0	1	1	0	1	0	-0.03
UFI	Ufiome JFM	2001	5436	99.67	TZA	NCoM	1	0	1	1	0	1	0	0	-0.04
WES	West Kilombero Scarp JFM	2002	192301	96.56	TZA	NCoM	1	0	0	1	0	1	0	0	-0.13

Annex C2. Sources for each case study used for the analyses.

Name CBFMA	ID	Sources
Addo-Elephant National Park	ADD	SANParks (n.d), Roe et al. (2009)
Afadjato Agumatsa Community Nature Reserve	AFA	Agyekwena (2009), Ekpe (2008), Ofori et al. (2014), Owusu & Ekpe (2011), Owusu (2009)
Amamsuri Conservation Area	AMA	Mensah et al. (2013), Microsfere (2013)
Angai VLFR	ANG	Mzui & Kaijage (n.d.)
Bimbia-Bonadikombo CF	BIM	Rufford Foundation (2014)
Boabeng-Fiema Sanctuary	BOA	Eshun & Tonto (2014), Saj et al. (2006), Saj et al. (2005)
Bonga NFPA	BON	Gobeze et al. (2009)
Bukalo CF	BUK	MAWF (2005), MAWF (2001), SAFLII (2006a)
Codevir CF	COD	Amsallem et al. (2003)
Covimof CF	COV	Beauchamp & Ingram (2011), Carrere (2007)
Derre FR CoM	DER	Nhantumbo et al. (2003), Sitoe & Tchaúque (2008)
Dodola-Adaba-Lajo NFPA	DOD	Amente (2006)
Duru Haitemba Forest (VLFRs)	DUR	Kajembe et al. (2005), Kajembe et al. (2002), Samuel (2007)
Esukawkaw FR (Anweam Sacred Grove)	ESU	Amoako-Atta (1998)
Goba Conservancy	GOB	Peace Parks Foundation (2009), Dlamini (2005), Lubombo EcoTrails (2010)
Gwira-Banso JFM	GWI	Appiah (2001), Arthur & Odoom (2003), Blay (2007)
Handei VLFR	HAN	Nussbaum et al. (2009); Woodcock et al. (2006), Zahubu, 2006
Handeni Hill JFM	HAH	Luoga (2003), Kajembe et al. (n.d.)
Il Ngwesi Community Trust	ILN	ICCA registry (2010a), NRT (n.d. b)
Kakamega FR	KAK	ICCA registry (2012), UNEP (2012a)
Kaya Bomu/Fimboni (Rabai Kayas)	KBO	Githitho(2003), Kibet & Nyamweru (2008), NMK (2008)
Kaya Dzombo	KDZ	BLI (2015a), Githitho (2003), ICCA Consortium (n.d.), Kibet & Nyamweru (2008), NMK (2008)
Kaya Gandini (Duruma Kayas)	KGA	Githitho(2003), Kibet & Nyamweru (2008), NMK (2008)
Kaya Giriama (Fungo)	KGI	Githitho(2003), Kibet & Nyamweru (2008), NMK (2008)

Kaya Jibana (FR)	KJI	Githitho(2003), Kibet & Nyamweru (2008), NMK (2008)
Kaya Kauma	KKU	Githitho(2003), Kibet & Nyamweru (2008), NMK (2008)
Kaya Mtswakara (Duruma Kayas)	KMT	Githitho(2003), Kibet & Nyamweru (2008), NMK (2008)
Kaya Mudzimuvya (Rabai Kayas)	KMU	Githitho(2003), Kibet & Nyamweru (2008), NMK (2008)
Kikole VLFR	KIK	MCDI (2013a), Village Government of Kikole (n.d.)
Kikuyu Escarpment FR	KIE	BLI (2015b), UNDP (2012e), UNEP (n.d.), WFN (2006)
Kisangi VLFR	KIS	MCDI (2013b)
Kongo CF	KON	Oyono et al. (2006)
Kwandu CF	KWA	MAWF (2005), MAWF (2003b), SAFLII (2006a), Schusser (2012)
Kwizu JFM	KWI	Kajembe (2004) in Banana et al. (2011), Kajembe et al. (2005)
Licuati FR CoM	LIC	Kanji et al. (n.d.), Sitoe & Tchaúque (2008)
Limpopo NP CoM	LIM	Peace Parks Foundation (2014)
Lower Tana Delta Conservation Trust	LOW	NRT (n.d. c)
Lubuta CF	LUB	MAWF (2005), MAWF (), SAFLII (2006b)
Madikwe Game Reserve	MAD	Roe & Jack (2001), Roe et al. (2000)
Mahushe Shongwe Game Reserve	MAH	Department of Environmental Affairs (2010), King (2007)
Maputo Special Reserve CoM	MAP	Peace Parks Foundation (2010)
Masida CF	MAS	MAWF (2005), MAWF (), SAFLII (2006a), Schusser (2012)
Matibane FR CoM	MAT	Dudley & Stolton (2012), Sitoe & Tchaúque (2008), TFCG (2007)
Mboké CF	MBO	Oyono et al. (2006)
Mbunju-Mvuleni VLFR	MBU	Duvail et al (2005), Rose & Mwambeso (2004)
Mecuburi JFM	MEC	Sitoe, A. & Maússe-Sitoe (2009), Sitoe & Tchaúque (2008), Sitoe et al. (2008)
Moangué-le-Bosque CF	MOA	Assembe Mvondo (2006)
Moribane JFM	MOR	Sitoe, A. & Maússe-Sitoe (2009), Sitoe & Tchaúque (2008)
Mount Elgon JFM	MEL	IIN (n.d.)
Mount Kenya JFM	MKE	KFS (2000), UNESCO (n.d.)
Mount Kilum-Ijim CF	MKI	Roe, D. (2014)
Mukogodo FR	MUK	IIN (n.d.), Swanson et al. (2006)
Murugu-Mognori CREMA	MUR	Bosu (n.d. a)
Ndumo Game Reserve	NDU	Peace Parks Foundation (2011)
Ngola-Achip CF	NGO	Assembe Mvondo (2006), Kenneth (2006)

Niassa Wildlife Reserve	NIA	Hance (2013), NCP (2013a), NCP (2013b)
Nou JFM	NOU	FARM -Africa (n.d.)
Nzienga-Mileme CF	NZI	Amsallem et al. (2003)
Okongo CF	OKO	MAWF (2005), MAWF (2000), SAFLII (2006a)
Ol Kinyei CC	OLK	MaasaiMara.com (n.d. b), Porini (2015), PP (2015)
Olare-Motorogi CC	OLA	MaasaiMara.com (n.d. c), Porini (2015)
Parfuri Triangle in Kruger National Park	PAR	Amend (2008), Steenkamp & Urh (2000), Stickler (n.d.)
Phinda Private Game Reserve	PHI	Zeppel (2006), Google (2015a)
Phongola Nature Reserve	PHO	LTCRA (2004), Peace Parks Foundation (2007)
Quirimbas NP CoM	QUI	MCDI (2013e), Ministry of Tourism (2004), Motta (2010), Soto (2007), WWF (2009)
Sikanjabuka CF	SIK	MAWF (2005), MAWF (2002), SAFLII (2006a)
Simien NP World Heritage Site PFM	SIM	Keiner (2000), SMNP & EWCA (2013)
Tinto CF	TIN	Minang (2003)
Tshanini CCA	TSH	Gaugris et al. (2012), Potgieter (2008)
Ufiome JFM	UFI	Ashkan Far (2011), Ericsson (2005)
Usuthu Gorge CCA	USU	Elephant Coast (2009), Hanekom (2009)
Wechiau Community Hippo Sanctuary	WEC	UNEP (2012b), Weighill (2013)
West Kilombero Scarp JFM	WES	Nielsen (2011)
Yazori-Kaden CREMA	YAZ	Bosu (n.d. a), Bosu (n.d. b)
Zinave NP	ZIN	Limpopo National Park (n.d.), Mansur & Zacarias (2003), Peace Parks Foundation (2014)

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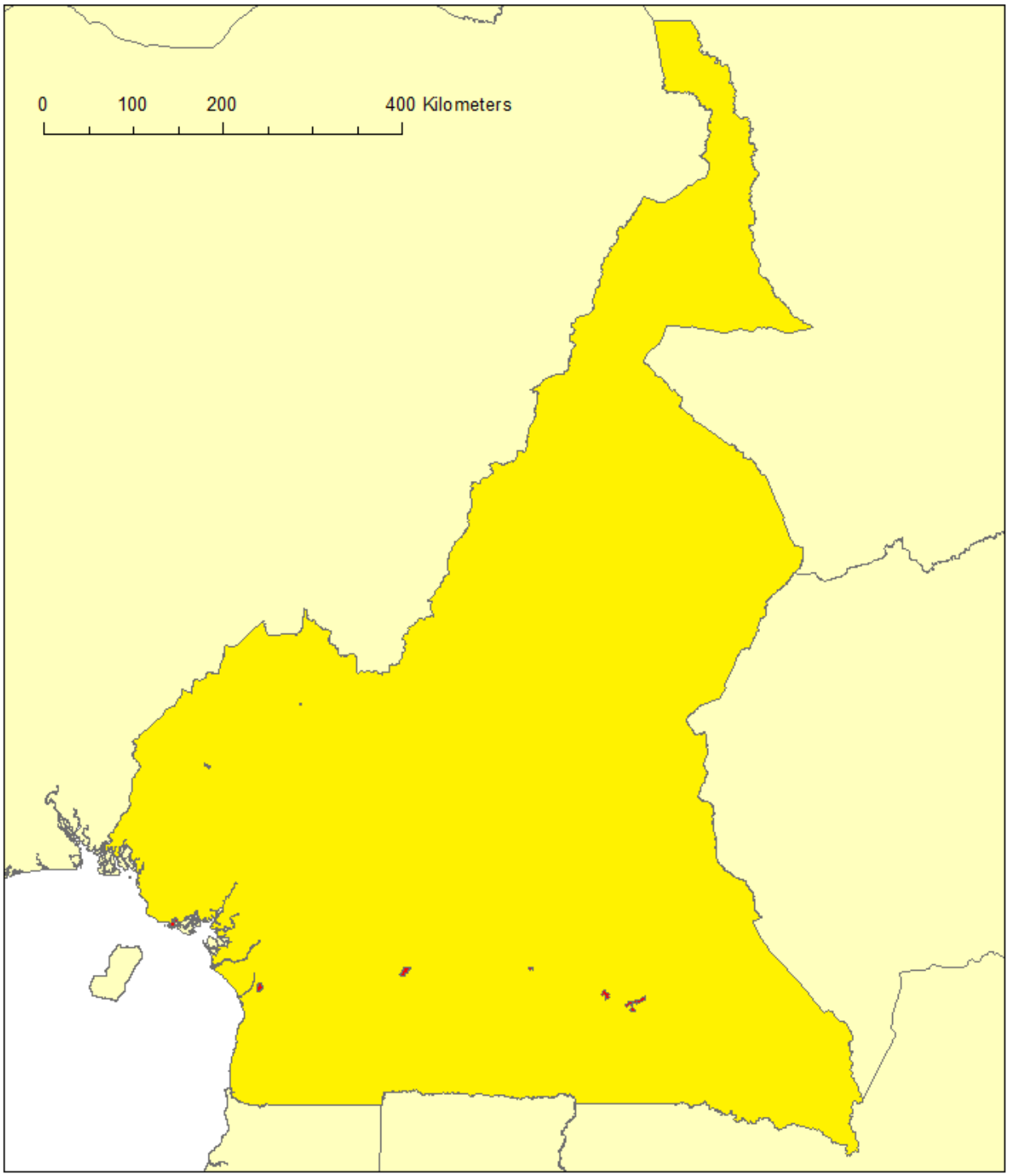
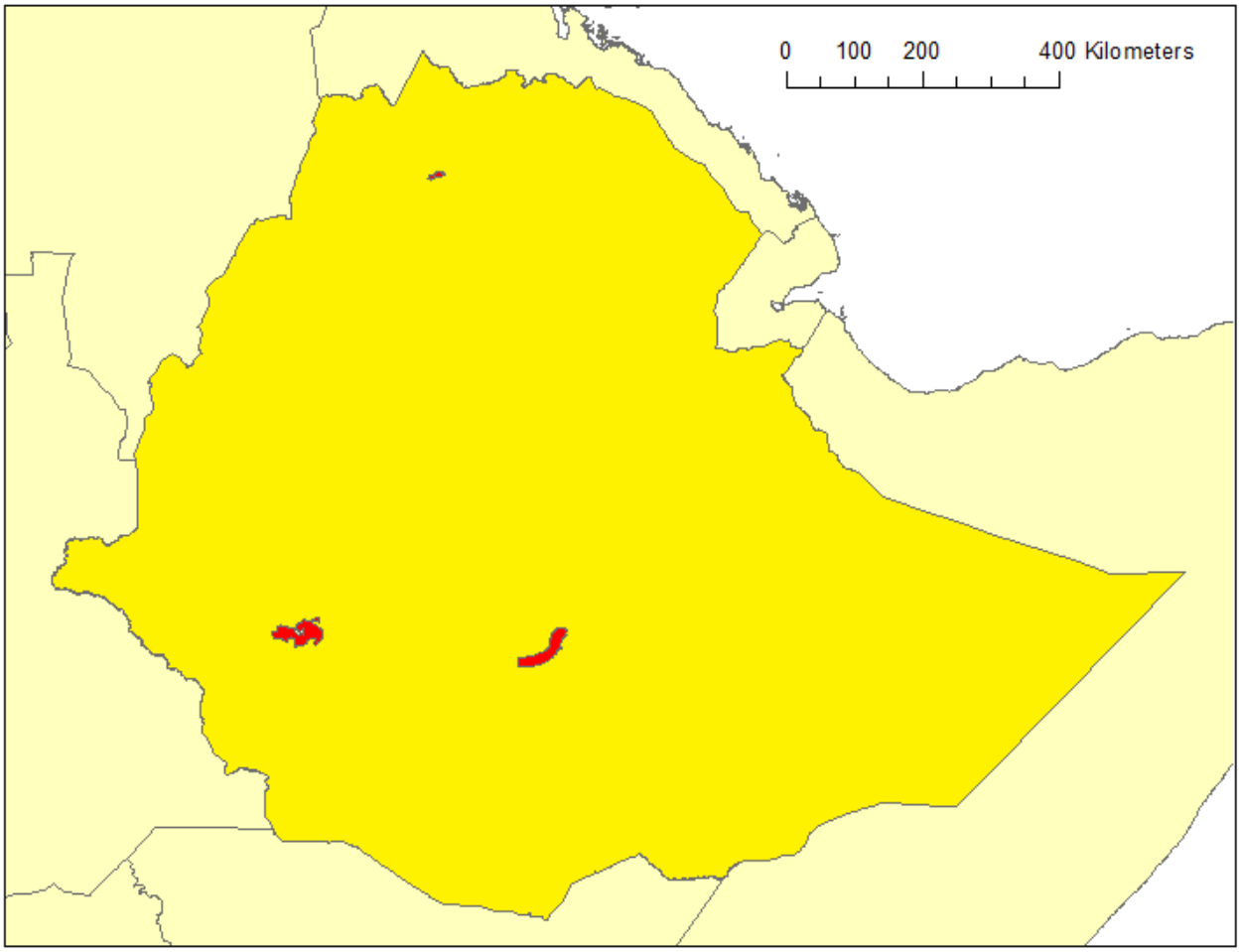
ANNEX D. Maps of all case studies per country.

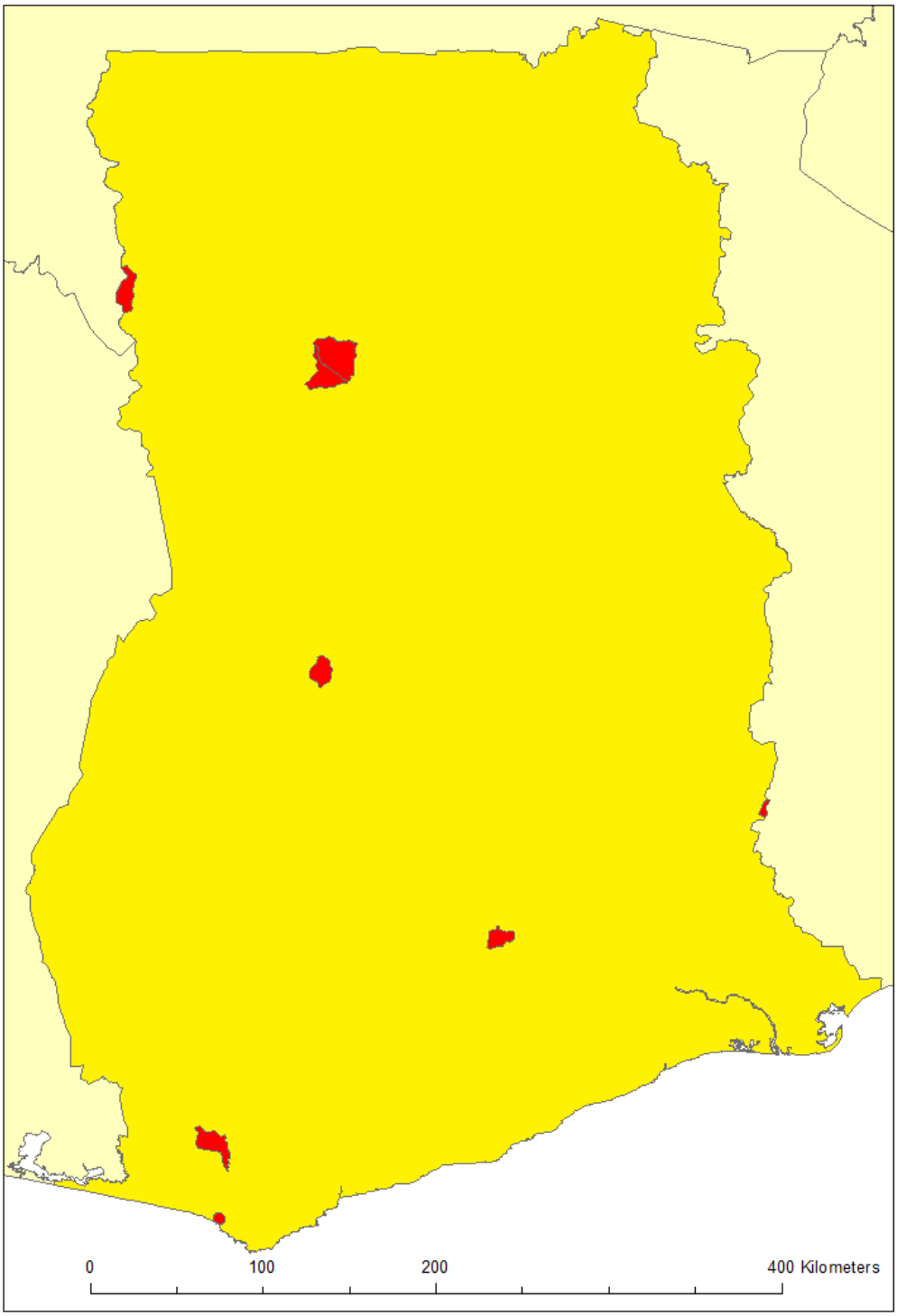
Annex D1. Map of Case studies in Cameroun; yellow= examined country, red= case studies.



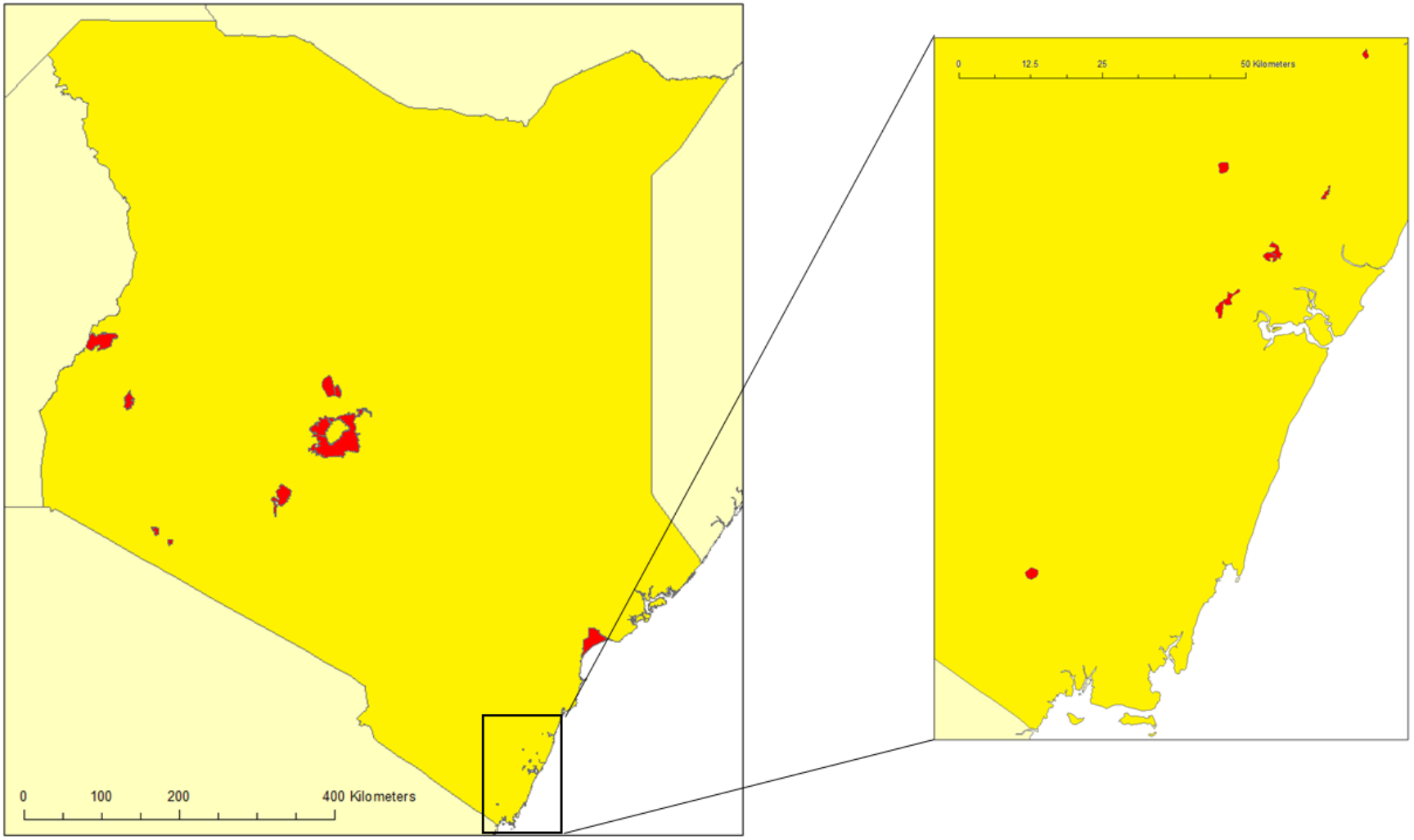
Annex D2. Map of Case studies in Ethiopia; yellow= examined country, red= case studies.



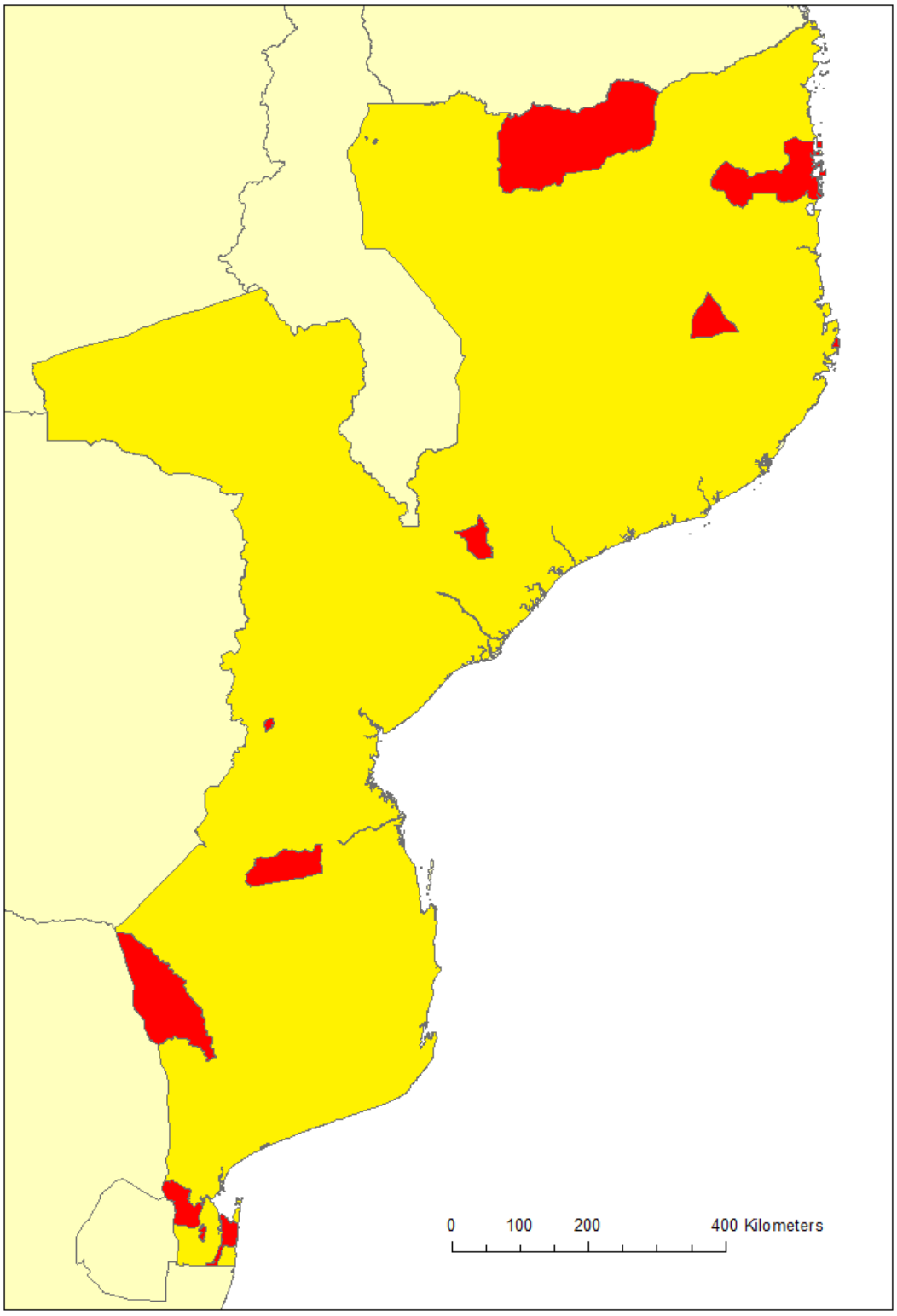
Annex D3. Map of Case studies in Ghana; yellow= examined country, red= case studies.



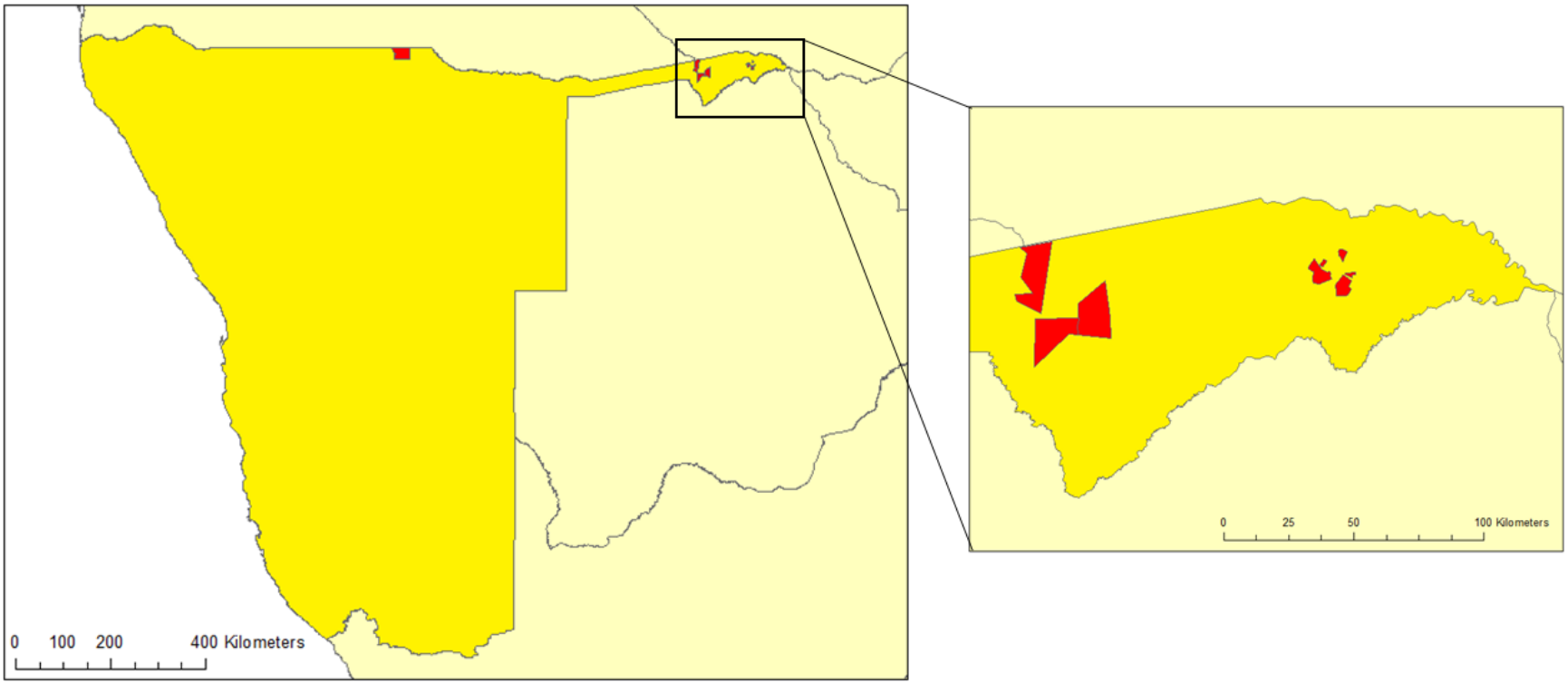
Annex D4. Map of Case studies in Kenya with close-up of small coastal CBFMAs; yellow= examined country, red= case studies.



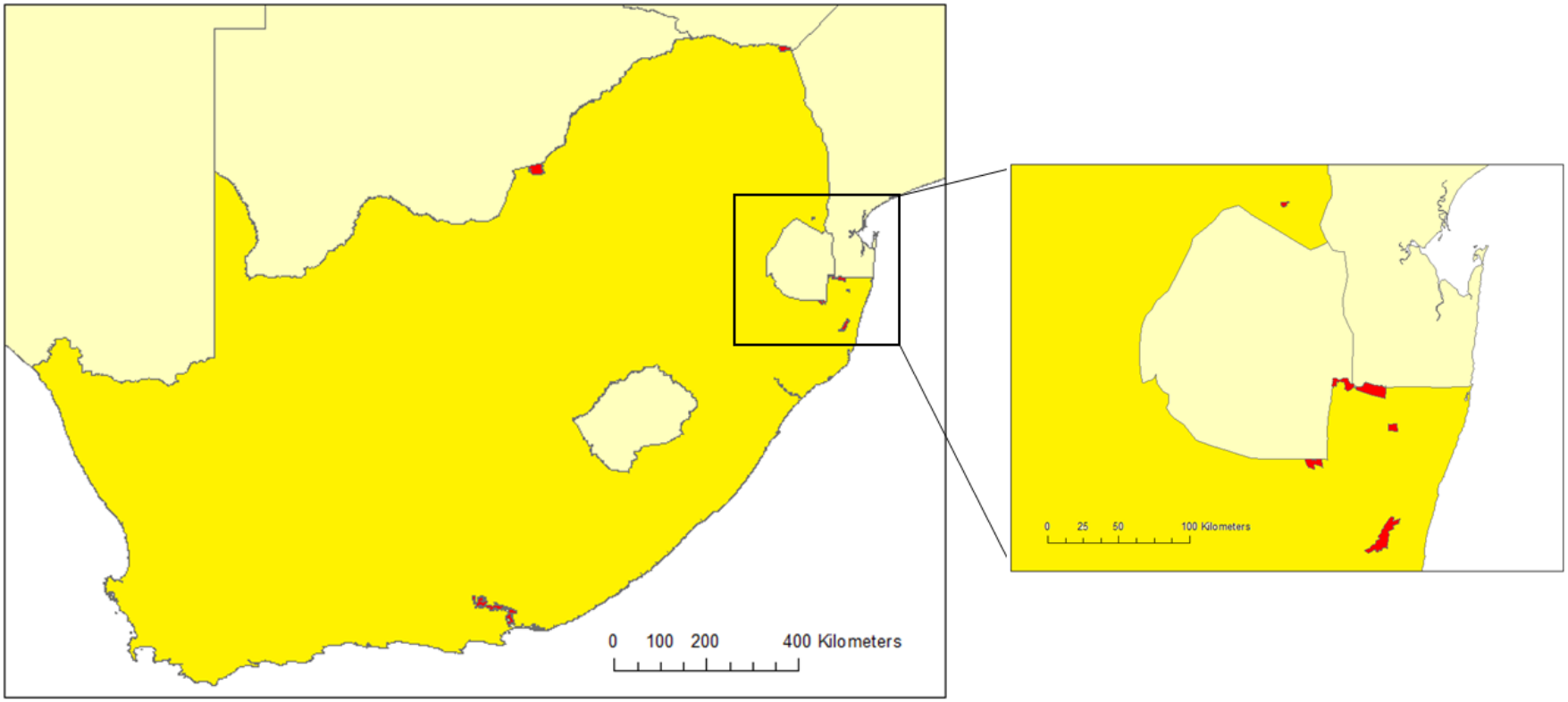
Annex D5. Map of Case studies in Mozambique; yellow= examined country, red= case studies.



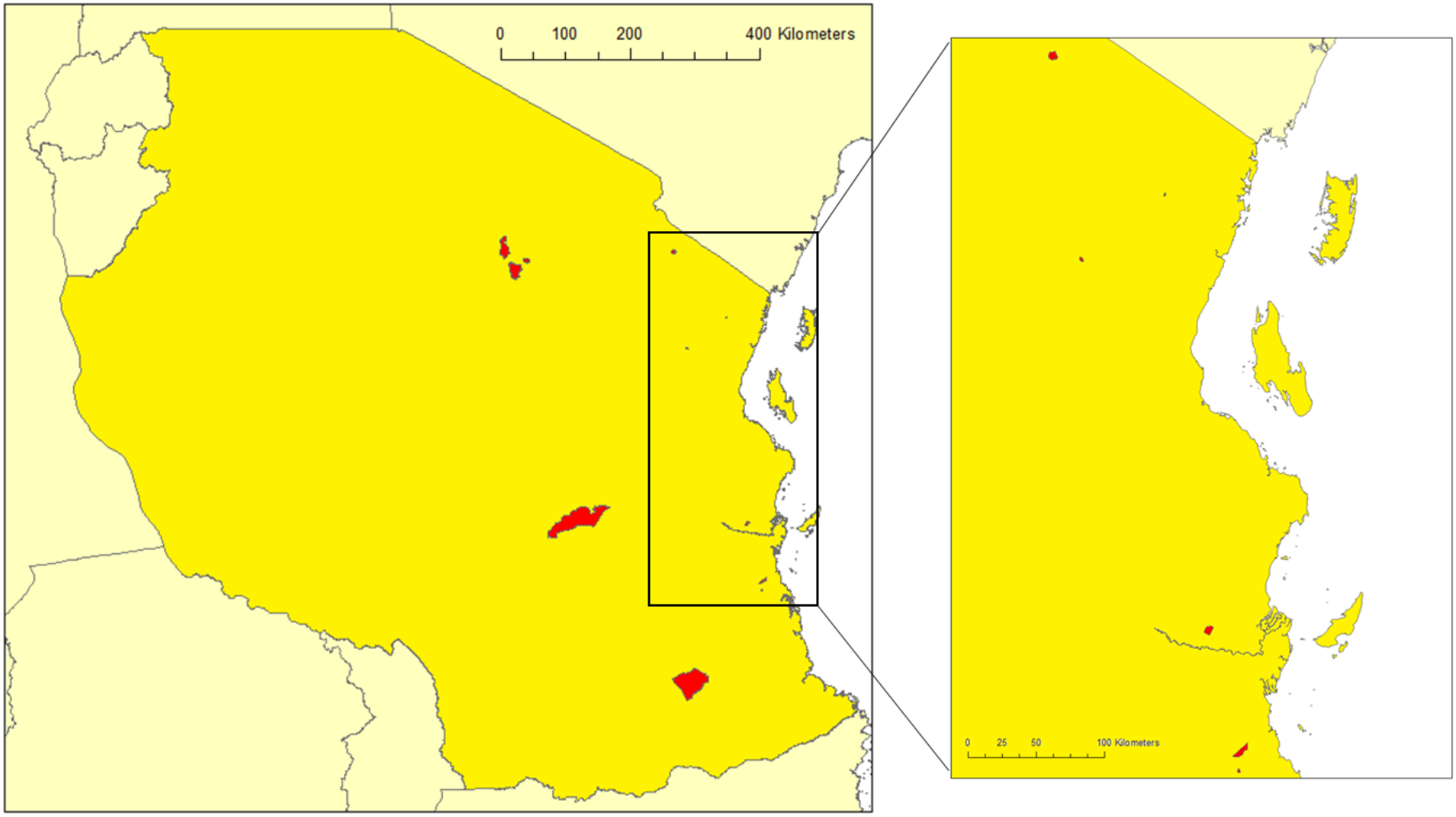
Annex D6. Map of Case studies in Namibia with close-up of small CBFMAs in the East of the country; yellow= examined country, red= case studies.



Annex D7. Map of Case studies in South Africa with close-up of small CBFMAs in the Northeast; yellow= examined country, red= case studies.

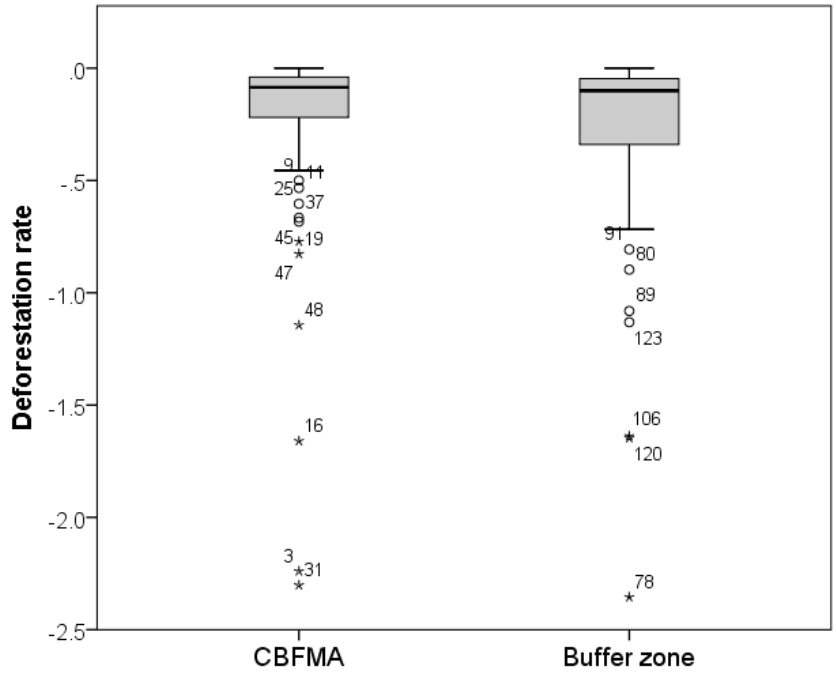


Annex D8. Map of Case studies in Tanzania with close-up of coastal CBFMAs; yellow= examined country, red= case studies.

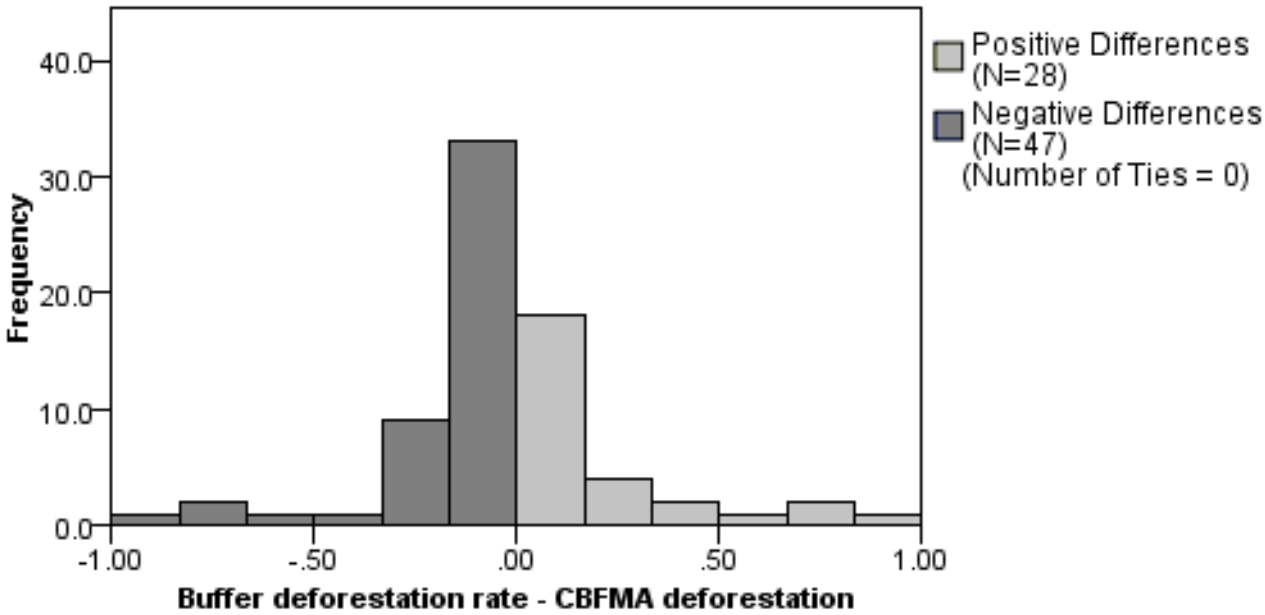


ANNEX E. Illustration of comparison of deforestation rates of CBFMAs and control group

Annex E1. Distribution of deforestation rate r for CBFMAs and the control group (= buffer zone of 5km); boxplot with mean rank.



Annex E2. Differences of deforestation rates between CBFMAs and the control group; negative difference=CBFMA had lower deforestation than its buffer zone; positive difference= CBFMA had higher deforestation than its buffer zone.



Annex F. National annual change rates from examined countries found by the FAO (FRA, 2010).

Countries	Mean	Standard Deviation	N	Mean Rank
TZA	-0,327	0,682	11	40,05
ZAF	-0,026	0,028	9	61,67
NAM	-0,044	0,029	6	54,17
CMR	-0,269	0,231	10	28,35
KEN	-0,230	0,248	17	30,65
MOZ	-0,256	0,335	11	35,00
GHA	-0,587	0,861	8	28,38
ETH	-0,132	0,106	3	37,67

Eidesstattliche Erklärung

Ich versichere hiermit, dass ich meine Masterarbeit

What makes Community-Based Forest Managed Areas (CBFMA) work?

A meta-analysis of the impact of tenure regimes and institutional and legal settings on the ecological effectiveness of CBFMA in Africa

selbstständig und ohne fremde Hilfe angefertigt habe. Von mir wurden keine anderen als die angegebenen Hilfsmittel benutzt. Ich habe alle von anderen Autoren wörtlich Übernommenen Stellen wie auch die sich an die Gedankengänge anderer Autoren eng anlehnenden Ausführungen meiner Arbeit besonders gekennzeichnet und verwendete veröffentlichte wie unveröffentlichte Quellen zitiert. Diese Arbeit hat in gleicher oder ähnlicher Form noch keiner anderen Prüfungsbehörde vorgelegen.

Sabine Schnichels Bayreuth, den 31.04.2015