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Forest certification as a policy option in conserving biodiversity: An empirical study of forest management in Tanzania

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ABSTRACT

Forest certification management standards aim at maintaining forest ecosystem integrity, including forest biodiversity conservation. However, studies from the Amazon and Congo basin find that forest certification may not protect forest biodiversity and ecosystems, and may therefore be unsustainable. This study evaluates the influence of forest certification on conserving biodiversity. Specifically, we (a) estimate tree (adult and seedling) species richness, diversity and density among different forest management regimes; (b) assess the relationship between environmental and human forest use variables, and species richness, diversity and density among the forest management regimes; and (c) assess the influence of forest governance of villages adjacent to the forests on tree (adult and seedling) species richness, diversity and density among the forest management regimes. This is achieved in a comparative study of Forest Stewardship Council certified community forests, non-certified open access forests, and non-certified state forest reserves in the Kilwa District in Tanzania.

Our results show that forest certification standards and implementation processes are positively related to biodiversity conservation. There are significantly higher tree (adults) species richness, diversity, and density in certified community forests than in open access forests and state forest reserves. These findings suggest that forest certification may be a good policy option to conserve biodiversity. The present study is one of the first studies in tropical Africa, which contributes to the limited data on the influence of forest certification on conserving biodiversity. Our results may also serve as baseline for further research on the contribution of certified forests in conserving biodiversity at both temporal and spatial scales.

1. Introduction

Tropical forests provide a variety of valuable ecosystem services, such as biodiversity, carbon sequestration, water cycling and scenic beauty (Gardner et al., 2009; Sasaki et al., 2011; Sell et al., 2007). They contribute to the long-term social and economic development goals of the people who depend on them (Sebukeera et al., 2005) to achieve the vision of green growth and sustainable economy (Muthoo, 2012). Tropical forests also play an important role in addressing the Millennium Development Goals, specifically in ensuring environmental sustainability (Sebukeera et al., 2005), including forest biodiversity conservation. Unfortunately, the capacity of tropical forests to provide these ecosystem services is reduced each year by deforestation (FAO, 2010), as well as by forest degradation due to uncontrolled human activities such as logging and forest fires (FAO, 2006; Sasaki et al., 2011). This results in habitat degradation and fragmentation, leading to the current rampant loss of forest biodiversity (Timonen et al., 2011). Human activities have changed ecosystems more rapidly and extensively than in any comparable period of time in human history, largely to meet rapidly growing demands for food, timber, fuelwood and fibre (Levy et al., 2005; Kindt et al., 2006). During the 21st century, a substantial and ongoing loss of forest biodiversity is projected to escalate (Alkemade et al., 2009; Kim et al., 2015) in the tropics (Mwase et al., 2007; Biggs et al., 2008), including Tanzania.

Forest resources in Tanzania have been managed by the state during and after the colonial eras (Burgess and Clarke, 2000). During these eras (colonial: 1880s–1961 and after independence: 1961–1990s), the state has undertaken a number of forest policy reform programmes, aiming at improving the management of natural resources (Burgess and Clarke, 2000; Zahabu et al., 2009; Petersen and Sandhövel, 2001). Most of these reforms have,

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however, not brought about the expected results (e.g. see Burgess and Clarke, 2000; Zahabu et al., 2009), as deforestation and forest degradation have escalated (Milledge et al., 2007). In combating this problem, the new Forest Policy was approved in 1998 and the Forest Act enacted in 2002. These led to the introduction of a communal forest management regime, whereby villagers have the mandate to set aside part of their village 'general land' forests as village land forest reserves under community-based forest management (CBFM). The CBFM aims at restoring degraded forests by controlling legal and illegal forest exploitation (URT, 1998).

In spite of the institutional and legal frameworks settled, and the aim of restoring degraded forests by controlling forest exploitation, illegal exploitation of forest resources in these areas has continued (Milledge et al., 2007). In response to escalating deforestation and forest degradation, particularly in the tropics, non-governmental bodies formed the Forest Stewardship Council (FSC) in 1993 (e.g. see Auld et al., 2008; Marx and Cuypers, 2010). The FSC is an international not-for-profit multi-stakeholder organisation for promoting responsible management of the world's forests (Karmann and Smith, 2009; FSC, 2015a), with the mission and goals of protecting forests for future generations (FSC, 2015b). The FSC forest management standards have ten principles and 70 criteria which provide details on how to manage forests responsibly (FSC, 2015a).

There are about 1400 village land forest reserves under CBFM in Tanzania (MNRT, 2008), of which a total of six were FSC-certified by the end of 2012. These communities are practicing CBFM through the application of FSC management standards (see Soil Association, 2009) under the coordination of a non-governmental organisation, Mpingo Conservation and Development Initiatives (MCDI). They apply the standards to reduce pressure on forest resources by creating alternative livelihoods to communities through selective logging (i.e. sustainable harvesting) for timber production (Ball, 2009, 2010), while maintaining forest ecosystem integrity, including forest biodiversity conservation (Karmann and Smith, 2009; Sheil et al., 2010). Studies from the Amazon and the Congo Basin, employing qualitative assessments, i.e. semi-structured interviews and meetings, and quantitative assessments, such as recording tree species seedlings, diversity, and logging damage, find that even limited logging affects forest biodiversity and ecosystems, and is therefore unsustainable (e.g. Ebeling and Yasué, 2009; Kukkonen et al., 2008; Poulsen and Clark, 2010; Medjibe et al., 2013). However, there is inadequate biological data on the effect of forest certification on biodiversity (see Tallis et al., 2011; Cubbage et al., 2010; Blackman et al., 2014; van Kuijk et al., 2009; Blackman and Rivera, 2010; Karmann and Smith, 2009; Sheil et al., 2010), particularly in Africa. Also, results from e.g. the Amazon and the Congo Basin forest environments may not apply to African Miombo forests. Thus, the lack of empirical evidence on the influence of certified forests on conserving forest biodiversity motivates this study, which attempts to answer the question: Is forest certification a policy option in conserving biodiversity?

To discern the influence of forest management intervention on forest biodiversity conservation among management regimes, we need to explore the effects of environmental and human forest use variables on species richness, diversity and density (see Hooper et al., 2005). Generally, easily accessible forests are more affected by human activities (Sassen and Sheil, 2013) depending on tree species (Ndangalasi et al., 2007); although effective forest management planning could reverse the situation (Ball, 2011). This study examines the relationships between human forest use indicator variables and forest biodiversity indicator variables to deduce the influence of forest certification. This is achieved by comparatively assessing biodiversity in FSC-certified community forests (FSC); non-FSC-certified open access forests (OCF); and non-FSC-certified state forest reserves (FRS) in the Kilwa District in Tanzania. Specifically, the study: (a) estimates tree (adults and seedlings) species richness, diversity and density among the forest management regimes; (b) assesses the relationship of environmental and human forest use variables with tree (adults and seedlings) species richness and diversity among the forest management regimes; and (c) assesses the influence of indicators of forest governance (e.g. rule compliance) of villages adjacent to the forests on tree (adults and seedlings) species richness, diversity and density among the forest management regimes.

The study acquires ecological data, used as forest biodiversity indicators, and socioeconomic data, used as human forest use indicators, to evaluate the performance of various forest management regimes. To collect and use such data, the study applies a mixed methods research design, i.e. integrated natural and social sciences research approaches (see Creswell, 2013; Lund et al., 2014). Specifically, the study focuses on the indicators of impacts, and on how to disentangle their effects from other confounding factors that may impact on forest biodiversity, and forest governance. This is made possible by triangulation through the use of multiple data sources and methods of analysis of the observations from the study.

2. Sites and methods

2.1. Study sites

The study was conducted in the Kilwa District in the Lindi Region in Tanzania. Six forests and four villages adjacent to these forests were chosen for this study (Fig. 1 and Table 1). The sites fall on the western part of Kilwa, and the study system is characterised by miombo woodlands with some patches of coastal forests, north Zambezian undifferentiated woodlands, and wooded grassland (Lillesø et al., 2014). Miombo woodlands are dominated by woody plants, primarily trees (Chidumayo and Gumbo, 2010), with high diversity and degree of endemism (Chidumayo et al., 2011; Chidumayo and Gumbo, 2010). They are dominated by species in the genera *Brachystegia*, *Julbernadia,* and *Combretum* of the *Caesalpinoideae* subfamily (Chidumayo and Gumbo, 2010; Frost, 1996). They are the most extensive tropical savannah woodland and dry forest formations in Africa (Campbell et al., 2007; Campbell, 1996), covering about 2.7 million km^2 of southern Africa including southern Tanzania (Chidumayo and Gumbo, 2010). Indicator miombo tree species, such as *Acacia polyacantha* Willd, *Lonchocarpus capassa* Rolfe, *Piliostigma thonningii* Schum, *and Xeroderris stuhlmannii* (Taub.) Mendonça & E.P. Sousa were observed in the study forests during fieldwork. Kikole and Kisangi forests are FSC-certified community forests under CBFM management regime, i.e. FSC-certified CBFM (Table 1). Likawage and Mchakama forests are village 'general land' forests under '*de facto*' open access management regime without certification (OCF), i.e. non-CBFM and non-FSC-certified forests. Mitarure and Rungo are forest reserves under state management without certification (FRS), i.e. non-FSC-certified state forest reserves (Table 1). In this study, 'open access' regime refers to a regime which is experiencing an ineffective enforcement of laws by the appropriators, resulting in '*de facto*' open access regime (see Milledge et al., 2007; Fennell, 2011).

All of the selected forests have undergone similar historical and management processes (e.g. see Ball, 2010; Burgess and Clarke, 2000), and they have almost similar biophysical and physiographic attributes (see Burgess and Clarke, 2000), i.e., they are located in the same agro-ecological zone and similar vegetation types (miombo woodlands biome) with similar range of soils, slope, elevation, and climatic factors (rainfall, temperature, humidity). They also have several tree species of economic importance, and they have a high tree species diversity (Howell et al., 2012; Backéus et al., 2006). However, these forests are heavily influenced by