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Sustaining protected areas: Identifying and controlling deforestation and forest degradation drivers in the Ankasa Conservation Area, Ghana

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ABSTRACT

Although protected areas in Africa contain possibly the highest repositories of carbon and thus can play a role in mitigating the effects of climate change through carbon sequestration, they are threatened due to increasing levels of deforestation and forest degradation (DFD). However, little information is available on the on-site causes of DFD in these areas. This paper estimates the levels of DFD and identifies the drivers in the Ankasa Conservation Area (ACA) in Ghana as a case study. A survey was used to identify both direct and underlying factors that promote the DFD. The extent of deforestation was estimated using satellite images. The survey data were analyzed using rankings and ordinal logistic regression techniques, while digital image classification and change detection were used to analyze land cover changes. The results show that DFD occurred at a higher rate in the periphery of the ACA compared to the core-protected and the farthest areas. Agricultural and wood harvesting activities were the main direct causes of DFD. Poverty and large in-migrations of people for cocoa farming were important underlying economic and population growth factors. To address these problems and enable ACA to contribute more to biodiversity conservation and climate change mitigation, the community resource management institutions should be fully adopted and strengthened and priority given to livelihood improvement and ecosystem services provision in the periphery of the ACA.

1. Introduction

Global climate change is a growing concern that has led to international negotiations under the United Nations Framework Convention on Climate Change (UNFCC) (Gorte, 2009). Climate change mitigation strategies aimed at addressing this concern have focused on reducing greenhouse gas (GHG) emissions. Estimates show that tropical deforestation and forest degradation emitted approximately 1–2 billion tons of carbon per year in the 1990s, which is equivalent to 15–25% of the annual global GHG emissions (Houghton, 2005). Because of the contribution of deforestation and forest degradation (DFD) to GHG emissions, reducing GHG emissions from DFD is among the most significant components of international strategies to mitigate climate change (Angelsen et al., 2009, 2012).

Although protected areas (PAs), by definition (IUCN, 1994), are established for biodiversity conservation rather than for climate change mitigation, they play an important role in carbon sequestration (Janishevski and Gidda, 2010). In addition to reducing deforestation within their boundaries (Campbell et al., 2008b; Clark et al., 2008; Naughton-Treves et al., 2005), PAs are found to store more carbon than their surroundings (Oliveira et al., 2007). However, the carbon storage and deforestation reduction potential of these PAs is increasingly eroded due to the effect of DFD occurring in and around them (Kelatwang and Garzuglia, 2006; Scharlemann et al., 2010). The extent of deforestation around these PAs appears to be a critical issue for the Reducing Emissions from Deforestation and Forest Degradation (REDD) initiative because PAs worldwide store approximately 15.2% of the terrestrial carbon stock and cover 12.2% of the Earth's land area (Brandon and Wells, 2009; Campbell et al., 2008a). In particular, in Africa, south of the Sahara desert, forest loss between 2000 and 2005, is higher in all PAs than in all forest areas (Brandon and Wells, 2009; Campbell et al., 2008a).

In Ghana, there are 21 PAs covering 1,347,600 ha, which is equivalent to 5.6% of the country's land surface (IUCN, 2010). These PAs include seven national parks, six resource reserves, two wildlife sanctuaries, one strict nature reserve and five coastal wetlands (Attuquayefio and Fobil, 2005; IUCN, 2010). Considering their size and above ground biomass (Mg ha^{-1}) of 275–400 compared to 125–225 in non-PAs (MLNR, 2012) it appears that these PAs have

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the potential to sequester large amounts of carbon. However, this potential is threatened due to the gradual increase in levels of DFD in and around them. These threats have arisen from poaching (illegal gathering of wild plants and animals), wildfire, farming and grazing (Bandoh, 2010; Förster, 2009; IUCN, 2010). Although there are several underlying reasons for this trend, inadequate support from law enforcement agencies, lack of funds for effective law enforcement, inaccessibility and the lack of buffer zones are reasons given by the management of PAs in Ghana (IUCN, 2010).

With the emergence of the REDD mechanism, which aims to provide compensation for tropical nations to reduce deforestation, there is a need for further investigation on the extent and the drivers of DFD in these PAs. Presently, there is little information available about the on-site causes of DFD in these PAs (Jachmann, 2008). This information must be made available for the effective redress of the DFD problems to sustain these PAs. However, studies assessing the levels of DFD in and around PAs rely largely on remote sensing techniques (Campbell et al., 2008a), which seldom include information on local communities' knowledge or socio-economic factors that indicate the bridge between the population and the PAs (Gibson et al., 1998; Naughton-Treves et al., 2005). The assessment of DFD in PAs without linkage to the people at the local level is not in conformity with the growing awareness among scholars that the actions of local communities greatly determine the success or failure of PAs management systems (Gibson et al., 1998).

IUCN (2010) recently assessed the management effectiveness of PAs in Ghana from the perspective of the official government authorities. Although there was little inclusion of the local communities' views and knowledge, common DFD problems related to specific sites were identified in seven national parks. In the IUCN (2010) assessment, the severity of common problems related to DFD, such as poaching and farming, varied by site. The current study seeks to fill these gaps in the estimation and analysis of the drivers of DFD in PAs using the Ankasa Conservation Area (ACA) in Ghana and the neighboring communities as a case study. The aim of the paper is to identify, estimate and analyze the drivers of DFD in the ACA. The study aims to (1) estimate the extent and importance of DFD in and around the ACA, focusing on the perspectives of the local residents and (2) identify the direct and underlying factors that promote DFD-related changes in and around this ACA to provide suggestions to ameliorate the situation. The following hypothesis is proposed for the estimation of the extent of DFD: there is greater exploitation of natural resources in the periphery (7 km radius zone around the outer boundary of the main/core-PA) than in the main/core-PA and the farthest areas (areas >7 km). This hypothesis assumes that this periphery still has some virgin lands favorable for cash (cocoa) crop farming compared to the farthest areas. It is worth noting that communities within this periphery have been organized into an association (Community Resource Management Area (CREMA)) to sustainably manage and use natural resources under the guidance of the official forest and wildlife managers.

2. DFD in protected areas: Background

Regarding the conservation of natural resources, wildlife and forest management in Ghana are two themes that have been slow in responding to paradigm shifts. The slowness of these themes appears to have been affected by the land and tree tenure policies, legislations and regulations of both colonial and post-colonial administrations of Ghana (Agbosu, 1983; Boni, 2006). Following an increase in the cocoa production, the colonial administration introduced a land tenure policy spelling out the rights of chiefs, farmers and government. This administration interpreted 'traditional' law in a way that gives land rights to chiefs and timber rights to logging firms (Boni, 2006). Natural resources conservation was not much an issue in both the colonial and post-colonial administrations as they granted timber rights to firms and chiefs sold the right of cultivation to immigrant farmers (Indigenous population acquired rights to farmlands free of charge by clearing the forest). Farmers became dissatisfied with the lack of benefits from the timber revenue and loggers dishonest in the tree harvesting, corrupting forestry officials in the process. These among others, sparked off the DFD in the country (FoE, 1992). To safeguard the forest and timber resources, government established forest reserves in the early decades of the 20th century under the Forest Ordinance, 1927-Cap 157 (Fairhead and Leach, 1998).

In Ghana, formal wildlife management began in 1901, after the 1900, London Convention required the Colonial Government in the country to ensure the sustainable exploitation and management of wildlife (Attuquayefio and Fobil, 2005). For a long time, forest and wildlife management in Ghana operated closely in line with the traditional paradigm of natural resource management, in which the local people have limited involvement in the management process (Terborgh et al., 2002). The paradigm has shifted from the traditional conservation of biodiversity toward the formation of partnerships between authorized bodies and development agencies, institutions and groups of local people (Naughton-Treves et al., 2005; Sunderland et al., 2008).

Unlike in Eastern Africa, community-based natural resource management models are less developed in Ghana (Roe et al., 2009). The emergence of these models in Western Africa began in the 1980s and 1990s following the introduction of decentralization policies (Roe et al., 2009). In relation to PAs, the important development that has occurred in Ghana is the World Bank-funded West Africa Pilot community-based natural resource and wildlife management project (Roe et al., 2009), which aims to introduce Community Resource Management Area (CREMA) projects. CREMA is a wildlife policy of Ghana that supports sustainable resource use outside PAs. The concept is based on the establishment of areas where wildlife management is integrated into the existing land use of the local people. Each established CREMA is provided with a certificate of devolution of management authority to operate (Braimah et al., 2009). The CREMA scheme, which began in 1999 in the Amokwao community in the ACA, has made some successes to date through increase in farmer knowledge, awareness of forest protection and slowing of rate of deforestation in the ACA. However, it is faced with many challenges. For example, although CREMAs have control over natural resources, they do not have control over the land and the commercial trees that occur naturally. Control of land and trees remains an important factor in land use change in PAs. In most areas, the traditional authorities (village chiefs) have overall administrative rights over community land and trees. Lands that are acquired on a rental basis must be continuously used, or they risk being taken over by the landowners for reallocation (Murphree, 2008). Such land use practices appear to be reversing the gains of CREMAs and hastening the DFD around these PAs including the ACA (Braimah et al., 2009; Damnyag et al., 2012).

3. Materials and methods

3.1. Study area

This study was conducted in communities around the Nini-Suhien National Park and Ankasa Game Production Reserve in Ghana, known as the Ankasa Conservation Area (ACA) (Fig. 1). The ACA is located in the Southwestern part of Ghana and lies in the three administrative districts of Jomoro, Ellembelle and Wassa Amenfi