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Community-based mangrove forest management: Implications for local livelihoods and coastal resource conservation along the Volta estuary catchment area of Ghana

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ABSTRACT

Even though global interest in mangrove research has increased in recent years, unveiling their immense ecological and economic roles, very little work has been done to investigate the primary driving factors motivating long-term community-based mangrove restoration and management on local scales. In Ghana, policy makers and coastal management practitioners have recently embraced the concept of community-based and co-management of coastal and marine resources. Community-based and co-management approaches require that key stakeholders, most notably the resource users themselves, play significant roles and responsibilities in the management process. However, there is little evaluation of the process in Ghana to assess the success or otherwise, particularly of the few and long standing examples of community-based approaches in coastal resource management. With special reference to an over two decade old community-based mangrove forestry programme along the Volta estuary of Ghana, this paper provides concepts for examination of the ecological and socioeconomic factors influencing mangrove restoration and management by fishers, fish mongers, farmers and their socioeconomic groupings. Participatory GIS mapping and the use of orthophotos generated for the period 1974–2011 provided additional information on temporal evolution of the extent of mangrove areas restored and managed by local stakeholders. Socioeconomic assessment of mangrove products utility was done through questionnaire interviews. The results indicate that livelihoods and economic benefits are the primary factors that motivate local stakeholders' participation in mangrove restoration and management. Mangroves provisioning services, markets and low livelihoods diversification are major drivers of mangrove resources exploitation. The study has shown that mangroves resources can be sustainably exploited, restored and managed if local customary rules are enforced and institutional arrangements put in place to mediate mangrove exploitation and regeneration rates. Such an approach if well developed, could promote coastal resources conservation with high economic returns for the users.

1. Introduction

Mangroves are highly productive biological habitats supporting multitudes of terrestrial and marine species (Nagelkerken et al., 2008). Due to their importance to local livelihoods, mangrove exploitation and utilization has been a long-standing activity in many coastal areas around the world with regeneration and restoration of mangrove habitats becoming important concepts for managing these areas in more recent decades. Mangroves are highly valuable as breeding and nursery habitats for juvenile and migratory marine fish species. These are important to subsistence fishers, who usually fish onshore since they cannot afford acquiring the more expensive offshore fishing gear (Kairo et al., 2009). Mangrove forests are responsible for producing as much as 600 kg of fish per hectare that can be caught in the nearby coastal ecosystems (Melana et al., 2000). Being central to coastal livelihoods, mangroves are increasingly utilized for wood products such as

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timber, poles, post, fuel wood and charcoal (Field, 1996; Bosire et al., 2008). Mangroves are important to humans for a variety of reasons, including aquaculture, agriculture, forestry, as a source of fire-wood and building material, alcohol, medicines, fodder and other local subsistence use (Spalding, 1998; Hogarth, 1999; Alongi, 2002; Walters et al., 2008). In addition, mangrove forests perform crucial ecological functions in coastal areas, including protection of coastal communities against natural hazards such as cyclones, tsunamis and shoreline erosion (Saenger, 2002; FAO, 2007).

Despite the foregoing functional importance of mangrove forests, the last few decades has witnessed rapid degradation of mangrove resources. Worldwide, loss of mangroves has been significant, although in some regions of the world mangroves still occur as very extensive forests (Nagelkerken et al., 2008). Recent estimate of 14.7 million ha coverage of mangrove forest ecosystems along tropical shorelines of the world (Kauffman and Donato, 2012) is a "remnant" of a decline from 19.8 million ha in 1980 and 15.9 million ha in 1990 which represent losses of about 2% per year between 1980 and 1990 and 1–2% annually since 1990 (Valiela et al., 2001; Alongi, 2002; Bosire et al., 2008). The global decline in mangrove habitats along with other estuarine and coastal ecosystems have been identified to affect at least three critical ecosystem services: the number of viable fisheries (33% decline); the provision of nursery habitats such as oyster reefs, seagrass beds, and wetlands (69% decline); and filtering and detoxification services provided by suspension feeders, submerged vegetation, and wetlands (63% decline) (Worm et al., 2006; Barbier et al., 2011). The processes leading to the degradation of these ecosystems are often mediated by multiple and complex factors with significant anthropogenic dimensions (Abuodha and Kairo, 2001). Human factors that impact coastal mangroves may be location specific or from sources that are external to communities fringing mangrove forests. Mangroves suffer from direct impacts such as cutting and other unsustainable harvesting practices, pollution, as well as from hidden impacts such as changes in inland freshwater management (Dahdouh-Guebas et al., 2005; UNEP, 2007), and are sometimes even regarded as unpleasant environments with little intrinsic value (Nagelkerken et al., 2008).

Nevertheless, as a result of increasing extreme natural events and risks of rising sea levels due to climate change (IPCC, 2014), several coastal nations have become increasingly involved in mangrove forest restoration for both livelihoods and amelioration of risks during such extreme natural events (ELAN, 2011). In some areas, mangrove restoration has been motivated by the knowledge of the protective services that these habitats provide (Walters, 2004; Millennium Ecosystem Assessment, 2005; Barbier et al., 2011).

Due to the past failings of several states in the management of natural resources, coupled with the increasing realization that local people can be empowered and effective management agents or as resource stewards; governments are no longer viewed as the sole or even primary stewards of forest and coastal resources in many parts of the world (Poffenberger and McGean, 1996; Walters, 2004). The notion of community-based management has increasingly been recognized by policy makers, resource managers and development partners, as a better alternative to the strict regulatory and exclusionary policies that were hitherto employed to counteract environmental degradation at the local level. Increasingly, policies and programs are being crafted with the intent of enlisting local people as partners in forest and coastal resources management as this is observed as eventually accomplishing both environmental conservation and development goals (Walters, 2004).

In Ghana, mangrove forests have been increasingly degraded as the country's population increase, for uses such as fishponds, saltpans, sugarcane production, clearing for building, fuel, fish processing and construction leading to the decline of habitat area from 181 km^2 in 1980 to 137 km^2 in 2006 (UNEP, 2007). Therefore, efforts by communities towards replanting and restoration of degraded mangrove habitats have been welcomed by government and promoted by nongovernmental organizations. However, along some communities near the Volta River estuary of Ghana, replanting of mangroves has been unsystematic and unable to match the rate of degradation and exploitation (Rubin et al., 1999) while in a few areas where there has been continuous replanting, the relative size of mangrove forest has been maintained (Tieku, 2010). Though these replanting initiatives have seen variable successes in the area, local communities' motivation for undertaking these projects has been unclear.

The type of motivation for community initiatives in mangrove replanting and restoration is viewed as an important factor in achieving environmental conservation goals (Field, 1998). In countries such as the Philippines, Thailand and Vietnam, studies have identified mixed results relative to the motivations for replanting and management of mangrove forests by local people. Wagner (2001) observed that the economic benefits that accrue to local people are a fundamental incentive in community-based restoration and management of mangrove forests. A study by Walters (2004) also identified that mangrove restoration and management initiatives in two areas in the Philippines were often more successful when evaluated with socioeconomic criteria but were less successful when assessed with environmental conservation objectives. In order to assess and understand the motivation and successes of mangrove habitat restoration, studies of long established local management systems are important (Walters, 2004).

This paper presents an assessment of the management practices of a community-based mangrove planters' association that has been involved in the management of mangrove ecosystems along the Volta River estuary in Ghana for over 20 years. The study explores the economic and ecological objectives that motivate mangrove restoration through interviews, and estimates the acreage of mangrove cover change resulting from the restoration exercise using participatory GIS mapping. The extent of success and potential sustainability of the association's approach to improving local livelihoods and conserving the mangrove forests along the Volta River estuary are also examined. The specific objectives of this study were to:

i. map temporal changes in mangrove cover along the Volta estuary
ii. analyse the evolution of livelihoods of communities fringing the estuary and the extent of dependence on mangrove resource
iii. examine the relative importance of socio-economic and ecological factors driving mangrove replanting
iv. estimate the economic benefits of mangrove wood harvesting
v. highlight the challenges and good practices of community-based approaches to coastal resource conservation in Ghana

2. Conceptual framework and review

2.1. Community-based mangrove forest management (CBMFM)

Community-based mangrove forest management can benefit local communities. Advocates have suggested that CBMFM can lead to local community empowerment, improved environmental governance and livelihood options, ecological, social and cultural benefits (Gan, 1995; Walters, 2004; ELAN, 2011). Ferrer and Nozawa