Forest Security Appraisal of Community Management Interventions against Threats of Forest Commons at Offinso North District in Ghana

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Abstract

The paper examines the viability of community forestry and how community participation affects the effectiveness of forest resource security and management. Both qualitative and quantitative techniques with stakeholders' observations and perceptions of managers' responses to major threats of forest commons were employed in this study. The paper establishes forest security through comparative analysis and discourse of solely government management intervention, solely community (private) management intervention and government-community partnership for forest management arrangements which are occurring in the Offinso Forest District of Ghana. The paper concludes that, community involvement in forest management interventions delivers better protection of forest commons; and the extent and autonomy of local community to participate actively in forest resource management significantly influences resilience against threats of forest commons. Hence, stronger community participation enhances the effectiveness of forest security efforts. Nevertheless, viability of community participation to deliver effective forest resource security is influenced by adequacy of resources in support of community forestry, empowerment and sense of ownership of communities for forest common management.

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Introduction

In many African countries, environmental management has been the responsibility of national or state governments, whereas people living close to such resources are neglected in its management (Ribot and Larson, 2005; Leach et al., 1999). In the mid-1970s however, the notion that local people have a role to play in the planning and management of their surrounding environment began to gain prominence in development literature. Following this, policy-makers, environmental scientists and some development practitioners have for almost half a century been advocating for and applying community forestry through a decentralized natural resource management arrangement as an appropriate means of environmental protection and sustainability in the forest resource sub-sector (Anderson, 2006).

Decentralization defined as the transfer of power and resources from central governing body to its local institutions and actors, has remained a major program of Ghana government for forest resource sub-sector management (Ribot and Larson, 2005). Globally, decentralized forestry has received growing attention in natural resource management in recent times as the most appropriate means for promoting environmental sustainability (Ahwoi, 2010; Ayee, 2000). Deforestation to some degree has been blamed on centralization of forest management in the post-colonial era (Agrawal and Gibson, 1999; Kidane-Mariam, 2003; Leach et al., 1999; Wagner and Cobbinah, 1993). Hence, community forestry which has been a strategy for decentralized forest management is driven by the assumption that, it partly but significantly reduces abuse or threats facing natural resources and at the same time supports the livelihoods and wellbeing of local people (Dorm-Adzobu et al., 1991; Oteng-Kufuor, 2004).

In Ghana, community forestry arrangements through decentralization policy reforms have taken place through a number of forestry interventions such as the Modified Taungya System (MTS) and the Private Afforestation Developers' Organisation (PADO) which in many cases co-exist with solely government forest management arrangements. These decentralized forest management interventions

have been implemented for more than two decades in the High Forest Zone of Ghana and for over ten years in the Offinso Forest District (OFD) chosen for this study. Hence, it was necessary to assess whether community participation in practice delivers the expected protection of forest commons against threats and disturbances within the local arena. We therefore chose community participatory (MTS and PADO) forestry and solely government owned forestry interventions as cases to study the nature of forestry reforms made in the Offinso forest zone of Ghana; and to investigate whether and how community participation strengthens or weakens resilience against major threats of forest commons in the Offinso Forest District as a guide for forest management policy recommendations.

Conceptualization and background of community forestry: review of related literature

As a development concept, decentralization has gained global recognition particularly in developing countries due to its association with grassroots participation in political, economic and social activities as well as its presumed connotation with democratic governance and effective service delivery to vast number of local areas (Okidi and Guloba, 2006).

Similarly, natural resource management theory and practice have shifted significantly in recent decades. In many countries, environmental management has been within the realm of national or state governments. Nevertheless, the potential of forests for poverty reduction and mitigation of climate change has stimulated a demand within the international political community and civil societies for better forest management that is sustainable and can provide both social and environmental benefits (Leach et al., 1999). These arguments for better forest management have centered partly on the transfer of skills and resources for natural resource management from the state, regional and local authorities to forest-dependent communities to enable them play a key role in forest management and at the same time derive benefits from the forest commons they manage. These views have collectively informed the endorsement of community forestry as a means to ensure effective management of forest commons in many countries. Community forestry differently referred to as decentralized forestry,

participatory forest management, community-based forest management, community-based forestry or collaborative management is perceived as an effort to incorporate local communities into the guardianship of their immediate forest environment in an attempt to meet ecological and social goals at both local and global scales (Agrawal and Gibson, 1999). Similarly, community forestry was originally defined by FAO (1978) as any situation which intimately involves local people in a forestry activity. Participation of local people in forest management in this regard may be for commercial and/or non-commercial purposes and may take the forms of either 'sole management' with full local communities' control of forest management, or 'co-management' where management responsibility is shared with government, a national park, or some other official bodies (McDermott and Schreckenberg 2009; Pokorny et al., 2008). Fisher et al. (2005) notes that, participation of local people in forest management is also characterized by the right to forest resources utilization by local people on an individual or household basis and may eventually evolve to include rationales for improving conservation, increasing biodiversity, and reducing rural poverty.

Community forestry first became a part of the international development cooperation in the late 1970s to address deforestation, fuel-wood crisis, and the resultant negative impacts on livelihoods (Nurse and Malla, 2005). Initially focused on woodlots and on-farm tree planting, it slowly began to include the management of existing forests and woodlands, especially in tropical dry forest areas such as parts of Sahelian, Eastern and Southern Africa and in the degraded forestlands of Nepal. Since then, participation of local people in forest management has been an integral element of development strategies. The evolution of community forestry in Nepal for example which dates back to the late 1970s was first introduced as an attempt to improve the management of forest resources and address environmental issues that were of great concern following the country's failing centralized forest policy. During the 1970s, erosion protection, local forest product supply and the generation of rural incomes were the dominant goals. However, these objectives and related approaches have changed

over the years. In the 1980s, an important shift towards promoting natural forest management occurred to achieve development and forest conservation objectives. Since the 1990s, community forestry support initiatives have explicitly focused on both poverty alleviation and forest conservation, with emphasis on legal and regulatory reforms, local capacity building, and small and medium enterprise development. Some of the earliest examples of community forestry came from Asia, where they grew out of social forestry efforts that began in the 1970s (Arnold, 1992; Glasmeier and Farrigan, 2005; Pardo, 1995).

Within the rural settings of most countries located in the tropical forest regions including Nepal, Indonesia, Korea, Brazil, India and some African countries, community forestry has been employed as a rural development strategy for poverty reduction, sustainable forest management and climate change adaptation and mitigation measure towards securing socio-economic benefits for local communities. Generally, community forestry is conservation-focused, and its basic aim is to keep the forest safe from damage or deterioration because of illegal farming, bush burning, invasive species, forest under-growth and illegal logging. This specific focus of community forestry is, and should remain at the local level, where local people come together to manage and utilize local natural resources in ways that blend multiple dimensions of community and ecological well-being (Adjei, 2012). This promotes awareness of forest management issues, identifies opportunities to enhance livelihoods, builds the capacity of civil society organisations, contributes to building consensus on controversial issues and gives voice to local communities in forestry decisions and benefit-sharing. The theoretical assumptions of forest and local livelihood security and sustainability associated with community forestry require empirical verification. For example, from their study in Thailand, Kijtewachakul et al. (2004) have argued that, community-managed forests which provided resources for local needs were as biologically diverse, even more so in some cases, than similar areas managed for conservation by state-run (centralized) agencies. However, whether and how community

participation guarantees effective security against threats of forest commons has not been systematically examined in many African countries including Ghana, which necessitated this study. We sought to fill this knowledge gap following a comparative case study design using three different forest management arrangements namely the solely government managed forests controlled by the District Forest Service Division (DFSD); solely community (private) managed forests by the Private Afforestation Development Organization (PADO); and co-managed forest arrangement between government and the community in the form of partnership for benefit-sharing under the Modified Taungya System (MTS) which are all occurring at the Offinso Forest District of Ghana. Emphasis was on community and officials' perceptions, experiences and observations of how and why these different forest management arrangements are affected by major threats of forest commons and managers' responses to such disturbances towards ensuring forest resource security and sustainability in the Offinso Forest District of Ghana. The following section provides detailed description of the three forest management arrangements employed for the forest security appraisal in the study area.

Context and case description and analysis

In Ghana, decentralized strategies have remained major programs of government where the local institutions and actors are involved. Under these strategies, decentralization has been employed as a tool for community participation and development. Hitherto, the exclusionist approaches to resource management especially in forest reserves prohibited local people from accessing and utilizing natural resources they relied upon for livelihood such as fuel-wood for cooking (Oteng-Kufuor, 2004). Hence, deforestation and high incidence of poverty in forest-fringe communities, to some degree, have been blamed on centralization of forest management in the post-colonial era (Kidane-Mariam, 2003; Leach et al., 1999; Wagner and Cobbinah, 1993). As a result, the government of Ghana, in 1996, launched the Forestry and Wildlife Master Plan to reverse deforestation between 1996 and 2020 that was estimated at 65000 (ha) per annum (Forestry Commission, 2011). These informed forest

management policy reforms that resulted in the introduction of community forestry interventions including the Modified Taungya System (MTS) of forest management, the Private Afforestation Developers' Organization (PADO) forest management scheme, and the Participatory Forest Resource Management Project (PAFORM).

In 1999, the Forestry Commission of Ghana was established as a corporate body to integrate the activities of all the public agencies that were previously individually responsible for the management and regulation of forest and wildlife resources utilization. At the local level, the District Assemblies are given statutory responsibility to harness human and natural resources including forest resources for the development of districts. Thus, districts complement the efforts of the District Forestry Office to protect and manage forest reserves and benefit directly from revenues generated from the reserves. Due to this, the Offinso Forest District of Ghana has over a decade witnessed different forest management arrangements including forest reserves solely managed by government and under the sole control of District Forest Service Division (DFDS) as well as community forestry interventions including the MTS and PADO forest management schemes which were employed to verify the effectiveness of community participation in forest security against major threats of forest commons in the Offinso Forest District of Ghana.

One of the three cases employed for this study is the Private Afforestation Developers' Organization (PADO) forest plantations management scheme. PADO is an association of individuals and households of forest-fringe communities committed to the development of forest plantations in their respective communities. The members are generally located in the Ashanti, Bono East, Ahafo and Volta regions of Ghana which are areas best known for sustainable forest plantations in Ghana. Members of PADO are sole owners and managers of their plantations established within their communities. PADO was formed at the high forest zones of Ghana with the main aim of bringing together these community forest plantation developers to spearhead private afforestation development in Ghana. The organization subscribes to the ideals of green global policy towards ensuring sound

environmental management in a sustainable manner. This subscription is achieved through planting and management of trees on large scale to ensure environmental greening and curb deforestation in a way that the effects of climate change on the environment and livelihoods of inhabitants of forest-fringe communities can be reduced. In this regard, the management system of these community forest owners has specific values, ideals and codes of conduct that guide its operations. These set of values, ideals and conducts bind all members in their management practices in their respective local communities.

The second case employed for this study is the Modified Taungya System (MTS). The MTS is a co-management intervention between government, represented by the Forestry Commission (FC) through the District Forest Service Division (DFSD) and forest-fringe community members. The MTS represents a partnership for forest plantation restoration in degraded forest reserves in the forest zones of Ghana. The MTS is an agro-forestry intervention whereby participating community members receive parcels of degraded forestlands from DFSDs to produce food crops and at the same time help to re-establish and maintain forest plantations (Abugre et al., 2010; Agyeman et al., 2003; FC, 2011). With the MTS, participating community members cultivate food crops and plant trees on the forestland received from the FC representing government, and continue to manage tree plantations into maturity after harvesting their food crops. In this way, the local people support the re-establishment of forest plantations in degraded portions of protected forestlands and co-manage the forest resources with the support of the District Forest Service Division (DFSD). The MTS Forest plantations are established under an agreement between the local authorities on behalf of the local people, and the Forestry Commission (FC) in which roles and benefit-sharing are specified. Through the MTS, the FC aims to promote effective local representation in forest management and benefit-sharing. The MTS Forest management scheme represented another case used in this study.

The third case used in this study as a control intervention for the forest security appraisal comprised forest reserves in the forest-fringe communities which are solely owned by government and managed solely by the FC through the DFSD on behalf of government.

Observation of the quality of forest plantations established through the above forest management arrangements together with stakeholders' perceptions of responses to major forest threats of the above three forest management interventions, were employed to examine the effectiveness of community participation in the management of forest commons. The chosen cases were ideal for this study considering their uniqueness in terms of levels of local people's participation in their management, and considering that all three different management arrangements are observed in the study area.

Site description

The Offinso North District Assembly was established by LI 1856 and inaugurated on 29 February 2008. It was carved out of the former Offinso District Assembly, now Offinso Municipal Assembly. It is one of the District Assemblies in the Ashanti Region and has its capital as Akomadan. The district lies between longitudes 2° 10'W to the west: 1° 30'W to the east and latitudes 7° 30' N to the north: 6° 50'N to the south. The total land area is about 945.9 square kilometers. It shares boundaries with Techiman Municipal Assembly in the North, Sunyani Municipal Assembly in the West, Ejura Sekyedumasi District Assembly in the East and Offinso Municipal Assembly in the South; Nkoranza South District Assembly in the Northeast, Wenchi District Assembly in the Northwest, and Tano North and South District Assemblies in the Southwest. The Trans-West-African Highway from Accra to Ouagadougou traverses the District, thus, making it the main gateway to the Ashanti Region from the northern part of the country.

The District lies in the semi-equatorial climatic zone and experiences double maxima rainfall regime. The major rainfall season starts from April to June, whilst the minor period starts from September

and ends in October. The mean annual rainfall ranges between 125cm and 180cm. The dry season is quite pronounced and occurs between the months of November and March. Relative humidity is generally high ranging between 75-80 percent in the rainy season and 70-72 percent in the dry season. A maximum temperature of 30º C is experienced between March and April.

The Offinso North District Assembly lies in the moist semi-deciduous forest zone, which is interspersed with thick vegetation cover. However, there is an emergence of guinea savannah and this is most prevalent in areas such as Afrancho, Akomadan, Nkenkaasu and Nsenoa. The District has four forest reserves namely, the Afram Headwaters Forest Reserve (189.90sq. km), the Afrensu-Brohoma Forest Reserve (89.06sq km), the Mankrang Forest Reserve (92.49sq km), and the Opro River Forest Reserve (103.60sq km). The common tree species in the reserves include odum, mahogany, and wawa. These tree species have immense economic value as they are used for lumbering purposes, fuel-wood and medicine. Figure 1 shows the location of the study area in national context.

Figure 1: Map of the forest reserves in the Offinso Forest District
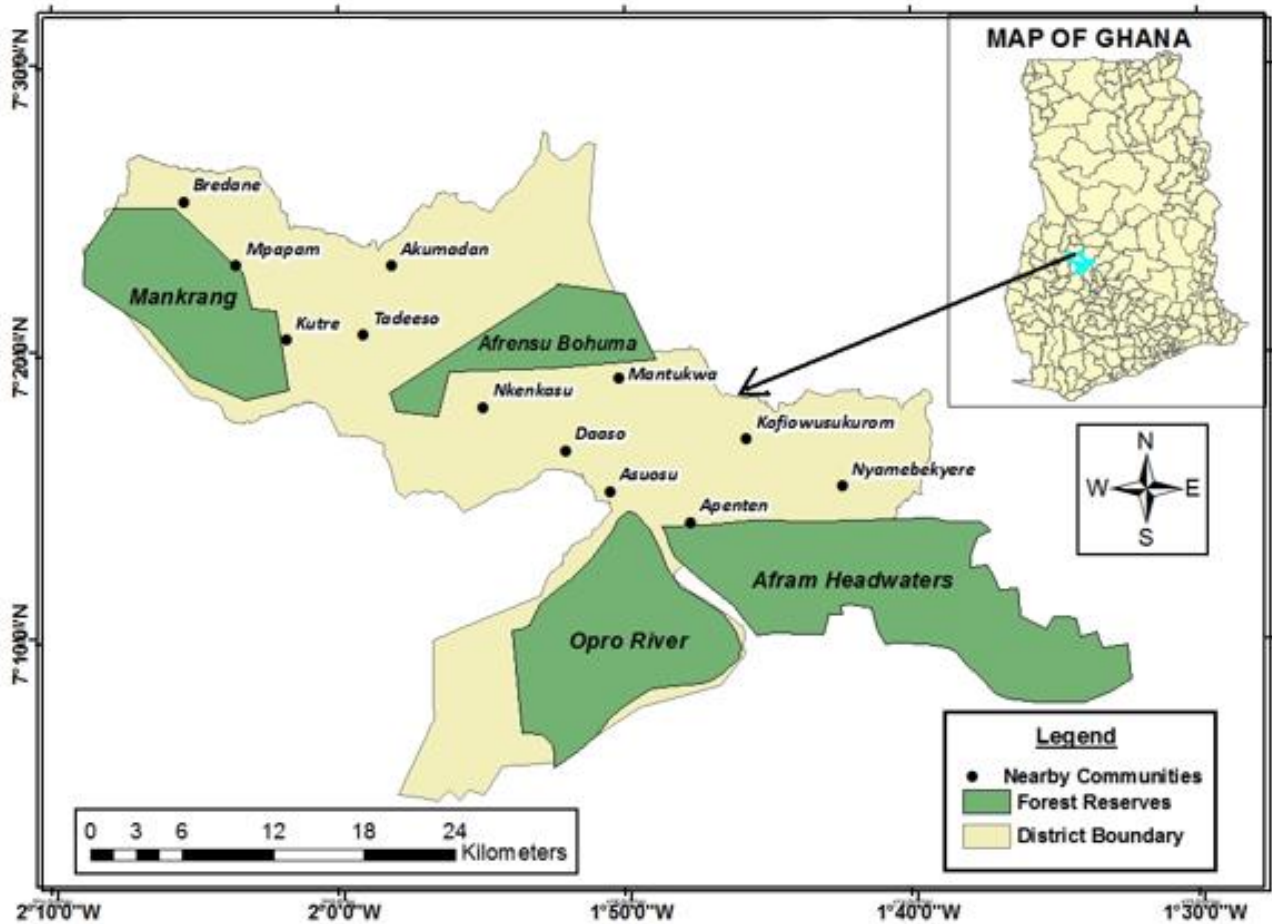
Source: Authors' construct (2022)

The selection of the forest-dependent communities from the Offinso Forest District was due to their experiences of all the three forest management interventions chosen for the study which then provided appropriate cases for appraisal and comparative analysis of the different forest management arrangements including the community forestry interventions.

Research methodology

We carried out this comparative analysis using three different forest management arrangements namely government forests managed solely by the District Forest Service Division (DFSD); solely community (private) forests managed by the Private Afforestation Developers' Organization
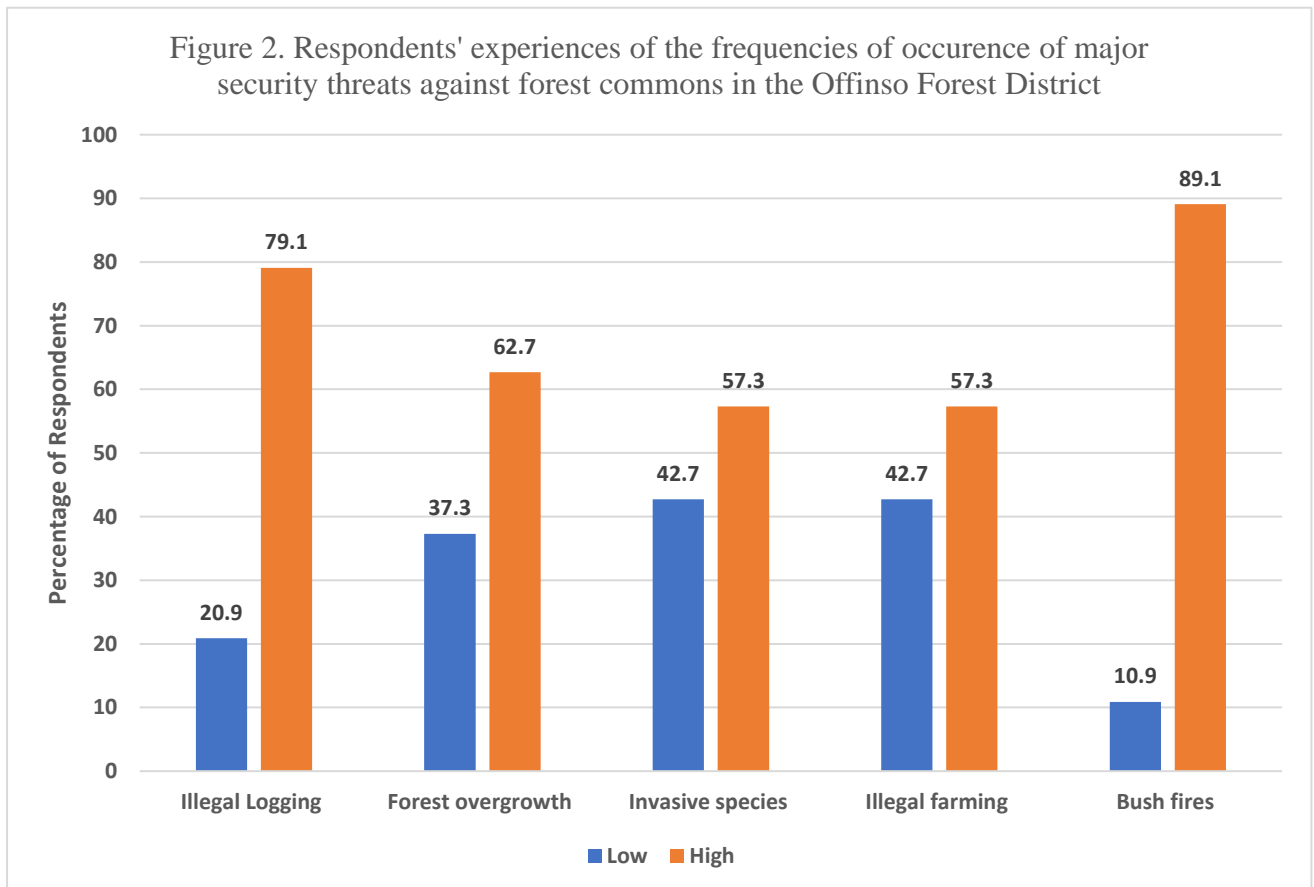
(PADO); and government-community partnership for forest management arrangement under the Modified Taungya System (MTS) which are all taking place in the Offinso Forest District of Ghana. Emphasis was on stakeholders' perceptions and observations of what the common threats affecting the various forest plantations under the various forest management schemes were, and how and why these different forest management arrangements respond to such major threats of forest commons in the study areas towards ensuring forest resource security and sustainability in the Offinso Forest District of Ghana.

Four forest-fringe communities were selected for data collection, and analyses following both qualitative and quantitative techniques have been done. These communities were chosen as study sites due to their significant experience in the practice of solely government owned forest plantation, as well as the MTS and PADO forest plantations under the Community Forest Management Projects. In all the selected communities, the management interventions have run for over a decade. Data collection was done using focus group discussions, observation, interview guide and questionnaire administration. The study adopted a multi-stage sampling technique. Purposive sampling was employed for the selection of the study district and communities as well as ten official respondents comprising project (forestry) officers drawn from the staff of the District Forest Service Division (DFSD), Taungya and PADO headmen, Taungya and PADO Management committee (Executive) members and traditional authorities serving as local representatives. Snowball sampling was adopted for the selection of 98 local respondents. The 98 local respondents consisted of eight forest guards working for the DFSD, 60 Modified Taungya Group (MOTAG) farmers, and 30 PADO farmers within the communities. Quantitative data collected were organised and analysed using descriptive statistics with the help of the SPSS version 20.0. Transcription of focus group discussion, vignettes, and direct quotations were employed for analysing the qualitative data. Descriptive statistics supported with Chi-square tests were used for the quantitative analysis.

Results and Discussion

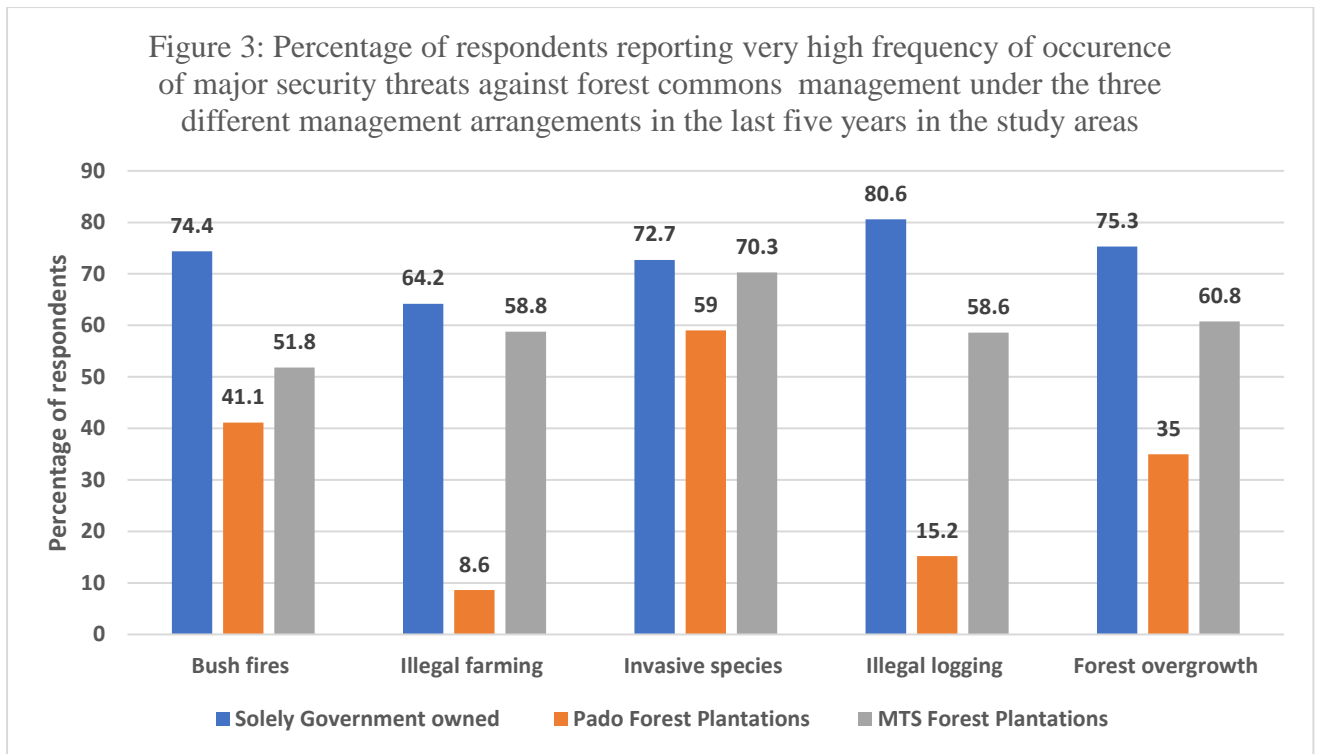*Major threats of forest commons in the Offinso Forest District*

This study revealed that, in the Offinso Forest District in general and the forest-dependent communities in particular, bushfires, illegal logging, forest overgrowth, invasive species and illegal farming constitute the five most common forest threats. These were highlighted by over 50 percent of the respondents as being the highly prevalent threats affecting the various forest plantations and reserves under the three different management arrangements in the study area as shown in Figure 2.

Figure 2. Respondents' experiences of the frequencies of occurence of major security threats against forest commons in the Offinso Forest District
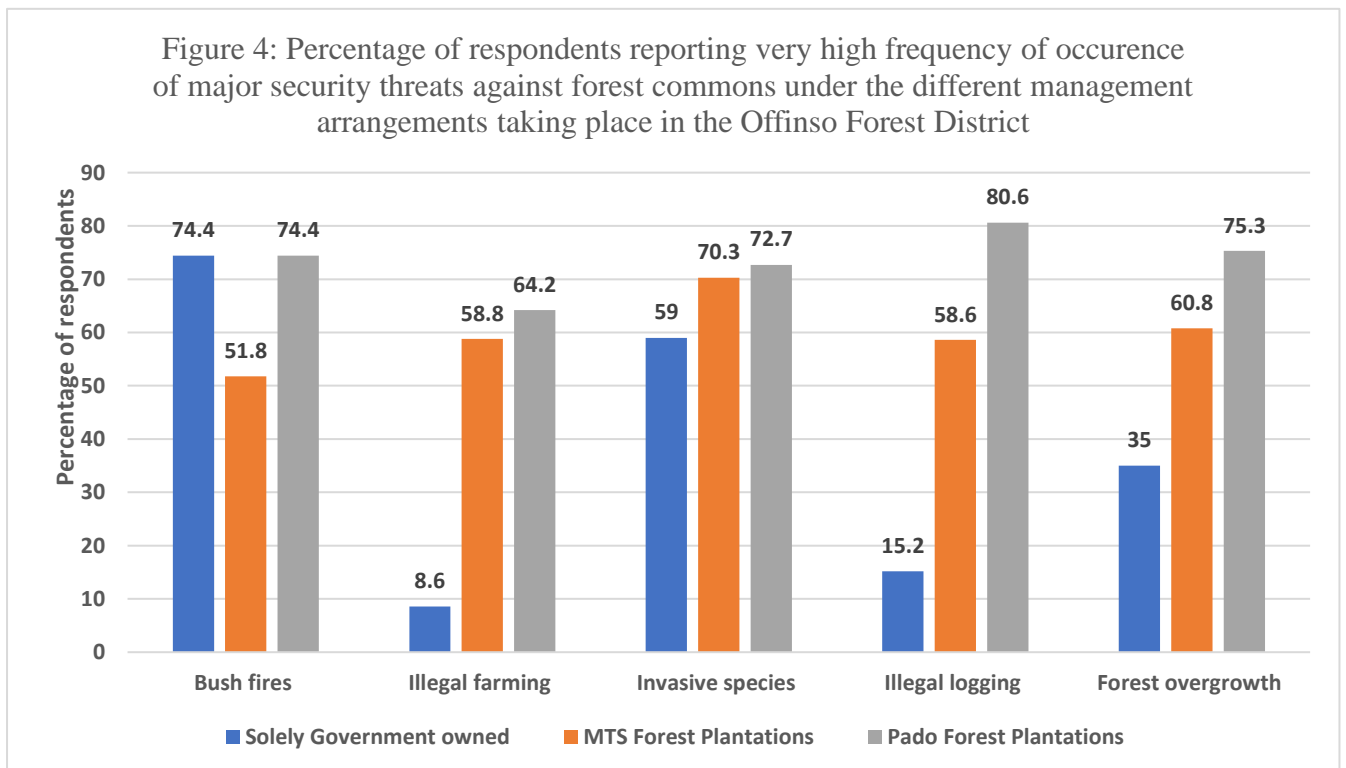
Source: Field Survey, 2017

It was further found that, forest reserves and plantations under solely government management arrangement with no formal community engagement and mandate to oversee their security were relatively highly vulnerable and frequently and severely affected by all the five major forest threats.

On the frequency of occurrence of major security threats against forest commons under the different management arrangements, 80.6 percent, 15.2 percent and 58.6 percent of the total respondents respectively reported that illegal logging was highly prevalent in the solely government managed, solely community managed (PADO) and government-community partnership (MTS) arrangements. Further, in the case of bush fires, 74.4 percent, 41.1 percent and 51.8 percent of the total respondents reported very high frequency of its occurrence in solely government managed forest plantations, PADO forest plantations and MTS forest plantations respectively; whereas 64.2 percent, 8.6 percent and 58.8 percent of the total respondents reported that the frequency of occurrence of illegal farming respectively in the solely government managed forest plantations, solely community managed (PADO) plantations and government-community partnership (MTS) arrangements is very high. With regard to the frequency of occurrence of forest overgrowth, out of the total respondents, 75.3 percent reported it was very high in the solely government managed forest commons, 35.0 percent reported it was very high in the solely community managed (PADO) forest plantations and 60.8 percent reported it was very high in the MTS forest plantations; whereas 72.7 percent, 59 percent and 70.3 percent of the respondents reported invasive species were very high respectively in the solely government managed forest commons, solely community managed (PADO) forest plantations and the MTS forest plantations. Details of these results are shown in Figures 3 and 4.

Figure 3: Percentage of respondents reporting very high frequency of occurence of major security threats against forest commons management under the three different management arrangements in the last five years in the study areas

Source: Field Survey, 2017

Figure 4: Percentage of respondents reporting very high frequency of occurence of major security threats against forest commons under the different management arrangements taking place in the Offinso Forest District

Source: Field Survey, 2017

As indicated in Table 1, in the case of solely government management strategy, bushfire is the most severe threat with a mean of 2.63, followed by illegal logging with a mean of 2.65, invasive species with 3.21 mean and forest overgrowth having a mean severity of 3.23. The threat with the least severity facing solely government managed forest is illegal farming with a mean severity of 3.28. Bushfires and illegal logging are major forest degradation drivers. Having high rate of severity and frequency in the solely government owned forest means its managers' ability or capacity to protect the resource is low.

Table 1: Kendall's ranking of the severity of forest threat in the various forest management strategies

Threat	Government forests		Community (Private) forests		MTS forests	
	Mean	Rank	Mean	Rank	Mean	Rank
Bushfires	2.63	1st	2.53	2nd	2.99	2nd
Illegal farming	3.28	5th	3.62	5th	3.24	4th
Illegal logging	2.65	2nd	3.56	4th	2.85	1st
Invasive species	3.21	3rd	2.43	1st	2.85	1st
Forest overgrowth	3.23	4th	2.86	3rd	3.06	3rd
N	95		95		96	
Kendall's W	0.060		0.165		0.013	
Chi-Square	22.67		62.74		5.157	
Df	4		4		4	
Asymp. Sig.	0.000		0.000		0.272	

Source: Field Survey, 2017

With regard to the PADO forest plantations, the threat with the highest severity is invasive species with a mean of 2.43 and bushfires being the next with a mean of 2.53. This is followed by forest overgrowth (2.86) and illegal logging (3.56). The threat with the least severity is illegal farming with a mean of 3.62. The threat with the highest severity in MTS plantations is illegal logging and invasive species with the same mean of 2.85. Followed by bushfires (2.99) and then forest overgrowth with a mean of 3.06. The threat with the least severity is illegal farming.

It was seen that bushfires, illegal logging and invasive species form the major threats hindering forest security and sustainability in the study communities. Bushfires and illegal logging cause a relatively

higher rate of forest degradation and these being high in the solely government owned forest management strategy indicates that arrangement is offered least protection as compared to the PADO and MTS forest management arrangements. The MTS forest management strategies also have less potential to secure forest commons against disturbances compared to the PADO. MTS plantations have illegal logging being highly severe in addition to bushfires and invasive species. This implies that, the rate of degradation in the MTS forests is higher than that of the PADO, making the PADO intervention the most appropriate forest management arrangement for forest protection at least against major forest security threats in the Offinso Forest District.

Responses to Forest Security Threats

The assessment of respondents' perceptions on forest threats in the various forest management strategies based on a three point Likert scale ranging from 'immediate response to threats, delayed response, to no response', revealed that, benefits derived from arrangements involving the local community serve as major factor influencing people's immediate response to forest threats.

Generally, the study revealed that, managers' responses to threats that confront PADO forest were much quicker, followed by that of the MTS forests, and then the solely government owned forest. This was found to be because of the high sense of community ownership attached to PADO forests than the MTS and solely government owned forest.

With regard to the PADO forests, a significantly higher percentage (above 90 percent) of respondents noted that forest threats affecting PADO forests very often receive immediate response compared to the MTS and solely government owned forest reserves.

Table 2: Percentage responses to forest threats in the various forest management arrangements

| FOREST STRATEGIES (n =90)	RESPONSE (%)		
	Immediate	Delayed	No Response
PADO			
Illegal logging	94	4.5	1.5
Forest overgrowth	97.1	0	2.9
Invasion species	95.6	1.5	2.9
Illegal farming	92.5	0.8	6.7
Bushfires	94.3	2.9	2.8
Collaborative/MTS			
Illegal logging	69.4	18.1	12.5
Forest overgrowth	35.9	32.8	31.3
Invasion species	64.3	21.4	12.9
Illegal farming	56.9	26.2	15.4
Bushfires	85.1	6.8	4.6
Solely government			
Illegal logging	55.1	13.1	43.5
Forest overgrowth	7.5	19.4	73.1
Invasion species	20.6	17.6	61.8
Illegal farming	29.1	30.6	40.3
Bushfires	61.8	7.1	30.0

Source: Field Survey, 2017

From Table 2, response to forest threats through the collaborative (MTS) forest management arrangement is sometimes immediate but often delayed whereas response to threats in solely government owned forest is most times delayed or denied.

An assessment of local people's participation in the management strategies indicated that inadequate access to land by the local people has led to higher participation in the MTS (collaborative) forestry than the PADO forestry. As shown in Figure 5, the forest management strategy that has the highest number of local participation is the collaborative intervention, which has 60 percent, followed by PADO with 23.6 percent.

Figure 5: Local people's participation in the various forest management strategies
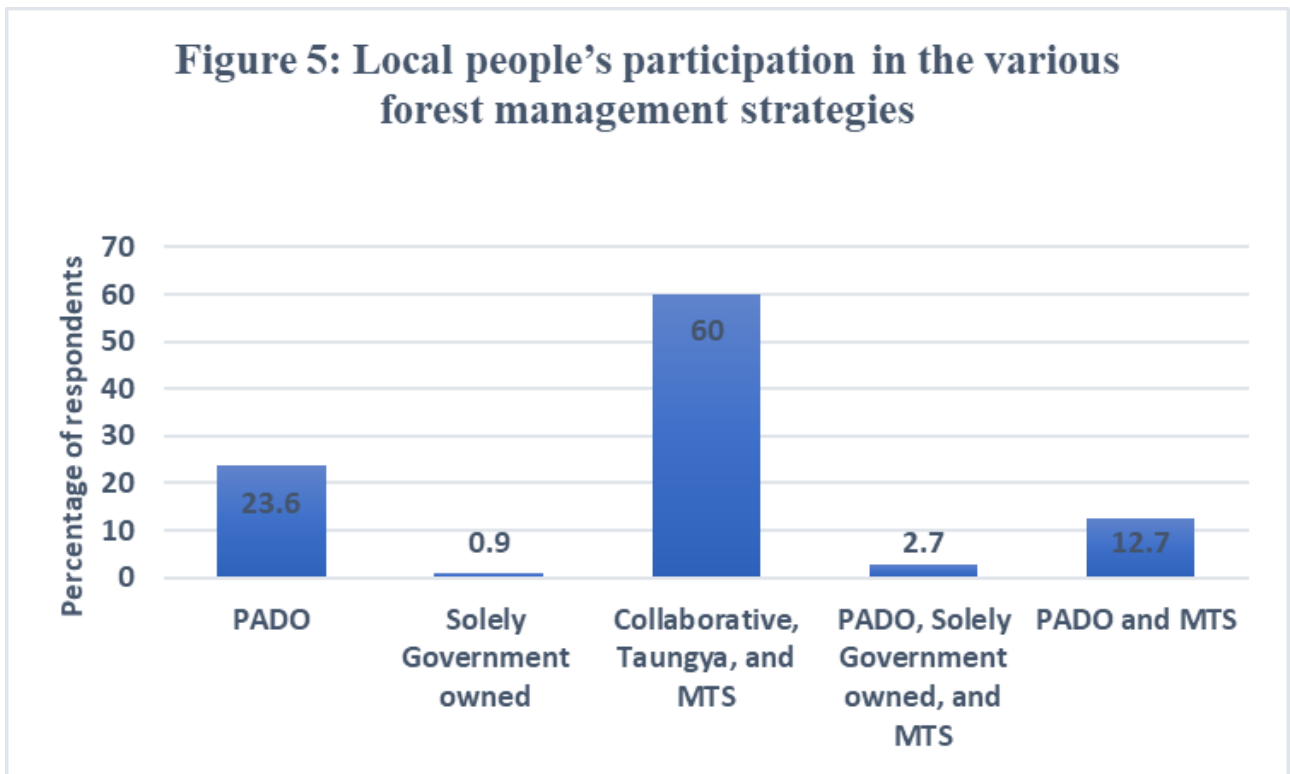
Source: Field Survey, 2017

An assessment of the effect of local people's participation in community forestry (MTS and PADO) showed improvement (confirmed by 96.3 percent of the respondents) in forest security and sustainability in the study area.

Figure 6: Effects of local people's participation in community forestry (MTS and PADO) on forest conservation and environmental sustainability
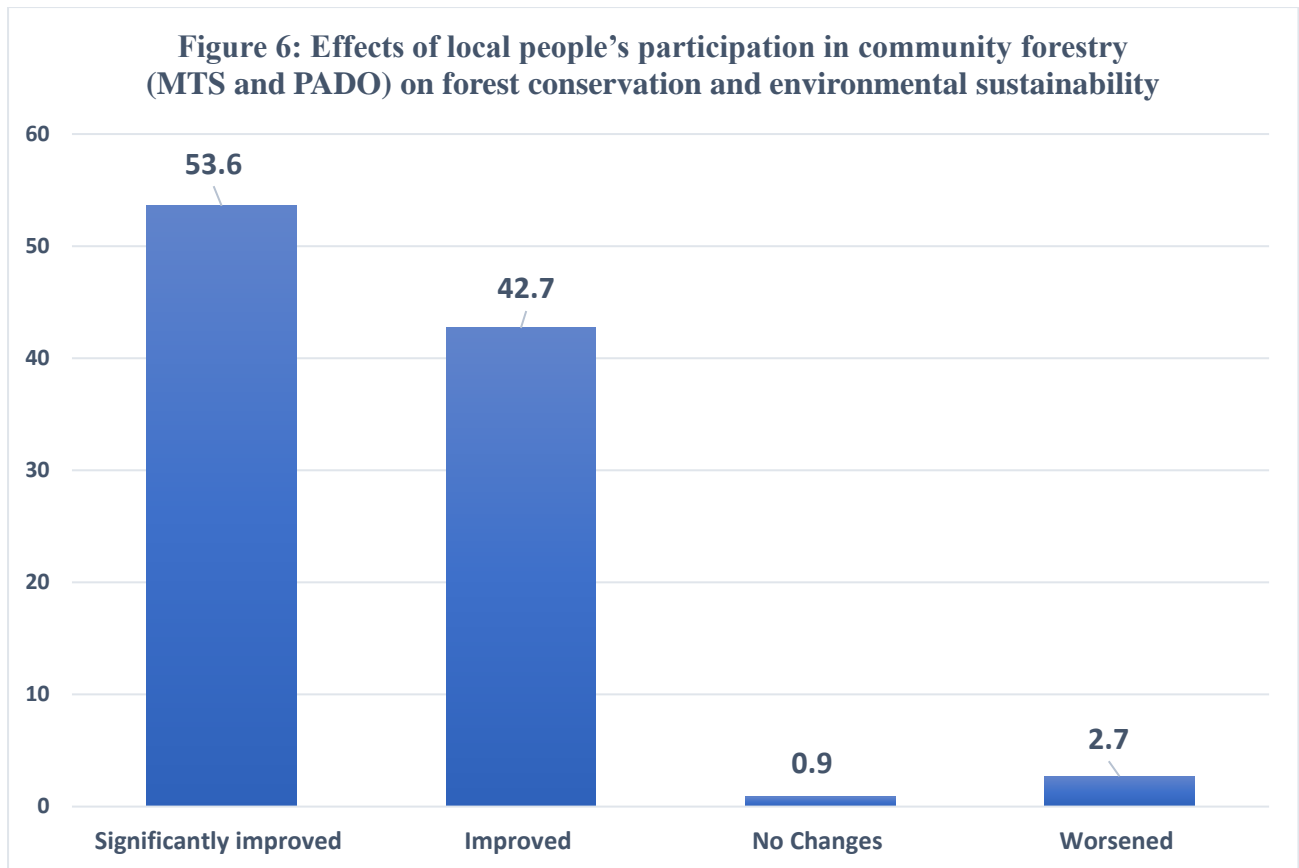
Source: Field survey, 2017

Threat assessment of forest management interventions

Degradation and deforestation of various forest commons across the globe have been highly linked to the alarming rate of forest threats such as bushfires, illegal logging, illegal farming, forest overgrowth, and invasive species among other natural or anthropologic causes. This indicates the numerous and complex nature of the causes of deforestation and forest degradation (Peluso, 1992; Rudel, 2005; Sponsel et al., 1996; Vandermeer and Perfecto, 2005; Wood and Porro, 2002). This situation is no different from the forest commons found within the selected site for this study. Forest security threats such as bushfires, illegal logging, forest overgrowth, invasive species and illegal farming are all very common within the various forest resources available in the region.

Anthropogenic activities such as harmful livelihood and cultural practices (slush and burn, game hunting, smoking in forest zones, unemployment, landlessness, inadequate farm tools etc.) of forest-fringe communities have been the causes of the relatively higher prevalence of these threats. However, numerous management interventions under both centralized and decentralized forest management strategies have been employed in the study area to help reduce the rate of forest degradation. The viability assessment of those management interventions against threats of forest commons has shown that largely solely government-managed forest reserves are often severely affected by all the various forest threats partly but significantly due to weak community participation and interest in responding to such threats. Most solely government owned and managed forest resources follow non-participatory management practices, which undermine community interest in forest protection. As a result, forest-dependent communities tend to exploit the forest resources illegally in areas with solely government-managed natural resources in order to ensure sustainable livelihoods. Where they are not illegally exploited, local inhabitants often show no concern about the security of forest resources they have no stake in. In the study area for example, majority of the respondents (80.6 percent) attested that illegal logging is the most common forest threat affecting the solely government managed forest reserves, followed by bush fires (74.4 percent) and then forest overgrowth (75.3 percent). The least threat facing the solely government managed forest is illegal farming (64.2 percent). Poor supervision of the reserves and lack of local community interests in solely government managed forest resources create spaces for corrupt forest officials (forest guards) to collaborate with illegal chainsaw operators for cutting forest trees for their own selfish gains. This was confirmed in an assertion made by a respondent that:

> *the chainsaw operators are always at work during the night, they cut all the big trees in the forest and even the small ones. The forest guards take money from them and show them places where they will not be guarding so they go for operation there. The officers are corrupt to the level that even when we report to them, they just arrest them, take money and allow them to continue (Discussion, 24/1/2017).*

Another respondent also made the assertion that:

> *I do not care about the government owned forest, whether it is burning or the trees are being stolen because the officials who are responsible do not do their work. When these things happen, they see it and yet do nothing about it.*

The exclusion of local people from the management of forest resources on which their livelihoods and well-being depend can   undermine the security of forest resources against threats. Leach et al. (1999) have earlier noted that local groups that may have historically managed natural resources are left with no incentive to preserve them because management is viewed as the role of government. With the forest threats and response assessment in this study, the individual local forest owners working under the PADO management intervention experienced low occurrence of the major forest threats. Since their forest resources define their livelihood assets, strategies and outcomes, they commit to ensuring that the forest is well protected to guarantee their livelihood sustainability.

It is established that the level of community participation plays a very important role in the efficacy of forest management interventions. An assessment of the three (3) forest management strategies revealed bushfires, illegal logging and invasive species as the most rampant threats in all three (3) forest management strategies. However, bushfires occur more frequently in the solely government (74.4 percent) than it occurs in the MTS (51.8 percent) and PADO (41.1 percent) forests. Illegal logging also occurred in the same manner with higher frequency (80.6 percent) in the solely government management arrangement, followed by the MTS (66.4 percent) and then PADO (15.2 percent). Similarly, invasive species follows the same trend with solely government managed forest experiencing higher frequency of occurrence (72.2 percent), followed by the MTS (70.3 percent) and then PADO (59 percent). Though the intention for all the different management arrangements is to protect forest commons from destruction, the level to which the adjourning community is involved in a transformative manner determines its efficacy for achieving this aim. Solely government owned and managed forests interventions fail to recognize the need for transformative participation of the local community in forest management and does not support benefits-sharing with the community. Thus,

sole government forest management arrangements without appropriate level of community participation affect the efficacy of forest commons protection.

Evidence from the study findings demonstrates that both the incidence and severity of threats to forests experiencing complete community exclusion from their management can be very high. On the contrary, the involvement of the community in the management of the MTS forests makes their protection more effective than that of the solely government owned forest. This strategy provides for the livelihood of the community by supporting MOTAG members with forestlands to intersperse their food crops with trees for a given period until the trees begin to form canopies. In addition, the benefits derived from the forest are shared between the government and the community. The MOTAG members demonstrate degree of ownership of the forest common, hence, commit to its protection together with their food crops. This makes the occurrence and severity of threats relatively lower than that of the solely government owned forest management strategy even though bushfires and illegal logging record high incidence and severity in both cases. However, MTS forest management strategies have less potential for the effective conservation of forest commons compared to the PADO intervention, which involves full community participation in terms of ownership, decision-making, implementation and benefit-sharing. The PADO members use their own farmland for forest plantations, have complete autonomy for forestry decisions, and retain all monetary and non-monetary benefits from the plantation. The sense of guaranteed ownership rights for the forest common by the PADO members influence their response to threats and disturbances. This makes the PADO managed forest resources much secure and sustainable since threats and disturbances are effectively kept under control.

Community response to threats facing forest commons forms one of the crucial approaches in the management and conservation of forest and related resources. People living in forest-fringe communities' show interest in forest commons which shape their livelihoods, and attitude towards their protection. However, when the local people do not show any interest and derive direct benefits

from the forest commons, they tend to ignore disturbances to the forest and do nothing to protect it against natural and anthropogenic threats.

Generally, response to threats that confront the PADO forests is much quicker and immediate compared to co-managed and solely government owned forest management arrangements. This is partly but significantly because of the high sense of community ownership attached to the PADO forests. The response to threats faced in collaborative (MTS) forest management strategy is generally on the average while that of solely government owned forest is very slow and low.

Although the PADO forestry tend to be the best management intervention in terms of security, it is relevant to note that majority of the people living in forest-fringe communities do not own land. However, the MTS being a collaborative management intervention provides the landless in the community access to lands to farm and therefore, has greater prospects to ensure sustainable livelihoods for majority of inhabitants in forest-dependent communities.

Thus, incorporating community into forest management interventions in a transformative manner is necessary considering its impact on the security of forest commons. This was evident in the study as the assessment of the effect of local people's participation in community forestry (MTS and PADO) indicated high improvement in forest conservation and environmental protection. This is in agreement with the advocacy of policy-makers that forestry decentralization is an appropriate means of ensuring environmental protection and sustainability (Anderson, 2006).

Conclusion

The various forest management strategies indicate the multi-layered nature of management of forest commons in Ghana. With the introduction of decentralized forestry (MTS and PADO), forestry interventions create a suitable space for local people to engage in forest management decisions, implementation and benefits-sharing. However, the effectiveness of the arrangement is dependent on

the level of community involvement and the benefits they derive from it. In the case of the MTS, though the community is involved in the management and benefits-sharing, the unsustainable nature of benefits derived by members subverts its effectiveness for fully protecting forest commons against threats since after the trees obtain their canopies, the MOTAG members lose the space on the forestland for food crop cultivation. Adherence to the MTS policies and the need to transfer adequate resources and decision-making powers to local representatives is therefore very necessary. In the case of the PADO, members are highly responsive to guidelines and policies due to the high level of benefits they derive. This, therefore, makes the intervention very effective in protecting forest commons against threats. However, its implementation is subverted by landlessness suffered by majority of the local people in the high forest zones of Ghana. Nonetheless, we conclude that high level of community involvement and adequate benefits-sharing in forest management is vital for adequate security and sustainability of forest commons in Ghana.

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