INTERNATIONAL TROPICAL TIMBER ORGANIZATION

Technical Report

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ADVANCING REDD+ IN GHANA: PREPARATION OF REDD+ PILOT SCHEMES IN OFF-

International Tropical Timber Organization
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Technical Report

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Disclaimer

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Summary

Like many tropical countries, there is evidence that the condition of Ghanas forests has been in decline for many years, particularly since the 1970s. Many forest reserves are heavily encroached and degraded, and the off-reserve stocks are being rapidly depleted. There are also heightened concerns not only about the future of the timber industry but also about the future quality of the natural environment. Therefore mechanisms such as REDD+ that seeks to put in place effective governance reforms to address deforestation and forest degradation is an important priority for the country on a number of fronts. For instance the significant convergence between REDD+ and other aspects of environmental, social and economic policy strengthens the governments commitment to REDD+ strategy development. This report seeks to explore the potential REDD+ project types in off-reserve areas, including, agroforests and secondary forests in various ecological zones of Ghana, as a contribution towards the overall national REDD+ strategy. Though there are basically nine ecological zones in Ghana, for REDD+ purposes, these ecological zones have been aggregated into three zones namely; (a) High Forest, (b) Savanna/grassland, and (c) Transitional. Within these three ecological zones, five major land representations were identified; forestland, cropland, grassland/woodland, wetland and other lands. A simple scoring approach was used to rank the major land use systems in relation to their relevance and viability for REDD+ interventions in the off-reserve areas of Ghana, based on social, biophysical and REDD+ related factors. Grassland/woodland has the viable opportunity for emission reduction potential in the off reserve landscape because of the following reasons: (1) Relatively small carbon stock per hectare compared to the other land uses. The relatively small carbon stock is due to the increasing negative impacts of charcoal, overgrazing and fire which are the direct drivers of landscape changes. (2) Significant dominance of grassland/woodland in the landscape. (3) The drivers of the expansion of the grassland/woodland are not only contributing to the lower carbon stocks, it also threatening the remaining forest patches in the landscape.

Like the savannah zone, the transitional zone exhibits very similar land use characteristics. However, the transitional zone has relatively high distribution of forests, which makes REDD+ strategies that involve avoiding emissions from deforestation and degradation viable. This is strongly linked to higher threats of deforestation and degradation, co-benefits and additionality. However, constraining factors such as tenure and land holdings must be critically examined to address issues of risks of non-permanence. Invariably, all the land use types in the HFZ proved to be very viable for REDD+ implementation, depending on the mitigation strategy under consideration, with the exception of grassland, basically because of the available area. But in a landscape REDD+ approach which encompasses all land use types, grasslands could be very viable for forest carbon stocks enhancement, using an appropriate agroforestry intervention.

Introduction

This technical report seeks to explore the potential REDD+ project types in off-reserve areas, including, agroforests and secondary forests in various ecological zones of Ghana, as a contribution towards the overall national REDD+ strategy. The report has been organised in six sections. After the introductory section, section two highlights the dominant land use types/systems in the major ecological zones in Ghana. Section three explores the criteria or factors determining REDD+ project types, while section four focuses on various classifications of potential project types in offreserve landscapes. The implications of the classifications for REDD+ activities in offreserve forest areas are presented in section five. Section six concludes the report with suggested recommendations.

Applied Methodology

The work was carried out using literature review and expert consultations.

A scoring matrix/approach was used to rank the major land use systems in relation to their relevance and viability for REDD+ interventions in the off-reserve areas of Ghana, based on social, biophysical and REDD+ related factors.

Presentation of the Data

Section two highlights the dominant land use systems in the major ecological zones of Ghana. Though nine ecological zones have been classified, for REDD+ purposes, these care conveniently bunched into three. In each of these ecological zones, the major land use types; cropland, forestland, wetland, grassland and other lands have been discussed in relation to their relevance for REDD+ interventions.

Analysis and interpretation of the data and results

Conclusions

The success of REDD+ implementation in off-reserve areas across the three ecological zones (based on REDD+ relevance) is mixed. Whilst forestland in the savanna zone appears to be feasible based on a set of factors; it is highly unrealistic to materialize in terms of scale. However, grasslands and savanna woodlands offer a better opportunity for REDD+ implementation, but this is also constrained by the fact that it cannot be considered as forests, based on the Ghana national definition of forests. Thus, the only viable REDD+ mechanism in the savanna zone that could qualify for the compliance or voluntary market is forest carbon stocks enhancement.

On the other hand, the transitional zone appears to have an appreciable overall rating for REDD+ implementation in the off-reserves, but only if an integrated landscape approach is adopted, due to the fact that the drivers are mosaic and not frontier, with charcoal production and unsustainable farming systems dominating the anthropogenic activities in the landscape. With regard to the HFZ, a viable REDD+ project in the off-reserve area is quite unclear, based on the classification of cocoa using the national definition of forests. However, if cocoa is considered as a cropland, then the only alternative intervention for REDD+ in the off-reserve areas is through forest carbon stocks enhancement. On the other hand, if cocoa is classified as forest (a position that will contradict the reality on the ground and the Ghana RPP), then there could be a huge scale for all REDD+ interventions.

Given the fact that few forests patches exist in the HFZ (mostly secondary and degraded forest), the viability of implementing avoided deforestation/ or degradation REDD+ projects is low. This is based on the scale of the project. There could however be approaches to avoid deforestation and degradation in the remnant forests in the HFZ, but the scale and emission reductions potential, need to be examined more critically. Tree incorporation in food crop systems and agroforestry interventions, could be viable forest carbon stocks alternatives that could be employed to boost the off-reserve forest cover.

But an area that is largely unexplored is the role of wetlands, particularly mangroves in emission reductions and removals. With below and aboveground carbon stocks almost 10 times higher than terrestrial forests, a massive threat due to exploitation for fuel wood and an appreciable scale, mangrove forests could be very viable mitigation projects.

Recommendations

The following recommendations are made:

i. An integrated landscape approach for REDD+ implementation in the savanna and transitional zones should be explored. This is based on the fact that per the national forest definition, only few patches remain as forests, with the bulk of the savannah landscape classified as grassland/woodland.

ii. Any mitigation project in the savannah and transitional zones will have critical co-benefit components, especially with respect to wildlife and biodiversity conservation, and improvement of rural livelihood.

iii. Other options for emission reductions such as agricultural carbon and NAMAs should be explored due to the scale, potential of the soil organic carbon pool and emissions associated with unsustainable landuse as well as fire.

iv. Forest carbon stocks enhancement, remains a veritable REDD+ strategy in the HFZ. Agricultutal carbon and NAMAs also could be options that can be pursued, because of the relatively flexible methodological considerations.

v. Cocoa remains a major driver of deforestation in the HFZ, there is an apparent confusion with regard to its classification (cropland or forest) based on the national forest definition and the RPP. It is therefore important that these issues are clarified, in order to fashion out a viable implementation strategy much more clearly.

vi. Mangroves should be included in the off-reserve REDD+ implementation strategy, based on the high emission reductions and removal potentials, including threats of massive and unsustainable exploitation.

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vi. Mangroves should be included in the off-reserve REDD+ implementation strategy, based on the

Recommendations

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Implications for practice

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Annexes

Working Paper

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FC Ghana Forestry Commission

Executive summary

Like many tropical countries, there is evidence that the condition of Ghana's forests has been in decline for many years, particularly since the 1970s. Many forest reserves are heavily encroached and degraded, and the off-reserve stocks are being rapidly depleted. Habitats of major plants and animal populations are becoming increasingly fragmented. There are also heightened concerns not only about the future of the timber industry but also about the future quality of the natural environment. Therefore mechanisms such as REDD+ that seeks to put in place effective governance reforms to address deforestation and forest degradation is an important priority for the country on a number of fronts. For instance the significant convergence between REDD+ and other aspects of environmental, social and economic policy strengthens the government's commitment to REDD+ strategy development.

This report therefore seeks to explore the potential REDD+ project types in off-reserve areas, including, agroforests and secondary forests in various ecological zones of Ghana, as a contribution towards the overall national REDD+ strategy. Though there are basically nine ecological zones in Ghana, for REDD+ purposes, these ecological zones have been aggregated into three zones namely; (a) High Forest, (b) Savanna/grassland and the (c) Transitional. Within these three ecological zones, five major land representations were identified; forestland, cropland, grassland/woodland, wetland and other lands. A simple scoring approach was used to rank the major land use systems in relation to their relevance and viability for REDD+ interventions in the off-reserve areas of Ghana, based on social, biophysical and REDD+ related factors. Grassland/woodland has the viable opportunity for emission reduction potential in the off reserve landscape because of the following reasons:

- Relatively small carbon stock per hectare compared to the other land uses. The relatively small carbon stock is due to the increasing negative impacts of charcoal, overgrazing and fire which are the direct drivers of landscape changes.
- Significant dominance of grassland/woodland in the landscape.
- The drivers of the expansion of the grassland/woodland are not only contributing to the lower carbon stocks, it also threatening the remaining forest patches in the landscape.

Like the savannah zone, the transitional zone exhibits very similar landuse characteristics. However, the transitional zone has relatively high distribution of forests, which makes REDD+ strategies that involve avoiding emissions from deforestation and degradation viable. This is strongly linked to higher threats of deforestation and degradation, co-benefits and additionality. However, constraining factors such as tenure and land holdings must be critically examined to address issues of risks of non-permanence. Invariably, all the landuse types in the HFZ proved to be very viable for REDD+ implementation, depending on the mitigation strategy under consideration, with the exception of grassland, basically because of the available area. But in a landscape REDD+ approach which encompasses all landuse types, grasslands could be very viable for forest carbon stocks enhancement, using an appropriate agroforestry intervention.

Table of Contents

List of Tables

List of Figures

Acknowledgements

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1. General Introduction

1.1 Setting the Context

Tropical forest contains about 80% of global terrestrial above-ground carbon stocks (biomass) and plays an important role in the global carbon cycle (Houghton 2005). Tropical forests are a strong carbon sink (Stephens *et al* 2007). However, tropical deforestation contributes about one fifth of total anthropogenic CO_2 emissions to the atmosphere (Houghton 2007). Recognizing the significant role tropical forest resources could play in mitigating future climate disruption, the United Nations Framework Convention on Climate Change (UNFCCC) initiated discussions on how to reduce emissions from deforestation and degradation (REDD+) in developing countries. This is because forest alone in developing countries has the potential to contribute as much as 6Gt towards the overall global target of 17Gt required to maintaining 450 ppm global pathways towards the global goal of limiting average temperature rise below 2^0C (IWG, 2009).

In decision 1/CP.13 of the Bali Action Plan, 'Policy approaches and positive incentives on issues relating to reducing emissions from deforestation and forest degradation in developing countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries' was recognized as an enhanced national action on mitigating climate change, among others. Paragraph 70 of decision 1/CP.16 of the Cancun Agreement encourages developing countries to contribute to mitigation actions in the forestry sector by undertaking the following activities (UNFCCC, 2010): (a) reducing emissions from deforestation, (b) reducing emissions from forest degradation, (c) conservation of forest carbon stocks, (d) sustainable management of forests and (e) enhancement of forest carbon stocks. Based on the IPCC guidance on land use representations, the REDD+ activities can be broadly grouped into two main categories (as illustrated in figure 1):

(i) <u>Land use change processes :</u> there are two REDD+ activities that fall within land use change processes based on the fact that it ultimately results in persistent transfer of the initial land representation to another type. E.g. (a) Deforestation (e.g. from forest land (FL), to other land uses) and (b) enhancement of forest carbon stock (e.g. from other lands to FL).

(ii) <u>Change processes within the same land category:</u> there are four REDD+ activities that are not classified based on the land use change processes. They rather represent the changes that occur within the same land representation over a period. For example, FL remaining as FL. (a) degradation (e.g. from unexploited to exploited forest or from unmanaged forest to managed forest); (b) sustainable management of forest; (c) conservation of forest carbon stocks; and (d) enhancement of forest carbon stocks.

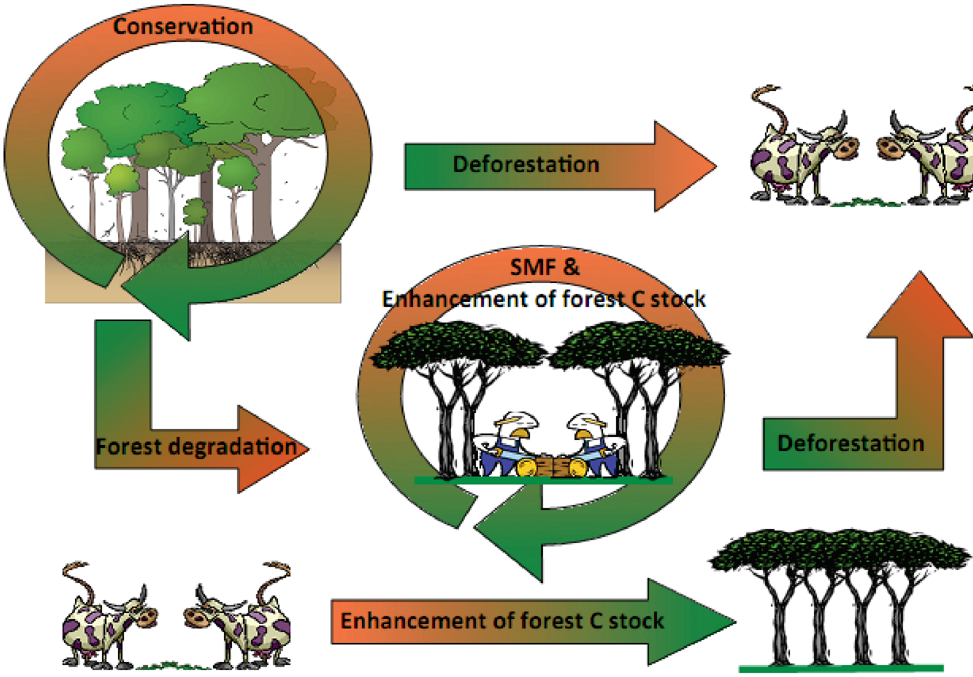

Figure 1: REDD+ forest related activities.
In this figure arrows show the carbon budget behavior of the potential activities. Arrows with a gradient from green to red represent potential source of greenhouse gases, while the arrow with a gradient from red to green represents a potential removal of greenhouse gases. Circular arrows represent a balance with possible positive (removal) and negative (source) results (Maniatis and Mollicone, 2010).

According to the Ministry of Lands and Natural Resources (2012), the forest sector contributes about 6% to Ghana's Gross Domestic Product (GDP), employs about 2.5 million people and exports wood products worth about $200 million annually. Nearly 60% of the total primary supply comes from biomass (woodfuel and charcoal). Like many tropical countries, there is evidence that the conditions of Ghana's forests has been in decline for many years, particularly since the 1970s. Many forest reserves are heavily encroached and degraded, and the off-reserve stocks are being rapidly depleted. Habitats of plant and animal populations are becoming increasingly fragmented. There are also heightened concerns not only about the future of the timber industry but also about the future quality of the natural environment. Therefore mechanisms that are aimed at halting deforestation and forest degradation is an important priority for the country on a number of fronts, and the significant convergence between REDD+ and other aspects of environmental, social and economic policy strengthens the government's commitment to REDD+ strategy development (Ghana RPP, 2010).

1.2 Scope and structure of report

This report therefore seeks to explore the potential REDD+ project types in off-reserve areas, including, agroforests and secondary forests in various ecological zones of Ghana, as a contribution towards the overall national REDD+ strategy. In that regard, the report has been organised in six sections.

- After the introductory section, section two highlights the dominant land use types/ systems in the major ecological zones in Ghana.
- Section three explores the criteria or factors determining REDD+ project types, while section four focuses on various classifications of potential project types in off – reserve landscapes.
- The implications of the classifications for REDD+ activities in off – reserve forest areas are presented in section five. Section six concludes the report with suggested recommendations.

2. Ecological zones in Ghana and associated dominant Land use Systems

This section highlights the dominant land use systems in the major ecological zones of Ghana. Though nine ecological zones have been classified, for REDD+ purposes, these care conveniently bunched into three. In each of these ecological zones, the major land use types; cropland, forestland, wetland, grassland and other lands have been discussed in relation to their relevance for REDD+ interventions.

2.1 Landscape Profile of Ghana

Different studies have used various approaches to construct the spatial structure of Ghana's landscape to the extent possible. This part of the report summarises the major highlights of two major approaches as the basis for the analysis of REDD+ potential in the off reserves areas in the country. The two approaches are based on (a) ecological distinctiveness of Ghana's landscape (b) IPCC land representations (climate change forest definition).

2.1.1 Landscape profile based on ecological distinctiveness

There are nine ecological zones in Ghana (Hall and Swaine, 1981), as shown in figure 2. However, for the purposes of this study, the classification has been regrouped into three vegetation zones; (a) high forest zone (HFZ), (b) transitional zone and (c) the savannah zone. This reclassification has been done based on the likelihood that Ghana might consider developing different forest reference scenarios for these three zones giving their distinct landscape characteristics. The savannah zone, which includes parts of the transition zone covers two-thirds of the country (15.6 million ha) and extend from the middle to northern part of the country. The remaining southern part (8.2 million ha) is covered by the HFZ. Much of the remaining forests and the commercial volumes of timber resources are located in the HFZ (GFC, 2002). Within the HFZ, there are 216 state-managed forest reserves with a total area of 1.7 million ha. In effect, almost a fifth of the total area of the HFZ is designated as forest reserves.

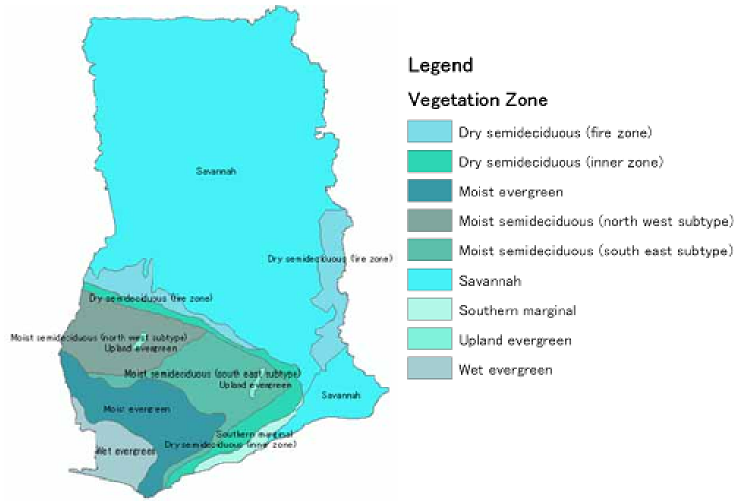

Figure 2: Ecological zone classification of Ghana.

The size of the forests outside the reserves in the HFZ is estimated to be about 400,000 ha spread across an area of 5 million ha (Abebrese, 2002; Kotey et al., 1998). It is in these off-reserve forests that much of the uncontrolled timber harvesting and deforestation that occurred in the past is taking place. The off-reserve forests are largely located on communally or privately owned-lands and therefore not subject to the strict control or jurisdiction of the state nor is there a land-use plan for the off-reserves either. The decision to put the communal or privately owned lands to any use is largely influenced by either economic gain or social considerations. Off-reserve landowners effectively have the right to do whatever they choose with their land i.e. whether to clear it for farming, grazing, settlements or for any other purpose. The only right they don't have is to commercially exploit timber resources on their land. Only the state has the authority to issue permits for the harvesting of timber subject to the consent of the landowners (Osafo, 2005). It is estimated that between 1960 and 1994 an enormous amount of timber was harvested from off-reserve areas (Kotey et al., 1998). As a result, what remains of these off-reserve forests are patches of forests in the form of scattered trees on agricultural fields, secondary forests regenerating from farming, riparian forest strips along streams, sacred groves and some closed-canopy forests (Kotey et al., 1998).

Table 1: Area coverage of High Forest and Savannah zones

Vegetation Zones	Area (ha)
High Forest Zone	
Wet Evergreen	657,000
Moist Evergreen	1,777,000
Upland Evergreen	29,200
Moist Semi-deciduous	3,318,000
Dry Semi-deciduous	2,144,000
Southern Marginal	236,000
Southeast Outlier	2,000
Total High Forest	**8,163,200**
Savanna Zone	
Tall-grass Savanna	14,694,800
Short-grass Savanna	1,000,000
Total savanna	**15,694,800**

Sources: FAO, 1998; MES, 2002.

Figure 3 shows the forest reserves and protected areas in Ghana. Basically, the white areas are the off reserve areas, and thus, the area of interest in this document. However, these areas are not necessarily forest but a mosaic of different land uses.

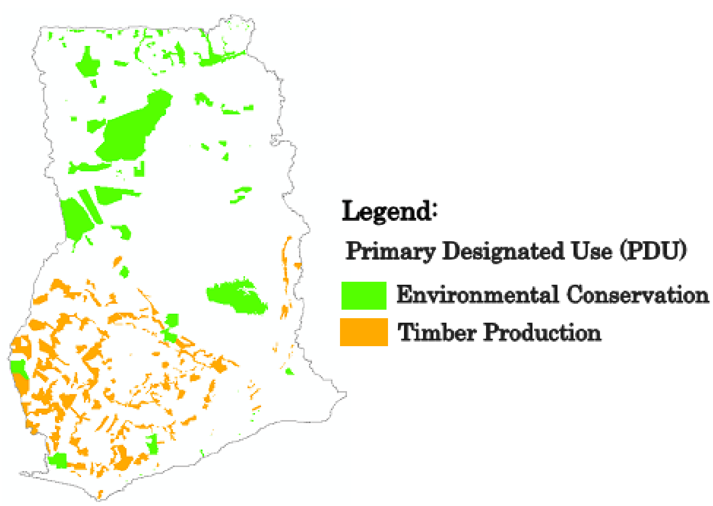

Figure 3: Forest reserves and protected areas in Ghana. Source: Forest Preservation Project/FC/2012.

2.1.2 Landscape profile based on IPCC land representations (forest definition)

Based on IPCC (2003) GPG for LULUCF accounting, there are six land representations for the estimation of anthropogenic GHG emissions by source and removals by sinks. These six representations are consistent with measures to ensure simplicity and reduce cost of forest monitoring. Thus in REDD+ accounting, one of the overriding factors is the changes in carbon stocks, though there could be ecological and structural differences between forest types or different landuse classes, what matters most is the differences in the carbon stocks. Therefore the six landuse classes are;

- Forest Land (FL): This includes all land with woody vegetation consistent with the thresholds of the national forest definition. It also includes land use types with a vegetation structure that currently fall below, but in situ could potentially reach the proposed national values used to define the forest land category in Ghana, i.e.;
  - Minimum mapping unit (MMU) is 1.0 ha
  - Minimum crown cover is 15 %
  - Potential to reach minimum height at maturity (in situ) as 5 m
- Cropland (CL): This consists of crop land (currently cropped or in fallow), including rice fields, and agro-forestry systems where the vegetation structure falls below the thresholds used for the forest land category. This includes land where over 50% of any defined area is used for agriculture.
- Grassland (GL): This comprises rangelands and pasture lands that are not considered cropland as well as herbs and brushes that fall below the threshold values used in the forest land category such as the other wooded land following the definition in Ghana:
  - Canopy Cover < 15 %,
  - height > 5 m,
  - MMU > 1 ha
- Wetlands: These include areas of peat extraction and land that is covered or saturated by water for all or part of the year (e.g., swamp forests and mangroves) and that does not fall into the forest land, cropland, grassland or settlements categories. It also includes reservoirs as a managed sub-division and natural rivers and lakes as unmanaged sub-divisions.
- Settlements: These consist of all developed land, including transportation infrastructure and human settlements of any size, unless they are already included under other categories.
- Other land: This category includes bare soil, rock, ice, and all land areas that do not fall into any of the other five categories.

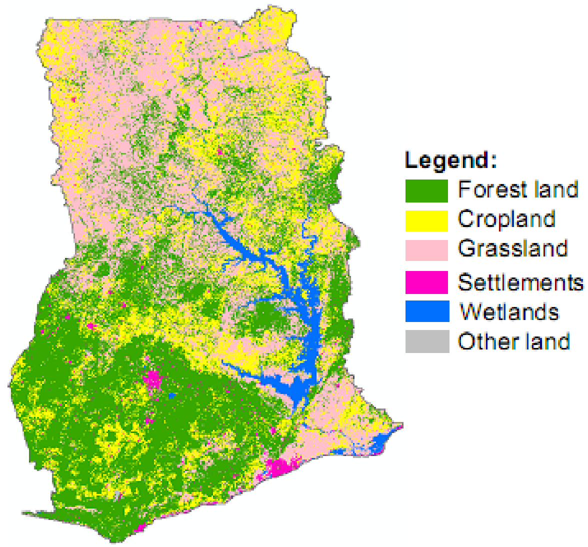

Figure 4: Landuse classifications in Ghana for 2010. Source: Forest Preservation Project/FC/2012.

Although this classification is largley coarse because of the wall-to-wall approach, it fairly represents the wide range of various land representations in Ghana. There are a number of issues that must still be further worked on to improve on the representation of these land use classes as they pertain on the ground. Apart from the fact that the total delineated forest area hardly distinguishes off-reserve and on-reserve forest, there are also cropland mix of both annuals and perenials. The major grey area is the classification of cocoa and oil palm plantations which could be a mjaor source misrepresentations because of spectral similarities of the phenology of typical forest. Another important point to take note is that, in the context of RPP, tree crops (mainly cocoa) for instance has been cited as a major driver of deforestation in the HFZ, however, in the forest definitation used in making this map, significant amount of matured tree crops fall within the forest bracket. It is therefore difficult to clearly unpack the actual factors behind the modification of the off-reserve landscape.

There is therefore the need to carefully consider the classification of these crops, because there could be instances where fallow areas or food crop farms with significantly lower carbon stocks are replaced with cocoa or oil palm. In such situations, once the plantation meets the definition of forest, it could be classified as such. It is therefore imperative to explore the application of various tools in segregating cocoa and similar plantations from forests. This could be the use of spectral signatures or other applications to ensure that spatial classification of landuse classes reflect the true situation on the ground.

In order to have a better understansing of the dynamics of off reserve landscape, it is imporant to consider the level of hetrogeneity of the landscape as much as practical. Figure 5 is a simulated land use map of Ghana which illustrates the diversity of the off reserve landscape in Ghana. However, it is important to consider establishing the optimal mapping unit (variability of scale) in the assessment REDD+ potential in the off-reserve areas. For instance in the map below (figure 5), cocoa and oil-palm are the dominant crops in the wetter southwest of the country, and maize, millet, sorghum and groundnuts in the drier north. Cassava is found between these zones and in the southeast. Though the six land use classifications are clear in definition, figure 5 gives further insight into the cropland areas, and the specific crops that are cultivated.

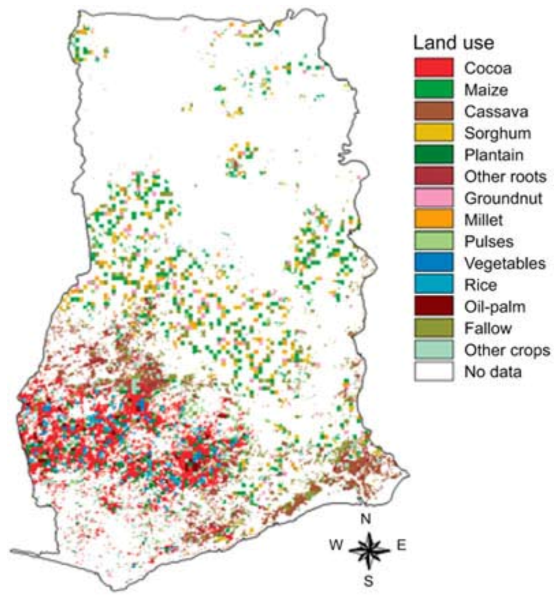

Figure 5: Simulated landuse map of Ghana. Source FAO, 2004.

With regard to forest areas, there is significant variation in forest classes based on canopy cover (Figure 6). The forest reserves are in better conditions than forests in the off-reserve areas. Whilst most forest reserves still have closed forest with 65% or more canopy cover, in the off-reserve areas canopy cover does not exceed 65%.

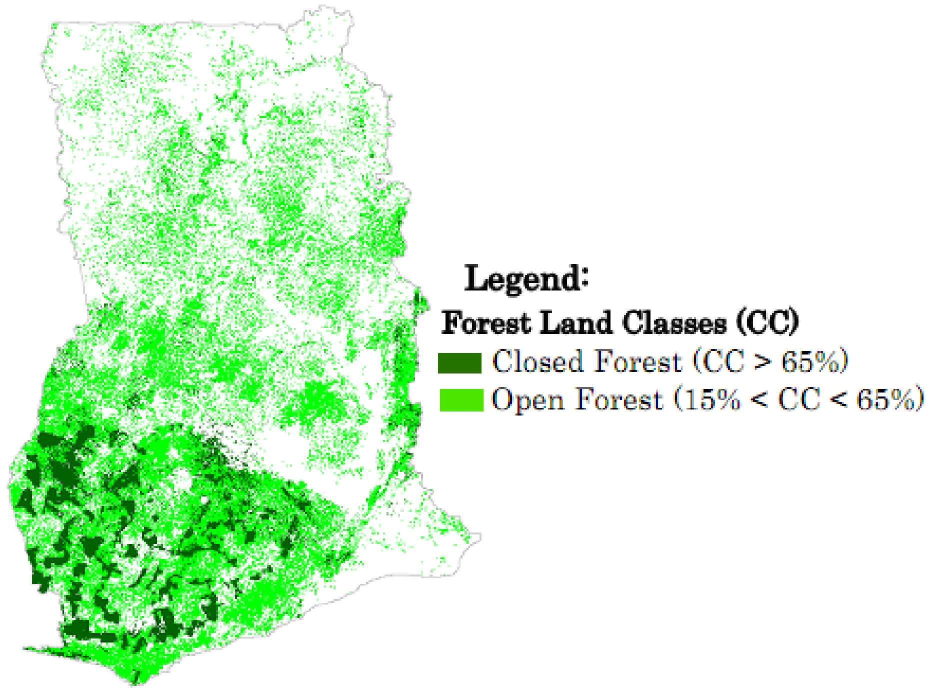

Figure 6: Forest land classes in Ghana based on canopy cover. Source: Forest Preservation Project/FC/2012.

3. Criteria or factors determining potential REDD+ project types

This section discusses the key criteria or factors identified to be determining potential REDD+ project types. Drawing on the relevant concepts and debate in the REDD+ arena, six factors (as a minimum) have been identified to be the key determinants of potential REDD+ project types: carbon stocks, co-benefits, constraints/integrity, drivers or agents of deforestation, additionality and other cross-cutting issues.

3.1 Identification of Criteria or factors

The major criteria determining the viability of REDD+ interventions in off-reserve areas have been broadly grouped into social, biophysical and REDD+ related concepts. Table 2 presents the major criteria for REDD+ project consideration in off-reserve areas.

Table 2: Criteria determining REDD+ projects in off-reserves areas in Ghana

A. Social criteria
Forest governance and harmonization of sectoral laws
Law enforcement
Collaboration with stakeholder institutions including traditional authorities and local people
B. Biophysical criteria
Baseline carbon stocks
Drivers, agents and underlying factors of deforestation and degradation
Sustainable forest monitoring challenges
C. REDD+ related criteria
Co-benefits
Constraints and integrity of REDD+ projects
Additionally
Applicability of REDD+ methodologies
Safeguards and land use right

3.1 Biophysical criteria

3.1.1 Baseline carbon stocks

Carbon stocks in different land use types give a good idea about the potential emissions due to anthropogenic activities in the baseline scenario. In addition, it also help understand land use change dynamics and contributes to the decision making process in project phase interventions that can be used to address the emissions. This provides an opportunity to also ascertain the amount of emission reductions or removals potentials that could be achieved in a given area over a period. For example, the carbon stocks in a unit area of an intact forest in the HFZ are higher than that of the savannah zone. This information gives a clear idea about the extent of emissions associated with anthropogenic activities in these ecological zones, including removals that could be achieved. Thus, these processes are important first steps in assessing the feasibility of a project and possible next steps towards project development. Figure 6 illustrates a snapshot of biomass stocks in different land use systems in Ghana as of 2012. The map shows an obvious difference in carbon stocks in the savannah, transitional and high forest zones. It is instructive to note that, though the savannah areas have relatively low carbon stocks, it constitutes about two-thirds of the total forest area of Ghana. Thus there is the possibility that the lower carbon stocks will be compensated for by the land area, which could amount to an enormous carbon build up. Within the high forest zone, the difference between the biomass found in forest reserves and protected areas, and the biomass in off-reserve areas dominated by agriculture and tree crops is clearly evident. Even though the high forest zone has the highest overall biomass, the biomass in forest reserves ranges (making up approximately 20% of the high forest zone) from 225-400 Mg/ha, although the uncertainty is also quite high (± 70 to 80 Mg/ha).

The remaining 80%, which falls within the "off-reserve" area of the high forest zone contains biomass ranging from 125 to 225 Mg/ha (± 70-80 Mg/ha). What the map (figure 7) also reveals is that in the high forest zone, biomass declines as one progress farther outside of protected areas. Thus, there are clear bands or buffers surrounding the forest reserves and protected areas that has higher biomass (225-250 Mg/ha) than the rest of the agricultural landscape and other land use types in the off-reserve areas. This indicates that over the past century, with the expansion of agriculture, deforestation and degradation have contributed to a significant reduction in off reserve carbon stocks (Asare et al., 2012).

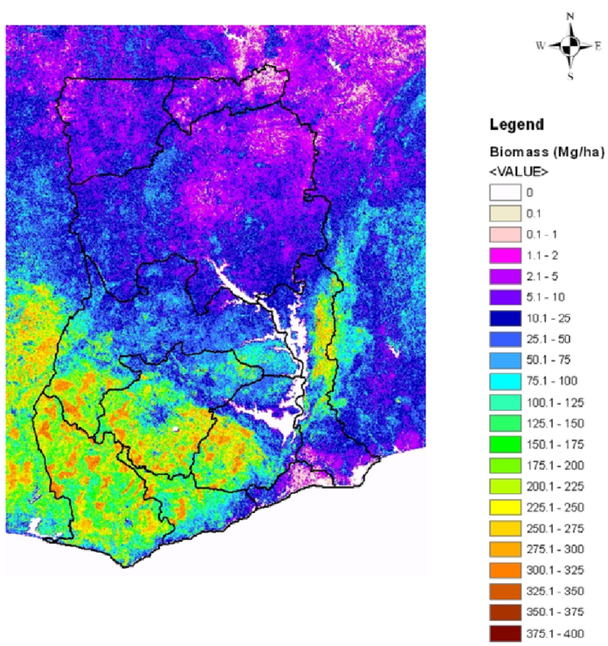

Figure 7: Aboveground biomass distribution in Ghana. Source: Asare et al., 2012.

Based on the landuse dynamics of the ecological zone or project area, it is important to consider which carbon pool(s) will be affected by anthropogenic activities, and thus offers a good opportunity for emission reductions. There are six carbon pools in LULUCF accounting, however, not all pools may be applicable in a REDD+ project. Table 3 shows the various carbon pools and their relative contribution to ecosystem carbon stocks.

Table 3: Carbon pools and their relative contribution to ecosystem carbon stocks in tropical forests

Carbon Pool	Description	% carbon storage in total ecosystem
Aboveground live tree Biomass	All trees components from stem to tops, leaves, and bark. Typically measured for trees greater than 5 to 10 cm diameter at breast height (DBH), calculated using allometric equations based on DBH for tree species densities.	15% to 30%
Belowground live tree root biomass	Coarse and fine roots, often calculated using a formula	4% to 8%
Coarse woody debris	Standing (greater than 5 to 10 cm diameter at breast height) and downed (greater than 10 to 15 cm small end diameter, 1.5 to 3 m length), often measured	1%
Non-tree aboveground live biomass	Herbaceous vegetation, regeneration and small diameter trees, and multi-stemmed shrubs.	0.06%
Organic litter and duff	Often only measured if affected by Management	0.04%
Inorganic mineral soil	Rarely measured because of wide variability	60 to 80%

However, to attract carbon credits or financing, a project needs to demonstrate its attractiveness based on a sustainable project implementation plan, co-benefits etc, with carbon revenue as an additional stream of financial flow. In effect, carbon financing of a project is not enough to sustainably support a REDD+ project, the non-carbon benefits should also be taken into account.

3.1.2 Drivers, agents and underlying factors of deforestation and degradation

The drivers, agents and underlying factors of deforestation and degradation contribute to assessing the degree to which the forest is under threat. It also provides a good basis to make a case for an intervention to address potential emissions associated with anthropogenic activities due to its conversion or use. It also provides a good understanding of the actors of land use change, and the viable mechanisms to be used in the intervention phase. But ultimately, it is important for REDD+ project proponents to demonstrate the emission reduction or sequestration potential of the land use, based on the carbon stocks, land area, threats and pathways to ensure removals and avoided emissions.

Studies have concluded that the greatest potential for reducing Ghana's GHG emissions and expanding its carbon sinks lies in the forestry and land-use change sectors (Ghana NatComm, 2000). This potential lies in reducing the deforestation rate in the off-reserve areas where much of the uncontrolled deforestation predominantly caused by "slash and burn" agriculture occurs. This is because farming in Ghana is traditional in the sense that it is small-scale and subsistence in nature, rain-fed and typically done with pick axes, hoes and cutlasses. It is therefore not mechanized nor is the use of modern inputs widespread or intensive as most farmers lack the capital to afford these products. As a result methods of farming are labour-intensive and land-extensive (Abagale et al., 2003; Abebrese, 2002; Gillet, 2002). This expansive trend has been responsible, in significant part, for the conversion of Ghana's forests – at least a third of Ghana's tropical high forest cover has disappeared in the past 20 years. As a result, very little forest remains in the off-reserve landscape (Hansen, et al. 2009).

With the rate of population growth exceeding that of food production (Asare, 2004 cited in Osafo, 2005), and the government supporting efforts to increase cash crop production, fallow periods are increasingly being shortened and agricultural lands are expanding at a rate of 9 percent every couple of years (Agyarko, 2001). This has progressed to such an extent that the state forestry authority, the Ghana Forestry Commission has been forced to issue permits to timber companies to salvage trees on farmlands which would otherwise have been destroyed by the farmers (Bamfo, 2005). Farmers are also unwilling to maintain trees on their land because of the damage caused to their farms from timber harvesting operations and the lack of adequate compensation payments for such damage. Farmers rather team up with chainsaw operators to illegally harvest trees for timber (Abagale et al., 2003; Glastra, 1999). Without economic incentives to convince farmers to conserve the remaining forests, practice agroforestry and/or enable the regeneration of forests, Ghana's deforestation rate and emissions will continue to increase.

Ghana's R-PIN gives an approximate estimation of the relative importance of the various drivers as: agricultural expansion [c.50%]; harvesting of wood [c. 35%]; population & development pressures [c. 10%]; mineral exploitation and mining [c. 5%]. (Ghana RPP, 2010). The underlying causes are those typical of degradation in the more heavily populated countries of the tropics, and involve a complex of demographic, economic and policy influences. The immediate drivers include: forest industry over-capacity; policy/market failures in the timber sector; burgeoning population in both rural and urban areas, which increases local demand for agricultural and wood products; high demand for wood and forest products on the international market; heavy dependence on charcoal and wood fuel for rural and urban energy; limited technology development in farming systems, and continued reliance on cyclical "slash and burn" methods to maintain soil fertility.

Furthermore, the prominence of one forest crop in the national economy (cocoa), and recent changes in shade regimes (from shade to full-sun systems), have also exerted a major influence on trends in forest cover. Mining (industrial and artisanal/small scale) is a concern in some areas, as is oil palm cultivation and the use of fire in livestock management. Figure 9, shows the deforestation risk map as of 2012. It is very clear that the high forest zone is under the greatest threat[1] (based on 3 risk factors; road, settlement and slope), and these areas are basically the off reserve forest. This threat of deforestation is confirmed by figure 10. From the historical deforestation perspective (figure 10), though the HFZ is undergoing a much rapid land use change, it is quite clear that the savannah and transitional areas are not insulated. However, as much as figure 9 gives some indication about the future threats to forested areas, it would have been much helpful if the projections had been based on much more additional and realistic parameters such as population, government policies and interventions etc.

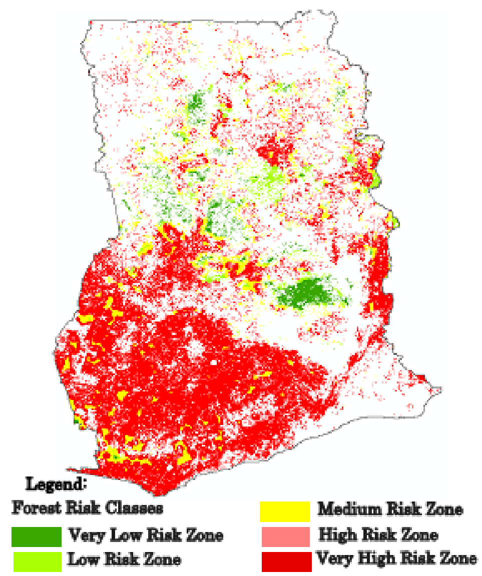

Figure 8: Deforestation risk map of Ghana. Source Forest Preservation project/FC/2012

[1] *It should be emphasized that the off-reserve areas in the HFZ also include cocoa farms and other tree crops, which were classified as forests. From a realistic point of view, it would take more than risk factors such as road, settlement and slope to convert cocoa and other tree/cash crops to other landuse.*

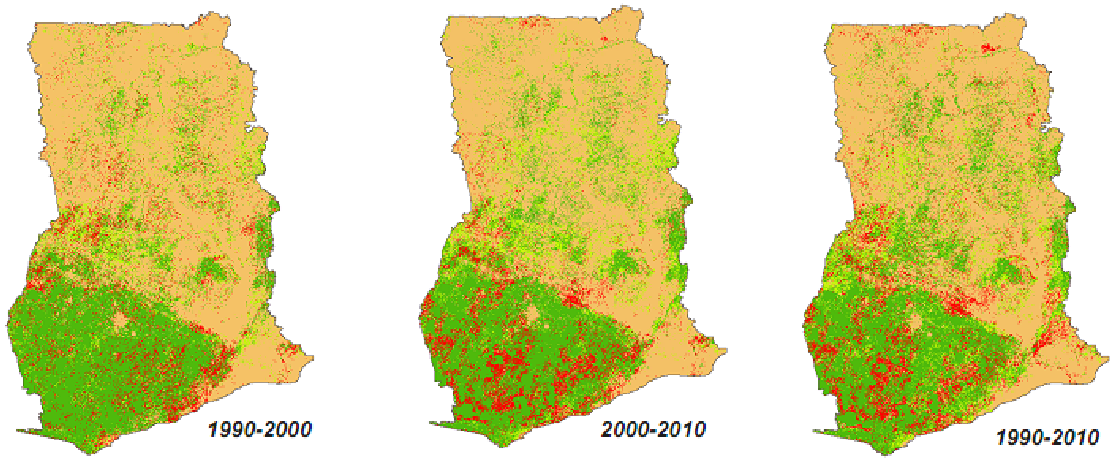

Figure 9: Historical landuse change maps from 1990 to 2010. Red markings show deforested areas. Source FPP/FC/2012

3.2 REDD+ Related criteria

3.2.1 Co-benefits

In every REDD+ project, the prime objective is to ensure removal of GHGs by sinks and also avoid emissions by sources. This entails the implementation of specific activities and programs such as forest monitoring, social and environmental safeguards, enforcement of laws and good forest governance practices, sustainable rural energy supply associated with the use of improved cook stoves and woodlot systems, sustainable agricultural intensification etc. Invariably, a successful implementation of these activities trigger ancillary benefits that come with preserving terrestrial ecosystems e.g. erosion and desertification control, improved health (associated with reduced exposure to indoor air pollutants through the use of improved cook stoves), protecting watersheds (purification, prevention of pollution and flood protection), biodiversity and wildlife, including ecotourism and rain making benefits.

These are also referred to as non-carbon values or benefits. Though co-benefits are not targeted outputs of REDD+ projects, they offer additional benefits and incentives which ultimately build into the intended livelihood improvements and ecosystem sustainability of the project. For instance most buyers in the voluntary market are willing to pay premiums for projects with demonstrable co-benefits, which could serve as additional avenues for financial flow through the REDD+ project. Hence co-benefits are important requirements which improve the attractiveness of the project. Figure 8 shows an example of how REDD+ project activities could trigger direct and indirect biodiversity co-benefits. However from the illustration in figure 8, it is obvious that REDD+ projects could also result in negative implications for co-benefits.

There is therefore the need for careful planning and implementation of REDD+ activities, with particular emphasis on safeguards and adherence to project methodologies and standards.

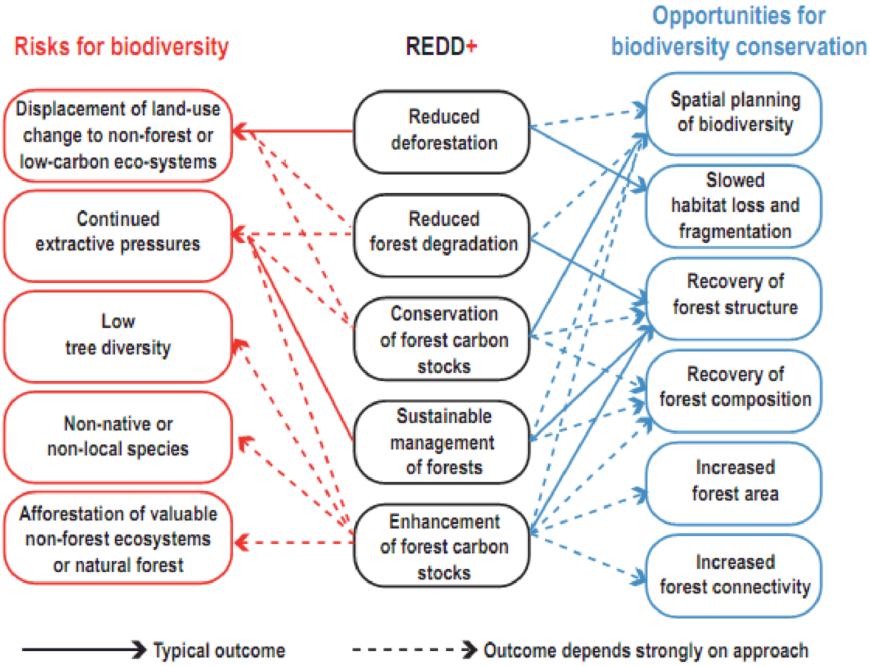

Figure 10: Major opportunities and risks for biodiversity benefits of REDD+. Source UNREDD.

3.2.2 Constraints/integrity

Like every forestry project, REDD+ projects have factors that limit the attainment of the desired outcome. These factors could also affect the integrity of the project as a mitigation activity in the forestry sector. It is therefore important to consider specific factors and activities that could affect the successful implementation of the project. A major constraint in Ghana that could seriously hinder the successful implementation of a REDD+ program in off reserve areas is land tenure and disputes associated with land ownership. This is particularly true for most off reserve areas in Ghana, and has implications for carbon rights, benefit sharing regime, project intervention strategies and sustainability of the REDD+ project. This could possibly be the reasons why many REDD+ project proponents are considering on-reserve sites.

Most off reserve land holdings are fragmented under different ownership and tenure regimes, and are under smallholder agriculture. Given the fact that a viable REDD+ project should cover hundreds to thousands of hectares (sometimes not in a contiguous manner), depending on the methodology being applied, it is important that serious attention is paid to tenure and land management rights. Disregarding secured tenure, limits the scope and potential of REDD+, places forest based people at risk, and may engender such opposition that can guarantee failure of the REDD+ project (Larson and Petkova, 2011). The permanence of the project is also an important constraining factor that could affect the integrity of the project. Permanence refers to how robust a project is to potential changes that could reverse the carbon benefits of the project at a future date. Although all sectors have the potential for impermanence, forest carbon projects face particular scrutiny due to a perceived risk that poor management, fire, pests, changes in government policy or political power etc. can lead to the destruction of forest and the subsequent release of emissions. Various strategies can be used to avoid and safeguard against the risk of impermanence. First and foremost, it is important that all stakeholder interests (government, local communities, private sector, etc.) are aligned with the long-term project objectives. Specific approaches, such as the land sparing and sharing, creation of protected areas, community development, establishment of endowments for project management and monitoring, and the use of carbon buffers can also help ensure permanence. Ultimately, strategies must be tailored to the particular project site and situation. But in the Ghanaian context, fire is an extremely important consideration, especially in the savannah and transitional areas, including parts of the HFZ. Other constraining factors are the capacity of the management team, financial viability, opportunity costs and associated pressures of alternative land uses, and project longevity based on legal agreements or requirements.

3.2.3 Additionality

The fundamental challenge for REDD+ mechanisms is to demonstrate "additionality." Additionality is simply defined for REDD+ as "carbon emission reductions and/or increased removals that are additional to what would have occurred without the REDD+ mechanism" (Cortez and Stephen, 2009). In order to provide real climate change mitigation, emission reductions financed through carbon markets must be additional. To be additional, nations or projects claiming REDD+ credits must show that reduced deforestation rates or increased sequestration rates attributed to the project would not have occurred in the absence of carbon finance.

Additionality of carbon benefits, i.e. the fact that they would not have been created in the absence of carbon finance, is at the heart of carbon offsets. The standard approach of demonstrating additionality has been developed under the CDM and is used in virtually the same form by the VCS. Two basic principles exist, and project activities are seen as additional either if they would have been financially less attractive than a realistic alternative (financial additionality), or if they would have faced insurmountable barriers that would have prevented their implementation under normal circumstances. A project can also be 'first of its kind', meaning that no precedence exists that would have paved the way for a comparable undertaking in the particular region or industry (Cortez and Stephen, 2009). In the Ghanaian context, incorporation of shade trees in cocoa farms could be a typical example of a project that exhibits additionality.

3.2.4 Other cross-cutting issues

Aside the above mentioned factors, there are other cross-cutting issues such as governance and harmonisation of sectoral laws (because the off-reserve area is comprised of a mosaic land use with sometimes competing interests), law enforcement, applicability of REDD+ methodologies, safeguards, decentralising the implementation of the national REDD+ strategy through collaboration with stakeholder institutions (including traditional authorities and local people) and synergy building, land use rights and sustainable forest monitoring challenges. Governance refers to "the setting, application and enforcement or non-enforcement of regime rules" (Kjaer 2004). This includes inadequate sensitization and enforcement of forest laws and policies, including non - enforcement of rules protecting local communities ' rights. Governance issues are critical building blocks of any REDD+ project, and could be localized, depending on the extent of the utilization and pressure on the resource. For instance, issues concerning off-reserve trees management and exploitation are totally different in the HFZ as compared to the savannah zone, basically because of the economic plays of cash crops in the HFZ. As such, reforming the tree tenure regime is widely viewed as a necessary precondition for reinvigorating the off-reserve stock, so are mechanisms to improve multi-stakeholder dialogue and decision making. A simple analysis of threats and decision-making under three hypothetical carbon-rights scenarios shows that when carbon rights are allocated according to the real drivers of deforestation and decision-making, the permanence risk is much less than when carbon rights are tied to economic tree rights or to land ownership and land tenure (Asare, 2010). This also dovetails into issues of land use rights and the role of migrants in land utilization and decision making. Thus, the fact that someone owns a land does not necessarily make him an agent of emissions.

Also, for an area to be viable for REDD+ implementation, and be able to gain certified emission reductions (CER) in the carbon market, an applicable standard and methodology should be selected. This is a very complex exercise that involves a careful examination of the land use dynamics and drivers, opportunity cost, as well as viable options for emission reductions, which fits into the overall feasibility of the project. For instance an area under consideration for a proposed REDD+ project can have a strong case to avoid emissions based on threats to forests etc., but if the communities are unwilling to subject themselves to the project phase interventions, there cannot be a REDD+ project. In effect it is not just enough for an area to have an emission reduction potential based on a few set of criteria, but a holistic analysis of the terrain is required, which includes several combination of factors and adequate satisfaction of the requirements of the chosen standard and methodology. This also means that the area under consideration and the project proponents should have adequate options for safeguards to ensure that negative impacts (social and environmental) of the project can be mitigated and positive impacts enhanced.

4. Classification of potential REDD+ project types on off-reserve landscapes

Based on the different land use systems in the major ecological zones, potential REDD+ project interventions have been discussed in this section. Basically, the land use type among other factors, determine the REDD+ intervention that could be viable. A scoring matrix for the various criteria as they relate the major land use types in the major ecological zones have been also presented to aid decision making on viable strategies for REDD+ in off-reserve areas.

4.1 Assessment of different land use types/systems

There are five emission reductions and removal enhancement activities that can be implemented under a REDD+ strategy. These are;

i. Avoided deforestation (planned and unplanned), eg halting the rate of secondary forest conversion.

ii. Avoided degradation (planned and unplanned), eg avoiding authorised logging in sacred grooves and relic forests.

iii. Sustainable forest management,

iv. Forest carbon stocks enhancement, eg agroforestry interventions, especially the use of shade trees, management of natural regeneration leading to secondary forest formation

v. Conservation of forest carbon stocks, eg management of sacred groves, dedicated forests and gallery forests.

There are also options for combining strategies to create a particular methodology, for instance, a methodology for carbon accounting in project activities that reduce emissions from mosaic deforestation and degradation. Depending on the land use dynamics and the interrelationships among the driving factors, etc., a particular standard and methodology can be selected or developed. But it is noteworthy that developing a new methodology under a given standard is quite expensive, and should be a final option. Hence serious considerations should be given to modalities to adapt an existing methodology for a proposed project.

Nevertheless, the off-reserve areas in Ghana are characterized by diverse land uses and drivers of land use change including land use rights, land and tree tenure as well as conflicting stakeholder interests. Therefore the potential for REDD+ project types in off-reserve areas require a careful analysis of the criteria above and other requirements to ensure project feasibility. Thus, to ensure major impacts, such a project should be always looked at from the landscape perspective to make it more viable. This could comprise an integrated project on forests under various canopy closeness or woodlands and croplands.

However, it is also important to note that REDD+ projects could be rolled out in different forms. Though the classical intention for the establishment of the REDD+ mechanism is to create an incentive for developing countries to protect, better manage and wisely use their forest resources through the implementation of projects, the architecture for the UNFCCC REDD+ mechanism is still evolving and is not yet fully functional. Hence the compliance and voluntary markets are the major platforms for REDD+ financing. It is obvious that not all projects could meet the methodological and eligibility requirements of generating certified emission reductions (CER) in the compliance and voluntary markets.

Thus, it is important to differentiate REDD+ projects which are being prepared for the carbon market from forestry projects which have mitigation potentials and co-benefits. In effect, not all mitigation projects could be described as REDD+ projects in the strict sense. This is important in managing expectations associated with REDD+ project incentives. For instance, a project could have a perfect emission reductions potential, but the area coverage could be too small, making it financially unattractive for the existing markets, because implementation costs could far surpass financial benefits that could be generated from the carbon market.

4.2 REDD+ Potential in the Savannah and transitional zones

The savannah zone of Ghana is made up of vast areas of savannah woodlands and grasslands, with few forests patches as per the forest definition of Ghana (tree height = 5m, canopy cover = 15% and land area = 1 ha), and as used by the Forest Preservation Project (FPP) of the Forestry Commission (figure 4, FPP/FC, 2012). Land tenure is pretty clear, with much reduced or no disputes over land ownership, mostly under a single paramount chief. This is particularly true for most parts of Gonja land, Dogomba and parts of the Upper West Region, where most of the remaining savannah forests and woodland are located. Though per the national forest definition, the forest cover in the savannah is very little and only exists in patches, there are vast areas of savannah woodlands with aboveground carbon stocks sometimes reaching 60MgC/ha.

Thus, lower levels of carbon stocks could be compensated for by area. The zone also experiences significant anthropogenic land-intensive activities which are sources of serious emissions of carbon dioxide, with associated loss of habitat and wildlife. Drivers of deforestation and degradation could be described largely as mosaic rather than frontier, and are linked to hunters and Fulani herdsmen setting fire to the vegetation, illegal logging of rosewood and mahogany, slash & burn agriculture, as well as unregulated charcoal production. The charcoal production chain is particularly a major driver of change of the savannah/transition landscapes. The emissions sources are both land based and non-land based throughout the supply chain. For example, the production processes as well as kilns are highly inefficient, and involve exploitation of huge volumes of wood, and are strongly linked to food crop production. For instance it is estimated that 7 kg of wood is required in order to produce 1 kg of charcoal (Mombu et al, 2007).

Currently, because of the immense pressure on the forests, shea trees are now being exploited for charcoal production, a situation that could be likened to a taboo in times past, due to the importance of shea trees to the rural economy of the savannah and parts of the transitional zones. The demand for charcoal has placed the vegetation in the savannah and transitional zones under immense pressure. When charcoal production is coupled with wildfires and shifting agricultural practices, the associated emissions could be alarming. However, any attempt to regulate and streamline charcoal production should be carefully examined, since it is a major component of the rural livelihood in the transitional and savannah zones. In this regard, the LPG price rationalization policy by government is expected to push demand for woodfuel or charcoal up.

Invariably, deforestation and forest degradation activities are mostly carried out in the off-reserve areas, because the reserved forests are under relatively strict controls. But a careful observation of the wildlife movement in the savannah zone indicates a need for harmonious relationship between the on-reserve and off-reserve areas. For instance, the off-reserve area between the Mole National park and Bui National park serves as an important migration corridor for most of the wild animals (pers. Comm with Victor Mombu), many of them under various levels of CITES protection. Hence project activities that seek to avoid or slow the conversion of savannah woodland for charcoal production and climate-smart agricultural interventions would boost efforts to sustainably manage the remaining forest patches and woodlands. But also, regulation of logging and good governance strategies could enhance the management of the off-reserve forest patches and woodland.

Therefore a REDD+ activity in the savannah and transitional zones could be associated with significant emission reductions probably as a cost-effective price. However the extent of the initial social cost could be prohibitive if the design of the REDD+ activity is not well thought through. In the long to medium term, critical co-benefits which will have transformational livelihood improvements for the rural poor, in addition to wildlife conservation could be a positive incentive. Therefore emphasis could also be given to sustaining ecotourism, with its associated multiplier effects on surrounding communities.

Based on observations in the landscape, the savannah and transitional zones could have feasible projects to reduce deforestation and forest degradation with possible extensions to forest carbon stocks enhancement strategies. The base case for “additionality” of such a project could be highly positive. This is because the unsustainable existing situation will most likely get worst without any intervention since there is no planned management of the off-reserve forests and woodland. Thus the northern region and most parts of the transitional zone offer good opportunities for forest carbon stocks enhancement in croplands as well as woodlands, which could be integrated into avoiding deforestation in the few patches of forest as shown in figure 4. Figures 4 and 7 provide useful information on the remaining forest areas as well as woodlands, with associated carbon stocks that could inform preliminary decisions on suitable areas for particular REDD+ interventions.

4.3 REDD+ Potential in the High forest zone

Ghana has one of the highest deforestation rates in Africa; approximately 2% per annum within the High Forest Zone (FAO 2006) and the country has lost more than 85% of its forest cover over the past 100 years (Hansen et al., 1999). Invariably, cocoa has been one of the prime drivers of deforestation in Ghana, in addition to other factors such as conversion of forested lands to annual agriculture use (slash and burn agriculture), illegal logging operations and uncontrolled harvesting of NTFPs. The rapid decline of the off-reserve tree stock is an area of particular concern. This was formerly government policy (off-reserve areas being earmarked for progressive conversion to agriculture and other non-forest uses), but a policy change in 1994 in favour of sustainable production has failed to arrest the decline.

With very little incentives, smallholder farmers will rather keep trees off their farms than risk collateral damage from timber operations to their plantation and food crops. The loss of forest cover in the off-reserve areas is also compounded by the unregulated chainsaw logging (Ghana RPP, 2010). For over a century, cocoa has been the major driver of land use change in the high forest zone, and in recent times, the evolution of the full-sun cocoa systems which are now widely adopted have accelerated the pace of deforestation and the removal of shade trees. It is known, however, that the traditional varieties ("Tetteh Quarshie") require much denser crown cover and, in the past, their need for high atmospheric humidity encouraged the farming population to support the forest reserve policy (Ghana RPP, 2010) and the retention of shade trees. But in recent times the full-sun systems are widespread. This is coupled with oil palm expansion and its associated implications for deforestation, though this has been less researched as compared to cocoa.

As the second largest cocoa producer in the world, some 30% of Ghana's population is dependent on cocoa for part or all of its livelihood, and cocoa exports account for approximately one quarter of total exports (ISSER 2003), with cocoa farms covering an estimated 1.45 million hectares (Anim-Kwapong and Frimpong 2008). The increase in cocoa production over the past decade, however, has largely been due to expansion of the land area under cocoa, rather than improved productivity. In fact, studies within the sector suggest that on-farm productivity is quite low and that 40% of farmers fail to make a net profit (Asare and David 2010). An additional challenge is that in the Western Region and southern Brong-Ahafo Region much of the cocoa is grown with low shade cover (less than approximately 10% canopy cover) - a management regime that tends to harbor less biodiversity and carbon (Wade et al., 2011) and is less resilient to changes in climate (Anim-Kwapong and Frimpong 2008) compared to some of the older cocoa growing regions where farmers still grow the crop with relatively higher canopy cover. In Ghana, the agro-forestry / tree crops / agriculture sector is as important as the forest sector itself in defining options for REDD+, because much of the processes of deforestation relate to agricultural or agro-forestry conversion. The cocoa sector presents particularly interesting opportunities in relation to REDD+, with potentially major impacts given its dominant position in the high forest zone.

The best way to do so could be to bundle timber rights with cocoa production, so that the additional timber income tips the balance in favour of the shade-loving cocoa varieties (Ghana RPP, 2010). Providing incentives for the re-establishment of the shade tolerant and dependent varieties would have the important knock-on benefit of enhancing public support for the retention of forest reserves (Ghana RPP, 2010). However, Aitken (2009) observed no significant effect of cocoa variety on carbon stocks or on the number of shade trees on farms growing new and old varieties[2]. Thus, from a realistic view point, it is not a matter of promoting shade tolerant varieties (i.e. Amazon and Amelonado/"Tetteh Quarshie"), because no farmer will do that under the current circumstances, but most importantly, an effective off-reserve REDD+ project could provide the right incentives[3] for farmers to incorporate shade trees in cocoa farms, irrespective of the variety (because the new varieties are also known to tolerate some level of shade), with strong emphasis on the trade-off between cocoa systems with shade trees and those without shade trees.

This could eventually create a corridor that links most protected areas and forest reserves that will result in biodiversity, watershed and improved livelihood co-benefits. More specifically, an off-reserve REDD+ strategy could explore the options of avoiding forest degradation by preventing community members from encroaching into forested areas to establish new farms (with options of integrating various agroforestry systems in food crop production), and encouraging them not to cut down mature forest trees in replanting old cocoa farms. In addition, it could focus on carbon stock enhancement (CSE) through the planting of shade trees or enabled natural regeneration in new/young farms (cocoa agroforests).

4.3 Matrix (rank/score different land use types based on criteria/factors above)

Given the above factors, the different land uses have been ranked according to the scores illustrated in table 4

Table 4: An illustration of scores for different land use types

Score	ƿ	ǂ ƿ	µ ǂ ƿ	β µ ǂ ƿ	Ω β µ ǂ ƿ
Description	Low		Medium		High

A higher illustration of symbols shows a high potential for the criteria in aiding the implementation of a REDD+ project. However, a higher value for constraint and integrity indicates a lower potential for REDD+. Thus, it is a major constraining factor. For instance, a high constraint of law enforcement is a major limitation to the realisation of emission reductions or removal enhancement.

[2] Old varieties represent Amazon and Amelonado/"Tetteh Quarshie", whilst new varieties represent the hybrids.

[3] These incentives could be the review and practical enforcement of tree tenure regimes, constant awareness creation and sensitization on favorable laws and policies that encourage trees in farming systems, as well as adequate compensation for farm damages and conflict management associated with off-reserve timber exploitation.

Savannah zone

Based on figure 7 (biomass map of Ghana), the carbon stocks of forests in the savannah zone were judged to be medium, with high drivers of exploitation and conversion, due to illegal logging, agriculture and charcoal production. There are also high options for additionality and co-benefits for habitats for wildlife, provision of NTFPs etc, but a major constraining factor for REDD+ project (avoided deforestation, conservation of forest carbon stocks or degradation) is that the area coverage could be too small to make it viable (figure 11). It is important to note that most of the forest patches in the savannah zone are located in the forest reserves and protected areas, with only few areas remaining in the off-reserve areas (circled patches). These areas offer the only opportunities for avoided deforestation and degradation options. However, there is the need to quantify the area of these forests for concrete decisions to be taken.

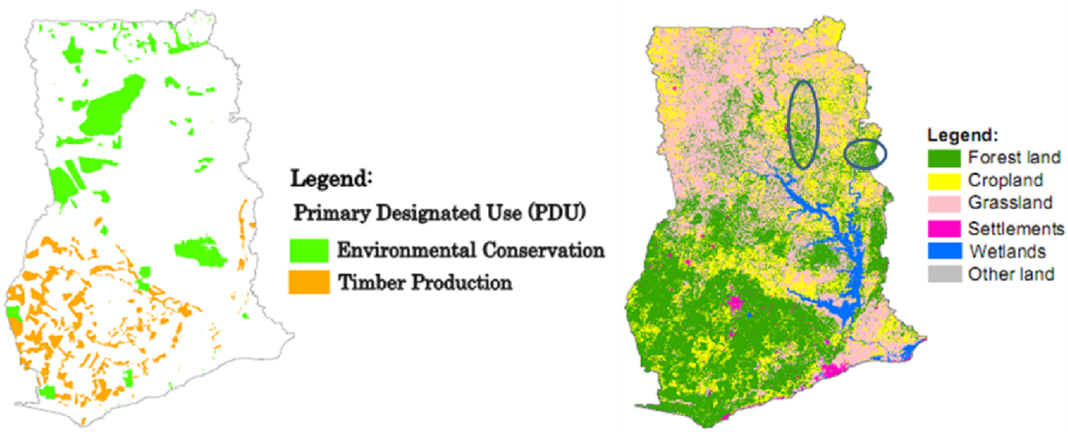

Figure 11: Protected areas and land use classifications in Ghana, showing potential forest patches for REDD+ implementation.

Croplands were also judged to have low carbon stocks, because annual crops which have low biomass are mostly cultivated. Being annuals, they practically have no threat of exploitation because they have short life cycles. Given that croplands are not forests, there is a huge potential for forest carbon stocks enhancement (assuming that forest carbon stocks enhancement is also applicable on lands which are not classified as forests). This is because of the high additionality, limited constraining factors and the potential for the implementation of cross-cutting issues such as good governance interventions. Similar to croplands, grassland/woodland has a huge potential for the implementation of forest carbon stocks enhancement, because it cannot be classified as forest. However, based on the high threat of exploitation for charcoal, agriculture and unregulated logging, there is the need for interventions that will halt the exploitation, including strategies that will boost forest recovery. Furthermore, wetlands and other lands have no scale for emission reductions and viability. Table 5 shows the REDD+ ranking for the different land use types.

Table 5: REDD+ potential matrix of the savannah zone according to landuse types

Landuse	**Criteria**					
	Carbon stocks	Co-benefits	Constraints and integrity	Drivers of land use change	Additionality	Cross-cutting issues
Forestlands	µ ƚ ƿ	Ω β µ ƚ ƿ	Ω β µ ƚ ƿ	Ω β µ ƚ ƿ	Ω β µ ƚ ƿ	β µ ƚ ƿ
Croplands	ƿ	µ ƚ ƿ	ƿ	ƿ	Ω β µ ƚ ƿ	β µ ƚ ƿ
Grassland/open woodland	µ ƚ ƿ	Ω β µ ƚ ƿ	ƿ	Ω β µ ƚ ƿ	Ω β µ ƚ ƿ	β µ ƚ ƿ
Wetlands	n/a	n/a	n/a	n/a	n/a	n/a
Other lands	n/a	n/a	n/a	n/a	n/a	n/a

Transitional zone

Based on figure 4, there are appreciable forest areas in the transitional zone, which have medium carbon stocks (figure 7). There is also an enormous pressure for exploitation for charcoal, agriculture and unregulated logging, including frequent wildfires, high additionality because these areas are under no form of regulation, with high co-benefit options and better chances of implementing successful cross-cutting issues. Therefore project interventions to halt deforestation and avoid degradation are possible. But a major constraint is difficulties associated with land tenure. Most of the land holdings are fragmented, and will require efforts to ensure permanence of the project.

Except the low carbon stocks and low threats of exploitation of croplands, there is a better scale for the implementation of forest carbon stocks enhancement in the cropland areas in the transitional zone. However, land tenure could be a huge constraint that needs to be addressed. Grasslands/woodlands do not have the scale to achieve emission reductions and removals that could be viable. Else, all other factors are favourable for the implementation of a forest carbon stocks enhancement. There is however, no applicable scale and favourable factors for any REDD+ intervention in wetlands and other lands in the transitional zone. Table 6 shows the matrix for REDD+ options in the transitional zone.

Table 6: REDD+ potential matrix of the transitional zone according to landuse types

Landuse	Criteria					
	Carbon stocks	Co-benefits	Constraints and integrity	Drivers of landuse change	Additionality	Cross-cutting issues
Forestlands	µ ł ƿ	Ω β µ ł ƿ	β µ ł ƿ	Ω β µ ł ƿ	Ω β µ ł ƿ	µ ł ƿ
Cropland	ƿ	µ ł ƿ	Ω β µ ł ƿ	ƿ	β µ ł ƿ	µ ł ƿ
Grassland/ open woodlands	µ ł ƿ	Ω β µ ł ƿ	Ω β µ ł ƿ	Ω β µ ł ƿ	Ω β µ ł ƿ	µ ł ƿ
Wetlands	n/a	n/a	n/a	n/a	n/a	n/a
Other lands	n/a	n/a	n/a	n/a	n/a	n/a

<u>High forest zone</u>

Based on figure 7, forestland in the HFZ have high carbon stocks, which are under huge threats of exploitation for cocoa and other tree crops, as well as agriculture and illegal logging. However, it is not clear if the remaining forest in the off-reserve areas could have good area coverage for a viable REDD+ project, given that they are highly fragmented and exist in small patches, coupled with major constraint such as land tenure issues. Most of the land holdings could be under different traditional authorities and families. There are also concerns about land disputes which could hinder the permanence of the project. There is the need to properly quantify the forests in the off-reserve areas to provide useful information for the implementation of avoided deforestation or degradation projects. But importantly, because some of the forests in the off-reserve areas could be sacred grooves and relic forest, there could be options for the implementation of forest carbon stocks conservation (assuming that the total area estimate could be adequate for a viable REDD+ intervention and also provided there could be a methodological guidance for forests in small patches). This is because most of the communities are losing their traditional governance and law enforcement mechanisms that restricted people from using these forests.

Similarly, land tenure issues are constraining factors that will limit the smooth implementation of forest carbon stocks enhancement projects in the HFZ. Else there is a scope for additionality, co-benefits and options to implement cross-cutting issues such as good governance strategies. Though grasslands could pass for a good forest carbon stocks enhancement, major constraints such as land tenure and scale could make it unviable. Wetlands on the other hand have very favourable criteria for the implementation of REDD+ strategies. There are very high carbon stocks compared to terrestrial forests, huge options for co-benefits due to the ecological roles mangrove play in fish spawning etc, and the massive exploitation that it faces, basically for fuel wood.

Table 7: REDD+ potential matrix of the high forest zone according to landuse types

Land uses	**Criteria**					
	Carbon stocks	Co-benefits	Constraints and integrity	Drivers of landuse change	Additionality	Cross-cutting issues
Forestlands	Ω β µ ƚ Ƿ	Ω β µ ƚ Ƿ	Ω β µ ƚ Ƿ	Ω β µ ƚ Ƿ	Ω β µ ƚ Ƿ	β µ ƚ Ƿ
Croplands	β µ ƚ Ƿ	Ω β µ ƚ Ƿ	Ω β µ ƚ Ƿ	µ ƚ Ƿ	Ω β µ ƚ Ƿ	β µ ƚ Ƿ
Grassland/ open woodland	Ƿ	Ƿ	Ω β µ ƚ Ƿ	Ƿ	µ ƚ Ƿ	µ ƚ Ƿ
Wetlands	Ω β µ ƚ Ƿ	Ω β µ ƚ Ƿ	Ω β µ ƚ Ƿ	Ω β µ ƚ Ƿ	Ω β µ ƚ Ƿ	µ ƚ Ƿ
Other lands	n/a	n/a	n/a	n/a	n/a	n/a

5. Implications of land use classifications in the major ecological zones for REDD+ activities in off-reserve forest areas

This section draws inferences from the matrix presented on the various ecological zones in the previous section. The opportunities and challenges for various REDD+ strategies have been discussed.

5.1 Implications to unique ecological characteristics.

5.5.1 Savannah zone

From the matrix, grassland/ woodland offers the best opportunity for emission reductions by source and removals by sink. Based on the fact that, though grassland/woodland is characterised by relatively low carbon stocks, the area coverage gives it a higher potential of deep cuts in emission reductions. This is also linked to the enormous threat to the remaining forest patches and woodland vegetation due to land use which results in high emissions in addition to higher opportunities for co-benefits, lower constraining factors and much greater chance of additionality.

However, it is also possible to explore a combination of land uses in a REDD+ project implementation, due to the mosaic nature of the threats. For instance it is possible to have a project area that encompasses grassland/ woodland, forest and croplands. Thus, depending on the specific requirements of the selected methodology all the REDD+ strategies are possible in the savannah zone. However a major challenge is that, if the current definition of forest is applied, then the savannah zone stands a much reduced chance of implementing any REDD+ strategy that involves avoiding emissions from forests. This is very evident in figure 4, which is a recent map of the FC with regard to land use distribution in Ghana. In such an instance, the only opportunity that remains for the implementation of a REDD+ program is enhancement of forest carbon stocks, which basically entails afforestation and reforestation, including regeneration management through wildfire control.

On the other hand, the savannah zone equally presents opportunities for agricultural carbon, with emphasis on the soil pool. For instance, Adu-Bredu et al., (2010) observed that the soil pool contributed almost 60% to the total ecosystem carbon stocks. However, their study also observed increased disturbance due to fire which could contribute to high emissions from the soil pool. It is therefore important that measures to reduce emissions from the savannah zone encompass landscape approach to agricultural carbon, instead of a REDD+ regime. Nationally Appropriate Mitigation Actions (NAMAs) could also be explored as a programmatic approach of mitigating emissions in the forestry sector.

5.5.2 Transitional zone

Like the savannah zone, the transitional zone exhibits very similar land use characteristics. However, the transitional zone has relatively high distribution of forests, which makes REDD+ strategies that involve avoiding emissions from deforestation and degradation viable. This is strongly linked to higher threats of deforestation and degradation, co-benefits and additionality. However, constraining factors such as tenure and land holdings must be critically examined to address issues of risks of non-permanence.

Additionally, the cropland and grassland/woodland areas offer good opportunities for emission removals through forest carbon stocks enhancement as well as agroforestry intervention with multi-temporal and multi-spatial benefits of forest recovery in most degraded and deforested areas, including agricultural carbon interventions. With charcoal production which is strongly linked to rural livelihood, being an important source of emissions in this zone, it is imperative that mitigation measures are looked at from the landscape perspective in order to attain the necessary scale for emission reductions. Thus, sustainable and efficient charcoal production could be employed as a project intervention to avoid deforestation and degradation of woodlands and forests. This can also be linked to the promotion and use of efficient cook stoves, and a switch to the use of LPG. Here too, program scale mitigation activities through NAMAs can be explored, without necessarily focusing on REDD+. Overall, the cost of project intervention and monitoring should be considered to ensure that incentives from carbon finance would be sustainable for the entire lifetime of the project. This is the major thrust behind a landscape approach to emission reductions or removals.

5.5.3 High forest zone

Based on the matrix, all the land use types in the HFZ proved to be very viable for REDD+ implementation, with the exception of grassland and other lands, basically because of area coverage. However this depends on the mitigation strategy under consideration. But in a landscape REDD+ approach which encompasses all land use types, grasslands could be very viable for forest carbon stocks enhancement, using an appropriate agroforestry intervention. Cocoa has been cited as a major driver of deforestation in the HFZ, with government projecting increased production up to 1 million tonnes by 2012 and beyond. However, given that the size of the forests outside the reserves in the HFZ is estimated to be about 400,000 ha[4] (mostly degraded primary or secondary forest), which is spread across an area of 5 million ha (Abebrese, 2002; Kotey et al., 1998), the potential for an avoided deforestation REDD+ project appears to be reduced in terms of scale, and the same is true for avoided emission through degradation. This basically means that the remaining off-reserve area's potential for REDD+ implementation is forest carbon stocks enhancement. But for this to happen, the position of cocoa as a land use should be adequately clarified as part of the national REDD+ strategy. It is very clear in Ghana's RPP that cocoa is considered as a crop, however, the latest land use map of the Forest Preservation Project of the FC clearly bunched cocoa up with natural forests, a contradiction that has implications for the kind of REDD+ strategy that can be implemented in

[4] This figure is outdated for this discussion, given the landuse dynamics in the Off-reserve areas in Ghana, it could be lower. However it's the only available figure as of the time of completing this report.

the HFZ. If cocoa is considered as a cropland, then the only alternative intervention for REDD+ in the off-reserve areas is through forest carbon stocks enhancement. On the other hand, if cocoa is classified as forest (a position that will contradict the reality on the ground and the Ghana RPP), then there could be a huge scale for all REDD+ interventions. There could however be approaches to avoid deforestation and degradation in the remnant forests in the HFZ, but the scale and emission reductions potential, need to be examined more critically.

Nevertheless, an area that is largely unexplored is the role of wetlands, particularly mangroves in emission reductions and removals. With below and aboveground carbon stocks almost 10 times higher than terrestrial forests, a massive threat due to exploitation for fuel wood and an appreciable scale (Asante and Jengre, 2012), mangrove forests could be very viable mitigation projects. The south-eastern coastline of Ghana has the highest potential, because of the massive exploitation of mangroves, coupled with pretty organized management regimes. However the condition of the mangroves in the south-western coastline is relatively intact, with very little exploitation pressure, but it is believed that this will be short lived, as infrastructural development associated with oil and gas exploitation and fuelwood utilization begins to peak (Asante and Jengre, 2012).

6. Conclusions and recommendations

This section presents the conclusions of major issues highlighted in the report and recommendations for further improvements for effective implementation of REDD+ in off-reserve areas in Ghana.

It is obvious that the success of REDD+ implementation in off-reserve areas across the three ecological zones (based on REDD+ relevance) is mixed. Whilst forestland in the savanna zone appears to be feasible based on a set of factors; it is highly unrealistic to materialize in terms of scale. However, grasslands and savannah woodlands offer a better opportunity for REDD+ implementation, but this is also constrained by the fact that it cannot be considered as forests, based on the Ghana national definition of forests. Thus, the only viable REDD+ mechanism in the savannah zone that could qualify for the compliance or voluntary market is forest carbon stocks enhancement.

On the other hand, the transitional zone appears to have an appreciable overall rating for REDD+ implementation in the off-reserves, but only if an integrated landscape approach is adopted, due to the fact that the drivers are mosaic and not frontier, with charcoal production and unsustainable farming systems dominating the anthropogenic activities in the landscape. With regard to the HFZ, a viable REDD+ project in the off-reserve area is quite unclear, based on the classification of cocoa using the national definition of forests. However, if cocoa is considered as a cropland, then the only alternative intervention for REDD+ in the off-reserve areas is through forest carbon stocks enhancement. On the other hand, if cocoa is classified as forest (a position that will contradict the reality on the ground and the Ghana RPP), then there could be a huge scale for all REDD+ interventions.

Given the fact that few forests patches exist in the HFZ (mostly secondary and degraded forest), the viability of implementing avoided deforestation/ or degradation REDD+ projects is low. This is based on the scale of the project. There could however be approaches to avoid deforestation and degradation in the remnant forests in the HFZ, but the scale and emission reductions potential, need to be examined more critically. Tree incorporation in food crop systems and agroforestry interventions, could be viable forest carbon stocks alternatives that could be employed to boost the off-reserve forest cover.

But an area that is largely unexplored is the role of wetlands, particularly mangroves in emission reductions and removals. With below and aboveground carbon stocks almost 10 times higher than terrestrial forests, a massive threat due to exploitation for fuel wood and an appreciable scale, mangrove forests could be very viable mitigation projects.

Based on the above conclusions, the following recommendations are made;

i. An integrated landscape approach for REDD+ implementation in the savannah and transitional zones should be explored. This is based on the fact that per the national forest definition, only few patches remain as forests, with the bulk of the savannah landscape classified as grassland/woodland.

ii. Any mitigation project in the savannah and transitional zones will have critical co-benefit components, especially with respect to wildlife and biodiversity conservation, and improvement of rural livelihood.

iii. Other options for emission reductions such as agricultural carbon and NAMAs should be explored due to the scale, potential of the soil organic carbon pool and emissions associated with unsustainable landuse as well as fire.

iv. Forest carbon stocks enhancement, remains a veritable REDD+ strategy in the HFZ. Agricultutal carbon and NAMAs also could be options that can be pursued, because of the relatively flexible methodological considerations.

v. Cocoa remains a major driver of deforestation in the HFZ, there is an apparent confusion with regard to its classification (cropland or forest) based on the national forest definition and the RPP. It is therefore important that these issues are clarified, in order to fashion out a viable implementation strategy much more clearly.

vi. Mangroves should be included in the off-reserve REDD+ implementation strategy, based on the high emission reductions and removal potentials, including threats of massive and unsustainable exploitation.

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