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# Exploring Opportunities for Promoting Synergies between Climate Change Adaptation and Mitigation in Forest Carbon Initiatives

**Eugene L. Chia [1,*,†], Kalame Fobissie [2] and Markku Kanninen [2]**

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1 C/o CIFOR P.O. Box 2008, Messa, Yaoundé 237, Cameroon
2 Viikki Tropical Resources Institute, Department of Forest Sciences, University of Helsinki, Latokartanonkaari 7, P.O. Box 27, Helsinki 00014, Finland; fobissie.kalame@helsinki.fi (K.F.); markku.kanninen@helsinki.fi (M.K.)
* Correspondence: lohchia@gmail.com; Tel.: +237-678-057-925; Fax: +237-222-227-450
† Independent Consultant.

**Abstract:** There is growing interest in designing and implementing climate change mitigation and adaptation (M + A) in synergy in the forest and land use sectors. However, there is limited knowledge on how the planning and promotion of synergies between M + A can be operationalized in the current efforts to mitigate climate change through forest carbon. This paper contributes to fill this knowledge gap by exploring ways of planning and promoting M + A synergy outcomes in forest carbon initiatives. It examines eight guidelines that are widely used in designing and implementing forest carbon initiatives. Four guiding principles with a number of criteria that are relevant for planning synergy outcomes in forest carbon activities are proposed. The guidelines for developing forest carbon initiatives need to demonstrate that (1) the health of forest ecosystems is maintained or enhanced; (2) the adaptive capacity of forest-dependent communities is ensured; (3) carbon and adaptation benefits are monitored and verified; and (4) adaptation outcomes are anticipated and planned in forest carbon initiatives. The forest carbon project development guidelines can encourage the integration of adaptation in forest carbon initiatives. However, their current efforts guiding projects and programs to deliver biodiversity and environmental benefits, ecosystem services, and socioeconomic benefits are not considered explicitly as efforts towards enhancing adaptation. An approach for incentivizing and motivating project developers, guideline setters, and offset buyers is imperative in order to enable existing guidelines to make clear contributions to adaptation goals. We highlight and discuss potential ways of incentivizing and motivating the explicit planning and promotion of adaptation outcomes in forest carbon initiatives.

**Keywords:** forest carbon; mitigation; adaptation; synergy; biodiversity and social benefits; carbon stocks sustainability

## 1. Introduction

Climate change is already having serious consequences on social and ecological systems with individuals, countries, and ecosystems being affected differently. Globally, policy efforts at the United Nations Framework Convention on Climate Change (UNFCCC) are ongoing to provide a response to the impacts of climate change through mitigation and adaptation (referred hereafter as M + A). Mitigation, which addresses the causes of climate change, is about reducing emissions of greenhouse gas (GHG) and enhancing sequestration [1]. The management of natural systems through land use, land use change, and forestry (LULUCF) activities are responsible for about 15%–25% of total

anthropogenic GHGs emissions [2]. Through natural systems, carbon sinks can be enhanced by carbon sequestration, while reducing carbon emission sources can be achieved by conserving carbon stocks exposed to degradation. Sequestration activities are aimed at transforming low carbon stock storing capacity land to land with higher capacity for storing carbon. Conservation activities prevent land with high carbon stocks from being converted to land with low carbon stocks [1].

According to the Intergovernmental Panel on Climate Change (IPCC) [3], adaptation is about addressing the effects of climate change, which refers to any adjustment in natural and human systems in response to present or future climate stimuli that mitigates harm and exploits beneficial opportunities. It deals with reducing vulnerability or enhancing the adaptive capacity of social and ecological systems. Land use, forest systems, and forest peoples are vulnerable to climate change, thus designing management strategies to enable these systems and peoples to adapt to climate change is important. However, in land use and forestry sectors, mitigation and adaptation might demand and/or compete for the same type of land use activities, financial and technical resources. Planning and using the same activities, arrangements, and inputs for mitigation and adaptation outcome is possible and necessary [4,5].

There is growing consensus that M + A can be designed and implemented in synergy at different scales in the forest sector. Efforts in policy approaches are still premature at the international, national, and project levels, with policy makers and practitioners still struggling to grasp its feasibility [6]. The bulk of the current research discusses synergy at the theoretical and conceptual level without pointing out how it can be planned and implemented, especially within the present mitigation-dominated climate change response context, *i.e.*, looking at the opportunities that exist in current forest carbon mechanisms, funds, and standards. This paper contributes to the M + A synergy knowledge by examining eight widely used guidelines for generating forest carbon emission reduction credits for climate change mitigation. The paper assesses the opportunities of these guidelines to direct and guarantee the planning and promotion of M + A synergy in forest carbon projects and programs. We assume that guidelines reflect how a project will be designed and implemented, and what it will achieve in practice in a successful situation.

This paper develops a set of principles and criteria against which the guidelines used in developing forest carbon projects and programs are compared and evaluated. Then, the case of a forest carbon project development experience is used to illustrate how the principles and criteria can be put into practice. The paper further discusses potential ways of incentivizing the planning and promotion of synergy outcomes in forest carbon initiatives. This paper is relevant for actors interested in M + A synergy in forestry from local to global levels.

## 2. Synergy between Adaptation and Mitigation in Forestry Activities: Meaning and Rationale

According to the IPCC [3], synergy refers to the "intersection of adaptation and mitigation so that their combined effect is greater than the sum effect if implemented separately." Some authors adopt a simple meaning by using the Greek and Latin translation for synergy, which stands for "working together," meaning that it is important to look at conditions where opportunities can be identified for M + A to support each other [7]. The overlap between mitigation and adaptation in forestry activities leads to interrelationships that require planning to take full advantage of potential benefits and minimize potential trade-offs. Firstly, the overlap leads to a relationship where adaptation actions have consequences (positive or negative) for mitigation. Secondly, the overlap leads to a relationship where mitigation actions have consequences (positive or negative) for adaptation. Thirdly, the overlap leads to actions that produce trade-offs between adaptation and mitigation. Both mitigation and adaptation can benefit from these relationships. First, carbon storage through avoided deforestation and forest degradation is more likely to be permanent if it integrates the adaptation needs of communities and forest ecosystems [8,9]. Second, integrating adaptation needs is an incentive and motivation for local people to accept carbon projects, thus a guarantee of sustainability [10]. Third, adaptation projects that integrate mitigation activities may be able to benefit from carbon funding and capacity building opportunities and donors may go in for adaptation projects that produce global mitigation benefits [4,8].

Planning and implementing M + A in an integrated manner can be more efficient and effective [9,11]. However, it is argued that the implementation of synergy measures will encounter institutional and organizational complexity at the international and national levels, and forcing them together might be counterproductive [8]. For example, at the UNFCCC level, these are two separate negotiation streams with different funding mechanisms, focal points, and funding sources. Similarly at the national level, these are two separate mechanisms with two separate focal points and ministries in some countries like Congo, Sudan, Ghana, Burkina Faso, *etc.* This paper builds on the second relationship, where synergy between M + A is seen as an achievement of adaptation goals in forest carbon initiatives.

According to Duguma *et al.* [12], looking at synergy only from the lens of co-benefits is necessary but insufficient to address synergy needs. They propose that synergy should be viewed from a landscape system approach, where M + A are considered as part of a broader number of multiple landscape functions that are delivered by a set of practices. However, other authors proposing this approach ("climate-smart landscapes") stressed that results will be achieved depending on how technical capacities, institutions, political support for multi-stakeholder planning, governance, spatial targeting of investments, and multi-objective impact monitoring are strengthened [13].

## 3. Methods

### *3.1. Choice of Guidelines*

This paper examines eight guidelines used in designing and implementing forest carbon initiatives. They are widely used and they provide guidance in the development of projects and programs at the national, sub-national, and local levels in multiple regions and countries of the world [14]. Six of these guidelines are provided by standards; they include Plan Vivo (PV) standards, Verified Carbon Standards (VCS), Climate Community Biodiversity Alliance (CCBA) standards, the Gold Standards, SOCIAL CARBON standards, and REDD Social and Environment (REDD S & E) Standards.

One is a policy mechanism, *i.e.*, the Clean Development Mechanism (CDM) of the UNFCCC, and the other a fund-based mechanism, *i.e.*, the Emission Reduction (ER) program of the World Bank Carbon Fund. This is one of the largest funding programs for forest carbon schemes (REDD+) and involves multi-lateral institutions providing compensation to participating countries for verified emission reductions.

### *3.2. Data*

Data were obtained principally from official guideline documents of the organizations setting up and driving the agenda of the fund, mechanism, and standards. Guidelines contain information related to project or program design, implementation, verification, monitoring, and validation. Guidelines are operationalized as principles, criteria and indicators that define issues of concern and conditions to be fulfilled in order to realize the development and implementation of quality forest carbon projects and programs. For project or program developers and communities, the guideline documents provide direction and recommendations to develop high-quality carbon projects that deliver sound environmental and community benefits. This is important to garner potential project investors. For investors or offset buyers, guidelines enable them to screen and select projects that can provide returns to their investments—projects that actively address environmental and social performance factors. Through recommendations from guideline documents, governments can monitor and ensure that projects within their boundaries contribute to their objectives e.g., sustainable development in the case of CDM initiatives.

The interpretation and judgment made on guideline documents for designing and implementing forest carbon initiatives is based on the expertise of the authors. Expert in this case refers to years of research experience on climate change adaptation and mitigation in the context of forests and forest-dependent communities from the local to the global levels. There is no doubt that experts' judgment might have limitations because their competence in proffering judgment might not be a guarantee of accuracy, but it can provide some reliable assessments.

### *3.3. Analytical Framework: Principles and Criteria*

Principles and criteria are important for planning and promoting synergy between M + A in forest carbon initiatives (Table 1). Principles provide a basis for guiding action in terms of designing and implementing forest carbon activities that deliver adaptation outcomes. Each principle is accompanied by a number of criteri, to help operationalize the principles and make judgments. The principles and criteria were developed from the existing literature (Table 1).

**Table 1.** Principles and criteria for guiding the integration of adaptation goals in forest carbon activities.

| Principles | Criteria | Sources |
| --- | --- | --- |
| The health of forests ecosystems should be maintained or enhanced | - The exposure of forest and other related systems to climate change should be assessed<br>- The sensitivity of forest and other related systems to climate change should be assessed<br>- Adaptation strategies for forest and other related systems should be designed<br>- The environmental impact assessment of project activities should be done<br>- Strategies to reduce impacts or enhance biodiversity and ecosystem services should be designed | [4,9,14–16] |
| The adaptive capacity of forest-dependent communities should be ensured | - The livelihood resources/assets in project and program areas should be assessed<br>- The impacts of projects and programs on livelihood resources should be assessed<br>- Strategies to enhance the livelihood resources of communities should be designed | [14,17,18] |
| Carbon and adaptation benefits should be monitored and verified | - Carbon values and benefits should be monitored and verified<br>- Adaptation benefits should be monitored and verified | [19,20] |
| Initiatives should demonstrate the need to plan and expect adaptation outcomes | - The population or social groups vulnerable to climate change and suitable to carry out forest carbon activities should overlap<br>- The location vulnerable to climate change and suitable for forest carbon activities should overlap<br>- Carbon activities implemented should potentially contribute to adaptation outcomes | [1] |

Principle 1: The Health Condition of Forest Ecosystems Should Be Maintained or Enhanced

Forest ecosystem health is a condition wherein a forest has the capacity for renewal, for recovery from a wide range of disturbances, and for retention of its ecological resiliency, while meeting the current and future needs of people for desired levels of values, uses, products, and services [21]. Pramova and Locatelli [14] state that to reduce the risks of climate change on forest ecosystems, it is important to assess vulnerability (exposure + sensitivity + adaptive capacity) and plan for adaptation measures. Given such risks, and without management strategies to enhance adaptation, the potential of planted forests and natural forests to sequester and store carbon will be diminished, thus feeding a positive feedback of carbon emissions [4]. Furthermore, the enhancement of the adaptive capacity of planted and natural forest may contribute in reducing the vulnerability of peoples who depend on forest ecosystem services [15]. Information on climate scenarios provides an opportunity for joint planning of adaptation and carbon conservation and reforestation projects [9]. Addressing and protecting safeguards related to the enhancement of environmental integrity through biodiversity and ecosystem services conservation provide opportunities to enhance synergy outcomes in forest carbon initiatives [16]. In this context, environmental impacts should be assessed, accompanied by strategies to reduce impacts. This will ensure the continuous flow of forest ecosystem goods and services relevant for the adaptation of forest and other related natural and production systems [20].

Principle 2: The Adaptive Capacity of Forest-Dependent Communities Should Be Ensured

The determinants of adaptive capacity are linked to the livelihood assets/resources in project areas. They include physical assets (infrastructure and technology e.g., irrigation, weather stations), natural assets (productive land, forest resources); social assets (collective action, property rights, access and use of resources; social networks, equity, and participation); financial assets (income diversification); and human assets (knowledge, skills, education, information) [14,17]. The determinants of adaptive capacity provide the bases for evaluating context-specific adaptation needs across individuals, communities, and locations [18]. Based on the assessment of livelihood assets/resources and the potential impacts of project activities on these assets, strategies for enhancing livelihood resources in project or program areas should be designed.

Principle 3: Carbon and Adaptation Benefits Are Both Monitored and Verified

Guidelines for forest carbon initiatives should consider a comprehensive monitoring and verification of both carbon and non-carbon values (biodiversity, ecosystem services, and social benefits that relate to adaptive capacity) to ensure that both M + A objectives are achieved in forest carbon initiatives [19,20]. Monitoring and verifying the performance of social and environmental indicators is important as it ensures that the adaptive capacity of communities are monitored and enhanced throughout the project cycle.

Principle 4: Initiatives Should Demonstrate the Need to Plan and Expect Adaptation Outcomes

Not all forest carbon projects and programs have the potentials to plan and expect adaptation outcomes. Murdiyarso *et al.* [1] proposed three parameters (Who, Where, Which) that can help forest carbon or adaptation project developers detect potentials for promoting synergy and minimizing trade-offs before making attempts to promote and expect synergy outcomes. First, the parameter of Who requires that the population or social group vulnerable to climate change and that suitable to carry out forest carbon activities overlap. Second, the parameter of Where requires that the location vulnerable to climate change and that suitable for forest carbon activities overlap. Third, the parameter of Which requires that activities to be implemented should have the potential to reduce carbon emissions or enhance sequestration, on one hand, and on the other hand provide opportunities for social and ecological systems to increase their adaptive capacities or resilience. The location of projects

and programs, the communities to be involved, and the type of activities to be implemented are very important in determining the need for adaptation and the effectiveness of mitigation activities [1].

## 4. Results

This section provides an interpretation of whether the proposed principles and criteria are taken into account in the operational guidelines of the standards, the mechanism, and the fund that support the design and implementation of forest carbon projects and programs.

### *4.1. Guiding Forest Carbon Initiatives to Deliver Adaptation Outcomes*

#### 4.1.1. The Health Condition of Forests Ecosystems Should Be Maintained or Enhanced

Of all the guidelines, only the CCBA standards have requirements that take into account the assessment of the exposure of forest and other natural systems to climate change. The other guidelines do not require projects and programs to demonstrate the risks that present and projected temperature, rainfall, and seasonal changes could have on the capacity of forests to deliver carbon benefits and ecosystem services. This is the same with the criterion for assessing the sensitivity of forests and other systems to climate change and that of the design of adaptation strategies for forests and other related systems (Table 2).

For the CCBA standards, projects to be verified as gold adaptation projects are required to identify climate change and climate variability scenarios and impacts, and show that current and anticipated changes are likely or unlikely to have an impact on forests systems in and around project areas. To respond to the likely risks and impacts, projects are required to describe actions to be undertaken to enable forest ecosystems to adapt to the probable impacts of climate change based on a causal relationship that explains how project activities will deliver predicted adaptation benefits [22].

As illustrated in Table 2, all mechanisms require environmental impact assessments, including biodiversity and ecosystem services impact assessments. Furthermore, projects are required to design strategies and measures that will reduce negative environmental impacts and enhance biodiversity and ecosystem services. Except for the CDM mechanism, which does not take into account the design of strategies to enhance biodiversity and ecosystem services, all other standards require projects to identify and moderate any threats to biodiversity as a result of project intervention. Projects, therefore, must not lead to any negative environmental impacts such as soil erosion and/or reduction in water quality. The Plan Vivo standards, for example, require that only non-invasive native and naturalized species should be planted to avoid any negative impacts on biodiversity and the provision of important ecosystem services in and around project areas [22].

All mechanisms except the CDM require projects and programs to present and justify how net positive environmental and biodiversity benefits will be achieved. Among the different mechanisms, only the CCBA standard provides comprehensive guidance on evaluating and enhancing the health of forests and other natural systems.

#### 4.1.2. The Adaptive Capacity of Communities Should Be Ensured

All guidelines require projects and programs to carry out livelihood resources assessment or baseline assessment of the socioeconomic conditions in project areas and identify potential impacts of projects on livelihoods (Table 3). Of all the standards, only the VCS lack guidance on the design of strategies to avoid the negative impacts of activities on community livelihoods. Furthermore, among the guidelines, the VCS and CDM guidelines lack requirements for projects to enhance the livelihood conditions of communities in project areas. The CCBA and Plan Vivo guidelines go further to demand social and livelihood impact assessments for surrounding communities, accompanied by measures to avoid negative impacts. In the guidelines, social or community aspects are strongly linked to financial, natural, social, and human resources. Projects are required to demonstrate clearly how project activities will improve the wellbeing of communities, especially the marginalized and/or the

vulnerable. From this perspective, all the guidelines except the VCS and CDM implicitly provide guidance for projects and programs to assess and enhance the adaptive capacity of communities.

#### 4.1.3. Carbon and Adaptation Benefits are Both Monitored and Verified

Of the eight mechanisms, only the REDD S&E Standards and SOCIAL CARBON do not require direct monitoring, verification, and certification of GHG benefits (Table 4). However, in the SOCIAL CARBON standard, in order to get carbon value verification and certification under their framework, projects can combine with the VCS. For adaptation outcomes related to social or livelihood aspects, or environmental, biodiversity, and ecosystem services, only the VCS does not provide a regulatory framework for monitoring and verification of performance. The other standards are required to demonstrate net positive socioeconomic and environmental performance. This can only be well demonstrated when a robust monitoring and verification plan is put in place. For the CDM, there is no clear net positive socioeconomic and environmental performance requirement; opportunities for monitoring and verification are limited to the measures of preventing negative environmental and social impacts. Notwithstanding, the VCS provides opportunities for project developers to combine VCS and CCBA standards to take advantage of the social and environmental requirements of the CCBA standards. Due to the complexity in carrying out biodiversity and ecosystem impact assessments, some standards provide tools that guide project developers to carry out rigorous assessments that are always done alongside carbon verification and monitoring. Most of the standards require monitoring and verification every five years, and some require additional yearly reporting of observed changes that might pose a risk in project areas [22].

#### 4.1.4. Demonstrating the Need to Plan and Expect Adaptation Outcomes

Of all the guidelines, only the guidelines of the CCBA standard provides opportunities for forest carbon projects to prove the need to plan and expect adaptation outcomes. The guidelines allows project proponents to show (1) the overlap between social groups vulnerable to climate change and suitable to carry out forest carbon activities; (2) the overlap between locations vulnerable to climate change and suitable for mitigation activities; (3) that activities to be implemented will increase the resilience of productive systems and the adaptive capacity of social systems.

### *4.2. Operationalizing the Criteria for Planning Synergy Outcomes: Case of the Envira Amazonia Project, Acre, Brazil*

The project was approved in April 2015 under the CCBA standard third edition as a Climate Adaptation, Community, and Biodiversity Gold Level project. The project started in 2012, with a lifetime of 60 years and a 10-year GHG accounting period. The project is expected to reduce deforestation and mitigate associated GHG over a project area of about 39,600 hectares [35]. This project was chosen based on the fact that the design and implementation of project activities is guided by the CCBA standard requirements, which attempt to take into account all the guiding principles and criteria relevant for planning and promoting synergy. It should be noted that the choice is not a measure of strength, but a simple example of how the proposed principles can be used in practice to improve existing guidelines for developing forest carbon activities that will deliver adaptation benefits (Table 5). In addition, as an early stage project with no available reporting, we focused on what the validated project design document stated rather than what is going on in practice.

**Table 2.** Assessing the guarantee of healthy forest ecosystems in the guidelines for developing forest carbon initiatives.

| Standards/Mechanism/Fund | Criteria to Guarantee Healthy Forest Ecosystems | | | | |
|---|---|---|---|---|---|
| | **The Exposure of Forest and Other Systems to Climate Change Should Be Assessed** | **The Sensitivity of Forest and Other Systems to Climate Change Should Be Assessed** | **Adaptation Strategies for Forests and Other Related Systems Are Designed** | **The Environmental Impact Assessment of Projects and Programs Should Be Done** | **Strategies to Reduce Impacts or Enhance Biodiversity and Ecosystem Services Should Be Designed** |
| Plan Vivo | 0 | + | 0 | + | + |
| VCS | 0 | 0 | 0 | + | + |
| CCBA | + ** | + ** | + ** | + | + |
| Gold Standard | 0 | 0 | 0 | + | + |
| REDD SES | 0 | 0 | 0 | + | + |
| SOCIAL CARBON | 0 | 0 | 0 | + | + |
| ERPs | 0 | 0 | 0 | + | + |
| CDM | 0 | 0 | 0 | + | + |

VCS: Verified Carbon Standards; CCBA: Climate Community Biodiversity Alliance; CDM: the Clean Development Mechanism; REDD SES: REDD Social and Environment Standards; ERPs: Emission Reduction Programs. + = Criteria are taken into account in the guidelines; 0 = Criteria are not taken into account in the guidelines; ** = Optional requirement; Sources: [22–34].

**Table 3.** Ensuring the promotion of adaptive capacity of communities in the guidelines for developing forest carbon initiatives.

| Standards/Mechanism/Fund | Criteria for Ensuring the Adaptive Capacity of Communities | | |
|---|---|---|---|
| | **The livelihood Resources/Assets in Project and Program Areas Should Be Assessed** | **The Impacts of Projects and Programs on Livelihood Resources Should Be Assessed** | **Strategies to Enhance the Livelihood Resources of Communities Should Be Designed** |
| Plan vivo | + | + | + |
| VCS | + | + | 0 |
| CCBA | + | + | + |
| Gold Standard | + | + | + |
| REDD SES | + | + | + |
| SOCIAL CARBON | + | + | + |
| ERPs | + | + | + |
| CDM | + | + | 0 * |

+ = Criteria are taken into account in the guidelines; 0 = Criteria are not take into account in the guidelines; * = Measures to reduce negative social impacts required; Sources: [22–25,27–34].

**Table 4.** Monitoring and verifying synergy outcomes.

| Standards/Mechanisms/Fund | Verification and Monitoring of Synergy Outcomes | |
|---|---|---|
| | **Verification and Monitoring of Carbon Values and Benefits** | **Verification and Monitoring of Adaptation Benefits** |
| Plan vivo | + | + |
| VCS | + | 0 * |
| CCBA | + | + |
| Gold Standard | + | + |
| REDD SES | 0 | + |
| SOCIAL CARBON | 0 ** | + |
| ERPs | + | + |
| CDM | + | 0 |

+ = Criteria is covered by the respective guidelines , 0= Criteria not covered by the respective guidelines. * = Can be combined with CCBA. ** = Can be combined with VCS; Source: [22–25,27–34].

**Table 5.** Analyzing project design with the conditions for planning and expecting synergy outcomes.

| Criteria | Case of Envira Project | Explanation |
| --- | --- | --- |
| The exposure and sensitivity of forest and other systems to climate change are assessed | Yes | Project proponents studied the regional climate change and climate variability scenarios for Acre, Brazil. Risks related to intense rainfall events, losses in natural systems including rainforest and biodiversity, favorable conditions for the spread of forest fires were identified. Intense rainfall could lead to soil erosion and nutrient depletion, which will in turn increase the conversion of primary forest to agriculture land by communities. |
| Adaptation strategies for forests and other systems should be designed | Yes | Project proponents have designed adaptation strategies for forest biodiversity. |
| The environmental impact assessment of projects and programs should be done | Yes | Environmental and biodiversity impact assessment was carried out in the project area including the assessment of vulnerable trees species and endemic bird species. |
| Strategies to reduce impacts or enhance biodiversity and ecosystem services should be designed | Yes | Project proponents provided a description of measures to maintain and enhance forest biodiversity. |
| The livelihood resources/assets in project areas should be assessed | Yes | The social conditions of communities were assessed, taking into consideration all the different social groups. |
| The impacts of projects and programs on livelihood resources should be assessed | Yes | The project proponents carried out social impact assessment studies in the project areas. |
| Strategies to enhance the livelihood resources of communities should be designed | Yes | Related programs have been designed to make contributions to community wellbeing, which equally targets marginalized and vulnerable groups e.g., livelihood diversification, agriculture and livestock intensification, increase in the delivery of agriculture extension services. |
| Carbon values and benefits should be monitored and verified | Yes | Project proponents have developed a monitoring plan to monitor deforestation and change in carbon stocks in project areas. |
| Adaptation benefits should be monitored and verified | Yes | Project proponents also developed a livelihood and biodiversity monitoring plan to demonstrate net positive social and biodiversity benefits. In addition, project proponents have developed indicators to monitor and demonstrate that project activities leads to net positive adaptation benefits. |
| The population or social group vulnerable to climate change and suitable to carry out carbon sequestration activities should overlap | Yes | Carbon emission reduction objectives will be achieved by changing the forest and land use patterns of the population in the project area, which depends on the socioeconomic condition in the project area. On the other hand, the same population are vulnerable e.g., food insecurity and decreasing income levels. |
| The location vulnerable to climate change and suitable for mitigation activities should overlap | Yes | Intense rainfall events, losses in natural systems including rainforest and biodiversity, favorable conditions for the spread of forest fires, soil erosion where identified as climatic threats, thus a need for adaptation planning. On the other hand, the rich tropical forest in the project area has potentials to avoid tons of carbon emission. |
| Mitigation activities should increase the resilience of production systems | Yes | Keeping trees standing for carbon will sustain the provision of ecosystem services e.g., reduce soil erosion and nutrient depletion resulting from intense rainfall. |
| Mitigation activities should increase the adaptive capacity of social systems | Yes | Project activities e.g., training from agriculture extension services will reduce pressure on forest resources and as well increase agriculture and livestock intensification, and livelihood diversification. For example, communities will be trained on the extraction and processing of medicinal plants, improving pasture management, alternative use of fire for land preparation, *etc.* |

Source: [35].

## 5. Discussion

### *5.1. Opportunities for Planning and Promoting M + A Synergy Outcomes in Existing Guidelines for Building Forest Carbon*

The guidelines are responsible for providing orientations through their procedures, principles and criteria for designing and implementing projects and programs at the national, sub-national, and local level. The analysis has shown that opportunities exist for these guidelines to ensure the planning

and promotion of the synergy between M + A in forest carbon initiatives. However, setting principles and criteria that will address adaptation and mitigation outcomes in projects could be challenging, depending on the environment in which the guidelines are frequently used. For example, the CDM and the ERP, which operates under the UNFCCC and multilateral funding systems, might have the diverse interests of parties to deal with before creating and accepting guidelines that will favor synergy outcomes. Parties might have different incentives and decision making dynamics in terms of costs, benefits, and other institutional and policy requirements. In this case it is difficult to see how parties' negotiations will agree on and deliver a defined global mix of M + A. Given climate change uncertainty, such an ideal mix could change over time [36].

The situation differs for voluntary market guidelines, where the voluntary nature of the market requires standard setters to design guidelines that will achieve greater acceptance either by project developers or offset buyers. Minimizing the social, environmental, and biodiversity risks, with limited transaction cost on project development and implementation, is important in this case. However, balancing acceptability and efficiency of guidelines is a major task when setting guidelines that will easily cover all aspects relevant for adaptation and mitigation [19]. Despite the lack of clear institutional settings to incentivize mechanisms and standards to guide projects towards synergy, land use and forestry mitigation project developers are still making efforts to integrate adaptation goals in their projects. Ensuring the long-term sustainability of projects is a major motivation for project developers to proceed with the integration of adaptation in their activities [37].

Including criteria such as the assessment of the vulnerability of forests and other natural systems to climate change and the design of adaptation measures could require additional costs for project developers, who are already having worries about the initial high transaction cost involved in developing forest carbon projects [38]. Apart from the cost, available and reliable data and expertise to assess present and future climate projections and impacts in particular project sites and program areas could be a challenge to project developers. Tropical developing countries are the main targets for forest carbon projects, and most of them lack meteorological and other related research infrastructures needed for analyzing and downscaling climate projections and climate change impact assessments [39].

The analysis shows that no guideline provides a compulsory and comprehensive coverage of the principles and criteria. The criteria for assessing the vulnerability of forests and other natural systems and the design of adaptation strategies with respect to projected climate change impacts are the least covered criteria. Only the CCBA standard provides an optional adaptation requirement that covers these criteria, necessitating both an analysis of climate change impacts on project activities and the project area in general, and the design of direct measures for adaptation. The little or no concern for these criteria may perhaps be due to the fact that the criteria have little influence on the public acceptability of forest carbon standards, in addition to the extra cost that might be incurred by the process of developing a project or program. Reyers *et al.* [23] assert that insufficient knowledge of climate change patterns, local climate-induced land use change, insufficient knowledge of the quantity, quality, and spatiotemporal pattern of risk occurrence, and lack of clear adaptation strategies are risks that may threaten the viability of forest carbon projects. Thus, to ensure the resilience of forest ecosystems and the maintenance of carbon sinks, adaptive management approaches are required.

The environmental, social, and biodiversity aspects of forest carbon initiatives that can be directed to contribute to social adaptation (*i.e.*, reducing the vulnerability or enhancing the adaptive capacity of peoples to climate change) are widely covered by the guidelines. This might be due to the fact that these aspects score high in the overall public acceptance of standards, especially for those operating in the voluntary market. To ensure that all the factors that influence public acceptance of standards are covered by the guidelines, some propose options for combining the requirements from two different standards. For example, the VCS have the option of combining with CCBA standard guidelines and the SOCIAL CARBON with the VCS guidelines. Allowing and encouraging such an approach indicates that guidelines have potential and are open to explicitly guiding the integration of adaptation in forest carbon initiatives.

Under UNFCCC, the emerging Joint Mitigation and Adaptation Mechanism for the Integral and Sustainable Management of Forest (JMA) is putting forward promising guidelines for developing projects that will deliver M + A outcomes. At the moment the JMA mechanism has not yet been qualified with clear criteria and indicators to operationalize or guide initiatives intended to achieve the objectives of mitigation and adaptation. However, in the submissions to the Subsidiary Body for Scientific and Technological Advice (SBSTA) the proponents of the approach put forward arguments on the potential of the approach to deliver mitigation and adaptation objectives. Theoretically, the JMA as a fund-based approach provideing opportunities to plan, promote, and expect M + A synergy outcomes in projects and programs. Firstly, JMA is considered to contribute to the strengthening of local resources use, management practices, and other land uses in forest landscapes—in community forest management, agroforestry, forest gardens, and smallholder tree planting—without compromising the multiple environmental and livelihood support functions of the forest. Secondly, the JMA approach supports local traditional forest use, which is climate-friendly as well as economically, socially, and culturally viable, with important contributions to poverty reduction. Thirdly, the sustainable use of forests maintains a high potential for adaptation to the changing climate and is the most productive option with few external inputs and so is economically and socially attractive. Lastly, the sustainable use of forests has a low impact on GHG emissions and with a favorable institutional environment can contribute to the enhancement of carbon stocks [40,41]. There is no doubt that the JMA builds on sustainable forest management principles already being practiced in many forest countries and regions. However, at the moment there is a lack of concrete practical experience and lessons on how JMA will actually deliver mitigation and adaptation outcomes, especially with the dynamics related to the multiple roles of forest ecosystems. To this effect, to move the JMA agenda forward, swift country- and region-specific pilot JMA initiatives are required to demonstrate the planning and promotion of adaptation and mitigation outcomes in sustainable forest management.

### *5.2. Incentivizing the Planning and Promotion of Adaptation Outcomes in Forest Carbon Initiatives*

Planning and promoting adaptation in forest carbon initiatives will definitely lead to additional costs for project developers. In this context, *ex ante* payments or financing could be necessary to incentivize and motivate project developers and standard setters to engage in setting and respecting standards that propose principles and criteria that require the planning and promotion of synergy between M + A. The framework proposed in this paper stresses the need to consider adaptation as part of the results of forest carbon activities and related costs that are to be included in the design and implementation phases of forest carbon activities. This links up with the Non-Carbon Benefits (NCBs) expectations of the REDD+ mechanisms, which is being propelled in the UNFCCC mandate [42]. The NCB approach considers adaptation to climate change as one of the categories of NCBs, in which adaptation as an outcome is considered in the early stages of project design and implementation. Currently, forest carbon is being developed through different mechanisms and forms of payments. This implies that it is important to have incentives and payment options that tie in with the characteristics of the different mechanisms. An analysis of recent party and observer SBSTA submissions by Katerere *et al.* [43] highlights three types of approaches that can be relevant to incentivize and motivate the planning and integration of adaptation as an NCB in ongoing forest carbon mechanisms. They include the composite, premium, and eligibility approaches.

In the composite approach, adaptation to climate change as an NCB is fully taken into account at the level of the conceptualization, design, and implementation of forest carbon activities. Payments for performance need to be made to cover the cost of generating emission reduction as well as credits and adaptation benefits. For example, in this approach, integrating adaptation in REDD+ requires that both the carbon objectives of REDD+ and the non-carbon objectives of adaptation are equally handled at all three phases of the REDD+ process. This approach is relevant for initiatives under the UNFCCC mandate, though methodological challenges related to the measurement, reporting, and verification (MRV) of adaptation as NBCs will be difficult to handle swiftly.

The premium approach is associated with the voluntary carbon markets where carbon credits generated from projects that produce NCBs e.g., adaptation to climate change, are sold at a higher price. In this case, standard setters in the voluntary market are encouraged to fully include in their standards principles and criteria for planning and promoting the integration of adaptation in the process of generating carbon credits. On the other hand, this will give project developers the opportunity to plan and promote the outcome of both carbon and adaptation benefits in project design and implementation.

The eligibility approach requires that the integration of NCBs in carbon projects and programs is considered as an additional condition to be fulfilled before accessing funds. Due to limited resources (financial and human), some countries might face difficulties in carrying out effective and efficient MRV of NCBs before accessing funds. In the ER program initiative, for example, NCBs are considered part of the ER program selection process and countries intending to access carbon funds are obliged to demonstrate how NCBs will be generated and promoted [44]. This approach is also associated with the compliance payment mechanism under the UNFCCC. Equally, countries that are not able to show how the social and environmental safeguards in national and sub-national REDD+ processes are identified, addressed, and promoted are not eligible for payments under the convention [38].

## 6. Conclusions

This paper analyzes forest carbon project and program design and implementation principles and the criteria of eight widely used guidelines against principles and criteria identified as important for planning and promoting synergy between M + A. The proposed principles and criteria cut across the social and ecological aspects of adaptation. The complex direct interactions between human and natural systems and climate systems might pose challenges for carbon project developers to analyze climate change vulnerability and design feasible adaptation strategies, even if they are recommended by guidelines to do so. The criteria related to the delivery of the social aspects of adaptation, e.g., socioeconomic benefits, improvement of livelihoods, and the provision of ecosystem goods and services, are taken into consideration in most of the guidelines. This is opposed to ecological aspects, e.g., the vulnerability of forest ecosystems to climate variability and the design of adaptation strategies for forests. The proposed principles require guidelines to direct carbon project developers to design verification and monitoring systems in order to prove the net positive environmental and social performance of their projects.

In general, the guidelines exhibit the potential of guiding projects and programs to deliver adaptation outcomes. However, the efforts made by guidelines, though considered by our analysis as relevant for achieving adaptation goals, are not explicitly considered as adaptation by the guidelines. The guidelines have different reasons for guiding project developers to deliver adaptation outcomes. This could be explained by the fact that adaptation and mitigation are driven by different actors and political economies with distinct international donors and offset buyers.

A framework that incentivizes and motivates different interest groups is important to explicitly introduce and reinforce principles that enhance the integration of adaptation outcomes in forest carbon development guidelines and methods. Framing adaptation as an NCB provides an opportunity to incentivize and motivate the planning and integration of adaptation into forest carbon activities, The composite, premium, and eligibility approaches for compensating NCBs are suitable to each of the guidelines *i.e.*, the voluntary market guidelines, policy mechanism, and fund-based guidelines.

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## References


1. Murdiyarso, D.; Robledo, C.; Brown, S.; Coto, O.; Drexhage, J.; Forner, C.; Kanninen, M.; Lipper, L.; North, N.; Rondón, M. Linkages between mitigation and adaptation in land-use change and forestry activities. In *Tropical Forests and Adaptation to Climate Change: In Search of Synergies*; Robledo, C., Kanninen, M., Pedroni, L., Eds.; CIFOR: Bogor, Indonesia, 2005.
2. Vermeulen, S.J.; Campbell, B.M.; Ingram, J.S. Climate change and food systems. *Ann. Rev. Environ. Resour.* **2012**, *37*, 195–222. [CrossRef]
3. The Intergovernmental Panel on Climate Change (IPCC). *Climate Change 2007: Impacts, Adaptation and Vulnerability*; A Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change; Cambridge University Press: Cambridge, UK, 2007.
4. Guariguata, M.R.; Cornelius, J.P.; Locatelli, B.; Forner, C.; Sánchez-Azofeifa, G.A. Mitigation needs adaptation: Tropical forestry and climate change. *Mitig. Adapt. Strateg. Glob. Chang.* **2008**, *13*, 793–808. [CrossRef]
5. Ravindranath, N. Mitigation and adaptation synergy in forest sector. *Mitig. Adapt. Strateg. Glob. Chang.* **2007**, *12*, 843–853. [CrossRef]
6. Duguma, L.A.; Wambugu, S.W.; Minang, P.A.; van Noordwijk, M. A systematic analysis of enabling conditions for synergy between climate change mitigation and adaptation measures in developing countries. *Environ. Sci. Policy* **2014**, *42*, 138–148. [CrossRef]
7. Illman, J.; Halonen, M.; Rinne, P.; Huq, S.; Tveitdal, S. *Scoping Study on Financing Adaptation-Mitigation Synergy Activities*; Working Paper Copenhagen NORDEN: Copenhagen, Denmark, 2013.
8. Locatelli, B.; Evans, V.; Wardell, A.; Andrade, A.; Vignola, R. Forests and climate change in Latin America: Linking adaptation and mitigation. *Forests* **2011**, *2*, 431–450. [CrossRef]
9. Matocha, J.; Schroth, G.; Hills, T.; Hole, D. Integrating climate change adaptation and mitigation through agroforestry and ecosystem conservation. In *Agroforestry-The Future of Global Land Use*; Springer: Dordrecht, Netherlands, 2012.
10. Wollenberg, E.; Springate-Baginski, O. *Incentives+: How Can REDD Improve Well-Being in Forest Communities?*; CIFOR Infobrief: Bogor, Indonesia, 2009.
11. Verchot, L.; Noordwijk, M.; Kandji, S.; Tomich, T.; Ong, C.; Albrecht, A.; Mackensen, J.; Bantilan, C.; Anupama, K.V.; Palm, C. Climate change: Linking adaptation and mitigation through agroforestry. *Mitig. Adapt. Strateg. Glob. Chang.* **2007**, *12*, 901–918. [CrossRef]
12. Duguma, L.A.; Minang, P.A.; van Noordwijk, M. Climate change mitigation and adaptation in the land use sector: From complementarity to synergy. *Environ. Manag.* **2014**, *54*, 420–432. [CrossRef] [PubMed]
13. Scherr, S.J.; Shames, S.; Friedman, R. From climate-smart agriculture to climate-smart landscapes. *Agric. Food Secur.* **2012**, *1*, 12. [CrossRef]
14. Chenost, C.; Gardette, Y.M.; Demenois, J.; Grondard, N.; Perrier, M.; Wemaere, M. *Bringing Forest Carbon Projects to the Market*; UNEP: Paris, France, 2010.
15. Pramova, E.; Locatelli, B. *Guidebook on Integrating Community-Based Adaptation into REDD+ Projects: Lessons from Indonesia and the Philippines*; CIFOR: Bogor, Indonesia, 2013.
16. Locatelli, B. *Mitigation-Adaptation Synergies. Brochure*; CIFOR: Bogor, Indonesia, 2014.
17. Munroe, R.; Mant, R. *REDD+ and Adaptation: Identifying Complementary Responses to Climate Change*; UN-REDD Programme Infobrief: Geneva, Switzerland, 2014.
18. Brooks, N.; Adger, W.N. *Assessing and Enhancing Adaptive Capacity*; Cambridge University Press: Cambridge, UK, 2005.
19. Yohe, G.W. Mitigative capacity—The mirror image of adaptive capacity on the emissions side. *Clim. Chang.* **2001**, *49*, 247–262. [CrossRef]
20. Locatelli, B.; Kanninen, M.; Brockhaus, M.; Colfer, C.J.P.; Murdiyarso, D.; Santoso, H. *Facing an Uncertain Future: How Forest and People Can Adapt to Climate Change*; CIFOR: Bogor, Indonesia, 2008.
21. Twery, M.J.; Gottschalk, K. Forest health: Another fuzzy concept. *J. For.* **1996**, *94*, 20.
22. Merger, E.; Dutschke, M.; Verchot, L. Options for REDD+ voluntary certification to ensure net GHG benefits, poverty alleviation, sustainable management of forests and biodiversity conservation. *Forests* **2011**, *2*, 550–577. [CrossRef]

23. Reyer, C.; Guericke, M.; Ibisch, P.L. Climate change mitigation via afforestation, reforestation and deforestation avoidance: And what about adaptation to environmental change? *New For.* **2009**, *38*, 15–34. [CrossRef]
24. Climate Community Biodiversity Alliance (CCBA). *Climate, Community; Biodiversity Standards*, 3rd ed.; CCBA: Arlington, VA, USA, 2013. Available online: www.climate-standards.org (accessed on 15 May 2015).
25. Plan Vivo. *The Plan Vivo Standards for Community Payments for Ecosystems Services Programs*; 2013 Version; The Plan Vivo Foundation: Edinburgh, UK, 2013. Available online: www.planvivo.org (accessed on 15 May 2015).
26. Forest Carbon Partnership Facility. Carbon Fund Methodological Framework. Available online: www.forestcarbonpartnership.org/carbon-fund (accessed on 10 May 2015).
27. REDD+ Social and Environmental Standard. *REDD+ Social and Environmental Standard*; Version 2; CCBA: Arlington, VA, USA, 2012. Available online: www.redd-standards.org (accessed on 14 May 2015).
28. Richards, M.; Panfil, S.N. *Social and Biodiversity Impact Assessment (SBIA) Manual for REDD+ Projects: Part 1—Core Guidance for Project Proponents. Climate, Community*; Biodiversity Alliance; Forest Trends; Fauna; Flora International; Rainforest Alliance: Washington, DC, USA, 2011.
29. SOCIAL CARBON. *SOCIAL CARBON Standard*; Version 5.0; SOCIAL CARBON: Sao Paolo, Brazil, 2013. Available online: www.socialcarbon.org (accessed on 13 July 2015.).
30. The Gold Standard Foundation. *The Gold Standard Afforestation and Reforestation Requirements*; Version 9.0; The Gold Standard Foundation: Geneva, Switzerland, 2013. Available online: www.goldstandard.org (accessed on 3 August 2015).
31. United Nations Framework Convention on Climate Change. *Clean Development Mechanism Project Standard*; Version 9.0; UNFCCC: Bonn, Germany, 2015. Available online: https://cdm.unfccc.int/ (accessed on 21 May 2015 ).
32. United Nations Framework Convention on Climate Change. *Clean Development Mechanism A/R Large-Scale Consolidated Methodology: Afforestation and Reforestation of Lands Except Wetlands*; Version 0.2; UNFCCC: Bonn, Germany, 2015. Available online: https://cdm.unfccc.int/methodologies/ARmethodologies/approved (accessed on 13 May 2015).
33. Verified Carbon Standards (VCS). *Verified Carbon Standard*; Version 3.5; VCS: Washington, DC, USA, 2013. Available online: www.v-c-s.org (accessed on 14 May 2015).
34. Verified Carbon Standards (VCS). *Verified Carbon Standard Agriculture, Forestry and other Land Use Requirements*; Version 3.4; VCS: Washington, DC, USA, 2013. Available online: http://www.v-c-s.org/sites/v-c-s.org/files/AFOLU%20Requirements,%20v3.4.pdf (accessed on 14 May 2015).
35. Climate Community Biodiversity Alliance (CCBA). Project Design Document for the Enviria Amazonia Project. 2015. Available online: http://www.climate-standards.org/category/projects/ (accessed on 12 February 2015).
36. Watkiss, P.; Benzie, M.; Klein, R.J. The complementarity and comparability of climate change adaptation and mitigation. *Wiley Interdiscip. Rev. Clim. Chang.* **2015**, *6*, 541–557. [CrossRef]
37. Kongsager, R.; Locatelli, B.; Chazarin, F. Addressing climate change mitigation and adaptation together: A global assessment of agriculture and forestry projects. *Environ. Manag.* **2015**, 1–12. [CrossRef] [PubMed]
38. Thomas, S.; Dargusch, P.; Harrison, S.; Herbohn, J. Why are there so few afforestation and reforestation Clean Development Mechanism projects? *Land Use Policy* **2010**, *27*, 880–887. [CrossRef]
39. Robledo, C.; Kanninen, M.; Pedroni, L. *Tropical Forests and Adaptation to Climate Change: In Search of Synergies*; CIFOR: Bogor, Indonesia, 2005.
40. United Nations Framework Convention on Climate Change. Previous Submissions from Parties to SBSTA. 2012. Available online: http://unfccc.int/documentation/submissions_from_parties/items/8017.php (accessed on 15 May 2015).
41. United Nations Framework Convention on Climate Change. Submissions JMA. 2014. Available online: http://www4.unfccc.int/submissions/Lists/OSPSubmissionUpload/39_97_130566389085107524-SUBMISSION%20JMA%2026.09.2014.pdF (accessed on 21 May 2015).
42. Elias, P.; Leonard, S.; Cando, L.; Fedele, G.; Gaveau, D.; Locatelli, B.; Martius, C.; Murdiyarso, D.; Sunderlin, W.; Verchot, L. *Synergies Across A REDD+ Landscape: Non-Carbon Benefits, Joint Mitigation and Adaptation, and an Analysis of Submissions to the SBSTA*; CIFOR: Bogor, Indonesia, 2014.

43. Katerere, Y.; Fobissie, K.; Annies, A. *Non-Carbon Benefits of REDD+: Options for Assessment and Incentives*; A Technical Paper Prepared for the African Group of Negotiators; CDKN and ACPC-UNECA: London, UK, 2015. In Press.
44. Forest Carbon Partnerships Facility. Update on Pricing Approach. 2014. Available online: https://www.forestcarbonpartnership.org/sites/fcp/files/2014/MArch/CF9%205.%20Update%20on%20pricing%20approach.pdf (accessed on 10 May 2105).