

Review

The Place of Community Forest Management in the REDD+ Landscape

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Abstract: Community forest management (CFM) is identified by many actors as a core strategy for reducing emissions from deforestation and forest degradation in developing countries (REDD+). Others however see REDD+ as a danger to CFM. In response to these contrasting views, we carried out a systematic review of CFM case studies to look at CFM's potential role in achieving forest carbon benefits and social co-benefits for forest communities. We evaluated the potential impacts of REDD+ on CFM. Our review showed that there is strong evidence of CFM's role in reducing degradation and stabilizing forested landscapes; however, the review also showed less evidence about the role of CFM in reducing deforestation. For social benefits, we found that CFM contributes to livelihoods, but its effect on poverty reduction may be limited. Also, CFM may not deal adequately with the distribution of benefits within communities or user groups. These insights are important for CFM-based REDD+ intervention; measures should be adopted to overcome these gaps. Innovative incentive structures to existing CFM are discussed. The recognition of rights for forest communities is one first step identified in promoting CFM. We call for sound empirical impact evaluations that analyze CFM and CFM-based REDD+ interventions by looking at both biophysical and social outcomes.

Keywords: community forest management; reducing emissions from deforestation and forest degradation (REDD+); livelihoods; benefit sharing

1. Introduction

Recent estimates suggest that deforestation has been responsible for the emission of 2.9 Gigatonnes (Gt) CO₂ of carbon dioxide (CO₂) per year over the period of 2001–2015 and forest degradation for 1.0 Gt CO₂ per year over the period 1990–2015 [1]. Starting in Montreal and following a proposal from Costa Rica and Papua New Guinea, the parties to the United Nations Framework Convention on Climate Change (UNFCCC) initiated negotiations for the creation of a mechanism that would provide positive incentives to developing countries to address tropical deforestation. In Bali, at the 13th session of the conference of the parties (COP 13), countries decided to launch demonstration activities aiming at reducing emissions from deforestation and forest degradation in developing countries (REDD). A policy framework for the creation of a performance-based mechanism was adopted in Cancun (COP 16) that would compensate developing countries (Non-Annex 1 countries) on the basis of the measured success in reducing emissions from deforestation and forest degradation or increase carbon absorptions through carbon stock enhancement, sustainable management of forests and forest conservation (REDD+). The Warsaw Framework, including a set of seven decisions, consolidates

REDD+ as one of the key policy option in the climate change mitigation toolbox [2], and REDD+ is mentioned explicitly as a component of the 2015 Paris Agreement [3].

While REDD+ might bring an unprecedented level of funding to tackle deforestation, with the potential to significantly contribute to rural poverty reduction, one of the challenges that REDD+ faces in developing countries is to create a governance structure that can ensure genuine participation and equitable benefit-sharing of those who depend on forest for their livelihoods. The Cancun Agreement specifies safeguard measures that should be respected and monitored in unfolding REDD+ activities in developing countries, including respect for the knowledge and rights of indigenous people and full and effective participation of indigenous peoples and local communities and the enhancement of social benefits, while considering “the need for sustainable livelihoods of indigenous peoples and local communities and their interdependence on forests in most countries” [4].

Community Forest Management (CFM) has been identified as one interesting option to reduce emissions or increase removals from forests [5]. Various academic publications, policy reports, popular press and advocacy papers place CFM at the core of REDD+ implementation [5–11]. Further, the majority of the readiness proposals for REDD+ presented to the Forest Carbon Partnership Facility (FCPF) (<http://www.forestcarbonpartnership.org/fcp/node/203>) of the World Bank and most of those presented to the Collaborative Programme of the United Nations for REDD (UN-REDD) (<http://www.un-redd.org>) refer to community forest management. For some countries such as Ethiopia, Madagascar, Nepal, the United Republic of Tanzania and other countries in Central and South America, a community management program, organized at a national level, is central to the REDD+ national strategy proposed [12].

CFM at the heart of REDD+ is somewhat surprising given that it is well established that the major causes of deforestation and forest degradation in tropical countries are large scale conversion to commercial agriculture and commercial timber exploitation [13,14]. These activities are generally carried out by corporations with government approval, and not by rural communities, even if the local inhabitants are co-opted as labourers. The reason for CFM being placed at the centre of REDD+ in many countries probably relates to the fact that it is much more difficult, politically and economically, to tackle large scale enterprise-based deforestation than community forestry, and because support organizations for indigenous and local communities have been vociferous in the policy debate in demanding that these groups benefit from REDD+.

The popularity of CFM in the global REDD+ discourse at the international level can be partly explained by the fact that it is perceived as being a strategy to achieve dual objectives, forest protection and poverty alleviation. In contrast to protected areas where conservation policy may feature substantial social costs due to exclusion and/or restriction on access and use [15,16], CFM is seen as an option to protect the forest, as well as meeting social goals. Many supporters of CFM see REDD+ as a means of increasing finance for community management and securing new grounds for forest communities through tenure reform and decentralization. They have therefore promoted CFM as a win-win governance framework to be adopted in the planning of national REDD+ programs [7].

Not all of those who have traditionally promoted CFM as a sound policy approach for forest management however consider REDD+ as a good thing for community forestry [17], and some identify REDD+ as a potential threat to forest decentralization and devolution [18]. In the light of past forest tenure reforms, it has also been argued that there is little to expect in terms of benefits for forest communities from REDD+ national policies [19].

Several reviews exist of CFM impacts on forests, livelihoods or both, using more or less systematic approaches. Our systematic review is the first to focus directly on CFM in the REDD+ context in order to generate lessons from CFM experiences for REDD+ and evaluate how REDD+ may influence CFM. This study takes a new angle by examining the role of CFM in achieving REDD+ climate mitigation objectives and social co-benefits, and the potential of REDD+ in promoting and sustaining CFM through access to new income sources, among other co-benefits.

Through a systematic review of literature and in the context of an existing debate and contrasting views about the role of CFM in REDD+ and of REDD+ for CFM, we attempt to answer three main questions: (1) Does CFM appear to deliver carbon benefits? (2) Does CFM appear to deliver social benefits (co-benefits)? and (3) How can REDD+ affect CFM? For the first two questions, we look at reported evidence of positive biophysical and social outcomes in the CFM literature by analysing published CFM case studies. The first question is directly linked to the environmental effectiveness of REDD+ activities and assesses reported evidence of the success of CFM at reducing deforestation and forest degradation, conserving forests, sustainably manage forests and enhance forest carbon stocks (Section 3.1). The second question looks at reported evidence of the success of CFM at generating social benefits including on income, employment, security, empowerment and equity at the local level (Section 3.2). For biophysical and social outcomes, we also test for statistical relationships with potential contextual factors or modifiers that can have an influence on the outcomes of CFM. For the third question (Section 3.3), we use small-scale community carbon sequestration projects and early experiences in REDD+ demonstration projects to explore early reported evidence on the same outcomes as for the first and second questions, acknowledging that there are still limited quantitative cases studies. We also discuss different benefit-sharing proposals as well as opportunities and risks that are relevant for designing better interventions with REDD+ implementation in the CFM context or at the community level.

In the following section, we discuss the global trend and underlying rationale for the promotion of CFM in developing countries. Then, we look at evidence that CFM is fulfilling REDD+ climate mitigation activities, after which we examine the reported social outcomes of CFM. We finally review experiences directly relevant to REDD+ benefit-sharing and participation in community forestry settings.

Community Forest Management: A Global Overview

CFM has various definitions and interpretations (Table 1) reflecting a variety of interventions, the specifics of which vary from place to place. It is a subset of the community-based management of natural resource practices that were initiated in the mid-1970s, designed specifically to promote forest management in a way that takes better account of the needs and interests of forest people. It was considered one of the most promising options for combining forest conservation with rural development, thus meeting poverty reduction objectives.

Table 1. Concepts of community forest management.

Definitions, Interpretations and Synonyms	Sources
An approach to forestry implying community or local control and management of forest resources	Glasseier and Farrigan [20]
Any situation which closely involves local people in forestry activity	FAO [21]
The sustainable management of the forest for wood, non-timber forest products and other services with a social or environmental value, performed by forest-dependent families or smallholders, community groups and indigenous peoples	Growing Forest Partnerships [22]
Type of management in which communities have some degree of responsibility and authority in forest management that encompasses multiple uses involving subsistence and marketing with the goal to conduct an ecologically sustainable use of the forest	Charnley and Poe [23]
Associated terms: “community forestry”, “community-based forest management”, “social forestry”, “participatory or collaborative forestry” or “agroforestry”	Arnold [24], Hajjar [25]

The rationale for promoting greater control by communities in forest protection lies in the following assumptions about the relationship between people and the forest [23]. First, people are more likely to take responsibility for forest resources if they have a sense of ownership and control over them. Secondly, because of their geographical proximity, local communities should be better able to provide effective protection of forests and enforce the rules of access and use. Third, local communities

may be encouraged to defer current livelihood benefits and take future profits into account if they have more control over them [26]. Finally, there are numerous examples of communities managing forests sustainably under customary institutions [27].

In terms of social benefits, thanks to local control, a larger portion of forest rents and greater benefits should accrue to forest communities under CFM in comparison to other conservation approaches [28]. Indeed, it is often assumed that greater local control will produce more social and economic benefits for forest communities. The logic behind this assumption is that: (1) central governments are more likely to prioritize national interests and industries, while local communities will favor their own interests; (2) local institutions are able to respond to community needs more efficiently than central governments because of better information and accountability; and (3) local control provides more opportunities for marginalized groups to influence policy [23,29–31].

Since the mid-1970s, decentralization has become a major trend in global forest governance accompanied by reforms initiated by the governments of major forested countries [32]. This transition came about for multiple reasons. First, it was a response to mismanagement by central governments and international pressure from donors for better forest governance. Centralized control and management of public forests is increasingly regarded as untenable [28]. Public agencies have often been poor stewards of forests due *inter alia* to the difficulty of defending the forest against residents who have little interest in maintaining it if they do not have rights to it and also to abuse by political elites and corrupt interests [33]. Second, it was considered a way of reducing the financial burden of forest governance on governmental budgets. Third, this trend for decentralization has been in response to social demands, domestic and international, for the recognition of the rights of indigenous peoples and local communities over forest resources and for their greater role in managing local forests.

A concomitant forest tenure transition is also taking place. While public ownership of forests still predominates (Figure 1), the absolute area of public forest land administered by governments in 25 of the world's 30 most-forested countries has decreased from 2583 Mha in 2002 (80% of the global forest estate) to 2409 Mha in 2013 (73%) [33–35]. The percentage of forest in developing countries either owned or directly administered by indigenous peoples and other forest communities reached 27% in 2008 (This figure includes data from the 15 countries with most reliable data sets) (Figure 2), representing a significant share of forest area in developing countries. In reality, the forest area *de facto* managed by local people under customary tenure greatly exceeds the area of community and indigenous lands acknowledged by statutory law (see Table 2 for key concepts).

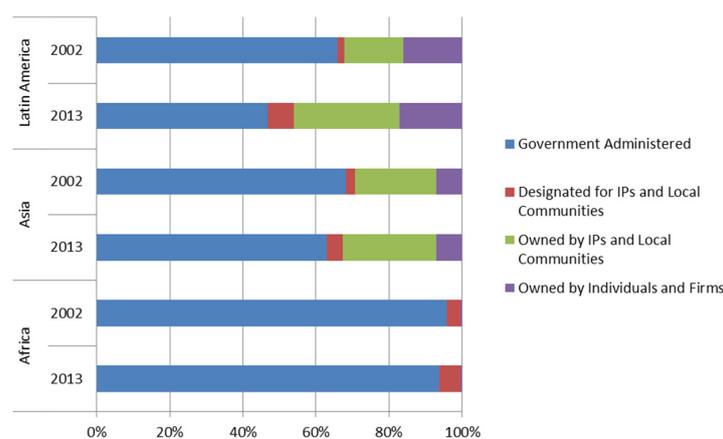


Figure 1. Changes in statutory forest tenure per region, from 2002 to 2013. Public forest ownership is predominant in South America, Asia and Africa. There has been a noticeable increase in forest area designated for indigenous peoples and local communities in Latin America and Asia. Forest owned by individuals and firms has increased in all three regions since 2002. Source: Rights and Resources Initiative—RRI's forest tenure database accessible through the Tenure Data Tool. Available at: <http://rightsandresources.org/en/resources/tenure-data/>.

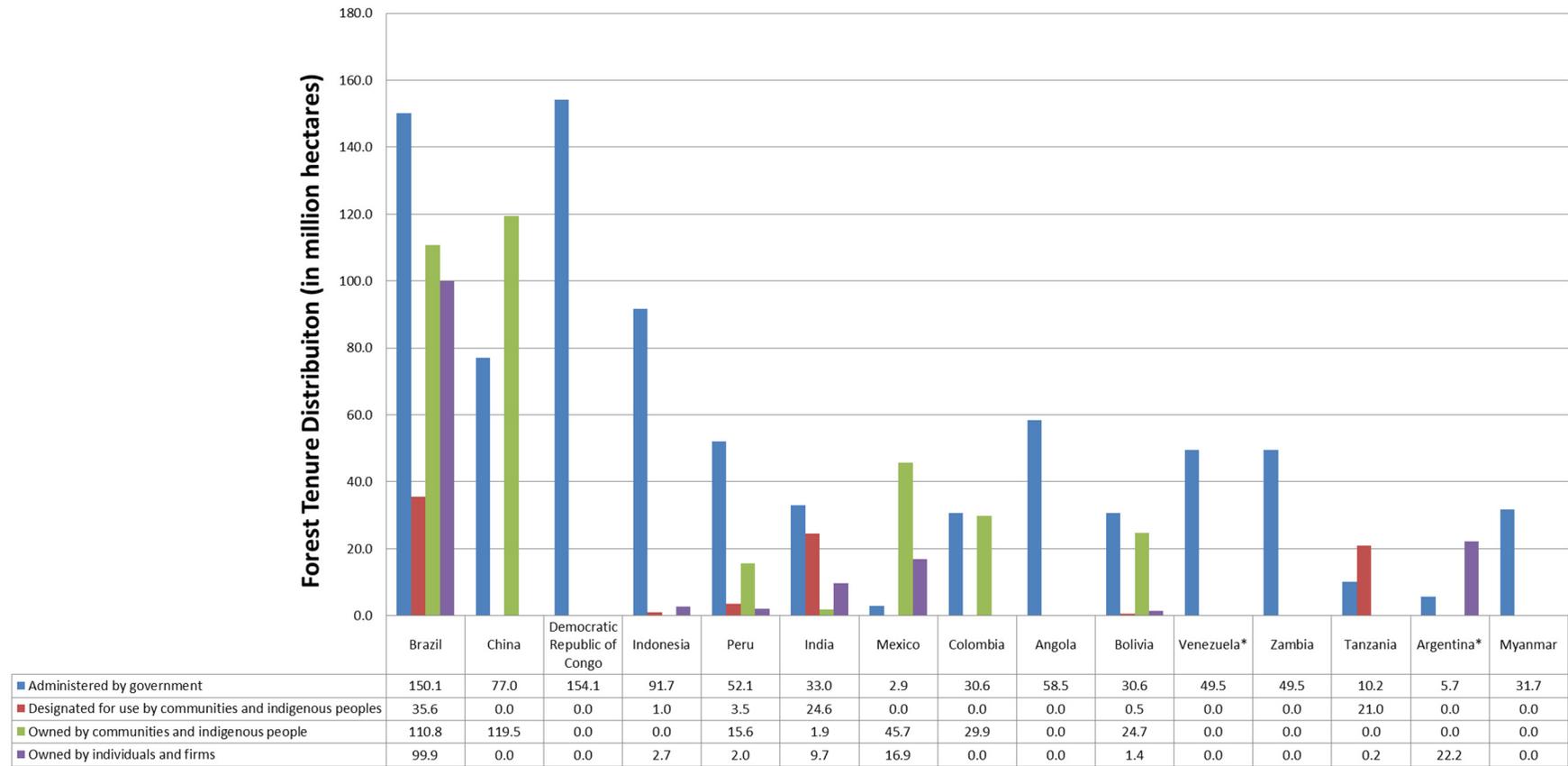


Figure 2. Forest tenure distribution for the 15 most forested developing countries (millions of hectares) in 2013. Source: RRI’s Forest tenure tool [35]; * No data were available for the year 2013.

Table 2. Key concepts for community forest management.

	Definition
Decentralization	The transfer of both decision-making authority and payment responsibility to lower branches of the government OR refers to a full or partial transfer of assets and power ^a from the central government to the lower branches of the government or local institutions. Decentralization is generally observed in forest management.
Devolution	The transfer of rights and responsibilities (of assets and power ^a) to non-state agents who are neither created nor controlled by the state including citizens or forest user organizations
Tenure systems	Rights that define ownership and resource specific user rights including duration and conditions
Customary tenure systems	Tenure systems established by custom or tradition and determined at the local level, rather than by law or contract, often based on oral agreements
Statutory tenure systems	Tenure systems applied by governments and codified by law.

^a Charnley and Poe [23].

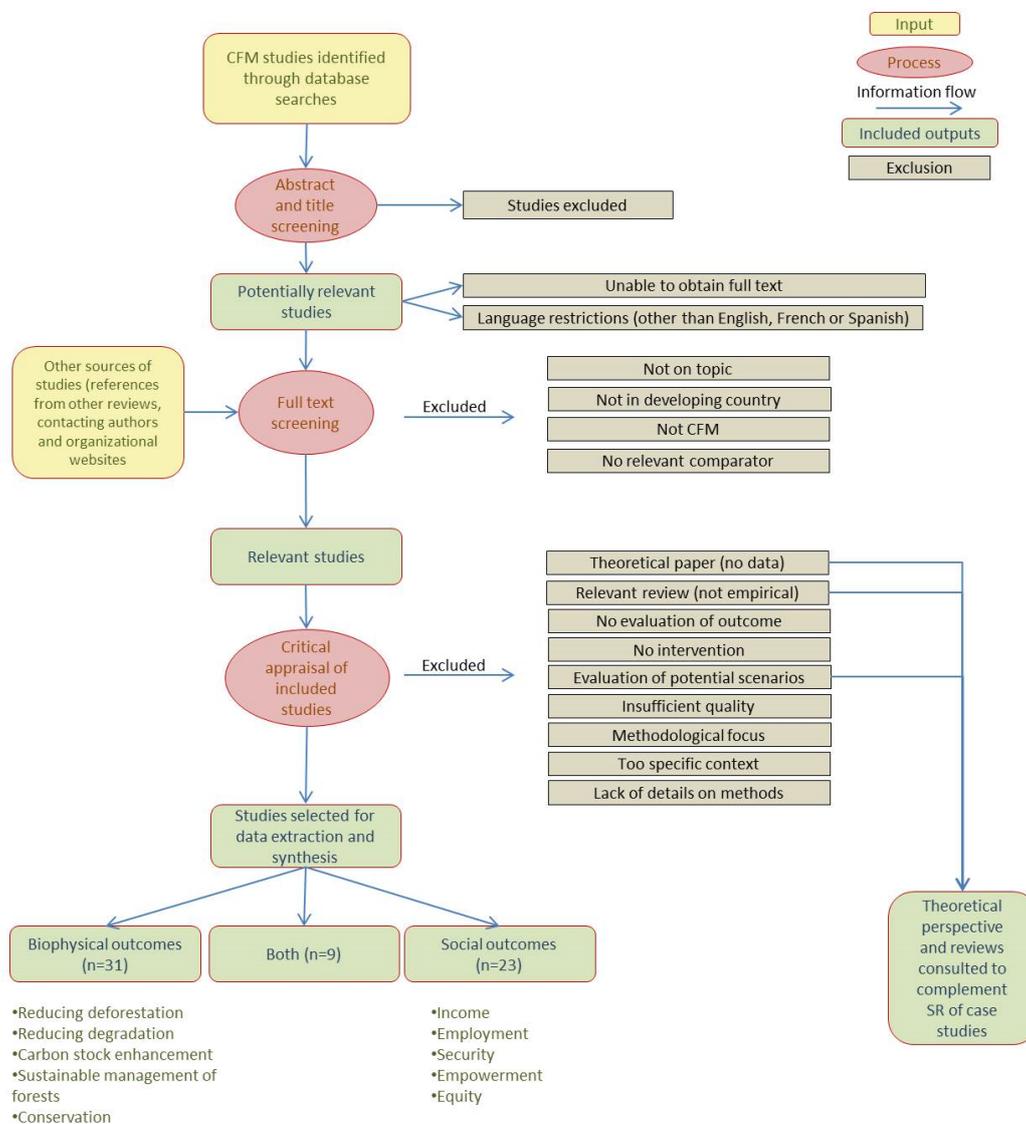
In CFM, the form of tenure and the institutional arrangements between local community or forest user groups and public agencies contribute to determining rights and responsibilities in the management of forests (with the involvement of non-governmental organization or not). There is a vast diversity of institutional arrangements and of realities that will have an impact on forests and livelihoods outcomes. Broadly, we can distinguish three different basic governance models: (1) collaborative/participatory forestry in which the land is formally held by the government and a contract or agreement is reached with local people regarding offtake rates and possibly silvicultural practices such as fire watching, in return for recognition of rights to certain forest products (e.g., Nepal, Tanzania, India, Kenya); (2) community-owned forest where the resources belong to the community and the government provides financial support for conservation through PES or for sustainable timber management (e.g., Mexico, Costa Rica) and (3) indigenous peoples' reserves in which granting of land rights (usufruct) is usually on traditional lands and which are usually more extensive.

2. Materials and Methods

In order to assess the role that CFM can play in REDD+, we examined the contribution of CFM to carbon and social benefits and generate lessons for CFM in the REDD+ context and for REDD+ implemented with forest communities. We performed a narrative systematic review, including also quantitative evaluation. Systematic review is a research methodology used to compile, critically appraise and assess results of primary research to build evidence that can be used to inform policy, highlight knowledge gaps and identify further research needs. This review is narrative as it uses textual and graphical descriptions of findings and key characteristics obtained from systematic review, and it is complemented by a quantitative synthesis with statistical testing.

Publications relevant to the issues were selected through search in the ISI web of knowledge, google scholar and internet. The keywords used in this search included: "Community forest management", "community forestry", "community forest", "community-based forest management", "social forestry", "participatory or collaborative forestry", or "agroforestry" and crossed with "carbon", "land cover", "deforestation", "degradation", "conservation", "carbon sequestration", "livelihoods", "development", "Clean Development Mechanism" and "Reducing emissions from deforestation and forest degradation". Individual terms were combined using appropriate Boolean operators. We also used available reviews on CFM to access original studies through their cited references and contacted expert authors to obtain their reference lists when not publicly available. The initial search generated >3000 results that were assessed for relevance using the title and abstract. The article screening was performed through an iterative process to examine the search results and select the studies

included in this review (inclusion/exclusion criteria). We based our selection on the research questions developed to identify publications reporting on case studies. For the first and second research questions, we included studies of CFM-type of interventions that provided an evaluation of the biophysical outcome in terms of forest conditions, of social benefits including livelihoods and development outcomes or of both biophysical and social outcomes. For the third question, we considered experiences related to carbon mitigation including early REDD+ projects, Clean Development Mechanism for small-scale Afforestation and Reforestation project, and community-based carbon sequestration projects. We limited the geographical scope to developing country cases. The temporal scope chosen for this review ranges from 1992 to 2014. We excluded several publications that discussed the potential of CFM (many cases for small-holders agroforestry) for carbon mitigation (not empirically-based), studies evaluating the contribution without comparator that could be directly assigned to the CFM type of intervention, or cases providing accounts that were too specific (e.g., war context), too theoretical, or with a methodological focus, as well as studies that were not largely applicable and directly relevant to the questions at hand (Figure 3).



Adapted from CEE (2013) Guidelines for Systematic Review and Evidence Synthesis in Environmental Management. Version 4.2. template p.45.

Figure 3. Diagram of the selection and filtering process for the systematic review.

Three broad types of publications were used to answer our research questions: case studies (63/145), reviews (16/145) and papers providing theoretical perspectives (65/145). Most of these are from peer-reviewed publications (122/145) and from journal articles (119/145). We systematically reviewed empirical case studies to obtain a quantitative appraisal of the contribution in both social and biophysical outcomes of CFM (Questions 1 & 2), as well as of small-scale carbon sequestration and early REDD+ project cases (Question 3).

2.1. Critical Appraisal and Data Extraction

In the systematic review of case studies, we used the publication as the unit of analysis and we defined a coding approach to extract data that allows integrating opposite outcomes reported in the same publication. This approach was considered the most realizable despite its limitations since the pool of empirical studies varies greatly in terms of geographical scope and methods, which are often not clearly reported. Separating by specific area of CFM would have required much more information than what is currently published for most cases or relying on a very limited sample size. Our approach aimed to strike a balance between extractable information and sample size. For each study, we coded the outcome as: positive (1), neutral (0), or negative (−1). When multiple cases of CFM were compared in the same study with diverging outcomes or if the same case study was reporting both positive and negative outcomes on the same criterion (e.g., gain and loss of income), the outcome was coded as mixed (1/−1). When a case did not report on a criterion, it was considered a missing value (NA). Therefore, we provide the number of studies that reported on each aspect, or the sample size (n), and we report on the percentage of studies, based on the sample size.

We assessed the reported biophysical and social outcomes of CFM, with 31 studies addressing biophysical outcomes, 23 addressing social outcomes, and nine studies addressing both. For the biophysical outcomes, we assessed reported studies in relation to the five REDD+ activities, i.e., (1) reducing deforestation; (2) reducing forest degradation; (3) carbon stock enhancement; (4) sustainable management of forests; and (5) forest conservation. Positive outcomes at reducing deforestation were identified when the study showed a decline in deforestation rates over time under CFM or lower deforestation rates compared to an area that is not under CFM. Positive outcome at reducing degradation was identified when poor forest conditions were noted to have improved over time under CFM or in comparison to other non-CFM areas. A positive outcome in carbon enhancement was noted with quantified growing stocks or biomass increment. Positive outcomes in terms of sustainable management of forests were observed with no change in forest cover despite community extraction, and conservation impacts qualified as positive with improved or no change in forest conditions were assessed. For social outcomes, we adapted a framework developed by Lawlor, et al. [36] and looked at the reported results in terms of (1) income; (2) employment; (3) security; (4) empowerment and (5) equity. Positive outcomes in terms of security were identified if the case study results reported improvements in land ownership and management rights, access and use rights, carbon rights, health and education through infrastructure development or ecosystem services. Positive outcomes in terms of empowerment were identified if the case study results reported an increased participation in decision-making regarding local land-use and development, capacity-building and training for building social capital to participate more effectively. Positive outcomes for equity were identified if the case study results reported equitable or 'pro-poor' distribution of benefits among wealth groups. For both social and biophysical outcomes, we identified the approach of comparison used in the study for evaluating the impacts of intervention (Is the intervention being compared with no intervention or are alternative interventions being compared with each other? (See Pullin and Stewart [37])). We also included an assessment of the robustness of the methodological approach used by the case study based on the strength of counterfactuals used to demonstrate impacts of CFM interventions, with three tiers of quality (1 = Strong; 2 = Regular; 3 = Weak). The quality of the methodology was qualified as 'strong' when the success of CFM was evaluated with a control or counterfactual and/or over time (using before and after comparison), assessed with statistical methods and controlling for covariates, i.e., the heterogeneity of the context. 'Regular' quality was assigned for studies using comparators, but only when the study did not account explicitly for some

relevant covariates. Study methodological approach was qualified as 'weak' when it relied on residents' perceptions and covariates are not accounted for. In evaluating the methodological robustness of case studies, we made a differentiation between studies assessing biophysical outcomes of CFM and those assessing social outcomes. The success of biophysical outcomes can be measured based on quantitative data with methods that are independent of the users, i.e., using a remote sensing approach and forest carbon inventories. For evaluating social outcomes, we acknowledge that measuring the success of the intervention, particularly for empowerment, security and equity criteria, is much harder to quantify and relies on inputs from the users. We took these differences into account when evaluating the methodological strength of case studies; however, for evaluating the outcomes of CFM interventions, we generally favored studies that apply rigorous counterfactuals, with a quantitative approach, including statistical testing to support evidence. The literature on CFM covering social outcomes includes a number of contributions based on qualitative research methods. These case studies were set in a separate class ('QR'), since they addressed different research goals and typically did not use formal counterfactuals.

Moreover, for each case study, we identify basic characteristics for each one including the country, the type of arrangement (as identified by its authors), the type of ownership (community ownership or designation for use by governmental authority), as well as the main type of extraction (subsistence, enterprise, or both). These characteristics (or modifiers) have been identified in the literature as influencing the outcome of CFM and were tested in this study. The full list of references and case studies evaluation is made available in Supplementary materials.

The reviews and theoretical perspectives publications were used to generate insights on key aspects of tenure, decentralization, participation, enforcement, equity and benefit-sharing, to obtain contextual information that typically characterizes the diverse array of CFM arrangements. Since REDD+ implementation has only just begun, there is a limited set of cases to compare. We have taken advantage of CFM experiences that are directly transferable to the REDD+ context, as well as papers with a more theoretical perspective to identify elements that are central to REDD+.

2.2. Data Synthesis

Data extracted was synthesized by determining the number of studies reporting on each of the ten outcomes. We also used Pearson's Chi-square test with simulated p -value for a relationship between the 10 outcomes and four CFM characteristics (the type of ownership, the type of extraction, the region and the type of arrangement), with a total of 40 contingency tables. For the type of arrangement, we reduce the number of categories from the authors' typology; we re-classified the 30 levels into seven categories: community forestry, indigenous reserve, joint forest management, community forest management, carbon project, REDD, and mixed. The null hypothesis for each Chi-square test is of independence between the two categorical variables. We use Freeman-Tukey (FT) deviates and/or the standardized residuals post hoc tests, to test for significant difference between the observed and the expected values in each cell of the contingency table [38]. The evaluation spreadsheet built for this review was imported in R statistical software [39] as a comma separated value (csv) file and summary statistics and statistical testing were performed based on selected criteria. We assessed the main cited criteria identified under CFM for obtaining positive forest condition, social condition and equity outcomes with relevance for REDD+ implementation at the community level by analyzing the content and recommendations of both empirical and reviews that aim to identify the factors promoting success in CFM. In the following sections, we provide the results from this review and summarize the main points identified in the case studies reviewed, as well as results from other reviews and theoretical work.

3. Results and Discussion

3.1. REDD+ Activities Realized by Community Forest Management

We sought to determine the contribution of CFM in slowing, halting and reverting forest cover loss and therefore its usefulness in terms of carbon benefits by looking to the five types of

REDD+ activities. This question is crucial, as the ultimate goal of REDD+ is to reduce emissions or increase removals of GHGs by forests.

Less than 23% of the studies reviewed report positive results at reducing deforestation (Figure 4). Although reducing deforestation contributes directly to forest conservation, the inverse is not true. Forest conservation does not necessarily imply a reduction in deforestation, a nuance that is important in the REDD+ context. To demonstrate its potential to reduce deforestation, CFM must be located in areas where the pressure of deforestation is strong; at the agricultural frontier, for example. This makes reducing deforestation harder to prove, since it has to be shown that without CFM intervention, forests would have been cut down. It is interesting to note that the studies reporting success at reducing deforestation are only for cases in Latin America, in indigenous reserves or CFM implemented in indigenous areas, with studies from Brazil, Mexico, Colombia, Panama, Guatemala, and Nicaragua. This relationship between success in reducing deforestation and region (Latin America) is statistically significant (FT deviate = 2.13; Critical value = 2.02, $df = 6$), see Table 3. For example, Nepstad, et al. [40] have shown the ability of indigenous reserves to control deforestation and fires in the Brazilian Amazon, where deforestation rates are very high. Aboriginal reserves also appear effective in preventing deforestation in the Guiana Shield in Colombia, despite their limited area [41]. Nelson and Chomitz [42] have demonstrated the effectiveness of Aboriginal reserves in Brazil in preventing forest fires compared to uninhabited protected areas. A recent study by Porter-Bolland, et al. [43] based on a statistical meta-analysis comparing 40 protected areas and 33 cases of community-managed forests found that forests managed by communities have slightly lower and less variable rates of deforestation than protected areas.

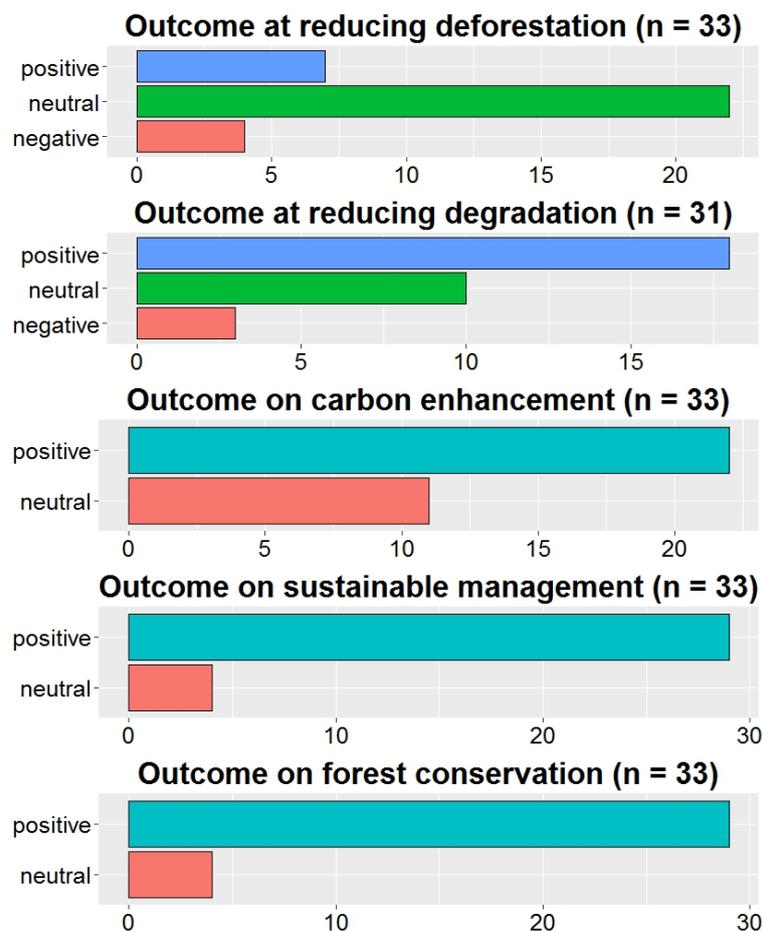


Figure 4. Frequency of the outcome identified for the five REDD+ activities evaluated in this systematic review. The number of studies reporting on each criterion is indicated as the sample size (n).

Table 3. Pearson’s Chi-squared test with simulated p-value between the assessed outcomes and four CFM characteristics. The null hypothesis for each test is of independence between the two nominal variables.

Outcome	Characteristics							
	Type of Ownership		Type of Extraction		Region		Type of Arrangement	
	X-Squared	p-Value	X-Squared	p-Value	X-Squared	p-Value	X-Squared	p-Value
Reducing deforestation	7.851	0.116	2.890	0.639	15.630	0.013 *	11.924	0.500
Reducing degradation	6.905	0.139	5.692	0.229	2.827	0.900	13.620	0.359
Carbon stock enhancement	3.075	0.262	0.797	0.866	0.283	0.999	4.765	0.676
Sustainable management	1.381	0.658	0.556	0.999	4.315	0.202	5.181	0.626
Forest conservation	1.381	0.648	1.806	0.550	4.315	0.210	8.838	0.232
Income	3.560	0.775	9.936	0.035 *	9.973	0.384	22.080	0.087
Employment	6.530	0.248	7.736	0.088	12.450	0.069	10.401	0.453
Security	15.438	0.019 *	4.152	0.592	11.347	0.232	17.628	0.288
Empowerment	4.909	0.311	4.359	0.427	9.098	0.162	10.054	0.511
Equity	7.481	0.527	8.438	0.219	10.102	0.371	11.178	0.780

The asterix ** shows a statistically significant result (at 95% confidence level).

The results of our systematic review of published case studies show that there is substantial evidence that CFM is effective at promoting sustainable landscapes through sustainable management of forests and forest conservation as this was reported in 87.5% of the cases [44–46]. CFM has also been shown to be effective at restoring forest cover and carbon density [47,48]. Sixty-nine percent of the studies indicated positive results for carbon stock enhancement and 60% for reducing degradation (Figure 4). For example, Hayes [49] showed the contribution of CFM to forest conservation and carbon stock enhancement for 163 forests located in 13 countries by reporting no significant difference between the forest conditions in protected areas and those managed by communities, with higher vegetation density in areas under local community control. In India, Somanathan, et al. [50], using state-managed forest as the comparison, showing no significant difference for broad-leaved forest and more percentage crown cover in pine forests under Village-Council forest management (VCFM), and also noted that VC forest management is seven times cheaper than management by the state. The positive contribution of CFM to the sustainable management of forests and forest carbon stocks enhancement was also measured directly through repeated forest carbon inventory by Karky and Skutsch [51] in Nepal.

Our results also show no statistical relationship between the five REDD+ activities and the types of ownership, extraction or arrangement (Table 3). We were unable to unveil clear patterns for these variables among the studies reviewed, but individual case studies identified that the size and type of forests, the quality of the resource, the type of utilization as well as a whole set of institutional and social factors can influence the forest outcomes. Some documented cases show persistent forest cover loss, indicating that CFM performance varies across communities and contexts. In Mexico, Dalle, et al. [52] show low rates of deforestation in *ejidos* of the Mayan zone of Quintana Roo. In Ecuador, indigenous reserves that do not overlap with land under conservation status display similar rates of deforestation to private lands. Furthermore, exogenous forces can influence the forest outcome, not just the activities of the communities themselves [12,53–56]. The success of CFM in protecting forest resources is more likely where population pressure is low, and less likely in the face of conflicts, market pressures, and rising population [57]. For example, while areas under CFM had lower rates of deforestation than protected areas under low colonization pressure in Mexico, in Guatemala both of these conservation strategies failed to maintain forest cover under high colonization pressure, an element symptomatic of weak governance [58].

Evaluation of the ecological outcomes of CFM has however been subject to criticism on the grounds of the methodology used [57,59,60]. In order to demonstrate the role of CFM in forest outcome, studies have to use data from comparable cases and/or counterfactuals. Most studies have compared CFM sites with other types of management (e.g., protected areas) in terms of forest cover change, while controlling for other confounding factors using appropriate statistical methods. Appropriate for quasi-experimental contexts, matching methods and propensity scores are especially interesting to avoid biased comparison and to control for heterogeneity across biophysical and community characteristics, and have been used in some of the studies we reviewed. Our analysis showed that 56% of the studies ($n = 39$) had a strong methodological approach. The most frequent approach to comparison combined before-and-after or time series of remote sensing images to assess forest cover change over time while controlling for confounding factors. When both social and biophysical outcomes are measured, the assessment of forest conditions often relied on local people's perceptions as ascertained through interviews, and was thus based on rather weak methodological underpinnings.

The lack of spatially-explicit national data on forests managed by communities has been and is still a major obstacle to a better understanding of the role of CFM in forest outcomes [61]. Information on the extent and location of CFM is highly fragmented, unavailable to the public or non-existent. Recent studies making use of newly available data sets for indigenous territory polygons in Panama [62] and Brazil [63] have been able to demonstrate the contribution of these reserves in conserving forests and the carbon they contain. In this sense, it is important to highlight the work of Rights and Resources Initiative for the creation of its Forest Tenure dataset (<http://www.rightsandresources.org/>

resources/tenure-data/) and the World Resources Institute's Status of Land Tenure and Property Rights map (<http://www.wri.org/resource/status-land-tenure-and-property-rights-2005>).

3.2. Livelihoods and Development Outcomes of Community Forest Management

We assessed the contribution of CFM in producing social co-benefits through improved livelihoods and development. Recent global comparative studies confirm the importance of forest resources in the livelihoods of the rural poor in developing countries, estimating that these represent on average 21.1% of total household income [64]. The importance of forest for subsistence purposes is particularly important where chronic poverty and forest cover overlap geographically [65]. This is due to the dependence of the poor on these environmental incomes, especially in remote areas, where often no substitute for forest products and services exists [66]. For communities living in poverty, restrictions in access to and use of forest resources can have a major impact on livelihoods, and such restrictions may conflict with the objective of poverty reduction [67].

The benefits derived from CFM depend on the quality of the forest resources, the access rights granted and the benefit-sharing mechanisms, which display high contextual variation. Almost all governments maintain certain rights of control over the use of land and resources, regardless of the formal property system [33,68]. Compared to the open access situation, CFM typically places new restrictive rules and regulations on extraction of forest-based resources. Even with statutory rights, communities do not automatically have rights to all resources (e.g., timber), and they are not always able to access or translate those rights into benefits [19].

We found that 44% of the studies reported beneficial impacts of CFM through an increase in forest incomes, and a further 44% reported neutral effects, neither positive nor negative (Figure 5). One case was reported as having negative impacts on income and two studies reported both negative and positive impacts. For the Pearson Chi-square test on income and the type of extraction (subsistence, enterprise or both), the null hypothesis was rejected at $p < 0.05$ significance level, meaning that the two variables are not independent; the fact of belonging to one category of the first variable influences the membership category of the second variable. However, none of the FT deviates or standardized residuals (Z statistic) post hoc tests showed a significant difference for all pairwise comparisons (FT critical value = 1.85 or Z critical value = 2.54, $df = 4$), indicating that the difference between the observed and the expected values is not large enough for individual cells to show significant results between income and the type of extraction. Benefits from employment were noted in 39% of the studies. However, the Chi-square test results were not significant for all the variables tested, meaning that the region, the type of extraction, arrangement or ownership are independent of the creation of employment benefits.

According to Mahanty, et al. [69], the potential for increases in the quality of life of rural populations through CFM depends largely on the type and size of the benefits created, how communities can make sure they get at least a part of these benefits, and how they are distributed locally. The importance of access rights was demonstrated in CFM in Ethiopia, as forest user group members had lower total income and assets than non-members where only subsistence use is allowed, while it was higher for members where timber harvesting is also permitted [70]. In Nepal, a study comparing the benefits and costs of CFM from eight user groups indicated that the impacts of this practice are highly variable within and between groups [71]. It was also shown that CFM tends to divert profits from individual households to the community level, with a decline in forestry-based income, but an increase in new sources of income (including grants, soft loans and other income-generating activities) that benefit poor households. Forest condition is also mentioned as a factor that will influence whether incomes generated through CFM are enough to cover the management costs and provide a direct benefit to communities [72]. In some cases, forests assigned by governments to communities can be of poor quality, as such forests have often been exploited and degraded by the logging industry and abandoned when the industry has no continued interest in exploiting them commercially [28,48]. It is

also important to acknowledge that even if very small, the income generated by CFM can make a difference for very poor households, as exemplified in Malawi by Jumbe and Angelsen [73].

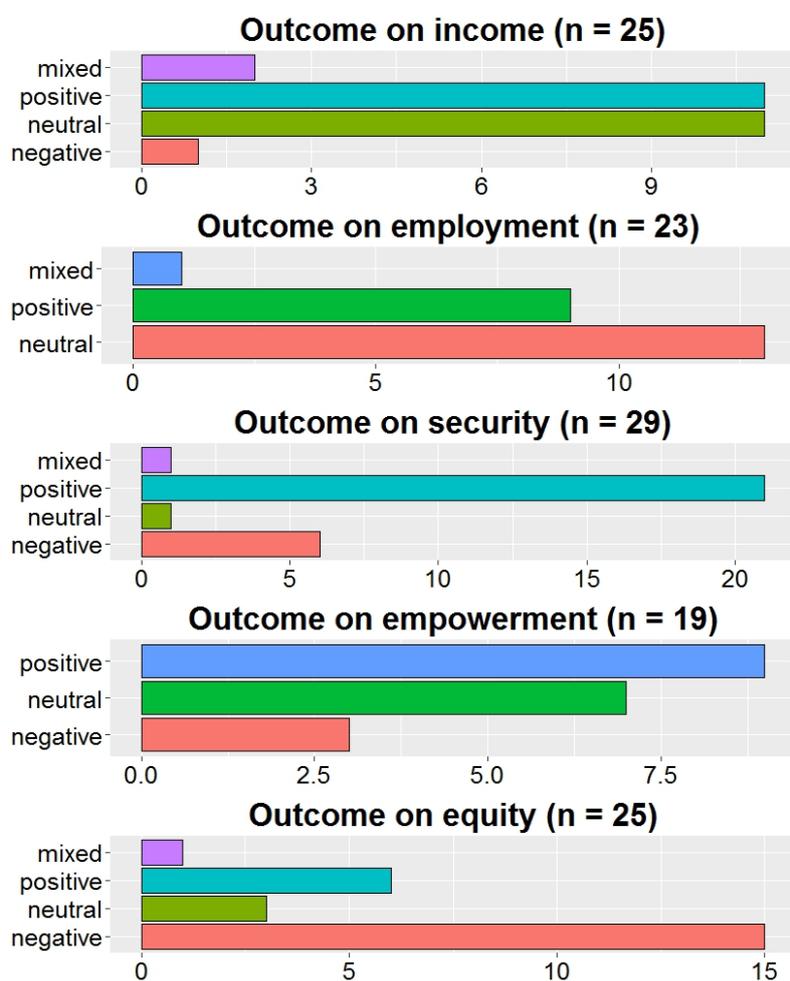


Figure 5. Frequency of the outcome identified for the five social criteria evaluated in this systematic review. The number of studies reporting on each criterion is indicated as the sample size (*n*).

In the studies reviewed, security was the most frequently mentioned benefit, in 72.4% of the cases (Figure 5). We also found a relationship between security and the type of ownership (Table 3), with positive outcomes on security with community-owned forests (FT deviate = 2.05; Critical value = 2.02, *df* = 6). This is not surprising since, generally, CFM involves a process that entails clarification and agreement on access and use rights. Benefits through empowerment, which is a more qualitative characteristic than variables such as income, were mentioned in 47% of the studies reviewed. In Mexico and Brazil, for example, Hajjar, et al. [74] showed that despite the fact that governments have maintained significant control over forest resources through heavy regulations on timber extraction, communities have effective decision-making power over the day-to-day planning and they derive considerable benefits from forest management.

One important finding is on the outcome observed on equity inside community-managed forest (Figure 5), and this is irrespective of the type of extraction, arrangement, region or ownership (Table 3). Sixty percent of the studies reported a decline in equity with respect to the distribution of local benefits for poorer and/or women-headed households under CFM. It is important to keep in mind that the notion of ‘community’ is a construct simplifying the heterogeneity of diverse actors found at the village-level who have diverse and sometimes competing interests (See also [75]). Indeed, processes and institutional arrangements that govern the implementation of CFM at the local level can easily be

dominated by the wealthier or more powerful community members, producing results that reinforce and perpetuate social inequality, including gender inequality [68,76]. In Nepal, negative effects of devolution have been reported among the poorest households as a result of a reduced access to forest products necessary for their livelihood, due to more stringent harvesting regulations and more 'equitable' distribution of benefits from forest, without taking into account the fact that the poorer households generally need more forest resources [77,78]. Vyamana [72] also found that devolved management through CFM does not support an equitable local distribution of benefits and costs in Tanzania, and that arrangements exclude the poor from income-generating activities because of initial investment costs for participation.

Thirty-seven percent of the studies reviewed were classified as having strong methodological underpinnings for assessing evidence of social benefits. These studies evaluated the impacts of CFM using strong comparative indicators, and by removing rival explanations or confounding factors that were unrelated to this type of management. Propensity scores and covariate matching models have been used for controlling for these confounding factors and for achieving a better attribution of the outcomes of CFM programmes [70,73]. The importance of collecting baseline data or Before-After Control-Impact (BACI) methodology to evaluate the welfare outcomes is paramount [79,80]. As shown in these results, stratification by welfare groups needs to be done in order to evaluate local distribution of benefits. The contribution of qualitative research methods with rigorous approaches is also essential, especially for understanding power dynamics and the kind of benefits that are important to local people but hard to measure.

Only a few studies provide an analysis of both stated objectives of CFM, i.e., improved forest condition and livelihoods benefits [26,81]. Based on the International Forestry Resources and Institutions datasets (<http://www.ifriresearch.net/resources/data/>), factors associated with win-win outcomes for forest carbon and livelihoods are identified including: rulemaking autonomy, local enforcement rules, well-defined property rights, and the design of effective institutional arrangements. Factors promoting synergies in achieving positive forest and social outcomes are synthesized in Table 4, as well as factors promoting equity at the local level.

Table 4. Criteria identified under CFM for assessing successful outcomes with relevance for REDD+ implementation at the community level.

CFM Success Factors	Forest Carbon Benefits	Social Benefits	Equity	Sources
Poverty reduction as a stated objective		X		Schreckenberg and Luttrell [76]
Allowing for both subsistence and commercial use of forest products		X		Ibid.
Design of effective institutional arrangements	X	X	X	Ibid.
Transparent and equitable benefit-sharing mechanism at the local level			X	Ibid.
Sufficient support and training during establishment	X	X	X	Schreckenberg and Luttrell [76]; Hajjar, Kozak and Innes [74]
Well-defined property rights	X	X		Pagdee, et al. [82]; Robinson, et al. [83]
Community interests and incentives	X	X		Pagdee, Kim and Daugherty [82]
Fair representation and active participation of the poor and women/Pro-poor measures			X	Mahanty, Guernier and Yasmi [69]; Maharjan, Ram Dakal, Suresh Thapa, Schreckenberg and Luttrell [71]
Rulemaking autonomy	X	X		Chhatre and Agrawal [26]; Persha, Agrawal and Chhatre [81]; Ostrom [84]
Local rules enforcement	X	X		Chhatre and Agrawal [85]
Local power dynamics check and balance arrangements			X	Agrawal and Gibson [75]

3.3. REDD+ Benefits and the Incentive Structure for Community Forest Management

There are active debates around the potential of REDD+ in promoting CFM with some seeing it as a way of reinforcing existing CFM by promoting the generation of new income sources and community development, others as a model to be scaled-up for REDD+ national strategy [5] and yet others as a potential threat to CFM that could destabilize successful existing community forest governance through a top-down approach and re-centralization [17–19,86]. REDD+ success in each country is seen largely as contingent on how forest management rules and incentives in place shape local actions related to the use of forests and forest land conversion [87]. In order to reduce emissions or increase removals of GHG at the scale required, REDD+ would need to generate sufficient incentives and social acceptability at the local level to stimulate participation and sustain it through time. However, there are trade-offs between effectiveness in reducing GHGs, cost-efficiency of mitigation activities implemented, and equity between those who benefit and those who assume the costs. It is unrealistic to assume that ‘win-win-win’ solutions can be found in all or indeed in the majority of cases, with existing tradeoffs [88]. It may be more realistic to aim for ‘no-harm’ situations, by ensuring that this new global policy affecting land use and forest management does not exclude or damage existing CFM initiatives, for instance, by taking away existing rights through new restrictions or exclusion, by reducing local control and decision-making power or by capturing carbon payments that should belong to forest communities. Since REDD+ and CFM policy interventions do not share the same goals and mechanisms, analysis of available evidence of the potential contribution of CFM to REDD+ objectives and of potential benefits and risks for CFM is important [89].

3.3.1. Early REDD+ and Carbon Mitigation Projects in Low-Income Communities

The failure of the Clean Development Mechanism to promote widespread adoption of afforestation and reforestation (A/R) projects provides useful lessons on the distribution of costs and benefits and the generation of incentives in carbon-based projects. This mechanism was created as a way for developed countries to meet part of their emission reduction targets under the Kyoto Protocol, by purchasing credits from verified, sustainable and additional forest carbon sequestration activities carried out in developing countries. Only 68 out of 8705 CDM projects (<http://cdmpipeline.org/> Accessed on the 30 July 2014) (or 0.78%) are A/R projects, largely due to the complications in administration, finance and governance issues related to these projects [90,91]. The high transaction costs and long validation times associated with CDM have been proven prohibitive for small-scale projects [92,93]. Other issues include the modalities, financial and production risks, labour demands, liquidity/sunk costs, and perceived equity [94]. Mixed effects of carbon projects on local populations and on poverty alleviation have been found [95,96]. What we can learn from this is that the transaction costs, the administrative quagmire, the potential risks, and the modality arrangements that are negotiated for REDD+ are likely to have a significant impact on community incentives and participation in REDD+.

In this review, we found indications of negative impacts on security (four of nine cases), on empowerment (two of six cases) and on equity (four of eight cases) criteria of carbon mitigation projects. In Tanzania, Beymer-Farris and Bassett [97] provide a cautionary note for REDD+ projects that are modeled on decentralized forestry schemes that are not decentralized in practice. It appears that, in spite of extended policy discourses on devolved decision-making, justice and equity in terms of resource access and actual local-level decision-making are not always forthcoming. Early results from a REDD+ pilot project in Nepal show that it imposes direct additional costs through new restrictions on forest product harvesting and reduced grazing, and indirect costs in time and labour due to increased participation as well as forgone benefits [98]. These results suggest that REDD+ payments, if based only on the exchange value of the carbon saved, might not generate sufficient incentive in the long run [98]. In Mozambique, the carbon incomes generated were found to be small even with liberal carbon accounting [96]. Lack of equity between participants and non-participants in a CDM project is discussed in Vietnam, where new restrictions are imposed on non-participants who do not receive project revenues, threatening the long-term carbon mitigation outcomes of the project [99].

Concerns over additionality (Reduction of emissions or increased removals due to project activities compared to a business-as-usual scenario), leakage (displacement of emissions) and transaction costs have been voiced for community carbon and REDD+ projects [96,100]. It is also recognized that because most CFM projects are small, high transaction costs will be involved [100]. Since many CFM projects already have positive forest carbon outcomes, it is questionable whether they would be considered additional and thus deserving of REDD+ payments; although it would of course be possible to expand the areas under CFM and achieve additionality in this way. This option however implies paying the newcomers but not those who have protected their forests in the past, raising important questions regarding whether such an approach would be considered politically legitimate or fair. For ensuring fairness, existing CFM participants should also be provided with incentives.

3.3.2. Incentives Structures for REDD+ as CFM

Different REDD+ incentive structures have been identified for CFM under REDD+. Skutsch, et al. [101] proposed two possible REDD+ incentives structure approaches for CFM. In the first, payments are ex-post, based on performance measured in terms of the amount of avoided or sequestered carbon compared to a baseline (carbon outputs). In the second approach, payments are made to compensate for management inputs and formulated to incentivize specific norms of sustainable forest management, that is, they are related to management inputs. Management inputs could include forest monitoring where the community would be paid for measuring forest carbon stocks and changes [102].

For performance-based payments, REDD+ would likely entail new restrictions on use and access to land and forest resources. Recent research demonstrates that some non-trivial forest income flows could be at stake for the rural poor [103]. In this matter, it is relevant to make a distinction between communities that use the forest mainly for subsistence and family consumption and those who would use it commercially (e.g., timber, non-timber forest products) [56]. For subsistence use, it may not be possible to compensate a reduction in forest access and use; resources will have to come from elsewhere. In many cases, calculated opportunity costs underestimate the true value that forest has for communities [104]. Other alternatives must be created to compensate for a limit placed on the supply of forest resources. In Tanzania, Fisher, et al. [105] show that paying communities to reduce deforestation from fuelwood collection is not sufficient; alternatives should be implemented to avoid an increase in the value of firewood and a displacement of emissions. If there is no real alternative or if the supply is insufficient, forests will continue to be used by communities. In Nepal, Karky and Skutsch [51] reported that introducing forest communities to the carbon market involves high opportunity costs because forests provide many non-monetary benefits to the local population, and indeed these are the main reason they conserve and manage them; the carbon credits will not be sufficient to cover the costs engendered by not exploiting forest resources. In other cases, compensation to local communities in exchange for differing livelihood benefits could be attractive enough to strengthen carbon storage benefits [26]. In tropical dry forests of Guinea-Bissau, Mali and Senegal, Skutsch and Ba [106] showed that even if only 10% of the financial return on the carbon value from reduced degradation and carbon stock enhancement were to reach the community, this would be a significant incentive for their participation in REDD+. Therefore, depending on the context, different incentive structures for REDD+ can be made to ensure that REDD+ contributes to the sustainability of CFM interventions.

In cases where the primary focus of CFM is for commercial timber production, with benefits in terms of additional income or direct employment, it is possible that REDD+ can strengthen existing forest enterprises or stimulate the creation of new businesses. The economic viability of community forest enterprises dedicated to timber extraction, as well as incomes, may depend *inter alia* on the volumes of timber harvested [107]. For commercial CFM activities, Putz and Romero [108] proposed synergies between the forest management certification and forest product legality as established by forest auditors, by facilitating on-the-ground verification and allocation of additional carbon incentives to these reduced impact operations. Tomaselli and Hajjar [109] argue that REDD+ direct support should be oriented towards the development and sustainability of community forest enterprises by

creating a conducive business environment and fostering the provision of business development and appropriate financial services.

Other authors suggest that the real way forward is to extend the coverage of forests under CFM [100], by using REDD+ to promote access and recognition of use rights, as well as defining and securing community forest tenure [7,110]. Effectively, as shown above, there are large forest areas already managed by communities under customary institutions and for which tenure rights recognition could contribute to both positive forest and social outcomes. The transfer of tenure to communities however might not be sufficient on its own for facilitating positive forest preservation outcomes. A recent review of the impacts of tenure form and tenure security on forest cover change concluded that it is tenure security that is associated with less deforestation, not the form of the tenure itself [111]. Effectively, tenure recognition is only a first step [19,112]. The implementation of those rights, their defence and ensuring access to the benefits by communities is a process through which REDD+ could help address fairness issues. To defend those rights in the context of REDD+ implementation, Robinson, Albers, Meshack and Lokina [83] argue that CFM REDD will face external forest change pressures similar to those of all previous enforcement programs aimed at preventing deforestation. Support from other institutions will be necessary for enforcement and for protecting those rights.

As we have noted, fears have been expressed that REDD+, which if carried out under UNFCCC rules will imply a coordinated national programme, may result in a return to re-centralization and top-down management [18]. The only way to avoid this trap is to design appropriate institutions at different levels which mediate between the social, economic, and environmental factors that cause tropical deforestation [87,113,114], without removing the management authority from local communities [18]. CDM experience illustrates the need for more effective institutions working at multiple levels to integrate local forest management into a national and global framework [115], with institutions providing grievance and redress mechanisms accessible at the local level. The development of multi-level or nested governance as a way to integrate REDD+ at multiple scale [116–118] remains a major challenge for policymakers and practitioners.

4. Conclusions

There is clear evidence of positive outcomes of CFM on forest conditions and terms of carbon benefits. However, our study indicates that CFM is more successful in forest conservation, sustainable management of forest which results in reduced rates of degradation, and enhancing carbon stock, than in reducing deforestation. The performance of CFM has been shown to be equivalent or better than that of protected areas in terms of maintaining forest cover. Reducing deforestation can be achieved through CFM, but several other factors exogenous to the governance and control of communities have to be taken into account. In terms of social benefits, there is some evidence of positive outcomes, but it would be prudent to say that, although CFM could provide a contribution to poverty alleviation, it is by no means a panacea to rural poverty. It is also clear that CFM does not deal very well with equity issues at the local level. We obtained very few significant statistical relationships when testing between forest or social outcomes and CFM characteristics (types of ownership, extraction and arrangement as well as region), perhaps because of the large heterogeneity of contexts found for CFM.

Revisiting assumptions about CFM experiences in order to derive realistic expectations based on strong evidence is paramount for designing better interventions in forest communities under the REDD+ context. Our results on equity in CFM indicate that other mechanisms or interventions would have to be put in place to ensure equitable distribution of benefits for the poor at the local level. REDD+ brings a whole new set of challenges and access to benefits in the form of carbon payments is no guarantee of equitable distribution, given what we have observed from CFM experiences. Deliberate action from government is needed to provide incentives as well as complementary poverty reduction interventions to CFM-type interventions. Recognition of rights for forest communities will be an important first step in promoting sustainable landscapes, but to address fairness in REDD+, a better evaluation of synergies and trade-offs between the different stated objectives is needed.

Further interventions will be necessary to avoid possible negative impacts on existing CFM cases and on the forest communities already involved in REDD+. Improving institutional coordination, an equitable benefit-sharing mechanism and capacity-building for community forest carbon monitoring are important areas requiring attention [89].

In order to keep learning about how to improve interventions for forest carbon and livelihood outcomes, reliable research methods using solid methodology are needed. Even if there have been recent improvements, the variation in methods still inhibits comparisons and meta-analyses of case studies that would provide the necessary quantitative evidence for policy recommendations [119]. Matching techniques and other contextual controls are essential in the selection of sites for comparison [103], and the construction of credible counterfactuals [79] must be a key element in the evaluation methods used. More emphasis on analyzing the human and natural aspects concurrently is much needed to be able to reach strong conclusions about these complex interactions, as well as to test for synergies and trade-offs between the two and with contextual factors [88]. The construction of global, spatially-explicit datasets of CFM will be crucial to evaluate the national and global outcomes of this approach, especially with the major changes happening in forest governance in the context of REDD+.

Supplementary Materials: The following are available online at www.mdpi.com/1999-4907/7/8/170/s1; List of references and case studies evaluation.

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