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Splitting the Difference: A Proposal for Benefit Sharing in Reduced Emissions from Deforestation and Forest Degradation (REDD+)

Arturo Balderas Torres^{1,2,*} and Margaret Skutsch^{1,3}

¹ CSTM, Twente Centre for Studies in Technology and Sustainable Development, University of Twente, Postbus 217, Enschede, 7500 AE, The Netherlands; E-Mail: m.skutsch@utwente.nl

² Ingeniería Ambiental, PTI Instituto Tecnológico y de Estudios Superiores de Occidente (ITESO), Tlaquepaque, CP 45090, Mexico

³ Centro de Investigaciones en Geografía Ambiental, Universidad Nacional Autónoma de México (UNAM), Antigua Carretera a Pátzcuaro 8701, Morelia, CP 58190, Michoacán, Mexico

* Author to whom correspondence should be addressed; E-Mail: a.balderastorres@utwente.nl.

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Abstract: The objective of REDD+ is to create incentives for the reduction of emissions from deforestation and forest degradation and for the increase of carbon stocks through the enhancement, conservation and sustainable management of forests in developing countries. As part of the international negotiations under the United Nations Framework Convention on Climate Change (UNFCCC), compensation would be estimated in relation to national performance but how these incentives will be channeled within countries has not been specified and there are concerns about how the benefits will be shared among different stakeholders. One central issue is that under the national approach good performance in one region can be offset by underperformance in other regions of the country thus preventing the generation of predictable local incentives. Other issues relate to the need to provide incentives to a wide range of stakeholders and to avoid perverse reactions. To address these and other issues we propose separating the accounting of reduced deforestation, reduced degradation and enhancement of forests. The local attribution of credits would be easier for carbon enhancement, and possibly reduced degradation, than for reduced deforestation, since carbon gains can, in principle, be measured locally in the first two cases, while estimating achievements in reduced deforestation requires a regional approach. This separation in attribution of rewards can help to create adequate incentives

for the different stakeholders and overcome some of the problems associated with the design and implementation of national REDD+ programs.

Keywords: avoided emissions; carbon enhancement; forest management; positive incentives

1. Introduction

Under the UNFCCC policy on Reduced Emissions from Deforestation and forest Degradation (REDD+), national forest emission reductions will be calculated and developing countries may claim rewards or compensation in relation to such reductions. For this they will have to demonstrate that they have reduced the aggregated national rate of emissions from deforestation and/or degradation, and/or increased the rate of sequestration of carbon in forests (enhancement of forest stocks). Parties negotiating at the UNFCCC have been clear that national level accounting based on national reference levels is essential in the long run [1,2], although in early phases of implementation of REDD+, reference levels and accounting might be used at sub-national jurisdiction levels (for example, at province or state level or at the level of natural regions such as watersheds) [3].

Results based financing for REDD+ would be new, additional and predictable and would come from different sources (public, private, bilateral, multilateral) [4]. It is not yet clear, however, whether the rewards/compensations will be in the form of carbon credits which may be bought and sold in a market or if financing would be channeled through funds. Decisions made at COP 17 leave the door open to both approaches [4]. The Cancun agreements indicate that REDD+ should follow a phased implementation: the first phase would be the preparation of national strategies or action plans, policies and measures, the second would focus on implementation with results-based demonstration activities, while in the third, systems would evolve into results-based actions which would be fully measured, reported and verified [5]. At this point, provided a system of safeguards and a national forest reference emission levels/reference levels (REL/RL) (or sub-national REL/RLs as an interim measure) are in place, results-based financing should follow [4,5]. Table 1 presents examples of REDD+ activities that could be developed at the local and national levels in participating countries. Most of the activities developed by landowners and communities would be direct REDD+ activities. On the other hand some of the activities to be implemented by governments will be administrative and some of them may start as part of the readiness activities and would continue until the full implementation phase.

One question still to be resolved is how to distribute the financial benefits from results-based actions among the many stakeholders who may have contributed to reduce emissions and may have legitimate claims [6]. In particular, there are fears that in a national REDD+ program, a large part of the financial rewards would remain in the hands of government authorities and that local level owners and managers (often seen as forest based communities) might receive very little of the benefit [6–8]. This could potentially reverse the advances that have been made during the last two decades regarding decentralization of forest management, since governments may be interested in maintaining control over forest areas with the potential to produce carbon revenues [9,10]. The objective of this paper is to discuss what different options could be considered for distribution of the benefits associated with REDD+, in order to create effective incentives for governments, communities and landowners. We

assume that participation of stakeholders in REDD+ would be voluntary and not mandatory, as suggested in some sources [11].

Table 1. Examples of REDD+ activities.

Scale	Implemented by	Examples of REDD+ activities
Local	Landowners, Communities, Projects	Sustainable management of forest (timber extraction, cattle exclusion); Sustainable extraction of products for subsistence (firewood, poles, fodder, <i>etc.</i>); Conservation; Agroforestry (e.g., coffee under shade); Change/intensification of agricultural activities; Enrichment planting/forest restoration; Local management (fire brigades, phyto sanitary control); Community monitoring.
National	Various national government bodies	Land use change regulation; Judicial control of illegal logging and fines; Regulation of carbon markets; PES programs; Design of agricultural subsidies; National fire brigades and phyto-sanitary programs; National forest inventories and remotely sensed analysis.

The structure of the paper is as follows: we first explain the rationale for national forest Reference Emissions Levels and forest Reference Levels which will be used as baselines to evaluate the performance of REDD+. We then identify a number of challenges that arise as regards the distribution of rewards in a national system. We consider contrasting cases: one in which all the REDD+ financial rewards are considered property of the national government and one in which they are all distributed to the landowners and local communities. Neither system is satisfactory, for a number of reasons. We then describe how a mixed system can be designed to reconcile these challenges through differentiating crediting and attribution for the different elements in REDD+ (reduced emissions from degradation, reduced emissions from degradation and carbon enhancement). Finally we summarize our proposal for benefit sharing and present our conclusions.

2. National RELs and RLs

Under REDD+, reductions in gross emissions from deforestation and degradation will be quantified relative to a national forest reference emission level (REL) and/or forest reference levels (RL). The REL/RL represents what would have occurred without REDD+ intervention, based on observed historical trends and national circumstances, which are usually understood to include national plans for development, and it is clear that in the long run returns to REDD+ activities will be valorized on a strictly results based metric relative to these baselines.

Although the definitions and differences between REL/RL are still not completely established [12], a REL is generally considered to refer to reductions in emissions only while a RL includes removals as well. It is clear that both refer to the yearly flux of carbon ($tCO_{2eq}/year$) [3]. In Cancun it was established that national REL/RLs could be a combination of subnational REL/RLs [5]. During the

35th session of the SBSTA, experts were in two camps concerning RELs and RLs. One group indicated that whether a country should use a REL or RL would be determined after balancing emissions and removals: a country having net emissions will use a REL while those with net removals will use a RL. The alternative point of view, and the one adopted in this paper, is that countries could generate both a REL and a RL, accounting separately for emissions from deforestation and degradation in the REL, and the removals from conservation, SMF and enhancement in the RL. This would separate the accounting of REDD from the plus (+) [12], and opens the possibility of separating the calculations of emissions from those of carbon enhancement.

Exactly how the REL and the RL will be established is not yet determined but the idea is that they will be based on historical trends at the national level as regards deforestation, degradation and forest enhancement, mediated by particular development factors relevant in each country. The decision adopted at Durban invites developing countries to submit a REL and/or a RL [3]. As mentioned above, sub-national REL/RLs may be adopted as an interim measure, but for simplicity we will assume that the REL/RL is set up at the national level. The main reason why the policy stresses a national REL/RL (or one for large scale territorial units in the run-up phases) is to contend with the issue of leakage [13,14]. Direct leakage occurs when activities that generate emissions of carbon are displaced to other locations as a result of a REDD+ activity in any given project area. A national baseline is considered to provide greater integrity with respect to the carbon results being claimed.

3. Challenges for Benefit Sharing under a National REDD+ Program

It is not yet clear whether internationally, financial benefits for REDD+ rewards will come through a market or through some kind of fund, and whether they will be seen as credits, rewards or compensation. Since the terminology may be confusing, we use the term “credits” as a form of shorthand to indicate the units of achievement in reducing emissions or enhancing carbon which will be valorized in some way under a results-based financing system. Although final text on the issue has not yet been agreed under UNFCCC, it is our understanding that international rewards (whether from a fund or a market) will be tied to national results or performance, as measured against the REL/RL, at least by Phase 3. Within a national program, “credits” could in practice be dispersed to stakeholders in the form of certificates (allowing stakeholders to sell these in a market or exchange them in a fund), as direct finance, or in other forms.

Making finance dependent on national performance however raises the question of how to share REDD+ “credits” within a country. A crucial issue is that the system by which rewards are to be distributed is transparent, legitimate and in accordance with accepted rights, all of these terms being subject to local interpretation and definition. This is important since in order to mobilize action it is essential that REDD+ creates sufficient incentives for participation among landowners and communities, as well as government agencies. The UNFCCC is not likely to promulgate rules about how the carbon revenues are to be divided within a country, since this is a matter of subsidiarity. The Voluntary Carbon Standard has suggested developing nested sub-national REDD+ programs at different jurisdictional levels and including a buffer to reduce the risk of non-permanence [15]; however they recognize that once these jurisdictions are established, developers would have to design an internal allocation program for credits and the jurisdictions should specify how allocation decisions

would be made [15]. It has been also proposed that national REL/RLs could be aggregated bottom-up to generate a scale neutral architecture for REDD+ [16] which as mentioned above is compatible with UNFCCC texts; however internal methods to bear the risk of having emissions beyond the REL at the national level would be required, such as national, regional or individual shared responsibility mechanisms or a compulsory cap and trade system [16], reduced dividends or debits under a stock flow mechanism [17], or through compulsory tax/subsidy payments [11]; however the conditions for this type of methods may not be in place yet [18].

International REDD+ policy attributes all “credits” to the national or subnational level in the first instance. This is for carbon accounting reasons, since the rewards are a function of the achievements against the national/subnational REL/RL, which can only be determined at these levels. It could be argued that due to the issues of leakage and the need for clear national level action on REDD+, the credits should remain the property of the government, providing it with financial resources to cover the costs of designing and implementing national policies to strengthen forest governance and control illegal activities and emissions. In this scenario, the financial flows from REDD+ benefits might be used to cover the public costs of the design, consultation, establishment and monitoring of the REL/RL, the MRV system and the system to ensure compliance with environmental and social safeguards, but also perhaps to provide financial incentives to local actors, for example in the form of Payments for Environmental Services (PES).

The central control of REDD+ benefits however raises the question of carbon property rights and legal ownership of the carbon “credits”. A large part of the literature in REDD+ supports the moral rights of forest owners, particularly communities, to the financial returns from sale of carbon credits [19,20]. Although the laws on property rights of individuals and communities to forest carbon have been established in only a few countries so far (Australia, Argentina), there are precedents that imply that carbon is akin to other tree products [21]; in most countries the products of trees belong to the owners of the trees. If this legal argument is accepted, it implies that all the “credits” should be re-distributed immediately from central government to the local stakeholders, commensurate with achievements at the level of the individual parcel or management unit, where the savings are actually being made. The corollary of this is that baselines would be needed at the level of the individual parcel or management, so that achievements could be assessed; while this may be feasible it may take some time until the information to do this at the local level is available as we discuss below. This however ignores the fact that some REDD+ programs may take place outside the forest, for example in intensification of agriculture, and that tracing the impacts of this on the forest in order to reward the individuals involved will be impossible.

Hence, although the choice between these two positions may at first sight appear a simple matter of policy, in reality it is constrained by a number of important technical and political issues:

3.1. The Need to Balance Carbon Accounts between Local and National Levels

Under a national REDD+ program, at least when this is fully functioning in Phase 3, rewards will be delivered on the basis of overall national achievements against the REL or RL, which represents an internal balance of gains and losses over the whole forest territory. Good performance by communities or landowners in one region of the country may thus be cancelled out by losses elsewhere, only

“residual” credits could be allocated [16]. This means that, in the worst case, landowners would not be entitled to compensation at all, even if the carbon losses in other regions were unrelated to leakage from the successful cases. This resembles the well-known local-scale problem of collective management of common pool resources, where individual benefits depend on the good behavior of all the actors, and the underperformance or negative behavior of a few can compromise the benefits for all. If the “credits” are to be attributed to the owners and manager of forest parcels, the challenge is how to manage expectations of these local level actors and ensure that despite the need for balancing overall accounts at the national level, successful participants are assured of receiving rewards commensurate with their own local achievements, since this is their incentive for participation and for good performance. In the VCS, this is dealt with through creation of a buffer [15], but to cover or insure against potential large scale losses at national level in many countries, the buffer would have to be of a considerable size, with payoffs to individual parcel owners being correspondingly reduced. Moreover, as noted above, at least in theory the possibility exists that overall national losses may completely outweigh gains in individual projects. Another alternative is the payment of internal compensation, or tax/subsidy systems for exceeding emissions [16,11], however this type of instruments may be controversial [18].

A corollary of the need to balance the national accounts with the local is that benefits can only be calculated at the end of the accounting period, meaning that individual forest owners and managers, communities *etc.* will not be sure of the level of their reward until the end of this period; and as noted already the size of the payments will be conditional on good performance elsewhere.

3.2. The Need to Enable Independent Carbon Trading to Stimulate Investment

Assurance that achievements at the level of the management unit will be rewarded is important not only for the owners and managers of forest parcels, but also for sponsors both domestic and foreign who want to finance decentralized REDD+ projects, and who may be an important source of up-front capital. Such investors need assurance that successful efforts will be rewarded, regardless of what goes on in other parts of the country. The interest of external sponsors and supporters brings with it pressure to allow at least some level of independent trading of “REDD+ credits” from project based activities. This follows from positive experience in the Voluntary Carbon Market in which REDD+/Avoided Land Conversion projects increased from 3 to 18 MtCO_{2eq} per year from 2009 to 2010, representing 29% of the carbon traded in this market [22]. Carbon brokers strongly support the notion of independent projects and nested projects trading their own “credits”, citing advantages of the private sector and this principle also has support from a wide range of international organizations and REDD+ observers [23,24]. Thus the national approach to REDD+ accounting and internal reward distribution generates critical implications for the potential international finance of projects at the sub-national and local levels.

3.3. The Need for Budget for Public Activities under REDD+

If all financial revenues are made over to the local level actors, other stakeholders, principally the government agencies at various levels, will not receive any incentives and may therefore not be able to provide the support that is required in implementing key supporting activities. On the other hand, if all

the funds are left in the hands of government, there are risks that the lion's share will be used for activities which do not result directly in carbon savings, rather than for payments to local forest owners and managers for their efforts. This could result in policy failure, particularly if the issue of carbon rights is raised, and if there is no transparency on how the revenues are utilized.

3.4. The Need for Clarity on Land Tenure and Associated Rights

In countries such as Mexico, where almost all the forest is owned by communities or individuals, the legal position is clear, since the owner(s) of the land would presumably also have the right to rewards from "credits" generated by the property. However in countries where most of the forest belongs to the government, but is (in places) managed by communities on an usufructuary basis or in other ways, rights to the carbon would need to be made explicit in the terms of the community management contracts or agreements, which in some cases already define rights to other products such as firewood, fodder and timber. This would involve negotiation, and communities may need legal support in making their claims in this respect. A not insignificant risk which is that the local attribution credits may intensify conflicts in areas which are already under legal dispute as regards ownership. It is even conceivable that the process of legalizing local tenure may be slowed down, as governments may be reluctant to grant tenure to local communities, given the potential of earning on carbon "credits" [9].

3.5. The Problem of the Attribution of Reduced Deforestation to Different Forest Owners/Managers

In order to attribute rewards from REDD+ locally to the owners of trees, a major challenge is how to identify whom to pay for reduced emissions from deforestation. First of all, a baseline for deforestation at the parcel level would be required. Secondly, it would be necessary to identify exactly who would have deforested in a given crediting period (*i.e.*, in the counterfactual case) in order to attribute the carbon credits. In practice it is rarely possible to fulfill these two requirements; only in cases where the deforestation was planned (*i.e.*, officially sanctioned), but averted as a result of REDD+, would this information be known. In the vast majority of cases the location of future deforestation is not known, even when it is legal. Owners of land, whether individuals or communities, may decide to convert the forest on it at any point in time to agriculture or sell it for urban development; this is not "planned" in the sense of being pre-registered in any database. Areas owned by the state but managed by communities or by the state itself under "no deforestation" rules may at any time be illegally deforested, either by the community or by outside forces such as immigrant people and organized criminal groups or may be damaged by fires spreading from other properties.

For this reason, baselines for deforestation are usually constructed nationally and sub-nationally over large areas covering a large number of parcels and landowners, on the basis of the percentage of forest loss in the past, and giving the *probability* of deforestation of any one hectare within this area. However at the level of the individual parcel, past deforestation events are unlikely to have followed a smooth historical pattern of the sort that could be converted into a simple projection into the future, particularly in small parcels such as those typically managed by communities. Clearance of a patch of forest within individual parcels or management units in any one year may well be followed by no clearances in next few years. In many cases it would be impossible to construct a deforestation

baseline for any individual forest management unit, since the unit would be either forested or deforested.

Identification of who would have deforested in a given period, but has not, is an even greater challenge. For example, if deforestation is occurring in a given region at say 2% per annum, this is equivalent to two forest owners out of 100 clearing their land in any given year (assuming for simplicity that all forest parcels are the same size). The problem is that if deforestation is reduced or halted over the whole area compared to this baseline, it is impossible to know exactly which owners would have been going to clear their forest in any given year. All of them could claim that this had been their intention and therefore all could demand carbon “credits” equivalent to the emissions that would have occurred from their land, had they cleared it. But in fact according to the historical data, only 2 properties per year were “saved” from deforestation and internationally, “credits” will only be issued for the equivalent of 2 properties annually, not 100. If the yearly carbon revenues are divided equally among all the properties, (which would have to be coordinated and agreed through some umbrella organization), the payment would be negligible and most likely would result an ineffectual incentive.

The dilemma here is that under current policy, REDD+ rewards will be based on results within a given accounting period. Under this logic, it is not possible to look at the long term scenario, in which (at a rate of 2 parcels per year) all the parcels would be cleared in 50 years, and to pay “credits” to all the owners now in return for the promise to preserve all their stock over these 50 years, which would resolve the problem of identifying whom to pay. Apart from other considerations, results-based logic requires *ex-post* payments rather than *ex-ante*, and the present value of “credits” paid in 50 years hence would be too low to create a meaningful incentive now. In this context it may be noted that for a given parcel the maximum amount of credits for avoided deforestation that could be granted in the long term (50 years in this example) will be equal to the current level of carbon stocks. The maximum credits for avoided emissions would not be higher than the initial level of carbon stocks in the forest.

A further issue making attribution of credits for reduced deforestation to stakeholders difficult is the fact that some REDD+ activities may be undertaken outside the forest, for example in the form of intensification of agriculture, which will reduce demand for forest clearance in the long run. Quantitatively assessing the carbon impacts of each stakeholder in such a program would obviously be impossible, yet it would be reasonable for them to be rewarded for their efforts.

3.6. The Problems of Developing Baselines for Forest Degradation and Enhancement

If the “credits” for reduced degradation and forest enhancement are to be attributed to individual owners and managers of forest parcels, then achievements on these variables would need to be measured at the level of the parcel. There is a fundamental difference in our ability to assess reduced deforestation as opposed to reduced degradation/forest enhancement at the parcel level. As explained in the previous paragraph, deforestation baselines are constructed on the basis of probabilities across large areas, and although we may know the general tendency at this level, we do not know *which* parcels would have been deforested in the absence of REDD+. At the level of the individual parcel, particularly in small parcels of the type commonly managed by individuals or communities, the forest may be cleared in one go (no line of tendency), or in chunks over time which are large relative to the

whole forest parcel, meaning that there is no simple line of tendency on which to construct a statistically acceptable baseline. Forest degradation and enhancement on the other hand tend to be continuous processes causing on-going changes in carbon stocks levels within forests within each parcel. For these, a baseline could in principle be constructed at parcel level showing the rate of change of stocks within the parcel, against which future rates of change can be compared. Unlike the case of deforestation, there is no ambiguity about which parcels have actually made achievements, although baselines would be needed to assess performance. The difference in our ability to assess deforestation and degradation/enhancement at the parcel level is thus related not to MRV but to the difference in the way baselines have to be constructed.

There are, however, problems associated with developing baselines for degradation at the level of the parcel, primarily because there may be no data available on past rates of degradation. Even at national level this may be a problem, since most countries have not carried out comprehensive and systematic forest inventories in the past. Where forest inventories have been carried out, they are generally aimed at providing information on average stocks over large areas, and cannot give reliable estimates for individual parcels since the spatial sampling grid is not sufficiently intense for this. Changes in canopy cover at parcel level can be assessed from a series of high resolution satellite images, although this would give only an approximation of changing biomass levels. LiDAR offers opportunities for better biomass assessments, but LiDAR surveys have not been carried out in the past, and moreover this information is very expensive. In other words in the early phases of REDD+, before data is collected in a comprehensive way, it will be rather difficult to assess historical changes in degradation rates at the level of the individual parcel [25]. However, if data were available on carbon stocks in a given forest parcel over the recent historical period, it would in principle be possible to attribute “credits” to individual parcels; this could also be supported by data on estimated extraction rates for timber and firewood as proxies, using gain-loss methodology for example.

The remaining difficulty is the construction of a REL for degradation at the national level, which would be an essential prerequisite since, as with the case of deforestation, the achievements in reducing emissions from degradation will have to be balanced out across all forest areas in the country. Even with high resolution satellite imagery such as SPOT, it is difficult to derive data on degradation since some types of degradation involve loss of carbon under the canopy, which is not visible. During the 35th SBSTA session in Durban when these difficulties were discussed, some experts were in favor of using IPCC default values to estimate emissions from degradation at national level, rather than to exclude its accounting in REDD+ completely [12], although this would result in large uncertainty factors which will require correspondingly large margins for conservatism. Establishing a RL for forest enhancement at national level would face the same problems as a REL for national degradation; it would require data of growth rates of forest which are not available in most countries.

As regards forest enhancement, however, the question of baselines may be much simpler. At the level of the individual parcel, forest enhancement can be measured by taking forest inventories at the start and the end of the accounting period (data would be strengthened if intermediate measurements were also taken). The baseline would then in effect be set at zero at the start of the period, and any increases in stock could be “credited”. Additionality would however have to be ensured, since the area could have been in a process of recuperation before the start of the accounting period. For this, in areas that were under degradation prior to REDD+ management, a quantitative assessment of the REL would

not be necessary, merely a verified statement that the area had been degrading, or was degraded but in a stable (non-growth) situation, immediately before the accounting period. It is important to note that in this case any measurable carbon enhancement would imply that earlier degradation has been reversed, implying that both the avoided degradation and the enhancement could be “credited” at the level of the parcel. This would leave open the possibility that if the parcel had been under recovery prior to REDD+ management, “credits” could still be awarded for any increases in biomass stocks to the extent that the rate of increase can be proven to be greater than it was earlier. A RL at national level would not be necessary since leakage from forest enhancement is unlikely, once leakage from degradation is dealt with, and hence it would be possible to attribute “credits” directly to individual parcels without compromising the integrity of accounting at the national level.

Table 2 presents a summary of the practical challenges discussed in this section, in relation to attribution of REDD+ benefits to the national scale (government) and to the local scale (individual forest owners/managers, communities), respectively. In the following section we propose a mixed reward scheme which can address many of these challenges.

Table 2. Summary of challenges facing the public and the local attribution of REDD+ credits within national REDD+ programs.

Attribution of all “credits” to	Leads to the following challenges
National (Government)	<ul style="list-style-type: none"> • Tree owners may oppose centralized control of “credits”, claiming legal and moral rights over carbon benefits produced by their trees/forests; • Uncertainty/lack of transparency about use of funds; • Uncertainty about whether local owners/managers and independent project developers will receive any rewards and on what basis, hence possible lack of interest in participating; • There would be no certainty for independently sponsored projects that they would receive rewards commensurate with their achievements in deforestation and degradation, hence such financiers may be discouraged from investing.
Local (Forest owners)	<ul style="list-style-type: none"> • “Credits” for deforestation and degradation could only be calculated ex-post and any losses elsewhere in the country would have to be factored in to the rewards paid to owners and managers of individual forest parcels, meaning that their rewards may be less than the face value of their achievements; • Payments could be made only at the end of the accounting period, which may discourage participation; • Government would receive no financial benefits and might not have the resources to implement necessary supporting activities; • Local attribution of credits may intensify existing conflicts over land ownership; • In countries where forest ownership is informal, there may be legal problems attributing “credits” to the de facto managers; • Governments may be reluctant to grant tenure to local managers, on account of the earning potential from carbon; • It is not possible to identify within the accounting period precisely which parcels would have been deforested without REDD+, hence not possible to allocate the rewards to specific parcels according to their performance; • Baselines for degradation at the parcel level would be required for assessing achievements, but there is little data available for this.

4. A Proposal for Benefit Sharing

It is necessary to recognize that in reality, both direct forest management activities implemented by local communities/landowners and public policies promoted by government may contribute in reaching the national performance goals of REDD+ (Table 1), and that both may therefore have legitimate claims to benefits. Considering this, and the various other challenges identified above, we propose a mixed approach for the distribution of benefits, aiming to create appropriate incentives for a variety of stakeholders (e.g., landowners, communities and government institutions), according to their sphere of action in reducing emissions and enhancing carbon stocks in forests. Three different sets of accounts would be needed: landowners and communities could elect which of the three schemes they join.

4.1. Reduced Emissions from Deforestation

Since, as discussed above, deforestation baselines cannot be prepared at the level of the individual parcels managed by landowners and communities, but only at a much higher level of aggregation, we propose that all “credits” associated with reductions in deforestation should be accounted and attributed in the first instance to this higher level of aggregation, probably represented by a government administrative level such as a district or a region. A clear and transparent agreement would then be required, under which part of the related financial flow is assigned to government for costs related to support of the REDD+ program. This could be seen as a fraction on the total “income” from carbon revenues. The rest would be destined for payment of incentives to landowners and communities registered as participants in the Reduced Deforestation scheme. Since, as explained above, it is not possible to identify which individual parcels have in reality been saved from deforestation in any given period, the most convenient approach may be a flat rate payment per hectare to all participants that comply with management agreements in these areas (*i.e.*, who do not deforest). This is in fact how most PES programs operate today; payments to participants are not proportional to individual results, but are given for compliance with practices which are considered to bring about the desired results, usually on an annual basis. It has considerable advantages in terms of transaction costs, since flat rate payments are much easier to administer than payments by results. A flat rate payment system may include differentiated payments, (e.g., higher payments in conserved forests and lower payments in degraded forests). Such schemes have been applied for instance in Mexico where higher payments are granted to cloud forests in virtue of their higher hydrological services [26]. The financing could be based on the revenues from avoided deforestation, for instance following the “flow withholding and stock payment” by which a percentage of the carbon revenues are used to make payments proportional to carbon stocks [16,27].

To encourage participation, however, it may be necessary for governments to capitalize this program up-front, making regular payments to the participants who follow the rules throughout the accounting period, and recovering the funds only when the “credits” are sold or exchanged internationally at the end of this period. This would involve some risk to government, as would the fact that losses in relation the national REL in other districts or regions would have to be factored into the

final calculation of “credits” available. However, the local level participants would be assured of fixed, if small, payments, provided they follow the management prescriptions.

It is clear that in areas where the rent for alternative uses of forest land is high, such payments will not be sufficient to prevent deforestation. In these areas, supplementary incentives and controls will be needed. The most important policy to control deforestation in areas of such high opportunity cost may be effective land use planning and control and a governance system strongly dependent on government norms and actions.

4.2. Reduced Emissions from Degradation

Reductions in degradation could be brought about by introduction of sustainable forest management practices by landowners and communities. Unlike the case of deforestation, baselines for reduced degradation can in principle be made at the level of the individual parcel, and achievements against these baselines can be measured. Nevertheless leakage through displacement of the activities that cause degradation also needs to be considered. Degradation “credits” cannot be issued independently of the national accounting system, and losses and gains will have to be compared against the national REL. This implies that “credits” for reduced degradation, like those for deforestation, need to be attributed in the first instance to higher level administrative level, where the necessary adjustments can be made at the end of the accounting period. As is the case with reduced deforestation, a fixed proportion of the related financial flows could be allocated to the government to cover the transaction costs, and the rest distributed among the landowners and communities who have registered as participating in a management program to reduce rates of degradation in their forests or the PES. In this case, however, the payments could be made proportional to the actual reductions that individual management units have achieved, against their own individual baselines when they become available. This would require ground level monitoring, and payments that could only be made at the end of the accounting period when results are known. The immediate difficulty is that in the short term it may be impossible to construct either parcel level baselines or a national REL for degradation, given the lack of historical rate on degradation rates. Claims for “credits” on reduced degradation may therefore have to be postponed for several years until sufficient forest inventory work has been done, both at national level and at the level of the individual parcels or until a system of default values is agreed under the UNFCCC.

4.3. Forest Enhancement

In contrast to reduced degradation which requires historical data in order to be “credited”, net increases in carbon stocks (forest enhancement) can be measured directly at the parcel level and can be monitored by local owners and managers [28]. If a forest inventory is made within the parcel at the start of engagement in REDD+, and repeated at intervals, then growth in carbon stock can be simply assessed compared to the initial inventory, which becomes the parcel level baseline. Additionality could be proved using a qualitative assessment of the previous situation, as explained above.

Although countries can establish RELs at national level for deforestation and degradation and/or RL for forest enhancement, it is likely that most of the countries will develop first the REL since it may be years before RL can be developed, as growth rates of stock in forest are scarcely known at present.

However, gains in carbon stock at the level of individual parcels could be “credited” and attributed directly to the owners and managers of these parcels, without reference to what is occurring in the rest of the country. As mentioned above, an assessment at the local level should be made to identify if an area was under degradation in which case there should be no need for a local RL to credit forest enhancement. In this case the parcel would have stopped degradation emissions but the landowner would not be receiving directly any credits for this, as described in the previous section. If areas showing net enhancements produce leakage through the displacement of previously degrading activities, which will certainly not always be the case, this will not affect performance in the region as long as the leakage is smaller or equal to the emissions that were expected in the parcel according to the REL[28,29]. The rewards for enhancements would be results based, directly proportional to achievements, but could only be assessed at the end of the accounting period. Also as pointed out earlier, measuring carbon enhancement in areas under degradation would be an incentive to encourage the definition of local baseline for degradation as well.

Landowners in forested areas would thus receive flat rate PES type payments if they comply with the requirements of the program and could in addition receive revenues from carbon enhancements. The option as described above of setting higher rates of PES in forests with higher conservation value could help prevent perverse incentives. The two streams of incentives would be addressing different REDD+ elements, the PES accounting for reduced deforestation or degradation and direct carbon credits from enhancement.

A summary of the main elements of the distribution system is given in Table 3.

Table 3. Proposed mixed scheme for the distribution of rewards in a national REDD+ program.

Crediting field	Reference for crediting/financing	Distribution of rewards
Reduced deforestation	Baseline at sub-national level (district/region), results subject to overall national achievements relative to national REL.	<ul style="list-style-type: none"> • Part of the “credits” from regional reduced degradation used to finance flat rate PES payments targeting landowners and communities in areas threatened by deforestation; • Part used to finance government support activities; • The division between these two claims needs to be agreed and transparent; • Up-front payments to forest owners and communities could be pre-financed by government and costs recuperated later from sale of “credits”.
Reduced degradation	Baselines at parcel level and at sub-national level (district/region), results subject to overall national achievements relative to national REL.	<ul style="list-style-type: none"> • Part of the “credits” from reduced degradation distributed to landowners and communities in proportion to their individual achievements (including through SFM) relative to parcel-level baseline. Payments at end of accounting period; • Rest used to finance government support activities; • The division between these two claim needs to be agreed and transparent; • It may be many years before any rewards for degradation can be awarded, as development of baselines requires historical data which is in many cases not available at present;

Table 3. Cont.

Crediting field	Reference for crediting/financing	Distribution of rewards
Carbon enhancement	Baseline at the level of individual parcel. No national RL.	<ul style="list-style-type: none"> • “Credits” from carbon enhancement attributed directly to parcel level; • “Credits” can be sold by parcel owners independent of government RELs and independent of losses or gains in other parts of the country; • Forest monitoring at start of period to establish baseline for stock level and at end to assess growth (<i>i.e.</i>, carbon achievements).

5. Discussion

The proposed scheme overcomes many of the challenges identified with respect to distribution of benefits within a national REDD+ program. This scheme for mixed incentives is based on realities as regards the possibilities of measuring carbon achievements and attributing these to landowners and communities, and on the need to balance carbon accounting at the national level. The separation of credits for carbon enhancement from those of deforestation and degradation, and attribution of forest enhancement solely to individual parcels creates the possibility for independent projects to orient themselves to the carbon markets directly, and a wide range of stakeholder could participate in this. The crediting of reduced degradation as soon as a national REL and parcel-level RELs for this can be developed, may offer another stream based on performance of landowners and communities in line with carbon property rights. The problem of identifying which parcels would have been deforested is solved by paying a flat rate PES-like payment (possibly up front) to all registered participants. By combining a flat rate payment for communities and land owners who do not deforest, and a results-based payment for reduced degradation, with independent, results-based forest enhancement “credits” at the level of the forest parcel, a more robust set of incentives would be in place.

As regards the share of the deforestation and degradation “credits” that government should be allocated compared to those used to cover payments to forest owners and communities, it may be important to distinguish between the roles of government at the national and the sub-national levels. Many of the governmental policies and actions (Table 1) will be implemented at national level and may have an indirect or diffuse effect on carbon stocks thus making it difficult to link them directly with any specific changes in carbon stocks. The national government will also face overhead and transaction costs related to the country’s participation in REDD+ (setting up the RELs, implementing national forestry inventories, instituting monitoring of land use change using remote sensing facilities, developing and disseminating public information, capacity building, *etc.*). These costs are unlikely to be covered by results-based revenues from REDD+ “credits”. Fortunately there are a variety of multi- and bi-lateral funds already available (the World Bank’s FCPF program, UN-REDD, NORAD, *etc.*) for these purposes. Given the fact that REDD+ is likely to have positive spin-offs and reinforce existing policies in the forest sector, it is not unreasonable that further costs of this sort are covered by regular budgetary sources in most countries.

At the sub-national level (regional, district, municipal) however, government organizations will have costs associated with direct support to the participation of forest owners and communities in

REDD+, for example in training, in monitoring, and in maintaining data systems for carbon accounting. Moreover, it is possible that government agencies themselves set up projects directly (reserves, conservation areas, *etc.*). Hence the suggestion that some part of the revenues related to carbon “credits” could flow to sub-national governments is not unreasonable. The proportion absorbed by government will vary from country to country. The most important point in this regard is that the level of the revenue used for such purposes should be determined through public debate, and that transparency in the use of all financial flows from REDD+ credits is maintained.

6. Conclusions

REDD+ is advancing in negotiations under the UNFCCC where the phases of implementation of national programs and the systems for MRV and the implementation of safeguards have been defined. However how benefits will be shared between stakeholders within national REDD+ programs is still an open question. We argue that it is possible to design a rewards and incentives system in which both landowners and communities managing forests and local government agencies will receive a share of the financial flows from REDD+. A critical step to enable this is the separation of accounting for deforestation, degradation and forest enhancement, and the setting of baselines for degradation and forest enhancement at the level of the parcel or management units, while the baseline for reduced deforestation applies to the regional level. Separated accounting enables the independent attribution of carbon enhancement and (in theory at least) reduced degradation to local landowners and communities. Although it is not easy to assess the relative potential for generation of carbon “credits” from reduced deforestation as compared to reduced degradation and forest enhancement, we do not believe that the separation of rewards would discourage governments from promoting reduced deforestation, or that such separation would alter the overall REDD+ system. Rather, we consider that it would encourage participation by providing appropriate rewards for all the stakeholders involved.

A formal registration of all activities under the national REDD+ program would be required to maintain a national registry of carbon credits generated and sold, and also to identify areas not voluntarily participating in REDD+ where land use regulations and control of illegal activities should be more stringent. We consider that finance for national policies implemented by the public sector as part of REDD+ should be derived from regular government budgets, a small share of the carbon revenues can be used to cover some of the transaction costs of the government, since in general it will be difficult to assess exactly how they impact on carbon stocks; this could also reduce the risk of government trying to commandeer carbon “credits” generated at the local level by communities and local land owners.

While the proposal presented may represent a sound and practical approach to the problem of distribution of benefits of REDD+, it is not yet at all clear to what extent the financial value of the “credits” will be sufficient on its own to generate adequate incentives for the participation of landowners. Both the biophysical potential for carbon gains for a broad range of ecosystems (from tropical to dry forests) and the international financial value of carbon “credits” will affect this, but in all probability, the funds derived from such “credits” will need to be supplemented by other sources of finance in order to achieve the goals of REDD+.

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Conflict of Interest

The authors declare no conflict of interest.

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fifth, punitive measures of this kind are unlikely to be acceptable to the general public, and are likely to raise public opposition to the whole idea of REDD+.

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