iREDD hedges against avoided deforestation's unholy trinity of leakage, permanence and additionality

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Abstract

Workable financial mechanisms are essential to abate greenhouse gas emissions. Deforestation, which contributes a large proportion of total global emissions, must be avoided as an effective emissions-reduction tactic, and to alleviate biodiversity loss and poverty. However, incentives to reduce emissions from deforestation and forest degradation (REDD) have had mixed and suboptimal success because of opportunity costs and administrative and technical issues, in particular, leakage, permanence, and additionality. We show that these latter concepts can be ambiguous, potentially contrived and in some cases, generate perverse outcomes. Encumbering avoided-deforestation projects with these administrative shackles risks massive increases in global deforestation and a concomitant loss of biodiversity, ecosystem services and emissions-reduction opportunities. We offer a solution built on a proven insurance-based hedging principle, a concept we call iREDD, that could indirectly address specific technical and administrative challenges, whether real or contrived. Project-specific iREDD insurance policies and premiums would be negotiated upfront using a simple assessment of risk based on governance quality, the integrity of management plans, liquidity, monitoring and evaluation frameworks, and political acceptability. iREDD acts as both an incentive for prudent forest management given the seller's potential financial windfall if forests are diligently managed, and guarantees not to disenfranchise the buyer.

Introduction

The international community's scramble to implement workable financial mechanisms that effectively abate greenhouse gas emissions is at the heart of climate change mitigation policy worldwide. Rapid global deforestation contributes a large portion of total global anthropogenic CO_2 emissions (Intergovernmental Panel on Climate Change 2007; Asner *et al.* 2010), but conversely, afforestation, reduction in deforestation and forest degradation, and forest restoration also provide possible emissions-reduction and mitigation options through global carbon finance mechanisms. After the 2011 United Nations Framework Convention on Climate Change meeting in Durban, however, the nature of these mechanisms still remains divisive and highly debated (Andrews *et al.* 2012), continuing a trend that began in the early 1990s.

In the 1990s, negotiations leading to the Kyoto Protocol of the United Nations Framework Convention on Climate Change failed to use the full potential of forests to mitigate climate change. Only afforestation of land deforested for at least 50 years, and reforestation of land deforested before 1990, were allowed for funding under the Clean Development Mechanism established by the Protocol. However, at the 2005 Conference of Parties to the United Nations Framework Convention on Climate Change, the idea of compensating countries for reduced emissions from deforestation and forest degradation resurfaced under the popular banner of "REDD" (reduce emissions from deforestation and forest degradation). The 2007 Conference of Parties in Bali decided to consider and stimulate action on REDD in preparation for the 2009 Copenhagen Conference of Parties. At Copenhagen, REDD+ (incorporating conservation and management of forests) was recognized as crucial in mitigation efforts. A commitment was made to establish a Green Climate Fund to support a range of activities including REDD+. The term "REDD+" itself was only clearly defined later at the 2010 Conference of Parties at Cancún to include reduced emissions from deforestation, forest degradation, conservation and management of forests, and enhancement of forest stocks (United Nations Framework Convention on Climate Change 2011).

The Cancún Conference of Parties provided some clarity for REDD, but faltered on financial structures. As well a defining the REDD concept itself, the Cancún meeting set out basic steps for countries to prepare themselves for the provision of finance for REDD programs, including developing a national strategy or action plan, a national forest-emissions reference level, a robust and transparent monitoring system, and systems for providing information on how safeguards (e.g., good governance, respect for indigenous peoples' rights, and biodiversity considerations) would be implemented (United Nations Framework Convention on Climate Change 2011). Country-level REDD programs were recommended to be implemented in three phases: (1) readiness planning; (2) implementation; and (3) results-based actions. The underpinning issue of how REDD should be financed, however, was not resolved at the Cancún meeting, with the role of market versus nonmarket-based approaches continuing to be divisive.

Many multilateral funds have been established to assist with REDD financing at the country level. The most important of these are the World Bank's Forest Carbon Partnership Facility (FCPF) launched at the 2007 Bali Conference of Parties, the United Nations-REDD program, and the World Bank's Forest Investment Program. The FCPF provides grant funding to assist readiness planning; the United Nations-REDD program launched in 2008 also provides assistance for development and implementation of REDD programs. The Forest Investment Program, also launched in 2008, is to provide larger-scale funds for national forest investment strategies based on pilots in selected countries. Despite being in their infancy, only 7% on average of the funds has been disbursed (Creed & Nakhooda 2011), demonstrating the complexity of rules, difficulty of coordinating country-level projects, high transaction costs, and the challenges of comprehensive application of safeguards and general due diligence.

Several critical reviews of the FCPF and the United Nations REDD Program suggest that the analysis of problems surrounding law enforcement, corruption and land tenure have been shallow, and consideration of governance has not moved beyond basic concepts (Bofin *et al.* 2011). Indeed, poorer relative governance quality is linked to higher rates of deforestation, biodiversity loss, and environmental degradation (Jepson *et al.* 2001; Smith *et al.* 2003; Ewers 2006; Li & Reuveny 2006; Bradshaw *et al.* 2010). The World Bank and recipient governments have also been accused of colluding to mask defects in FCPF operations and planning (Dooley *et al.* 2011). Thus, although REDD emerged from a sense of crisis in global carbon emissions and biodiversity, it now seems that an effective, seamless, global response to REDD is unlikely in the near future.

Private investment in carbon-market projects has already started to decline because of continuing uncertainty in climate negotiations, and there is a risk that more delays could stall interest altogether (Zhu *et al.* 2010). In reality, although REDD financing remains controversial, a basket of financial options from which individual countries can choose depending on their circumstances, is the most likely means of resuscitating the concept. At the Durban Conference of Parties, the final REDD+ agreement opens the way for both public and private sources of finance, and for new market-based solutions (Boyle 2011). We describe one such solution for site-level projects that could generate immediate action and provide a critical means for channeling investment while helping REDD maintain momentum.

Leakage, permanence, and additionality

To operationalize REDD (used henceforth to incorporate all REDD programs and its variants), countries will need to include specific projects in their accounting system—it is at the project level where much of the activity and innovation in REDD approaches are taking place (Angelsen 2008). But for individual projects, there are many obstacles associated with REDD's implementation and acceptance (Miles & Kapos 2008; Kintisch 2009; Phelps *et al.* 2010). These can be summarized as additionality/baseline, leakage, measuring and monitoring, permanence, and socioeconomic aspects (Trines *et al.* 2006). Paramount among these is accounting for the problems of leakage, permanence, and additionality, which tend to form an unholy trinity against REDD implementation by encumbering projects with administrative shackles and concerns about credibility. The general concept of leakage (Miles & Kapos 2008) refers to the unanticipated increase in emissions outside an avoided-deforestation project's accounting boundary (Murray 2008). Leakage can be further categorized as activity shifting, and market leakage (Meyfroidt & Lambin 2009). Recent studies of activity shifting "spill overs" found only small and not easily detected shifts (Angelsen 2008). A review of carbon projects across Africa found it difficult to show direct causal links between project activities and leakage (Rayden *et al.* 2010). The first apparently clear evidence (Ewers & Rodrigues 2008) of activity-shifting leakage can be sourced to a 2007 study on avoided deforestation through protection and forest concessions in the Peruvian Amazon (Oliveira *et al.* 2007), but the construction of new roads, long known to facilitate deforestation (Laurance *et al.* 2001) and not associated with the project, confounds this conclusion. Protection can in fact stimulate reduced deforestation in adjacent unprotected areas and alleviate poverty in neighboring communities (Andam *et al.* 2010). Indeed, protected areas in Sumatra and in the Brazilian Amazon promoted protection in adjacent areas (Gaveau *et al.* 2009), and resulted in a net reduction in regional deforestation presumably because the creation of protected areas discourages illegal land-grabbing (Soares-Filho *et al.* 2010). Although leakage is a legitimate concern, the cost and complexity of accounting for it, particularly given the difficulty of finding direct causal links, results in major impediments to project implementation.

Accounting for market leakage assumes that market demand must be met (Pearson *et al.* 2006). Market demand for forests and biodiversity globally is mainly driven by industrial and urban growth, agriculture, and household consumption (DeFries *et al.* 2010; Gibbs *et al.* 2010; United Nations' Environment Programme 2010); worldwide, household consumption drives 72% of greenhouse gas emissions, and a doubling of household income results in 81% more CO_2 emissions (United Nations' Environment Programme 2010). It would seem inevitable that forests give way to the pressures of agriculture, urban growth, and household consumption unless they can play in the market place. Overly complex rules for accounting for leakage might simply hamper REDD actions without doing anything for avoiding deforestation.

Permanence is the guarantee that avoided deforestation will remain so for a meaningful time. The Kyoto Protocol's Clean Development Mechanism deals with permanence in its afforestation and reforestation projects by issuing either long-term or temporary certified emission reductions. Both of these have expiry dates and must be replaced by permanent certified emission reductions from energy projects. This reduces demand, lowers the price, and weakens the competitiveness of planted forests (Wang 2010). Other risk-based standards such as the Verified Carbon Standard estimate the risk that sequestered carbon is eventually released again within the timeframe of the project. The risk buffer generated compensates for future losses. This means that "permanent," fully eligible and tradable carbon (part of a regular carbon market) can be generated.

The final obstacle addressed here, invoked by the Clean Development Mechanism, is the additionality criterion. Additionality means that activities must demonstrate emissions reductions that would not otherwise have occurred without the support of the Mechanism or, in the voluntary market, the project monies. "What would otherwise have happened" is an ambiguous concept and essentially immeasurable (Raymond 2010). Markets, and especially the private sector, eschew ambiguity because it translates to risk. Risk introduces uncertainty that, as is the case for permanence, reduces the attractiveness of the investment, demand, and hence the price of carbon. This implies that the opportunity cost of not harvesting a forest increases, thus perversely incentivizing accelerated deforestation. Projects implemented in Africa have not been chosen based on where there is the greatest threat to carbon stocks; instead, they are placed where pressure on forests is high, people are most receptive, and where there are fewer political obstacles (Rayden *et al.* 2010).

Meanwhile, as we debate the merits of REDD and continue to raise obstacles against it, deforestation, not surprisingly, continues apace (Bradshaw *et al.* 2009) as is evident through various examples. Deforestation in Brazil continues (Instituto Nacional de Pesquisas Espacias 2011), and in insular Southeast Asia, it has been unrelenting since the turn of the century, with an overall 1.0% average yearly decline in forest cover (Miettinen *et al.* 2011). Indeed, the eastern lowlands of Sumatra and the peatlands of Sarawak, Borneo have lost around 50% of the peat swamp forest area available in 2000 (Miettinen *et al.* 2011).

The estimated resources needed to reduce emissions from REDD by 50% range from US$17 to 28 billion per year (O'Sullivan *et al.* 2010), and since the 2009 Copenhagen climate conference, additional funds of US$4 billion per year from 2010 to 2012 have been pledged to REDD efforts, which is barely a third of the lowest estimates needed (Swickard & Carnahan 2010).

In reality, the issues of leakage, permanence, and additionality are indicators of real-world complexities, not necessarily unique to carbon projects (Rayden *et al.* 2010). Unfortunately however, it seems that carbon projects bear the disproportionate burden of accounting for what ultimately might be contrived problems. This results in marginal benefits to project proponents that, in turn, act to stall potential investment. If we care about forests (as clearly we must), scaling up private investment is essential. Currently, much of the activity and innovation in REDD is happening at the project level where critical private-sector investment has occurred and should be maintained to ensure adequate financing and program effectiveness (Swickard & Carnahan 2010). Here we suggest an elementary, practical, yet robust financial mechanism that would help encourage private sector involvement in REDD to complement public efforts and avoid REDD becoming peripheral to climate change mitigation. The basic premise of this financial instrument is that it desires to reduce the risk embedded in an uncertain future through an insurance mechanism that has the potential to benefit both the buyer and the seller of the carbon at the date of contract maturity, while simultaneously reducing the negative aspects of leakage, permanence, and additionality.

iREDD

The REDD industry (or market) has already started to address some of these aforementioned challenges by introducing measures such as reserve carbon pools and risk discounts (Lopes 2009). Although these measures can address the risk profile of the project, they are insufficient to overcome the challenges the market is posing against leakage, permanence, and additionality. We offer a strong solution to these problems based on proven insurance-based hedging principles—a form of REDD insurance policy which we call "iREDD." This is not the first time that insurance has been linked either to conservation in general, or to REDD specifically (Angelson *et al.* 2009; Holland 2010). Ours is, however, probably the first proposal of a formal framework where insurance can play a meaningful role in addressing the challenges seriously constraining current REDD development.

The first element of iREDD concerns the risk profile. At the beginning of a forest carbon project, the proponent would normally elaborate the risk profile, provide details on how the risks would be managed and, under some standards (such as the Verified Carbon Standard), suggest a buffer discount. Under iREDD, the risk profile of each project would be ascertained and negotiated beforehand by both the buyer and the seller combined. Before entering into a REDD contract, both parties would be obliged to agree on the perceived risk, effectively monetizing it. The outcome of the risk analysis is that the higher the risk concerning leakage, the lack of permanence, and low additionality, the higher the insurance premium, and vice versa.

There is a wide range of project risk assessments available upon which market actors could agree to use in evaluating a project's risk. Importantly from an iREDD perspective, however, linking the risk profile as analytically and objectively as possible to an insurance premium is essential. One option would be to use a Likert scale whereby the risk of the project is scored from low (1) to high (5) risk in each of the following five categories: (1) governance structures, (2) management plans, (3) project liquidity, (4) acceptance, and (5) political buy-in. Although this list might not be conclusive, and although market actors could certainly adapt our proposed system, this list has been developed successfully through practical experience in restoration-related activities (Aronson *et al.* 2006; Blignaut *et al.* 2007; Turpie *et al.* 2008; Blignaut *et al.* 2010). The purpose of these criteria is to develop and score a project's risk profile, and to convert the score to a project-specific insurance premium. This premium would, at project closure, befall either those on the demand or on the supply side of the transaction, or both. The scored criteria therefore provide a direct mechanism to "quantify" the risk posed by leakage, permanence, and additionality; without such an explicit appraisal of risk and the associated compensation imposed by the adjustable premium, potential investors tend to remain sceptical and avoid investment.

Project risk is thus assessed based on: (1) Quality of governance, such as the permanence and stability of the institutions involved, which can be determined inter alia by examining the balance sheets of the project management agency or related institutions (the implementing agent), as well as the implementing agent's historical longevity and income flow; the weaker this ability, the higher the project risk, and hence, the greater the insurance premium. (2) There must be a well-defined management plan with deliverables, including mitigation plans for disasters such as fire and illegal deforestation, well-documented human migration predictions within the proposed area, and an account of current and future land-tenure structure. The weaker and less robust such management plans, the higher the project risk and hence the insurance premium payable. (3) Project liquidity is essential to ensure enough cash and in-kind resources are available to execute the management plan: for example, building fire breaks, policing boundaries, monitoring, fencing, basic maintenance, and salaries. If the project does not possess sufficient cash, the likelihood that it would be in the position to implement any form of disaster management, or even be able merely to implement its stated management plan, would be low. Such susceptibility increases the project's overall risk and hence, the required insurance premium. (4) A successful and low-risk project must be able to integrate with existing monitoring, evaluation and reference groups, projects, and networks, such as the subnational "nested approach" (Pedroni *et al.* 2009). The more a project (and its implementing agent) is connected to other groups, and the more developed its own self-policing system, the more these will signal the agent's willingness and openness to prudent land and project management. (5) The project must have political acceptability, that is, whether the project is considered a policy priority in the relevant jurisdictions to address unemployment, education, biodiversity legislation, and international agreements. If a project operates outside the boundaries of nationally stated priorities, then the risk of the project becoming marginalized is greater than what would otherwise be the case, and hence, the higher the project risk.

The second major consideration in an iREDD scheme is deciding on the size of the premium. Although the market actors can and would derive their own project-specific formula, we suggest the following four aspects to determine the size and application of the negotiated premium: (1) the project's risk profile as discussed above; (2) the premium size relative to the risk profile; (3) the type of insurance investment that will be made (i.e., the form of the investment); and (4) the terms of use of the trust fund or insurance policy and varying conditions of performance. Once the project risk has been determined, the next step would be to decide upon an investment vehicle, that is, the destination and the management of the insurance premium. The two most obvious insurance investments include trust funds at a recognized financial institution, and genuine insurance policies. The terms of use of the trust fund or insurance policy would have to be negotiated and be made part of the project's contract.

A simple example (Table 1) suffices to illustrate how an iREDD project might proceed once the combined Likert-scale risk profile and premiums had been assessed and concurred among parties. If, for example, the negotiated price of the carbon credit is \$15 per ton CO_2, and the project has low risk, then a small amount (e.g., \$1 per ton CO_2) is set aside in a trust fund or to buy an insurance policy. Should the risk be high, this amount could rise to, for example, \$5 (see the developed example in Table 1). Although it remains the prerogative of the market actors, it is unlikely that iREDD projects would remain viable should the insurance premium exceed one-third of the carbon credit price because anything larger would imply that the actual payout to the sellers would be reduced by too much, reducing the incentive (and even the liquidity necessary) to maintain and operate a functional program. Doing so would imply that the project's risk is too high and that the bulk of the carbon payment is deferred to a later stage. The balance between the purchase price (e.g., \$15 per ton CO_2) and the premium (e.g., \$5 per ton CO_2) is paid to the seller of the credits. The premium, as it has accumulated plus interest, is shared between the buyer and the seller when the contract has reached maturity according to the principles discussed below (Table 1).

iREDD therefore provides a monetary tool and mechanism through which project risks can be financially hedged, and most importantly, managed. Under iREDD, ongoing project monitoring and evaluation is intrinsic to determine the degree to which the project attained its objectives and targets. The built-in insurance approach makes "risk" an integral part of the management process. Additionality, leakage, and permanence are ongoing problems, but iREDD makes it explicit and provides a management and intervention tool to account ex post for these risks, in a way that current ex ante approaches, applied during the time of highest uncertainty, cannot.

Specifically, leakage is addressed at set intervals from contract settlement through the activities listed and described in the management plan compared with actual land use changes and evidence for any activity shifting. Instead of attempting to predict leakage beforehand under classic REDD approaches (normally an impossible task), iREDD provides an evidence-based mechanism to account explicitly for, and to mitigate financially, that risk. Where leakage occurs beyond contract specifications (according to a frequently updated risk-profile assessment schedule), an amount equal to the value of the "leaked" carbon credits should be paid to the buyer to reinvest in carbon transactions elsewhere (Table 1). The sellers therefore have a direct incentive to limit leakage, and the buyers are hedged in that in the case of any losses, they will be compensated.

Carbon credits have "permanence" within an iREDD contract's parameters if the terms are met diligently within the project's time frame; if not, then some project failure is accepted and buyers are appropriately compensated, enabling them to invest in another project to attain the required number of carbon credits. In this way, the buyer will obtain permanence even if that implies one or more contracts or projects.

Although additionality is, by definition, a concept fraught with challenges to mitigate, an evaluation of "what would have happened otherwise" upon contract maturation could be done by comparing the project with reference or baseline sites not included within the project boundaries. It would be advantageous to set those reference site boundaries beforehand, but it is not strictly necessary. The number of carbon credits can therefore be adjusted accordingly before final disbursement of trust fund or insurance returns. iREDD thus acts both as an incentive for prudent land and project management, and as a guarantee not to disenfranchise the buyer. The buyer's risk is therefore minimized, and the sellers have the distinct incentive to reduce risk as far as possible given the considerable financial windfall from the premium's interest that might surface upon project completion if their forests are diligently managed.

Table 1 Hypothetical example of an iREDD evaluation: sequestration (s) rate of 5,000 tons CO_2 per year for 20 years (y) in which the gross price for the carbon credit (p_1) is fixed at US$15 per ton CO_2. (a) Assessment at the start and (b) end of the project. Each risk category is scored between 1 and 5 on the Likert scale relative to perceived (and agreed between parties) risk (1 = lowest risk; 5 = highest risk). The mean score across all five risk categories represents the risk premium used to adjust the iREDD insurance premium. The simplest method uses the mean risk value to adjust the capital value of the project. Thus, the 2.2 risk premium (r) in this example is multiplied by the total carbon credits to become a capital value of $220,000 for 100,000 tons CO_2, which is adjusted according to current per annum market interest rates (i) over the duration of the project (20 years [y] in the example). During and postproject assessment identifies a loss of 5,000 tons CO_2 from leakage to nearby forest degradation and loss, a noncompliance of project terms (e.g., some forest loss/degradation through illegal logging) equating to 8,000 tons CO_2 (loss because of nonpermanence), and 2,000 tons CO_2 lost from postproject assessed additionality (the carbon amount that would have been sequestered in the project area without any REDD investment as estimated from baseline comparisons outside of the project area). This 15,000 tons of "lost" carbon (l) is charged at the per unit carbon price at the project's completion (p_2 = US$25 per ton CO_2) for a total of $375,000; this component of the premium is paid to the buyer, and the remainder ($574,454) is disbursed to the seller. Over the 20 years then, the buyer receives 85,000 tons-worth of carbon credits and a cash return because of noncompliance of $375,000 that can be reinvested in other projects to make up for the loss of 15,000 tons CO_2. The seller receives $1,280,000 REDD funding disbursed at agreed intervals over the 20-year project plus $574,454 of the risk capital fund accumulated over time for a total income of $1,854, 454

	Linking risk categories to elements of leakage, permanence, and additionality			Determining risk premium		
(a) Risk categories	Leakage	Permanence	Additionality	Possible range[1]	Actual score	Risk premium[2]
1. Quality of governance		√		1–5	2	Mean score = 2.2
2. Management plan	√			1–5	3	
3. Project liquidity			√	1–5	3	
4. Integration	√	√		1–5	2	
5. Political acceptability			√	1–5	1	

(b)		
Project insurance premium	Carbon sequestered ($s{\cdot}y$)	100,000 tons
	Unit risk value (r)	2.2 per credit
	Capital risk value ($s{\cdot}y{\cdot}r$)	$220,000
	Interest (i)	0.08 (8%) per year
	Insurance premium at project end $r{\cdot}s{\cdot}y\ (1+i)^{y-1}$	$949,454
Losses of carbon credits	Leakage	5,000 tons
	Permanence	8,000 tons
	Additionality	2,000 tons
	Total (l)	15,000 tons
Value of carbon credit losses	Unit price at end of period (p_2)	$25 per ton CO_2
	Total value of loss incurred by buyer ($l{\cdot}p_2$)	$375,000
Distribution of premium[3]	Buyer ($l{\cdot}p_2$)	$375,000
	Seller ($r{\cdot}s{\cdot}y\ (1+i)^{y-1} - l{\cdot}p_2$)	$574,454
Attribution summary	Buyer: 85,000 tons ($s{\cdot}y - l$) carbon credits + $375,000 ($l{\cdot}p_2$) cash return	
	Seller: $1,280,000 ($[p_1 - r]{\cdot}s{\cdot}y$) + $574,454 ($r{\cdot}s{\cdot}y(1+i)^{y-1} - l{\cdot}p_2$) = $1,854,454	

[1] Where 1 denotes "low" and 5 "high" risk.

[2] Various methods can be used to convert the range of the risk to the value of the risk premium. The simplest, yet most transparent, way is to equate the average of the risk premiums across all risk categories to be equal to the $ value of the risk premium. This premium has to be dedicated, either through a trust fund or an insurance policy, towards addressing the potential differential between the actual project performance and the contracted performance. Once the mean score (and hence risk premium) exceeds 33% of the carbon price, the risk is probably too high to continue with the project; in the current example, the mean risk premium of 2.2 represents 14.7% of the carbon price.

[3] In the unlikely event that the loss incurred by the buyer exceeds the premium value at project end, the deficit is borne by the buyer. That would constitute a real loss in value. This necessitates the careful determination of the risk premium from the outset.

Using iREDD is therefore a powerful, yet simple method to deal with leakage, permanence, and additionality. It will also contribute meaningfully towards diligent project management. Afforestation, the reduction in deforestation and forest degradation, and forest restoration projects can now take their rightful place in the quest to combat climate change and biodiversity loss.

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