



Research Results on International Equity in REDD Mechanisms*

- Skewed distribution of incentives to reduce emissions from deforestation and forest degradation (REDD) can emerge as a stumbling block in REDD negotiations
- This paper clarifies possible interpretations of equity, and highlights how different notions of equity lead to different conclusions about which REDD design is most equitable
- If equity is perceived as equality for tropical countries to manage their forest carbon stocks as they deem appropriate, then one can measure equity in terms of incentives received relative to a country's endowment of forest carbon stock. If that is the case then a REDD mechanism compensating a uniform qualified share of carbon stocks is the most equitable.
- If equity is perceived as "equal compensation for equal effort", then a measure of equity would be the incentives received relative to the opportunity costs of participating in REDD. According to such a measure the most equitable REDD mechanism would be the one withholding a part of the payments for emission reductions to compensate for carbon stocks.
- Equality relative to opportunity costs incurred in REDD provides the broadest base of countries willing to participate, and is not in conflict with environmental effectiveness and economic efficiency objectives

Introduction

It is becoming broadly accepted that dangerous climate change cannot be avoided without large-scale effective action on reducing emissions from deforestation and forest degradation (REDD) and on increasing carbon sequestration in land-based systems (Eliasch, 2008). Including a REDD mechanism in a global climate agreement presents an opportunity to achieve stronger global emissions reductions targets more quickly and cheaply, while providing countries which choose to retain forest cover with a valuable economic development opportunity (Stern, 2007; Eliasch, 2008). In this context, for all proposed REDD designs, emissions reductions from participating countries would be measured relative to an agreed-upon reference level. Countries' actual emissions from deforestation would then be monitored and verified. Any country whose actual level of emissions from deforestation is less than its reference level would be eligible to credit this difference as an emissions reduction. Reference levels of emissions will determine a REDD mechanism's overall reductions in emissions from deforestation ("effectiveness"), reductions per dollar spent ("efficiency"), and distribution of REDD revenue across countries and regions ("equity") (Stern, 2007; Angelsen, 2008). Aspects of environmental effectiveness and economic efficiency of different reference

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level designs have been analyzed in Busch *et al.* (2009). However, the international equity dimension of REDD is more elusive to define relative to effectiveness and efficiency, and remains yet to be analyzed in depth.

This brief clarifies possible interpretations of equity surrounding REDD in the international arena, and then uses an open-source model to examine how different REDD design options compare in terms of equity measures. Here only South-South equity is discussed, where funds are distributed among tropical forest countries, as opposed to broader issues of burden-sharing or inter-generational equity in climate change policy, which have been addressed elsewhere.

Notions of equity

The perception of equity is a key element in stakeholders accepting the potential outcome of a negotiation. The notion of equity of a REDD mechanism is tightly related to the concept of distributive justice. Given a fixed amount of positive incentives to be distributed across countries, what does it mean to have an equitable distribution? Zartman *et al.* (1996) call this the referent question: equality or inequality of *what* and *why*?

With respect to distributing incentives to reduce emissions from deforestation, the referent question can be answered in more than one way. Below are two possible choices that are relevant for the REDD mechanisms to be considered here.

- *Equity based on endowment of carbon* – this can be interpreted as equal final impact on the environment if completely deforested, since the carbon stock would largely be emitted into the atmosphere, measured in (net REDD \$)/(ton of carbon in standing forest). Along similar lines one could also envision equity based on endowment of forest hectares.
- *Equity based on return relative to the opportunity cost* – countries reducing emissions from deforestation may have very different opportunity costs, so an equal economic return from participation in REDD relative to opportunity costs, reflecting “equal compensation for equal effort” may be an informative metric concerning equity among REDD countries; measured in (net REDD\$)/(cost REDD).

These two measures, which are not exhaustive, are meant to highlight how equity can mean different things to different people, and how REDD proposals may be equitable or not depending on the notion of equity adopted.

REDD design, reference levels, and international equity

REDD design options differ in the manner in which countries’ reference levels are established, which in turn leads to differing incentives for countries to participate in a REDD program. We follow Busch *et al.* to quantitatively model and compare the impact of REDD financial transfers for emissions reduction for five national-scale REDD incentive-design options under one set of illustrative conditions[†]:

[†] Results reported here are outputs of OSIRIS v2.6 using the following parameter values: carbon price = \$5/ton CO₂; permanence reduction scale = 1.00 (no permanence withholding); exponential demand with price elasticity = 2.00 (elasticity neither perfectly elastic nor perfectly inelastic); fraction of soil carbon eligible for REDD = 0.10; coefficient on slope of supply curve extensions = 0.10; Social preference for agricultural surpluses parameter = 1.00; management and transaction cost = 2001 US\$3.50/Ha/yr; fraction of national average timber rent included = 1.00. Furthermore, the following design-

- “National historical” – Reference levels equal to a country’s national historical rate (Santilli *et al*, 2005)
- “Higher than historical for low deforestation” – Reference levels equal to national historical rates for countries with historically high deforestation; reference levels higher than national historical rates for countries with historically low deforestation rates (da Fonseca *et al*, 2007; Mollicone *et al*, 2007)
- “Weighted average of national and global” – Reference levels are a weighted average of national and global historical rates (Strassburg *et al*, 2008)
- “Uniform fraction of qualified stock” – Some portion of national forest stock is assumed to be at risk; reference level is a uniform fraction of at risk forest stock (Ashton *et al*, 2008)[‡]
- “Standard Stock-flow” – A percentage of payment for emissions reductions is withheld to fund payments for forest stock (Cattaneo, 2008)

The formulae for calculating reference levels under each design option are presented in Busch *et al*. (under review). Most of these design options require the specification of a design-specific parameter, e.g. the weight placed on global average historical rates, or the percentage of flow payment withheld. For each design, a “best foot forward” design-specific parameter was selected for which the design achieved its maximum effectiveness and efficiency.

Multiple indicators of inequality exist in the economics literature. Probably the most well known is the Gini coefficient (G), which varies between zero (perfect equality) and one (maximum inequality).

What tradeoffs do equity considerations involve?

The Gini coefficients for the different proposals can be quite different depending on the notion of equity. For example, if by equality is meant that any standing ton of forest carbon could be released into the atmosphere, then a payment based on a qualified share of carbon stock is by far the most equitable, with a Gini coefficient (G) of 0.28, when compared to a straightforward historical emission approach (G=0.47). Alternatively, if one thinks of equity as equal compensation for equal effort, one obtains results that are quite different based on the distribution of REDD funds relative to the distribution of opportunity costs. So, for example, a flow payment with withholding for a stock payment is the most equitable in terms of distributing funds according to opportunity costs faced by countries (G=0.20).

Several of the proposed mechanisms appear to be acceptable on equity grounds in terms of financial incentive they offer to countries. It is therefore useful to provide a comparison of how proposals perform in terms of environmental effectiveness and economic efficiency alongside equity considerations to see the tradeoffs involved. Under one set of illustrative conditions, the REDD mechanisms considered here result in a 73%-76% decrease in emissions from deforestation from business as usual.

specific parameters are assumed: reference level for countries with low deforestation rates = 0.003; weight on national historic rates = 0.40; fraction of forest and other terrestrial carbon land protected = 0.20; reference level as fraction of unprotected land = 0.01; flow withholding = 0.20 for stock-flow.

[‡] Note that a number of defining elements of the Ashton *et al* (2008) proposal have not been modeled here, including variation in the portion of at-risk carbon stock across countries..

Table 1. Gini coefficients for REDD proposals according to different notions of equity (the lower the coefficient, the more equitable the outcome), with estimated emissions reductions and REDD payments

	Inequality relative to carbon stock	Inequality relative to opportunity cost	Number of countries opting into REDD (out of 84)	Total reduction in deforestation emissions	Economic Efficiency
	Gini coefficient	Gini coefficient		%	%
National historical	0.47	0.27	55	-73%	98%
Higher than historical for low deforestation	0.44	0.26	68	-76%	99%
Weighted average of national and global	0.39	0.26	67	-76%	104%
Flow withholding and stock payment (stock-flow)	0.34	0.20	77	-75%	116%
Uniform fraction of at-risk stock	0.28	0.34	64	-75%	47%

Considerable differences can be observed in economic efficiency, with mechanisms yielding measures of 47% to 116% . An efficiency measure above 100% indicates a cost per emission reduction below market price. This could occur if reference levels are set low enough that not all reductions that occurred were credited, yet enough to encourage country participation in REDD. An efficiency lower than 100% can occur for two reasons. Either some reference levels were set too low, in which case leakage of deforestation resulted in more credits purchased than net reductions to the atmosphere, or some reference levels were set too high, in which case some credits purchased emissions reductions that would have occurred anyway. The difference in efficiency translates into different amounts paid at \$5/ton CO₂e for a per ton reduction of CO₂-equivalent with values ranging from 4.4\$/ton CO₂e to more than 10\$/ton CO₂e. This disparity results in considerable variation in the annual cost of a “full” REDD mechanism -- from 26 billion\$/yr for the most efficient to 60 billion\$/yr for the least efficient. The “flow withholding and stock payment” performs well in this regard, as it distributes financial incentives quite equitably relative to the carbon endowment and to opportunity costs, while preserving economic efficiency. This approach demonstrates that equity may be achieved in a manner compatible with cost-containment.

In Table 1 the number of countries opting to participate in REDD under each mechanism is also provided. For such countries the financial return to deforestation is lower than what they would obtain by participating in REDD. This is therefore a measure of how broad participation would be in REDD depending on the REDD mechanism adopted. It is important to note that it is not equality relative to carbon endowment, but rather equality relative to opportunity costs that provides the greatest level of country participation. The rationale for this result is quite simple: participation in REDD is based on the expectation that REDD payments will exceed opportunity costs. Accordingly, the more equitably profits are distributed relative to opportunity costs, the broader

the participation because fewer countries will be left with costs exceeding benefits of participation.

Conclusion

The notion of equity among countries potentially participating in REDD is central to the outcome of UNFCCC negotiations, as it provides a basis for evaluating relative gains in participation and incentive distribution relative to issues of effectiveness and efficiency. Our conceptual and empirical analysis between five prominent REDD mechanisms with similar emissions reduction potential reveals marked differences in terms of equity and of economic efficiency. There are important tradeoffs between economic efficiency and equity when the latter is intended as equal payment per ton of standing forest carbon. On the other hand, if one considers equity as an “equal payment for equal effort” there are REDD mechanisms that perform well in terms of both efficiency and equity and encourage broad participation. An approach targeting equality relative to opportunity costs incurred in REDD provides the broadest base of countries willing to participate, while achieving environmental effectiveness and economic efficiency objectives.

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