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Points of Reference

Finding Common Ground among Reference Level Approaches to Move REDD+ Forward

SUMMARY

Policies for reducing emissions from deforestation and degradation combined with related pro-forest activities (REDD+) can play a major role in combating climate change. The technical aspects of REDD+ still need to be worked out, including the contentious issue of setting deforestation reference levels (i.e., the quantities of emissions below which countries receive REDD+ credits). While many reference level approaches are based on past emissions (i.e., the national historical baseline), some approaches also include "expected" emissions either by (a) comparing a country's emissions to a global average or (b) calculating the amount of carbon stock present in a given country.

A few key points emerge when the various reference level approaches are compared:

- National historical baselines offer a good starting point. But in order to reduce "leakage"—a shift of carbon-emitting activities to a different region or country that results in no global emissions reduction—reference levels should include incentives to encourage participation by historically low-deforesting countries.
- The differences between proposed reference level approaches are small in terms of emissions reductions and cost.
- The risks of not enacting REDD+ are great.
- Policy makers should decide on a reference level approach quickly in order to move ahead with REDD+ as soon as possible.

INTRODUCTION

With tropical deforestation and forest degradation now accounting for about 15 percent of global CO_2 emissions, there has been renewed effort in recent years to include policies for "reducing emissions from deforestation and degradation plus related pro-forest activities" (REDD+) in programs designed to combat climate change. The driving force behind REDD+ has been the United Nations Framework Convention on Climate Change (UNFCCC). REDD+ was first officially proposed at the UNFCCC Conference of Parties (COP) in Montreal in 2005. At the 2010 COP meeting in Cancun, REDD+ was officially accepted as an important tool.

In spite of this recognition, many of the technical aspects of a REDD+ mechanism must still be worked out, including how to set deforestation reference levels—the quantities of emissions below which countries can be compensated for reducing their emissions. Reference levels are critical to the functioning of a REDD+ system because they affect the answers of some basic questions: How should REDD+ money be distributed among countries? How can REDD+ encourage broad participation by countries? How can REDD+ ensure that emissions reductions are "additional" (see below) and have environmental integrity?

Because reference levels determine how much money countries will make from REDD+ and what they need to achieve in order to earn that money, the issue has become a contentious one among countries. In most REDD+ proposals to the COP, a country would be compensated for the difference between its actual emissions and the set reference level. But since REDD+

was first introduced, numerous other reference level approaches have also been proposed (Parker et al. 2009). This paper presents an overview of the literature on all the major methods for establishing reference levels that have been proposed to date, and it draws from that overview some fundamental conclusions for guiding negotiators as they work out the details of global REDD+ mechanisms.

REFERENCE LEVEL APPROACHES

Terminology

Although the two are not synonymous, the terms "reference level" and "baseline" are often used interchangeably, so it is worth clarifying them. Baseline can refer to one of three concepts: historical baselines, business-as-usual baselines, or crediting baselines (Angelsen 2008). **Historical baselines**, or national historical baselines, are based on countries' observed average deforestation rates over a set period of time. **Business-as-usual baselines** use models based on current trends to determine future emissions, assuming that no preventive actions will be taken (hence business as usual). **Crediting baselines** are the emissions levels below which countries get compensated for emissions reductions; they can be the same as the historical or business-as-usual baselines or be set on the basis of other criteria.

The term **reference level** generally refers to a crediting baseline; another term—**reference level scenario**—is sometimes used synonymously with reference level or crediting baseline. The Forest Carbon Partnership Facility (FCPC) often employs the term, in the context of on-the-ground implementation of REDD, to differentiate the FCPC from the UNFCCC process (which uses the term reference level). In most approaches, the reference levels are based in part on national historical baselines. Other approaches, termed **forward-looking reference levels**, attempt to estimate potential future deforestation by using either a business-as-usual baseline or some other method.

For a REDD+ mechanism to produce real reductions in emissions, reference levels must be set so that they create **additionality** and reduce **leakage**. Only emissions reductions that would not have taken place in the absence of REDD+ are considered additional**.** For example, if Nicaragua were expected to reduce its deforestation emissions by 20 percent a year without a REDD+ mechanism, then it would need to reduce emissions by more than 20 percent for its marginal reductions to be paid for through the mechanism. Setting an accurate reference level helps ensure that reductions undertaken as a part of REDD+ will be additional.

Further, a REDD+ mechanism will have to guarantee that carbon-emitting activities are not simply moving, or leaking, to a different region or country. For example, if Indonesia establishes a REDD+ project within its borders that reduces the country's emissions by 10 metric tons of CO_2 equivalent ($MtCO_2e$) but this action leads to a corresponding increase in emissions from Papua New Guinea, then no real global emissions reductions have taken place. Indonesia's emissions have simply "leaked"

over to Papua New Guinea. A REDD+ system must be as comprehensive as possible in order to minimize the chances of such leakage.

When considering leakage, it is important to consider the scale of REDD+ programs. Reference levels can be set for individual projects, subnational regions (such as states or provinces), nations, regions (e.g., the Congo or Amazon basins), or the whole world. Project-level and subnational schemes have a high probability of leakage. Because of this tendency, most proposals for setting reference levels pertain to the national/international scale (Parker et al. 2009). In that spirit, this paper focuses mainly on national-scale reference level proposals as well.

Historical Reference Levels

The first REDD+ proposals specified the simplest option as the basis of a reference level—a country's historical deforestation rate (Santilli et al. 2005), with further reductions below that level being compensated. (This approach is often called **compensated reductions**). To account for annual and short-term fluctuations in deforestation rates, many proposals recommend setting a reference period of 5 to 10 years (Environmental Defense Fund 2007)—though given that some countries have more accurate or comprehensive data on historical deforestation rates than other countries, the reference-period time frame could initially be negotiated by each country. Also, to better enable some countries to accurately determine their reference level, foreign assistance could be provided (UNFCCC 2009). Further, reference levels might be reduced over time (Santilli et al. recommend revising after 20 years) to motivate countries to continue decreasing their deforestation.

There are a few concerns about basing reference levels solely on historical deforestation rates (Olander et al. 2008). First, countries with historically low deforestation rates would have little reason to participate in a REDD+ mechanism, thereby greatly increasing the chance of international leakage into their territory. Countries with a large amount of intact forest and a low deforestation rate, so-called HFLD (high-forest low-deforestation) countries such as Guyana and Gabon, are of particularly great concern (da Fonseca et al. 2007). Many HFLD countries are less developed, and have fewer roads and industrial-processing facilities, than countries with high deforestation rates. (The low deforestation rate in these HFLD countries has more to do with the passive protection of their limited infrastructure than with strong conservation policies.) But given HFLD countries' large tracts of remaining forests, they have potential for increases in deforestation rates as they develop. If REDD+ were instituted without HFLD countries participating, it is possible that much of the emissions reduced elsewhere would leak into those countries, leading to no overall global decline in emissions.

A second, and related, concern is the issue of equity (i.e., the fair distribution of REDD+ funds). HFLD countries and other less developed nations, concerned that they would be unfairly penalized for having low deforestation rates due to their lack of development, might resist participating in REDD+ altogether. Some proposals therefore suggest including a development-adjustment factor,

calculated country by country, in determining reference levels. The factors would be based on individual countries' current development levels and anticipated future development needs.

Adjusted Historical Reference Levels

One proposed solution to the equity issue is to assign reference levels to HFLD countries that are higher than their historical or current deforestation rates; such levels would be based on historical baselines but adjusted to increase equity and decrease leakage. The Joint Research Council (JRC) proposed a model whereby countries with deforestation rates higher than half the global average use their historical rate, while countries with deforestation rates lower than half the global average use half the global average as their reference level (Mollicone et al. 2007). This method, called **incentive accounting**, would provide an incentive for low-deforesting countries to enter into the REDD+ system, thus addressing the issue of leakage. However, countries below half the global average deforestation rate could be paid for emissions reductions they were not actually making. For example, if the global historical baseline were 0.5 percent and Guyana had a national historical baseline of 0.1 percent, it would be paid for any emissions below 0.25 percent (half of 0.5 percent). Thus not all emissions reductions would be real and the additionality criterion would not be met.

Because of the uncertainties surrounding historical baselines (annual variability, for example, or the lack of historical data in some countries) and to address equity and leakage, some groups have proposed not relying on incentive accounting or compensated reductions to determine reference levels. Joanneum Research and others propose using a range of values as a reference level (Joanneum Research et al. 2007). This method, called the **corridor approach**, would set an upper and lower reference level, with each country negotiating its levels individually.

Two such scenarios for distributing REDD+ funds have been proposed. Under the first, countries would incur a debt if their emissions went above the upper limit of the corridor, but they would begin to accrue credits once they went below the upper limit. They would not be able to trade or sell credits, however, until they had reduced emissions below the corridor's lower limit.

In the second scenario, countries would begin receiving payments once they were within the corridor, but emissions would be increasingly discounted as they approached the upper limit. And they would incur no debt for emissions above the upper limit. By setting the upper limit of the corridor above national historical baselines and providing strong incentives for countries to dip below the lower limit, this approach would make it easier for countries to join a REDD+ system and would encourage them to reduce emissions quickly. However, because the corridors would span national historical baselines, some of the emissions paid for would certainly not be real.

The Centre for Social and Economic Research on the Global Environment has proposed a method that is designed to reduce leakage (Strassburg et al. 2009). Under the Centre's approach, called

combined incentives, reference levels would be based both on the historical emissions of individual countries and on historical emissions for the total set of REDD+ countries. These two factors would then be weighted (using a value called alpha) and combined to determine expected emissions. Historical national and global reference time periods would be the same for all countries.

The only measure subject to negotiation would be the alpha weighting factor. If every country were given the same alpha, then the reference levels for all countries would add up to a global total. This global additionality would be an added level of security against leakage. As countries decrease deforestation, the alpha value could be adjusted to ensure their continued participation. One disadvantage of this approach is that countries with deforestation rates higher than the global average would receive less money than they would if reference levels were based solely on national historical data. This would give them less incentive to participate in REDD+.

A similar adjusted historical approach to reference levels, which would account for expected emissions, has been developed by researchers at the Woods Hole Research Center. This method, termed **stock-flow**, would address expected emissions by crediting for current carbon stock (standing forests) rather than adjusting the reference level with respect to a global deforestation rate (Cattaneo 2008). Each country's crediting baseline would be based on its historical deforestation emissions. However, a set portion of money from each REDD+ payment would be withheld and deposited in a global fund. Money from the fund would then be distributed to participating countries according to the proportion of remaining global forest stock they retain. For example, given that Brazil contains about 30 percent of the world's tropical forest carbon, it would receive 30 percent of the fund.

By paying both for stocks and flows, this method would entice HFLD countries to enter into REDD+. Additionally, countries with increasing forest area could receive greater stock payments over time. Therefore this method would also have the potential to bring *low*-forest low-deforesting (LFLD) countries into a REDD+ system. However, given that the proportion of money withheld for stock payments would be determined through negotiations, it is possible that the proportion could be set so as to discourage some countries' participation. For example, if the proportion were set too low, HFLD countries might not have enough incentive to join REDD+; and if the proportion were set too high, high-deforesting countries might be discouraged from participating.

Forward-Looking Reference Levels

In order to include HFLD countries, some groups have proposed reference levels based not on historical baselines but that are purely forward-looking. In the Terrestrial Carbon Group's (TCG's) method, credits would be based on countries' carbon stocks (TCG 2008). Terrestrial carbon within a country would be surveyed and specific areas classified either as protected carbon areas or tradable carbon areas. Protected areas, not eligible for compensation under REDD+, would have to be maintained, but the country would be permitted to emit a certain percentage of its tradable carbon stocks

each year. Countries would be compensated for the difference between what they were allowed to emit and what they actually emitted. Tradable carbon stocks that were not emitted in a given year would then be considered protected and off limits for future trading.

FINDING COMMON GROUND

Comparing Approaches

As the UNFCCC process has moved forward and the need to decide on technical details has grown, there has been an effort to compare the existing reference level proposals. Several studies have compared a variety of reference level approaches, including many of those mentioned above (and others), and have investigated a number of outcomes, including effectiveness (amount of emissions reduction), efficiency (cost per unit reduction), equity (fair distribution of funds), participation, and regional/functional (e.g., HFLD, HFHD) differences.

A team from The Nature Conservancy (TNC) was the first to compare reference level approaches (Griscom et al. 2009). Team members classified countries into five groups: high-forest low-deforestation (HFLD); high-forest medium-deforestation (HFMD); high-forest high-deforestation (HFHD); medium-forest medium-deforestation (MFMD); and low-forest low-deforestation (LFLD). They then modeled the number of emissions credits that each group would receive under eight different reference level approaches: (1) simple historical reference level; (2) compensated reductions (simple historical baseline for all groups except HFLD, which was given historical plus 10 percent of historical to take into account "national circumstances"); (3) corridor (variant 1); (4) corridor (variant 2); (5) combined incentives (with an alpha of 0.9, favoring national emissions over global emissions); (6) stock-flow; (7) incentive accounting (JRC); and (8) the TCG's annual tradable carbon approach.

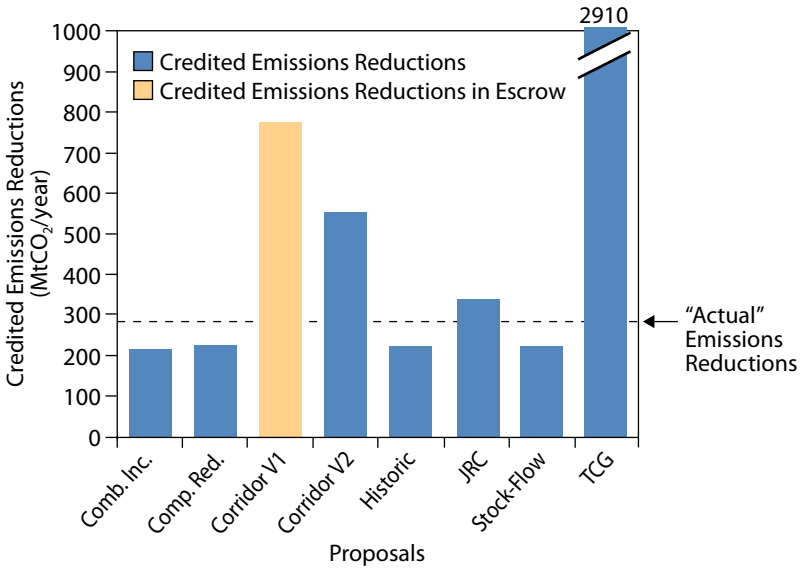
The researchers calculated credited emissions reductions for each of the approaches and compared them to the "actual" emissions reductions (observed emissions for the years 2000 to 2005 minus 10 percent) globally and for each country group. They found that three of the approaches (stock-flow, combined incentives, and compensated reductions) produced similar emissions reductions (Figure 1). The authors considered these models to be: (a) "credible," because their credited emissions reductions were within 10 percent of the simple historical reference level; and (b) "conservative," because all credited emissions were below the nominal "actual" emissions. They also found that these conservative approaches (plus the simple historical reference level) produced similar emissions credits for the country groups, indicating that these four methods were all more or less equally likely to encourage country groups (e.g., HFLD countries) to participate.

The remaining approaches (corridor, incentive accounting [JRC], and TCG) produced more credits than the modeled actual emissions reductions and thus were considered "liberal" approaches. Corridor and TCG approaches credited far more emissions than were actually emitted, meaning the emissions

paid for under this approach would not be additional. Moreover, the incentive accounting, TCG, and combined incentives approaches offered more emissions credit for HFLD countries than they did for HFHD countries, suggesting that the latter's participation might be discouraged.

The authors drew a number of conclusions from their study. First, there was a large disparity in credited emissions, mostly due to the differences between the conservative and liberal approaches. Second, the simple historical baseline (and models predicated on it) offered a credible and accurate reference level. Finally, they noted that HFLD countries (and to a lesser extent HFMD countries) faced the biggest tradeoffs between ensuring that emissions were additional and avoiding leakage.

Figure 1. Credited Emissions Reductions under Eight Reference Level Approaches. Approaches are compared with "actual" deductions (10 percent less than observed deforestation emissions from 2000 to 2005).



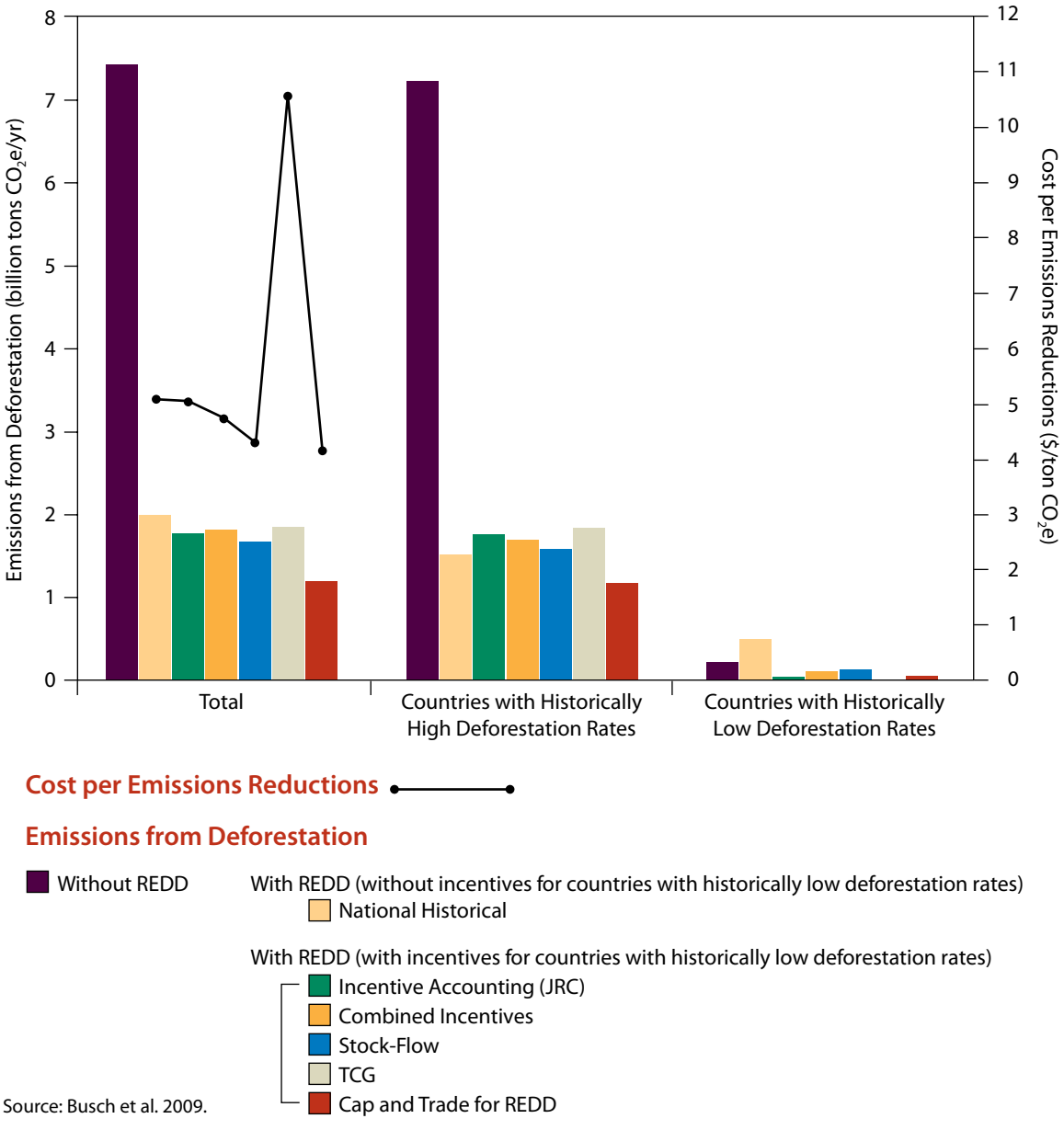
Source: Griscom et al. 2009.

In their own investigation, Busch et al. (2009) went a step further by modeling emissions reductions (and the costs associated with those reductions) under different reference level approaches. After constructing a partial-equilibrium economic model using the open-source OSIRIS database, they compared national historical reference levels, incentive accounting, combined incentives, stock-flow, TCG's annual tradable carbon model, a model REDD+ cap-and-trade system, and a scenario in which REDD+ was not in place.

On a global basis, the Busch team found that when compared with the scenario in which no REDD+ had been established, all REDD+ approaches achieved substantially lower emissions and there was little difference in emissions among those approaches (Figure 2, p. 8). Further, all approaches except TCG had a similar cost per unit of emissions reduction (the cost of TCG was more than double those of the other approaches—see the peak of the black line indicating cost in Figure 2). All approaches substantially reduced emissions in countries with historically high deforestation rates. For countries with historically low deforestation rates, most approaches had similar emissions levels—except for the unadjusted national historical model, which produced by far the most emissions.

The authors drew a number of conclusions from their work. First, there was little difference between the approaches both in terms of emissions and costs (with the exception of TCG). Second, excluding countries from participating in REDD+ could lead to leakage. And third, approaches that included

Figure 2. Emissions from Deforestation and Cost per Emissions Reductions under Six Different Reference Level Approaches



Source: Busch et al. 2009.

incentives for historically low-deforesting countries had the least leakage, the most emissions reductions, and the least cost.

A study by Leischner and Elsasser (2010) took a slightly different approach in investigating countries' participation in a REDD+ system. This study compared four reference level approaches—compensated reductions, compensated conservation (where payments are only made for increases in carbon

stocks), the corridor approach, and incentive accounting—under two scenarios for participation in REDD+. First they looked at which reference level approach countries would prefer, assuming that participation in REDD+ was mandatory. They found that countries leaned toward models that gave them the most credits or the fewest debts, but the preferred approach was not the same for all countries. As the TNC group did, the Leischner team found that the corridor approach produced the most credits.

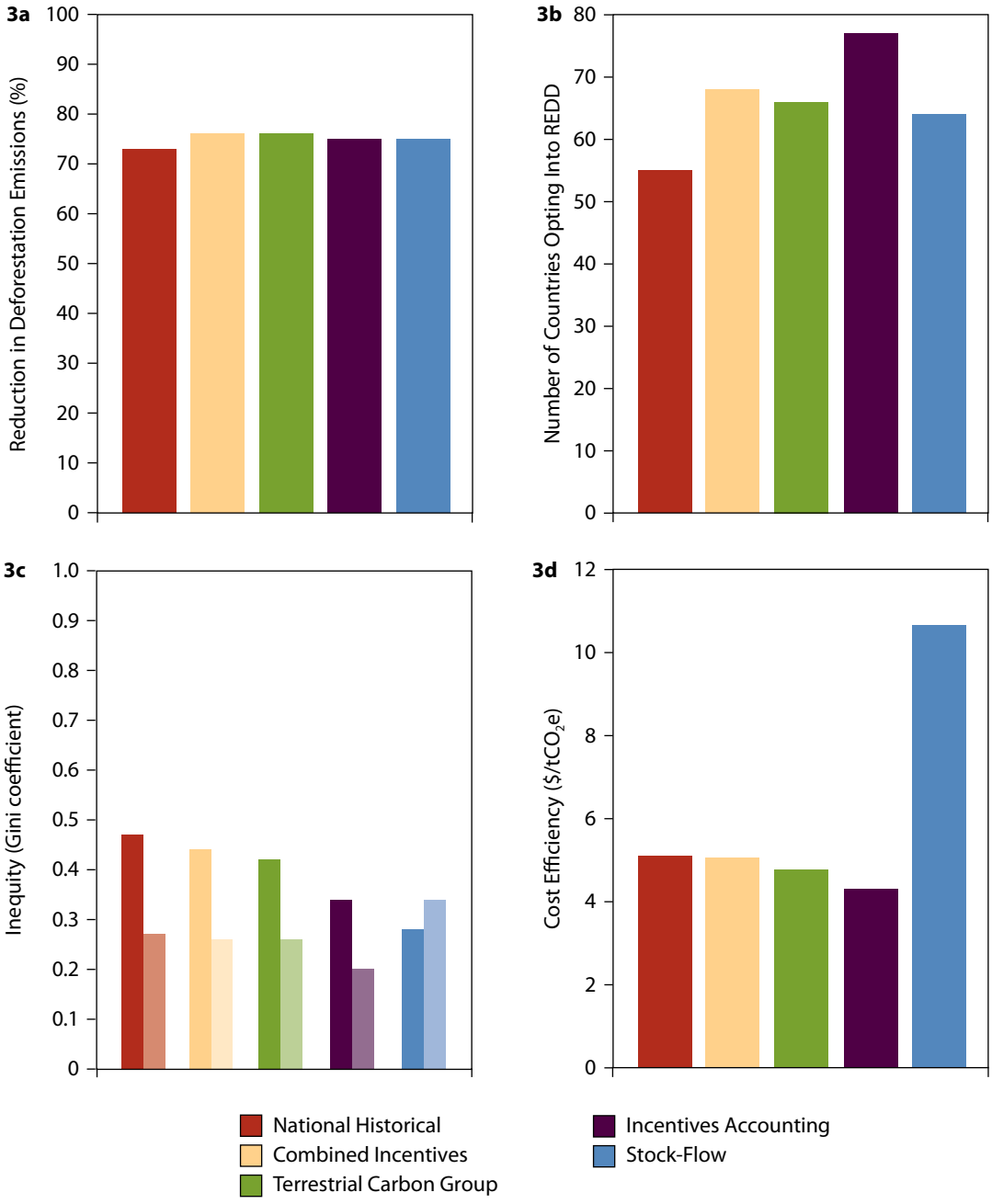
Next, the researchers investigated preference if participation was not mandatory (i.e., a country would not participate if it would receive only debits and not credits). Given a choice of participating in a compensated reductions system, a compensated conservation system, or not participating in REDD+, 42 preferred compensated reductions, 23 preferred compensated conservation, and 19 preferred not to participate. Further, the team noted that countries preferring compensated reductions had the highest forest areas and above-average deforestation rates, typical of HFHD or HFMD countries.

Another study, by Cattaneo et al. (2011), looked explicitly at the equity of different reference level approaches. They compared national historical baselines, incentive accounting, combined incentives, stock-flow, and TCG's annual tradable carbon approach. The authors considered two different measures of equity: one that determined compensation based on countries' carbon stock and one that determined compensation based on countries' opportunity costs incurred by participating in REDD+. In addition to equity, they also compared the efficiency, effectiveness, and participation of the approaches.

The authors found that all models were comparably effective in reducing emissions (Figure 3a, p. 10) and that all (except TCG) were similarly efficient (Figure 3d). They found differences, however, in terms of participation and equity. The national historical baseline approach had the least participation (55 countries) while stock-flow, with 77, had the highest (Figure 3b). Patterns in equity varied, depending on the two different measures of equity (Figure 3c). For equity relative to carbon stocks, the national historical model was the least equitable and the TCG was the most. For equity relative to opportunity costs, however, TCG was the least equitable and stock-flow was the most. Given stock-flow's high equity (in one metric) and high participation, the authors concluded that the stock-flow approach had the highest overall performance.

In other words, while reference levels remain a contentious issue and many of the technical details have yet to be worked out, studies are beginning to indicate that the differences between reference level proposals are not as great as once thought. It may actually be easy to rise above the contention and find a reference level approach that ensures the best outcomes for countries and achieves real emissions reductions.

Figure 3. Comparing Reference Level Approaches across Four Metrics. Box 3a shows the effectiveness of REDD (in percent reductions from baseline emissions); 3b shows the number of countries participating in REDD; 3c shows two measures of equity, with dark bars representing equity based on carbon stock and light bars reflecting equity based on opportunity cost (lower numbers translate into greater equity); and 3d shows the efficiency of REDD (in cost to reduce one ton of CO_2-equivalent emissions).



Source: Cattaneo et al. 2010.

CONCLUSIONS

These studies offer useful early comparisons of the existing reference level proposals. Continued research will be needed to provide more comprehensive analyses, which could be of value to the UNFCCC as it addresses the reference level issue. But although such additional efforts are needed, some conclusions based on the currently available literature can be drawn now:

Doing something is better than doing nothing. In the studies that have been done, there were not huge differences between the proposed models' results, especially when compared with what would happen if REDD+ were not established. Given the consensus that we need to build a REDD+ system as soon as possible if we are to avoid the worst effects of climate change, we should not let the details of establishing a reference level model delay this much-needed action.

Start with national historical baselines. Basing reference levels on national historical baselines should be the starting point for establishing reference levels, as these baselines ensure that reductions would be additional. However, some modifications must be made to avoid leakage.

REDD+ needs to encourage HFLD participation. It is apparent from the many reference level proposals that REDD+ must include major HFLD countries in order to reduce leakage. Otherwise, even with success in high-deforestation countries, there will be no additional reductions globally but rather a shift of emissions to other locales. Approaches that include incentives for HFLD countries are the most effective and efficient.

Global additionality should be maintained. Even if some countries are paid for non-additional emissions reductions, this should be part of a system that ensures additionality at the global level. Global additionality is key to the environmental integrity of REDD+.

Don't sweat the small stuff. Many of the details of the mechanism will have relatively little impact on the most important results: how much emissions are reduced, how much it costs to reduce those emissions, how much different countries get paid, and, most importantly, whether there is global additionality and environmental integrity. Starting in the near term with a "good-enough" system is better than negotiating for many years in hopes of creating a perfect one.

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More information about UCS and the Tropical Forest and Climate Initiative is available at *www.ucsusa.org/forests.*

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The Union of Concerned Scientists is the leading science-based nonprofit working for a healthy environment and a safer world.

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