info brief

A step-wise framework for setting REDD+ forest reference emission levels and forest reference levels

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Developing countries wishing to participate in the REDD+ mechanism can start developing forest reference (emission) levels, based on the guidance provided by COP 17 of UNFCCC and by considering the following points:

- The quality and availability of data will determine the methods used to develop forest reference (emission) levels.

- The step-wise approach proposed in this policy brief can reflect different national circumstances and facilitate broad participation by enabling countries to develop relatively simple forest reference (emission) levels that can be improved over time. These levels can be set alongside efforts to improve measurement and monitoring capacities and reduce uncertainties conducted as part of the three REDD+ implementation phases (which countries are required to follow).

- Considering the drivers and activities that cause deforestation and forest degradation will be particularly important in relation to 'adjusting' reference (emission) levels according to 'national circumstances'.

- A sub-national approach to developing forest reference (emission) levels should be restricted to Phases 1 and 2 of REDD+ and national forest RELs/RLs should be developed for Phase 3 of REDD+ when any financial incentive scheme will be based on fully measured, reported and verified results-based actions. This will ensure the cost-efficiency and will safeguard the environmental integrity of the REDD+ mitigation mechanism.

Introduction

Negotiators at the 17th Conference of the Parties (COP 17) of the United Nations Framework Convention on Climate Change (UNFCCC), held in Durban, South Africa, in December 2011, discussed and agreed upon setting benchmarks for assessing each country's performance in implementing the five REDD+ activities:[6] forest reference emission levels (RELs) and forest reference levels (RLs). RELs/RLs are important in measuring the effectiveness of REDD+ policies and measures, because the way in which countries develop them will ultimately determine the cost-efficiency and environmental integrity of the REDD+ mechanism.

As indicated in COP decision 1/CP.16 (III C Paragraph 73; UNFCCC 2010), REDD+ will be implemented in phases to allow countries to participate in the mechanism in a way that considers their national circumstances. Most REDD+ countries are currently in Phase 1: the development of national strategies or action plans, policies and measures, capacity-building and demonstration activities (Phase 1: readiness phase). The focus of Phase 2 will be the implementation of national policies and measures and national strategies or action plans that could further involve capacity-building, technology development and transfer, and results-based demonstration activities (Phase 2: results-based demonstration activities). Transitioning into Phase 3 will involve moving to more direct results-based actions, i.e. emissions and removals that should be fully measured, reported and verified (MRV'd) (Phase 3: MRV'd results-based actions). As countries move through these phases, they have to develop national, or as an interim measure subnational, forest RELs/RLs.

Our objective is to support countries in this endeavour by presenting a step-wise framework for setting forest RELs/RLs for REDD+ in light of the provisions of decision 12/CP.17. This policy brief: 1) highlights relevant paragraphs and guidance in this decision; 2) presents the step-wise approach we believe would be helpful to countries; 3) stresses the importance of the quality of historical data and capacity-building; and 4) provides conclusions and some take-home messages for scientists, technical experts and policymakers involved in this process.

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6   The five REDD+ activities are: 1) reducing emissions from deforestation; 2) reducing emissions from forest degradation; 3) conservation of forest carbon stocks; 4) sustainable management of forests; and 5) enhancement of forest carbon stocks.

Summary of UNFCCC COP 17 guidance

Modalities for forest RELs/RLs

Decision 12/CP.17 provides 'modalities' for forest RELs/RLs supported by an Annex on 'Guidelines for submissions of information on forest reference levels' (UNFCCC 2011). At COP 17, it was decided that forest RELs/RLs should be consistent with 'anthropogenic forest-related greenhouse gas emissions by sources and removals by sinks' in countries' greenhouse gas inventories. When developing forest RELs/RLs, countries are invited to submit details on their national circumstances[7] and to explain how those national circumstances were considered if the RELs/RLs are adjusted to take them into account. Furthermore, the decision agrees that a step-wise approach to national forest RELs/RLs may be useful because it would allow countries to improve their forest RELs/RLs over time. Countries should update their forest RELs/RLs periodically to reflect new knowledge, new trends and any modification of scope and methodologies. Importantly, the decision acknowledges that subnational forest RELs/RLs maybe elaborated as an interim measure, covering less than the entire national territory, while transitioning to a national forest REL/RL.

Guidelines for submissions of information on forest RELs/RLs

The Annex to the decision on guidelines for submissions of information on reference levels, states that the 'information provided should be guided by the most recent Intergovernmental Panel on Climate Change [IPCC] guidance and guidelines.' It should include: 1) information that the country used to develop its forest RELs/RLs, including historical data, presented in a comprehensive and transparent way; 2) transparent, complete, consistent and accurate information, including methodological information, used at the time of developing the forest RELs/RLs, including a description of the data sets, approaches, methods, models and assumptions used (as applicable); 3) pools and gases, and the REDD+ activities, which are included in a forest REL/RL, along with reasons for omitting a pool and/or activity, noting that significant pools and/or activities should not be excluded; and 4) the definition of 'forest' used in the development of the forest RELs/RLs.

Implications

The above guidance highlights the importance of a 'data-driven' approach to the construction of RELs/RLs in terms of using IPCC guidelines, historical data, adjusting for national circumstances, and the pools and gases that have been included or omitted. As such, a key issue underpinning the construction of forest RELs/RLs is the quality of data – both the available data and the data that countries will collect. While this 'data-driven' approach is clearly encouraged,

data availability (including historical data) and national capacity varies greatly between countries (Herold 2009; Figure 1).

The issue of considering drivers and activities causing deforestation and forest degradation (and hence greenhouse gas emissions), particularly with regard to 'adjusting' RELs/RLs according to 'national circumstances', has received increasing attention in the REDD+ debate. Decision 1/CP.16 (UNFCCC 2010) encourages developing countries that will participate in REDD+ to identify land use, land-use change and forestry activities, particularly those linked to the drivers of deforestation and forest degradation, and to assess how they can potentially contribute to the mitigation of climate change. The assessment of expected future developments and forest changes is directly related to specific activities and their underlying causes; assessments should therefore be made separately for each driver of forest carbon stock changes within a country. Where assumptions about expected future developments differ from the observed historical trends in forest changes and emissions, these assumptions should be properly justified and supported by an explanation of activities and drivers at the national level. The underlying causes of forest change can be related to issue that are international (e.g. markets, commodity prices), national (e.g. population growth, domestic markets, national policies) and local (e.g. subsistence land-use patterns). Therefore, in addition to data on historical forest area change and associated emissions, the development of forest RELs/RLs requires information on drivers and activities at work and their specific contribution to future national emissions.

The assessment of national circumstances is already a reporting requirement for all UNFCCC parties, to be presented in a specific chapter in the National Communication. However, there are currently no clear guidelines for the assessment and compilation of national circumstances and each country is free to assess these following autonomous methodological approaches. Pending further guidance from the UNFCCC, and based on existing guidance, the assessment of national circumstances could consider the following information (UNFCCC 2003):
- geographical characteristics (climate, forest area, land use, other environmental characteristics);
- population (growth rates, distribution, density, etc.);
- economy (energy, transport, industry, mining, tourism, agriculture, fisheries, waste, health, services);
- education (including scientific and technical research institutions);
- any other information considered relevant by the party (e.g. information relating to Articles 4.8, 4.9 and 4.10 of the UNFCCC).

The flexibility in decision 12/CP.17 with regard to the possible omission of non-significant carbon pools when developing forest RELs/RLs is of great importance; this allows countries to adopt a conservative approach to estimating forest carbon stock changes, whereas allowing such omissions was only suggestion provided by the IPCC for reporting under the Kyoto Protocol (Grassi *et al.* 2008).

The issue of subnational forest RELs/RLs as an interim measure is likely to be an important consideration for countries when

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7   Paragraphs 3, 4 and 5 of Chapter 2 ('National circumstances') of the Annex to decision 17/CP.8 (Guidelines for the preparation of national communications from Parties not included in Annex I to the Convention) provides some guidelines on national circumstances. The UNFCCC (2003) user manual for the guidelines on national communications from non-Annex I parties provides further information and explains how to apply these paragraphs.

developing forest RELs/RLs. A step-wise approach (see below) that uses subnational RELs/RLs as an interim measure should provide a clear rationale for doing so and explain how these will eventually lead to national forest RELs/RLs. On one hand, it will be more difficult to scale up an amalgamation of subnational approaches into a national forest REL/RL in a transparent, complete, consistent and accurate manner, than to develop a national REL/RL. On the other hand, 'testing' the development of forest RELs/RLs at a subnational level and as part of a learning-by-doing approach may provide useful insights into how to develop forest RELs/RLs at the national level for Phase 3 of REDD+. Therefore, we suggest that the subnational approach to developing forest RELs/RLs be restricted to Phases 1 and 2 of REDD+ and that national forest RELs/RLs should be developed for Phase 3 of REDD+, with any financial accounting scheme based on fully MRV'd results-based actions, to ensure the cost-efficiency and to safeguard the environmental integrity of the REDD+ mitigation mechanism.

The step-wise framework

Given the variability in the data available for measuring forest area and carbon stock changes (Figure 1), as well as in the knowledge and understanding of forest change drivers, decision 12/CP.17 proposes a step-wise approach to the development of national forest RELs/RLs(UNFCCC 2011). Such an approach provides parties with a starting point from which they can improve over time by incorporating better data, improved methodologies and additional pools as part of their capacity development for REDD+ readiness. This idea is similar to the 'tiered approach' that helps a country to match and deal with data availability and uncertainty, and thus allows for broad country participation (Huettner *et al.* 2009). This 'tiered approach' is proposed in the IPCC Good Practice Guidance for Land use and Land-use Change and Forestry (Penman 2003) as a mechanism for addressing, and progressively improving, uncertain and incomplete national-level data to estimate and report on forest carbon stocks and changes.

To estimate carbon stock changes ('emission factor'), the IPCC guidelines propose the use of a hierarchical structure (Tier 1, Tier 2 and Tier 3): higher tiers reflect greater methodological accuracy and precision. Tier 1 uses IPCC default values obtained from the IPCC Emission Factor Database. Tier 2 improves on Tier 1 by using country-specific data. Tier 3 includes models and inventory measurement systems tailored to address national circumstances, repeated over time, and driven by high-resolution activity data disaggregated at subnational to fine grid scales. Although it is the least accurate, use of Tier 1 data allows countries without sufficient national data to estimate and report carbon stock changes, while being encouraged to improve measurements over time to achieve higher, more accurate tier levels. The concession to omit non-significant carbon pools in the development of forest RELs/RLs, as set out in decision 12/CP.17, provides countries with greater flexibility to move from Tier 1 to Tier 2 to estimate emission factors (Grassi *et al.* 2008). Hence, it is also likely that it will be cheaper and faster for countries developing forest RELs/RLs to prioritise measurements for Tier 2 data on the significant pools while using a

conservative estimate for non-significant pools. It will be important for countries to take this option into account as part of the step-wise framework for developing forest RELs/RLs.

Similarly, three non-hierarchical approaches have been suggested for measuring land area change ('activity data') (GOFC-GOLD 2011). The first approach is based on identifying the total area for each land category. The second approach allows for the tracking of land-use changes between these categories, while the third approach represents the geographically explicit tracking of land-use changes using sampling or wall-to-wall mapping techniques.

Quantitative national data on drivers and activities causing deforestation and forest degradation are also uncertain. For example, the question of how much of the deforestation (emissions) in a country is caused by a specific activity type or driver (e.g. expansion of agriculture versus infrastructure) cannot be answered accurately in most developing countries.

It is clear that the quality of data with regard to activity data, emission factors and drivers of forest change should determine the methods used in developing forest RELs/RLs. When data are incomplete and/or inaccurate, the use of complex analysis and modelling cannot be justified, as such approaches can multiply uncertainties. Complex methods should be applied only if sufficient evidence and understanding of land change through real measurements and monitoring can be provided, so that the data can be both assessed transparently and potentially challenged. This relationship between available data, the ways in which to make adjustments for national circumstances and related uncertainties is presented in the proposed 'step-wise' framework (Figure 2).

Step 1

Nationally reported activity data for Approach 1 and Tier 1 emission factors are available for all countries using forest area and carbon stock estimates for 1990, 2000, 2005 and 2010 (FAO 2010). Current data on emission factors in developing countries are often estimated using Tier 1 and can be applied consistently for historical periods. Thus, any changes in emissions are assessed using activity data only. When using Approach 1 and Tier 1 data, only a simple model should be applied to consider national circumstances as Step 1. Consistency and transparency are very important in this case; the extent and nature of uncertainties are largely unknown and they should be assessed and managed using default uncertainties and conservative assumptions. Providing quantitative evidence for deviating from the projected historical trend will therefore be complicated, and only simple rules should be applied for potential adjustments that take account of national circumstances.

Despite the incurred levels of uncertainty, all countries could use Approach 1 (activity data) and Tier 1 (emission factor) data as input to explore a Step 1 methodology. Examples of a Step 1 methodology can be taken from the Brazilian Amazon Fund (a subnational approach) and Guyana (a national approach). The Amazon Fund subnational REL is based on gross deforestation of aboveground biomass and a conservative estimate of aboveground
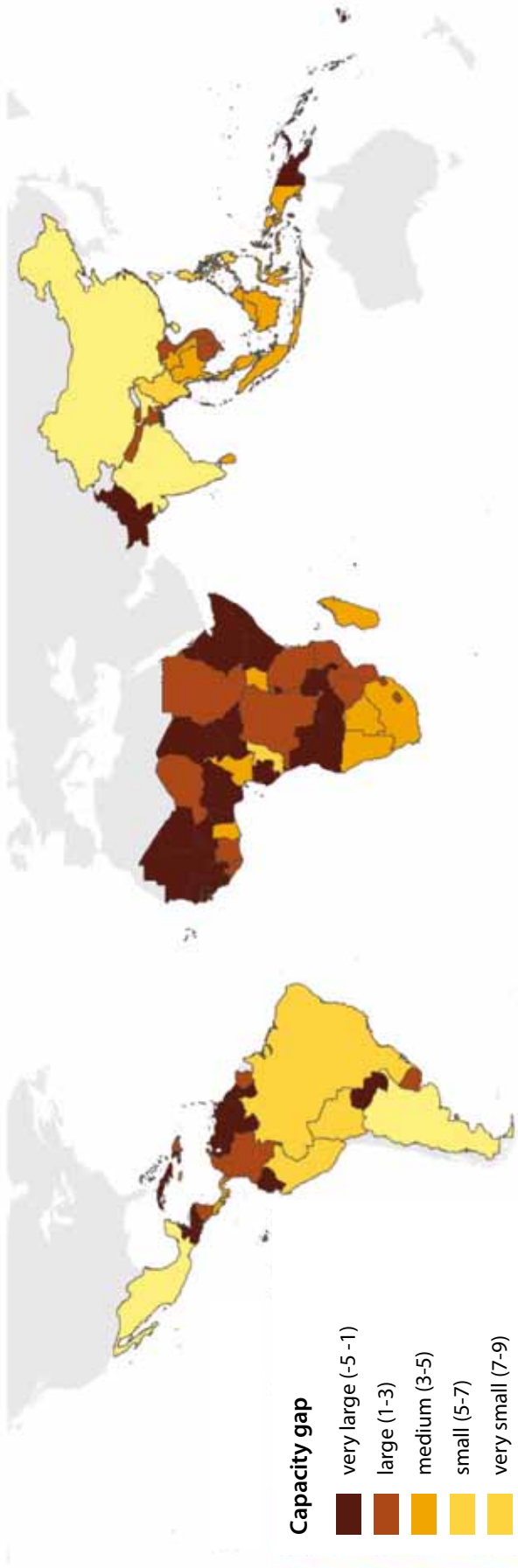
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Figure 1. Capacity assessment based on FAO Forest Resources Assessment 2005/10; includes information on forest area change, forest inventory and carbon pool reporting (adapted from Herold 2009)

Capacity gap

- very large (-5 - 1)
- large (1-3)
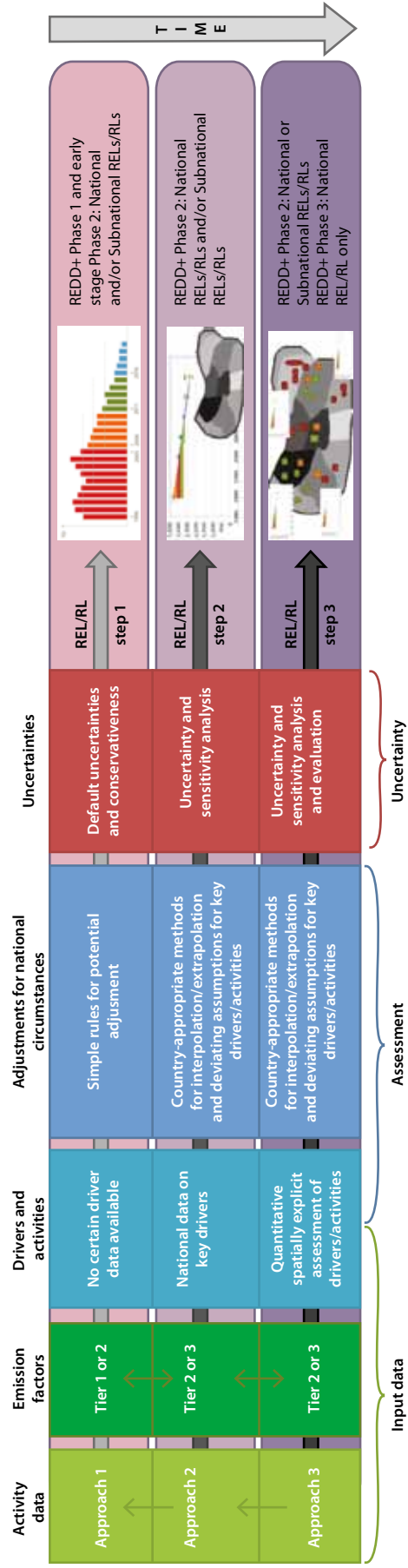- medium (3-5)
- small (5-7)
- very small (7-9)

Figure 2. Framework for a step-wise approach for developing forest RELs/RLs on a national and/or subnational level (as an interim measure) in accordance with the three REDD+ phases
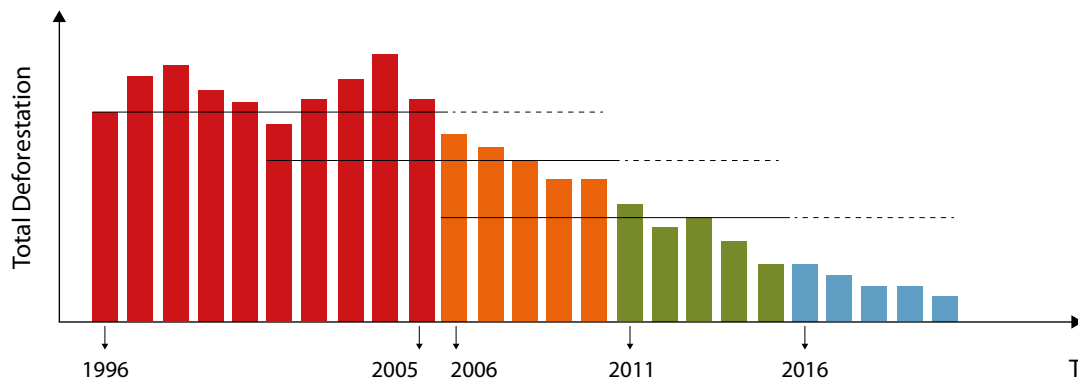
Figure 3. Model of deforestation reduction used in the calculation of emission reductions showing the 10-year average deforestation rates, updated every 5 years

carbon stocks of 100tC/ha. The annual deforestation rates used in the calculation of emission reductions are compared to the average deforestation rates for 10-year periods, which are updated every 5 years. (Amazon Fund 2009; Figure 3). In the case of Guyana, a national REL was developed based on the mean deforestation rate for 2000-2009 and the global average as the basis for compensation and an aboveground carbon stock of 100tC/ha.

Based on the most recent data (mean of Guyana's historical deforestation rate of 0.03% - 2000 to 2009- and the global average deforestation rate of 0.52% -FRA 2010), the national REL for Guyana is set at 0.275%. Economic activities are permitted in the forest within a ceiling of 0.056% per annum. This means that if the deforestation rate rises above the REL (0.275%) by 0 to 0.056%, Guyana still receives full compensation, if it rises by 0.056% to 0.100% Guyana receives partial compensation, if it rises by above 0.100% Guyana will not receive any compensation (Norway Ministry of Environment, 2011).

Step 2

Step 2 and Step 3 of developing RELs would retain the predictive power of historical trend data, but increase accuracy by including a driver-based assessment and eventual adjustments, including the consideration of relationships with underlying causes. This approach should offer data-driven reasoning for deviations from historical trends (i.e. national circumstances). These steps require higher-quality data for emission factors and activity data.

Step 2 requires at least Approach 2 for activity data to separate gross emissions and removals, and to better link the five REDD+ activities. With more data available, country-tailored methods can be developed and applied to extrapolate/model/explore/implement any adjustments for national circumstances. Step 2 should also endeavour to use higher tier levels – of at least Tier 2 – for the significant pools and a conservative estimate for any non-significant pools. An example for moving towards a Step 2-type RL is described in Box 1.

Box 1. Forecasting future deforestation in Brazil using a Step 2 approach

One way of predicting future deforestation is through regression analysis, which seeks to establish the link between rates of current deforestation and historical deforestation and other predictors (potential 'national circumstances'), including forest cover, roads and income level. A simple regression equation (ordinary least squares, logarithmic) was estimated, using deforestation at municipality level for the Brazilian Amazon provided by INPE (Brazil's National Institute for Space Research). 'Historical deforestation' is the annual average for the period 2000–2004, while 'predicted deforestation' is the annual average for the period 2005–2009. In terms of predictive power, historical deforestation is the most effective as it explains about 79% of the variation. However, other factors also contribute to the predictive power of the model. The result in Figure 4 shows that the elasticity of historical deforestation (indicating how a percentage change in each variable changes the current deforestation) equals 0.49, which indicates that a simple extrapolation of historical rates would overestimate future deforestation in the case of Brazil. Forest stock (cover) and distance from the capital have positive elasticities, proportionally higher rates of deforestation in remote and high forest cover areas. Roads also contribute to accelerating deforestation, while high population density and income (GDP), perhaps surprisingly, have the opposite effect.

Step 3

Step 3 requires spatially explicit forest change data (Approach 3) that also includes specific information on drivers and activities. Although
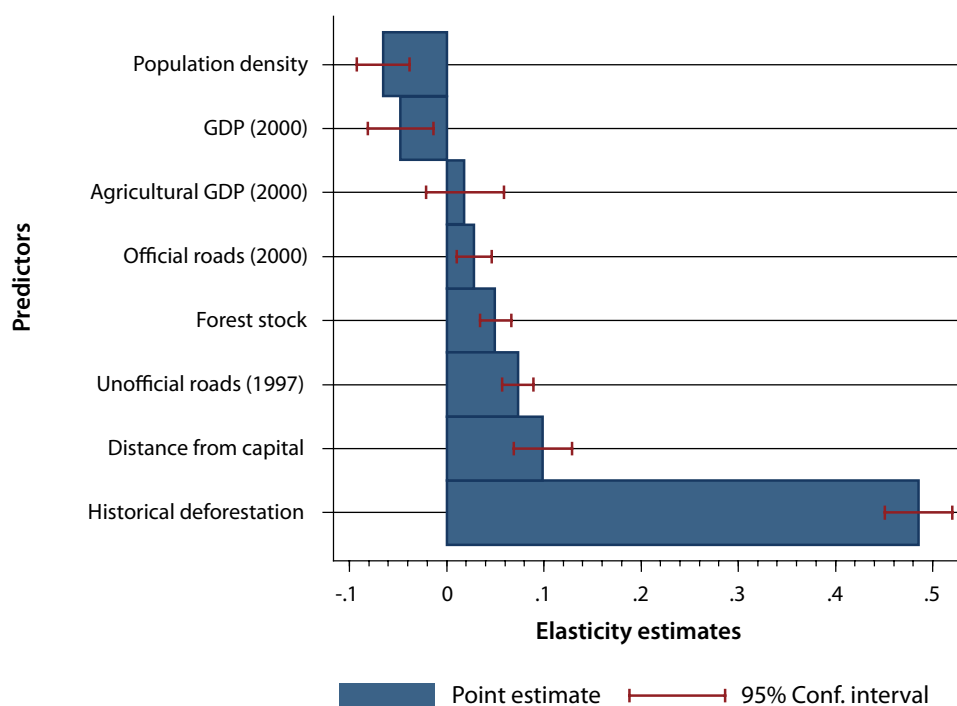
Figure 4. Predictors of deforestation in the Brazilian Amazon, 2005–2009

it takes more time to develop national emission factor estimates, countries using Step 3 should endeavour to use a Tier 2 approach for emission factors. To provide consistency between the monitoring of results-based demonstration activities (REDD+ Phase 2) and direct results-based actions (REDD+ Phase 3) and activity data, it would be more desirable and cost-effective for countries to use wall-to-wall mapping techniques, subject to adequate funding. Step 3 could be seen as the minimum requirement for setting a national forest REL/RL in REDD+ Phase 3. It could also be used in REDD+ Phase 2 but can be regarded as the 'gold standard' for Phase 3 of REDD+ when it is likely that financial accounting mechanisms will be linked to the national forest REL/RL.

Improving historical data and developing capacity are key factors for enabling country participation

The proposed step-wise approach offers broad country participation, addresses national data availability and uncertainty management and allows countries to graduate from Step 1 to a 'higher' step as data availability and quality improve.

Step 1 forest RELs/RLs represent a starting point that emphasises consistency and transparency but, by nature, can contain unknown biases and has important limitations, which would be restricting its use as the basis for setting a benchmark for financial incentives ('crediting' or compensation). Thus, the key idea for the step-wise framework is to provide motivation to reduce uncertainties

and move to higher steps over time, thus allowing countries to set more accurate forest RELs/RLs that can be used to assess the impact of policies and measures and that can form the basis for a compensation benchmark. As REDD+ is a results-based compensation mechanism, this approach is essential to ensure its cost-efficiency and environmental integrity.

Approaches to using available data sources to provide quality activity data and emission factors have been documented (GOFC-GOLD 2011). Countries can acquire data to develop forest RELs/RLs for higher steps fairly quickly and at a 'reasonable' cost. For example, starting with very limited data, Guyana has invested in acquiring activity data, emission factors and data on drivers of deforestation and forest degradation in a short period (GFC 2011). Similarly, the Democratic Republic of Congo has acquired information on activity data and concluded a first study on the national and subnational drivers of deforestation and forest degradation, and will undertake fieldwork in 2012 to provide a conservative proxy for emission factors. Both countries could be in a situation to have the data to develop a Step 2 forest REL/RL by the end of 2012.

It is important to stress that national institutions will be responsible for the development of forest RELs/RLs. In the initial steps of the proposed framework, governments can be supported by international expertise if and where necessary. Direct support both of basic and of more sophisticated capacity development within the national institutions should become a condition *sine qua non* for international technical organisations to support national institutions when moving through the steps. In other words, countries should

lessen their reliance on external products and expertise as they progress through the REL/RL steps.

Conclusion

A step-wise approach to developing forest RELs/RLs is useful and would encourage wide country participation. Most developing countries who wish to participate in the REDD+ mechanism are able to follow Step 1 of the step-wise framework proposed here when developing their forest RELs/RLs. Although the approach is simple and the results may have a high level of uncertainty, following this step will allow all countries to initiate REL/RL activities. As the proposed step-wise framework is based on a data-driven approach, the availability of more and higher-quality data will increase the robustness and certainty of forest RELs/RLs over time.

Although developing forest RELs/RLs may appear a daunting task for most developing countries wishing to participate in the REDD+ mechanism, this policy brief illustrates that it is possible to develop relatively simple forest RELs/RLs that can be improved over time, and that this can be done alongside the three REDD+ implementation phases that countries will have to follow.

Subnational forest RELs/RLs should only be used during Phases 1 (readiness phase) and 2(results-based demonstration activities) of REDD+. Subnational forest RELs/RLs could be developed based on any of the three steps proposed in our step-wise framework. However, care will need to be taken if subnational approaches are then used to produce an amalgamated national forest REL/RL, with issues particularly likely to arise with regard to transparency, consistency, completeness and accuracy. National forest RELs/RLs could be developed for Phase 2 of REDD+ using Steps 1 and 2 of the step-wise framework. With regard to Phase 3 (MRV'd results-based actions) of REDD+, a national forest REL/RL should be developed based on Step 3 of the proposed framework to ensure the cost-efficiency and environmental integrity of the REDD+ mechanism.

We propose that, during Phases 1 and 2 of the REDD+ mechanism, countries should prioritise the following activities:
1. analysing national historical data to estimate activity data with at least three time intervals;
2. collecting and analysing preliminary field data to produce a national conservative estimate for emission factors (while prioritising significant carbon pools) for the forest types where significant deforestation and forest degradation have occurred; and
3. analysing the drivers of deforestation and forest degradation at the national and subnational levels (e.g.provinces), including through quantitative and qualitative studies.

Improvements in data quality can be achieved quickly and at reasonable cost (UNFCCC 2009), and further resources should be provided so that countries with limited information available can start or continue to derive accurate activity data, emission factors and quantitative and qualitative information on the drivers of deforestation and forest degradation.

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