Ms. Barbara Bamberger, California Air Resources Board

RE: Comments to California Air Resources Board on Sector-Based Crediting and Subnational Reducing Emissions from Deforestation and Degradation (REDD) as part of California's Cap-and-Trade Program.

August 20, 2010

Dear Ms. Bamberger:

Thank you for the opportunity to submit comments on California's efforts to establish a program of Sector-Based Crediting and Sub-national activities for Reducing Emissions from Deforestation and Degradation (REDD). We commend the Air Resources Board for its pioneering efforts to establish the rules of a sectoral crediting program for REDD as part of California's cap-and-trade system. We also commend CARB for recognizing the importance of a nested architecture through which projects and other sub-state/province activities can be credited within an accounting system at the state or province level.

The REDD program established by CARB will be crucial to contain costs and provide environmental and social benefits under California's climate program. More broadly, this program is critical in creating a roadmap for how REDD can work within compliance markets for emissions reductions. We appreciate CARB's openness to input and engagement of stakeholders throughout this process. We have organized our comments according to the specific issues raised by CARB during the series of stakeholder conference calls and at the July 30 workshop on the topic noted above.

The emphasis of these comments is on the establishment of a program that ensures environmental integrity and establishes appropriate benchmarks over time based on performance at the level of the entire jurisdiction of the host state/province. Establishing a framework for directly issuing credits to individual projects or other actors within these jurisdictions is critical for mobilizing private financial resources for REDD investment. However, a focus on the environmental integrity of the aggregate amount of credits issued at the overall jurisdiction level will simplify the regulatory task for California while encouraging more comprehensive deforestation reduction efforts and enabling risk pooling and other economies of scale.

We will be happy to provide additional details on any of these issues and look forward to continuing to work with you and your colleagues at the Air Resources Board to design a REDD program that works for California and creates a model for other climate programs.

Sincerely yours,

Ruben Lubowski and Derek Walker, Environmental Defense Fund
Jonah Busch and Toby Janson-Smith, Conservation International

Comments to California Air Resources Board on Sector-Based Crediting and Subnational Reducing Emissions from Deforestation and Degradation (REDD) as part of California's Cap-and-Trade Program.

Quantitative limits

Should there be a limit on credits from sector-based crediting programs within the existing quantitative limit?

- There should not be additional quantitative limits on credits from sector-based crediting programs within the existing quantitative limit. To the extent allowed by the existing quantitative limit, the constraints on sector-based crediting should be according to quality rather than quantity criteria. Rigorous quality standards should ensure the integrity of the environmental goal while providing regulated entities with as much flexibility as possible in terms of how those entities can achieve that goal. This approach will allow market incentives to determine where and when emission reductions occur. Such flexibility, including the ability to bank credits generated in one compliance period for use in future compliance periods, is essential to drive down costs. The limited size of California's market makes it even more critical not to impose further quantitative constraints so as to ensure a robust demand for REDD and other sector-based credits.

Reference levels

What is the best method to establish sector-wide reference levels for host states? (historic, projected, etc.)

Note on terminology: The "reference level" is the benchmark level of emissions against which reductions are measured. This is distinct from the "crediting baseline" which determines the level at which emission reductions can begin generating REDD credits. This is also distinct from a deforestation "target" that is a goal for reducing deforestation each year under a state or national plan which may be reliant on funding received through the REDD crediting program.

- Sector-wide reference levels for host states should be set at a historically-representative level of deforestation emissions. In particular, a reasonable approach would base the reference level on the average of annual historic deforestation emissions during the most recent period before 2010 of no less than five and not more than ten years for which appropriate data are available from a combination of remote-sensing and ground-level measurements. The length of the time period used to determine this level should allow for flexibility, as the robustness of the data is more important than the precise length of time over which the deforestation emissions are measured.

The initial reference level should be calculated using the most recent data to date, allowing for flexibility to allow harmonization with ongoing efforts in the host state so as not to penalize regions that have already undertaken ambitious early efforts to reduce deforestation, particularly since the signing of the Memorandum of Understanding on

Deforestation at the Governors' Global Climate Change Summit of November, 2008.[1] For example, as discussed further below, it would appropriate for CARB to use 1996-2005 as the initial historic period for calculating the initial reference level of Brazil's states to ensure consistency with existing Brazilian federal and state-level deforestation-reduction plans and in consideration of their early actions to reduce emissions.

Brazil has already engaged in an ambitious national plan on climate change, announced in December of 2008, and has established national and state targets to reduce deforestation. The most updated version of this plan, as adopted by Brazil's Amazon Fund, calls for reducing the amount of national deforestation by 42% for the period 2006-2010, relative to the average deforestation for the previous ten year period of 1996 to 2005. Additionally, the plan calls for policies to decrease the amount of deforestation by another 42% every 5 years until 2020, by which time the carbon emissions from deforestation would be 80% below the 1996-2005 historic level of approximately 712 million tons of CO_2 per year.[2] Government actions have already been instrumental in reducing Brazil's deforestation rates to the lowest rates in recent history, but significant challenges remain to sustain and deepen these accomplishments.[3]

- Starting from the historic average, the reference level should readjust downward every 5 to 10 years with the aim of establishing tightening requirements for REDD crediting while enabling the state or province to transition to a lower carbon development path. Readjustments to the reference level should be according to a predetermined trajectory, based on a combination of the reference level and deforestation targets for each state in previous periods. This is preferable to a mechanism where the reference level evolves over time based on the state's actual level of emissions during each period. For instance, if the reference level declined every 5 years based on a rolling average of actual emissions, this would perversely penalize states that are more successful in reducing emissions by assigning them a lower reference level in future years.

The preferable approach for resetting the reference level over time is along the lines established by Brazil's national deforestation reduction program. The Amazon Fund has proposed that the reference level for crediting states under its umbrella should readjust downward every 5 years based on the average of the previous 5-year period's reference level and the targeted level of deforestation for each state (e.g. in 2016, the reference

[1] It may also be reasonable not to use data later any than 2010 in calculating the reference level for any particular state, so as not to create potential perverse incentives for state's to increase their deforestation statistics in the future so as to obtain a more generous reference.

[2] This differs from the national deforestation target originally announced in December, 2008 that called for a reduction of 71% by 2017 relative to the 1996-2005 level. See Governo Federal Comite Interministerial sobre Mudanca do Clima. 2008. *Plano Nacional Sobre Mudanca do Clima* (PNMC). Brasilia, Brazil as well as *Plano de Ação para Prevenção e Controle do Desmatamento e Queimadas do Estado do Mato Grosso* (PPCDQ/MT 2009), Governo do Estado de Mato Grosso, Secretaria de Estado do Medio Ambiente (SEMA), October 2009.

[3] The policy environment for reducing deforestation in the Brazilian Amazon is discussed by Nepstad, D., B. Soares-Filho, F. Merry, A. Lima, P. Moutinho, J. Carter, M. Bowman, A. Cattaneo, H. Rodrigues, S. Schwartzman, D.G. McGrath, C.M. Stickler, R. Lubowski, P. Piris-Cabezas, S. Rivero, A. Alencar, O. Almeida, and O. Stella. 2009. "The End of Deforestation in the Brazilian Amazon." *Science* 326: 1350-1351.

level resets to the reference level and target over the 2010-2015 period). This is illustrated in figure 1 which illustrates a scenario for crediting reductions in the Brazilian state of Mato Grosso, the state with the highest deforestation rate and total emissions in the Amazon over 2000-2005, accounting for over 40% of deforestation in the Brazilian Amazon during this period.[4] This figure shows how actual deforestation emissions have fluctuated historically, creating the need to use a multi-year period for setting the reference level. In this figure, the initial reference level for the state (the black line) is set at its 1996-2005 historic average of deforestation, as per the national climate plan proposal. Mato Grosso's assigned share of Brazil's overall target under the national climate plan is shown in the figure as the dotted black line. This target lies above the more ambitious target established under the state's own climate plan, which is the dark blue solid line shown in the figure.

Along with the national plan's overall deforestation target, the state's share of the national target entails 42% reductions by 2006-2010, relative to the initial 1996-2005 reference level, and 42% additional reductions over each subsequent 5-year period. Even though Mato Grosso's actual emissions (the blue line) declined below its target during 2006-2009, this does not affect the reference level during the following periods. Recent reductions in deforestation do not guarantee that deforestation will not increase in future years, with changing commodity prices and other factors.[5] This arrangement establishes a trajectory for the reference level that phases down the potential level of credits over time but maintains incentives for the state to benefit from greater reductions in emissions during each period.

- We also commend CARB for its intent to consider whether reference levels should be adjusted for the circumstances of "high-forest low-deforestation" (HFLD) states that are under near term threat. In the case of these states, reference levels based on historic deforestation emissions may not provide adequate incentives for preventing increases in emissions in future periods. The initial priority for establishing this REDD program is states that have significant historical deforestation emissions. As the REDD program develops, rules should be considered for setting state reference levels above a historic average, in the context of a broader national or regional program that meets California's standards and where the aggregate reference level for emissions from the country or broader region (e.g. the Congo Basin) does not exceed the historic average level. One way to achieve this, for example, would be to set each state's reference level as a weighted average of its historic deforestation emissions and the historic deforestation emissions of the country overall. If this method was applied uniformly to each state in the country, the aggregate reference level would be the historic average level for that

[4] Instituto Nacional de Pesquisas Espaciais (INPE). 2008. "Monitoramento da Floresta Amazônica Brasileira por Satélite." Projeto PRODES, http://www.obt.inpe.br/prodes/.

[5] More specifically, a recent study of the significant decline in deforestation in the Brazilian Amazon over 2004-2006 attributes 44% of the decline.to a slowdown in agricultural prices, 37% to new protected areas established by the government, and 18% by other factors outside the model. Soares-Filho, B., P. Moutinho D. Nepstad, A. Anderson, H. Rodrigues, R.Garcia, L.Dietzsch F.Merry, M.Bowman, L.H. Rafaella Silvestrini, and C. Maretti. 2010. "Role of Brazilian Amazon protected areas in climate change mitigation." *Proceeding of the National Academy of Sciences*. 107(24): 10821-10826.

country.[6] Alternatively, countries may choose to establish a "stock-flow" system[7] or other arrangement for redistributing international REDD financing to reduce leakage across jurisdictions within a country. This would reduce the need for California to consider its own program to address HFLD states in that nation.

Crediting baseline

How much should the host states be expected to reduce emissions before CA entities can use credits from compliance? Where should the crediting baseline be set, relative to reference level? (50, 25%, etc.)

- The overall level of credits that a host state is eligible to receive over a commitment period of one or more years should be determined ex-post by its aggregate verified reductions in emissions cumulatively achieved over the course of that period relative to a crediting baseline that is set below the reference level over that period. The difference between the reference level and the crediting baseline constitutes the state's "own efforts" that must be contributed before any potential further reductions below the crediting line are compensated with REDD credits.

- A nested crediting system by which California may directly issue credits to project-scale or other sub-state/province scale activities is critical to mobilizing private investment for REDD activities. The linking agreement between California and the host region should establish the reference level and crediting baseline that defines the maximum total number of credits that, over a particular period, can be generated within the jurisdiction as a whole (including, but not limited to, the sum total of all the projects nested within that jurisdiction). The protocols and criteria for approving and allocating credits for projects--subject to the aggregate performance of the jurisdiction--will also be a necessary element of the linking agreement but should not factor into the system for setting the reference level and crediting baseline.

Maintaining the environmental integrity of the program will require California to calculate, over the course of each commitment period, the total number of reductions generated by the state at the overall sectoral level, relative to the crediting baselne, and then to distribute no more than this amount of credits among the projects and other entities eligible to receive credits within the jurisdiction. This is the essence of a nested system that allows for project crediting while maintaining sectoral-level accounting. For example, in the event that projects are approved with the potential to generate 100 credits,

[6] Consider a country with two states with 100 units of forest each, where historic deforestation is 10 units (10%) in one state and zero in the other so national historic deforestation is 10 (5% of the 200 forest units). If each state's reference level was an equally weighted average of its historic deforestation rate and the country's historic rate, the reference level of the high deforestation state would be 7.5 or 7.5% (10*.5+5*.5) and that of the low deforestation state would be 2.5 or 2.5% (0*.5+5*.5). The sum of the two would be 10, the historic deforestation of the country. See Strassburg B, Turner K, Fisher B, Schaeffer R and Lovett A 2009. "Reducing emissions from deforestation: the 'combined incentives' mechanism and empirical simulations." *Global Environmental Change* 19 265–78.

[7] See Cattaneo, Andrea. 2010. "Incentives to Reduce Emissions from Deforestation: A Stock-Flow Approach with Target Reductions." Chapter 6 in: *Deforestation and Climate Change: Reducing Carbon Emissions from Deforestation and Forest Degradation* (V. Bosetti and R. Lubowski, eds.) Edward Elgar, Northampton, MA.

but only 50 eligible credits are actually achieved by the jurisdiction a whole, relative to its crediting baseline, then California would need to distribute at most 50 credits to all the projects and other entities within the jurisdiction. The rules approved by the host state and California should clearly establish the position of different projects and other actors with respect to their claims on the pool of issued credits (e.g. all claimants could have equal seniority and have their credits scaled down in equal proportion or some could be first in line relative to receive their credits relative to others). Precisely how this is done is fundamentally a distributional matter of how the host state chooses to implement its REDD program. Verified project reductions not credited under the California compliance system could be used for other purposes, including being sold into the voluntary carbon market.

- A performance buffer or other insurance mechanisms within the host state can address the risk that projects could receive less than their full share of potential credits due to underperformance related to the host government or other actors in the jurisdiction. As already noted, this performance risk should not be a factor that determines the way in which the crediting baseline for the state/province is established. Rather, this is an issue for host states to address through a "performance buffer" (built up over time with a share of credits generated by projects and/or other actors across the jurisdiction) or other system of guarantees and insurance established within the host state to promote REDD.[8] These mechanisms would be the means of compensating projects (based upon a clearly established line of priority) in the event that, in aggregate,projects achieve greater creditable reductions than the reductions achieved across the entire jurisdiction. To ensure a workable system that attracts private incentives, California may want to require a mechanism for "performance" insurance as part of its linking agreement with the host state, so that performing projects are not unduly penalized for lack of performance elsewhere in the state. As suggested further below, "early action" credits could potentially be used to help stock this performance buffer during early commitment periods. These provisions to manage the risk to projects related to the overall performance of the larger jurisdiction are distinct from the need for a buffer reserve and/or other insurance to address the risk of reversals, as describe in the section on this issue further below.

- The crediting baseline for the host state should allow for crediting from the onset of the program (e.g. 2012 or earlier though "early action" provisions) so as to provide immediate incentives to embark on an ambitious emissions reduction trajectory. A fixed crediting baseline based on an absolute reduction threshold of 25 to 50% relative to the reference level is unlikely to provide sufficient incentives for jurisdictions to ambitiously participate in California's REDD program. The attached appendix provides quantitative estimates for Indonesia based on the scale of crediting and prices expected under AB-32. These estimates indicate that lowering provincial crediting baselines below historical reference levels can leverage uncredited reductions from the host states/provinces, but

[8] The role of performance buffers in a nested REDD system is described in Cortez, R., R. Saines, B. Griscom, M. Martin, D. De Deo, G. Fishbein, J. Kerkering, D. Marsh. 2010. A Nested Approach to REDD+ Structuring effective and transparent incentive mechanisms for REDD+ implementation at multiple scales. The Nature Conservancy and Baker & McKenzie. Arlington, VA.

increases the risk that these jurisdictions will not participate. In particular, using a historic 5-year average of emissions as the reference level (assumed to equal business-as-usual emissions for this modeling scenario), a provincial crediting baseline that is 25% below the reference level provides incentives for a very limited range of reductions in Papua, West Kalimantan and Aceh but none for East Kalimantan. A 50% threshold eliminates is estimated to eliminate all the incentives for any province to participate (See attached appendix for further details).

- Rather than relying only on a fixed threshold (e.g. 25% or 50%) relative to the reference level as CARB has suggested, the crediting baseline could be set in relation to an ambitious deforestation reduction trajectory or "target" that is appropriate for each state and increases in ambition over time. The crediting baseline should lie below the reference level but above the targeted level of deforestation emissions in each host state so as to allow that state to receive crediting that will support and sustain its efforts to achieve and potentially even exceed this target. Establishing a crediting line in relation to a target trajectory, rather than as a uniform fraction of the reference level, allows more flexibly to tailor the crediting requirements over time according to the capacities and other conditions in each host state.

Figure 1 illustrates an example of this concept with a hypothetical crediting scenario for the state of Mato Grosso, Brazil. As described above, the solid black line that declines in a stepwise fashion is the state's deforestation emissions reference level under the framework established by the Amazon Fund. The state's share of the overall national target is the dotted line while the state has independently adopted a state-level plan with the even more ambitious targeted trajectory shown by the solid blue line. California could establish a crediting line that credits up to some share of the aggregate reductions achieved each crediting period between the reference level and the target plus any reductions beyond the target that are achieved in that period. For simplicity, figure 1 shows a scenario in which the crediting line each year is set halfway between the reference level and the most ambitious target as set by the state's own plan.

Under this scenario, the state and the international community would evenly split the responsibility for achieving the targeted level of reductions.[9] The state would be required to achieve the first 50% of the planned reductions each period between the reference level and its target as its "own effort," while any additional reductions beyond this point, including any potential reductions below the target, could be eligible for crediting by the carbon market. The 50% split is shown for illustrative purposes only and different ways to establish the crediting line in the region in between the reference level and the target will be appropriate for different states based on the capacity of each state and the level of ambition of its target.

Rather than a crediting line that establishes a threshold above which crediting is zero and beyond which crediting is complete, an alternative approach could use a sliding scale of

[9] This 50/50 split has been proposed by the Amazon Environmental Research Institute (Institute de Pesquisa Ambiental da Amazonia; IPAM) as the manner in which Brazilian states could split responsibility for reductions with the federal government.

crediting within the zone between the reference level and the target in each period.[10] Such a scheme would have the advantage of providing some credits even for lower levels of effort that otherwise would receive zero credits if emissions remained above the crediting baseline. However, this system could add unnecessary complexity and would need more detailed evaluation if the higher incentives for jurisdictions to achieve initial reductions below the reference level would come at the expense of lower incremental (marginal) incentives for more ambitious actions at levels approaching the target (e.g. in the region below the crediting line where reductions would otherwise be fully credited).

The goal of a 50% reduction in deforestation by 2020 – as proposed and broadly supported by stakeholders at the Governors' Climate & Forests Task Force technical workshop with ARB in February – seems an appropriate benchmark for the level of ambition of the overall program. However, we recommend flexibility in defining different targets for each jurisdiction according to their varying circumstances. In addition, ARB may want to consider a future target of zero deforestation. A target of zero deforestation by a given date for a particular jurisdiction also should not mean the crediting baseline reaches zero by that date. First, the state will likely require financing to achieve and maintain deforestation at a net zero level. Second, net zero deforestation does not require that deforestation itself would be zero only that the land area deforested equals the area of land afforested/reforested. Third, a goal of net zero deforestation relates to the area of forested land, rather than to total forest-related emissions. Because the emissions released upon deforesting a given area will generally greatly exceed the annual emissions sequestered from planting trees on an area of similar size, total forest sector emissions could still be significant (in gross as well as net terms) even when gross deforestation is zero. As a result, even upon meeting a zero deforestation goal, additional financing may be required to provide incentives to maintain reductions and further reduce total deforestation emissions.

- A system for crediting "early action" activities undertaken prior to the onset of California's cap-and-trade system in 2012 will help ensure a robust supply of offsets for private entities to use at the beginning of the program. As an illustration, Figure 1 shows the range of reductions that could potentially be credited as "early action" based on the reductions to date as well as potential future reductions by Mato Grosso state from the onset of its state-level climate plan in 2008 through 2012.. Early action reductions could potentially be credited if they are determined to have met all other relevant standards and criteria for eligibility in the REDD program. The scale of the early action credits already to date would exceed the potential offset demand under AB-32 if they were all to be credited directly. However, one potential use some portion of these "early action" credits would be to stock a performance or permanence buffer to insure the future REDD

[10] For example, if there are 100 units of potential reductions within this zone, a crediting line down the middle of this zone would yield zero credits for the first 50 credits and 1 credit for each additional credit such that up to 50 credits could be achieved if 100 units were reduced by the jurisdiction. Alternatively, the first 0-10% of aggregate reductions could be credited at a 20% trading ratio, the next 10-25% of credits could be credited at 30%, and the next 25-50%, 50-75%, 75-90% and 90-100% at a 40%, 60%, 70% and 80% ratio, respectively, while any reductions beyond 100 would be credited at 100%. Such a scheme would mean that if the jurisdiction achieved 100 units of reductions, the potential credits issued would be up to 50 as well since (10*.2)+(15*.3)+(25*.4)+ (25*.6) +(15*.8)+(10*.8)=2+4.5+10+15+10.5+8=50.

program in the state. This could be a powerful mechanism to help leverage REDD financing. The role of these buffers is discussed in the section of comments below addressing insurance.

In addition, our organizations have submitted to ARB a proposal for crediting pilot project activities for a limited initial period, which would provide incentives for REDD while states transition to full sectoral accounting systems.

- A successful REDD program will also require a crediting pathway that rewards host/state provinces for the effects of policies and measure and other actions undertaken at the level of the state/province as a whole, as well as for project-scale activities. We understand that there may be legal concerns stemming from liability and "chain of custody" issues that complicate the direct issuance of credits to a state or provincial government. One potential way to address these concerns could be for the state/province government to establish one or more trust funds or other entity that would be the recipient and legally liable entity for credits generated at the jurisdiction-wide level.[11] We urge California to explore this and other legal means to facilitate the crediting of emissions reductions achieved at the scale of the overall state or province.

Liability and insurance for reversals

Who should have liability (buyer, seller)? What insurance mechanisms can be put in place? As part of a host-state avoided emission reduction target, how should the program be designed to address reversals at the state level? Should the state need to establish a buffer reserve to address reversals at the state level?

Regardless of to whom ultimate liability is assigned, it is important that ARB establish rules for ensuring that risk is effectively managed and mitigated by participating host-state programs, per the suggestions outlined below.

First, as emphasized below, California should require that reversals are made up at the level of the entire jurisdiction, rather than at the level of individual projects. This jurisdiction-wide accounting is itself the best insurance mechanism as it will pool the risk of reversals due to fires and other risks across the entire jurisdiction. This will be particularly effective against uncorrelated risks that can be quantified and anticipated as part of the crediting protocols.

Second, the risk of reversals at the level of the entire jurisdiction should be insured against through a jurisdiction-wide reversal buffer fund to which projects and other actors contribute via a share of their credits or of their revenues, through private insurance, and/or another insurance mechanism to account for reversal risks at the jurisdiction level

[11] For example, a three-fund structure to channel REDD funding to private landowners, indigenous groups, and protected areas is proposed by Nepstad, D., B. Soares-Filho, F. Merry, P. Moutinho, Hermann O. Rodrigues, M. Bowman, S. Schwartzman, O. Almeida, S. Rivero. 2007. "The Costs and Benefits of Reducing Deforestation in the Brazilian Amazon." The Woods Hole Research Center. Woods Hole, MA.

(see Cortez et al. 2010 for more discussion of how such systems can be structured)[12]. A buffer reserve of credits is an attractive alternative but is not the only viable mechanism. A buffer may also need to be supplemented with escrow accounts or other mechanisms, especially in the early years of the program when insufficient credits may have been generated to stock a reversal buffer reserve (though this issue could be ameliorated, at least in part, through the use of early action credits as already suggested above).

Third, if the jurisdiction-wide buffer reserve or other insurance mechanism proves insufficient, California should consider provisions by which a host state/province can true up any credits reversed through reductions earned in subsequent commitment periods (plus an interest penalty). This true-up would need to occur before issuing any additional credits for reductions in that period.

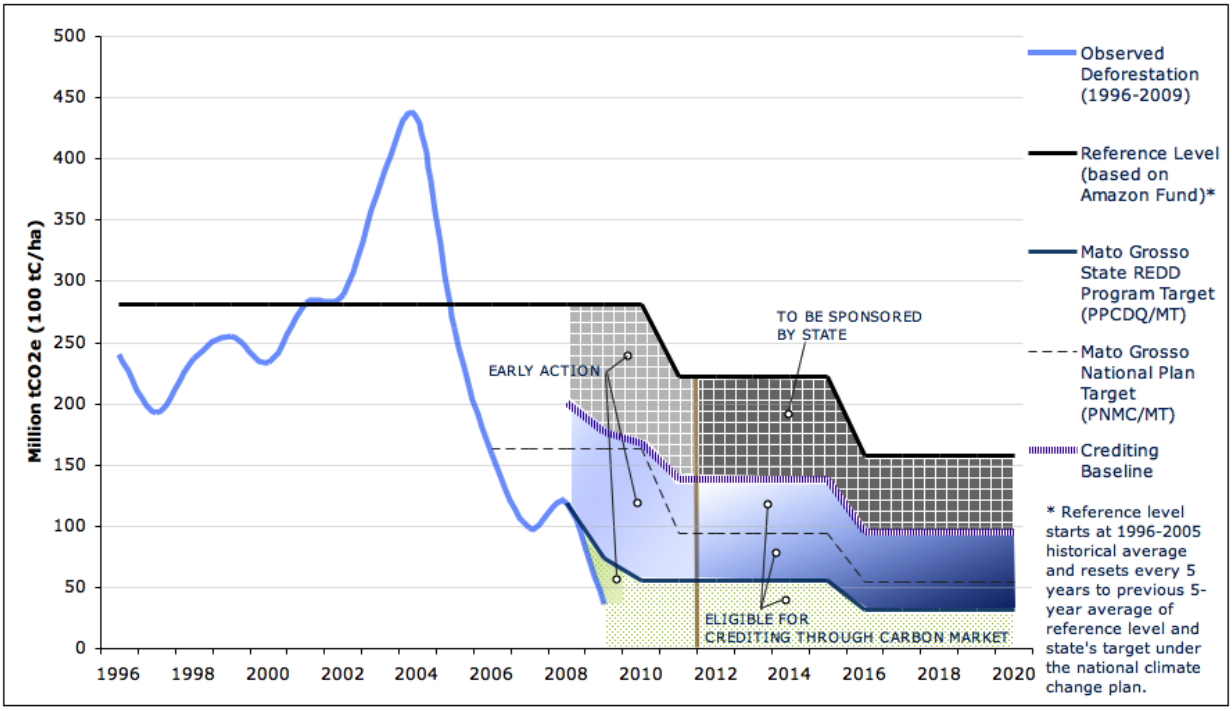
Finally, private insurance mechanisms may develop through which market participants can cover any residual risks not effectively managed internally by the host states. A price premium should accrue to host states that can produce credits with lower expected risks. Allowing prices to reflect such different risks is appropriate to provide market incentives that reward superior performance.

How should project crediting be addressed in the event that the project that is nested in a state that has met its reduction for some period of time but has reversed itself?

Once credits are issued to projects or other actors within a state/province, California should establish requirements to ensure that any reversals are made up *at the level of the entire jurisdiction, rather than at the level of individual projects*. While appropriate project-level protocols should account for differences in the risk of reversals when the amount of credits is granted, California should monitor progress at the level of the entire jurisdiction, rather than tracking actions at the individual project level. Accordingly, California should set reversal insurance requirements at the jurisdiction level, such as a minimum share of credits granted that must be maintained in a reversal buffer. How the host jurisdiction chooses to manage the liability for project level reversals of different kinds is an issue of internal distributional equity and not an issue of the environmental integrity of the program.

Figure 1. Hypothetical Scenario for Reference Level and Crediting Baseline for Mato Grosso state, Brazil

[12] Cortez, R., R. Saines, B. Griscom, M. Martin, D. De Deo, G. Fishbein, J. Kerkering, D. Marsh. 2010. A Nested Approach to REDD+ Structuring effective and transparent incentive mechanisms for REDD+ implementation at multiple scales. The Nature Conservancy and Baker & McKenzie. Arlington, VA.



Source: The state targets and other statistics are detailed in *Plano de Ação para Prevenção e Controle do Desmatamento e Queimadas do Estado do Mato Grosso* (PPCDQ/MT 2009), Governo do Estado de Mato Grosso, Secretaria de Estado do Medio Ambiente (SEMA), October 2009.

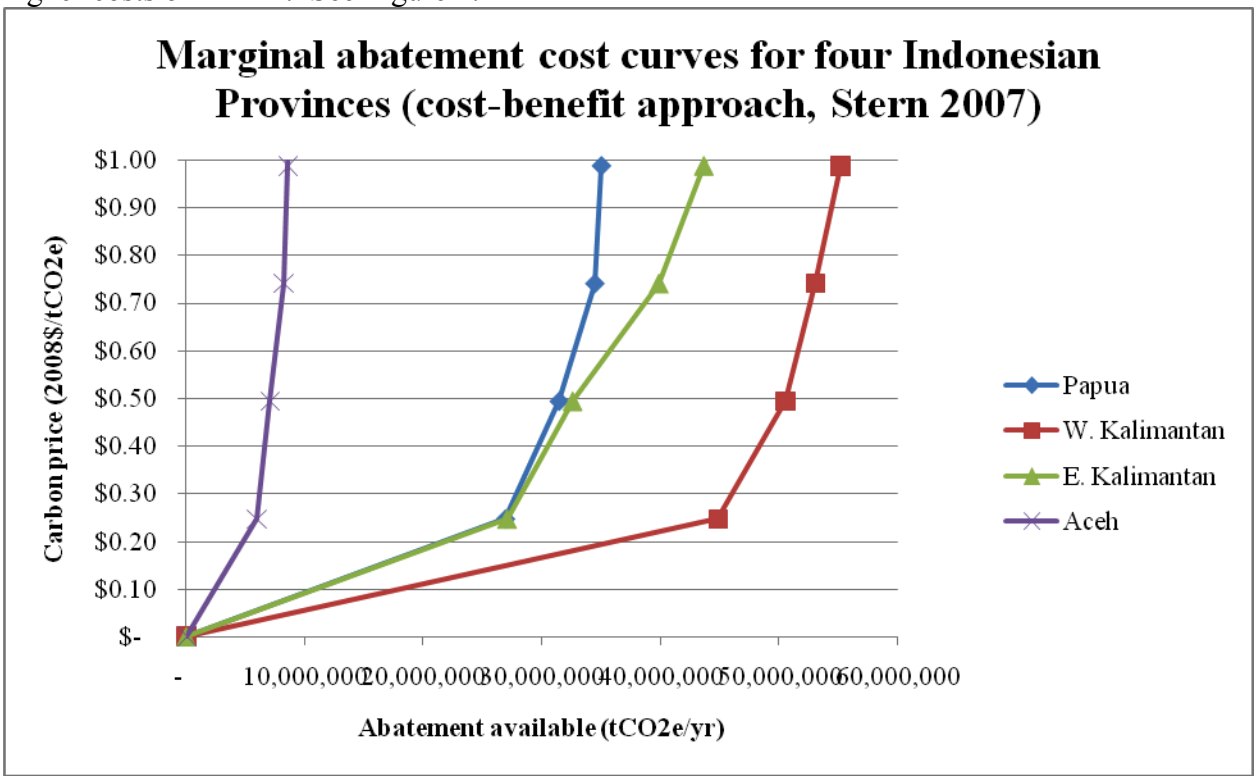
Technical Appendix
Preliminary quantitative analysis of REDD potential
in four Indonesian provinces and five Brazilian states

Jonah Busch, Ph.D. (CI) and Ruben Lubowski, Ph.D. (EDF)

August 20, 2010

I – An engineering cost-benefit approach could substantially underestimate the cost of REDD, relative to the theoretically preferable regression approach. Marginal abatement cost curves for REDD have commonly been estimated with the assumption that if the benefit of carbon payments outweighs the cost of foregone agricultural revenue at a site, then deforestation at that site will cease completely. Studies that have taken this approach, e.g. Stern 2007,[13] Nepstad et al. 2008, have estimated marginal costs of available abatement from REDD to be very low—in the low single digits of dollars per ton. See Figure 1.

A theoretically preferable approach to calculating marginal abatement cost curves for REDD uses multivariate regression analysis to estimate the impact of natural variation in agricultural revenue on observed variation in deforestation, controlling for the influence of site accessibility and land tenure. This approach, as used in OSIRIS-Indonesia,[14] finds higher costs of REDD. See Figure 2.



[13] Stern, N. The Economics of Climate Change: The Stern Review (2007). Great Britain Treasury, London, UK.

[14] OSIRIS-Indonesia beta (2010). Busch, J., Lubowski, R., Godoy, F., Juhn, D., Hewson, J., Austin, K., Steininger, M. Indonesia national reference level/BAU = 1.00. Revenue sharing = 0.0. Liability sharing = 0.0. Leakage = 0.0. Site-level decision making. Historical emissions and business-as-usual emissions both based on 2000-2005 forest cover change data.

Figure 1.

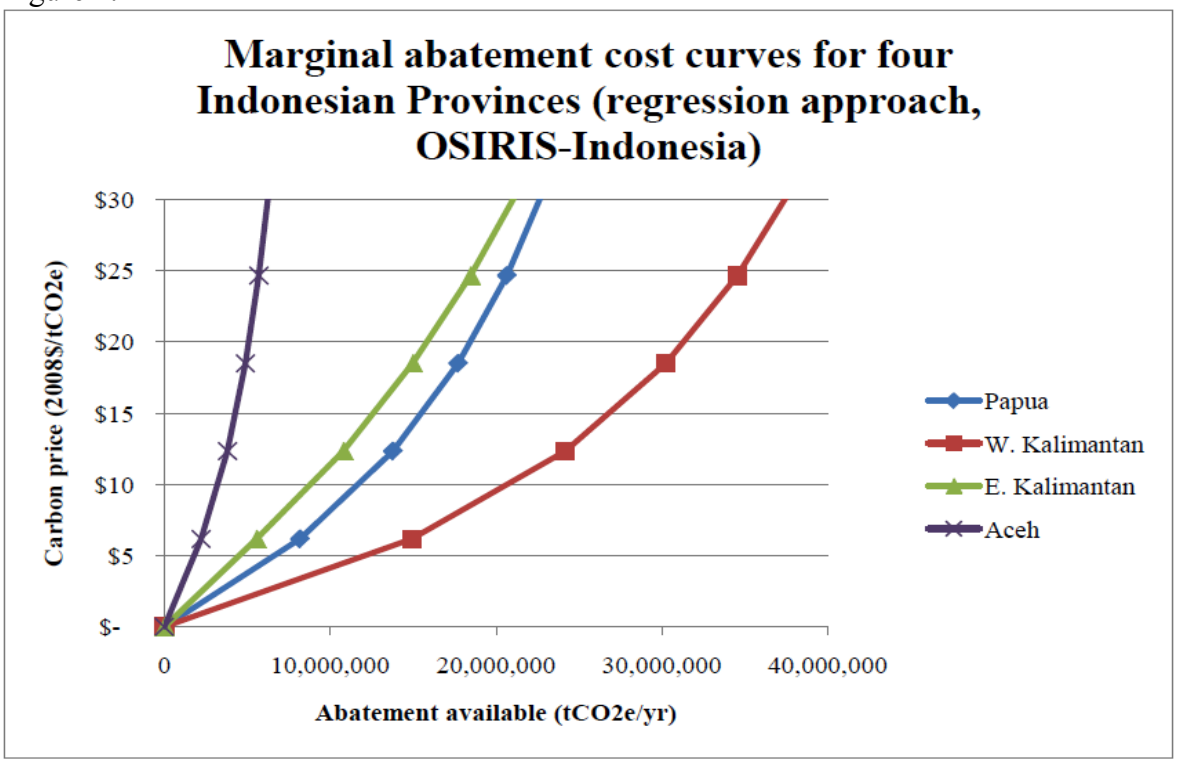


Figure 2.

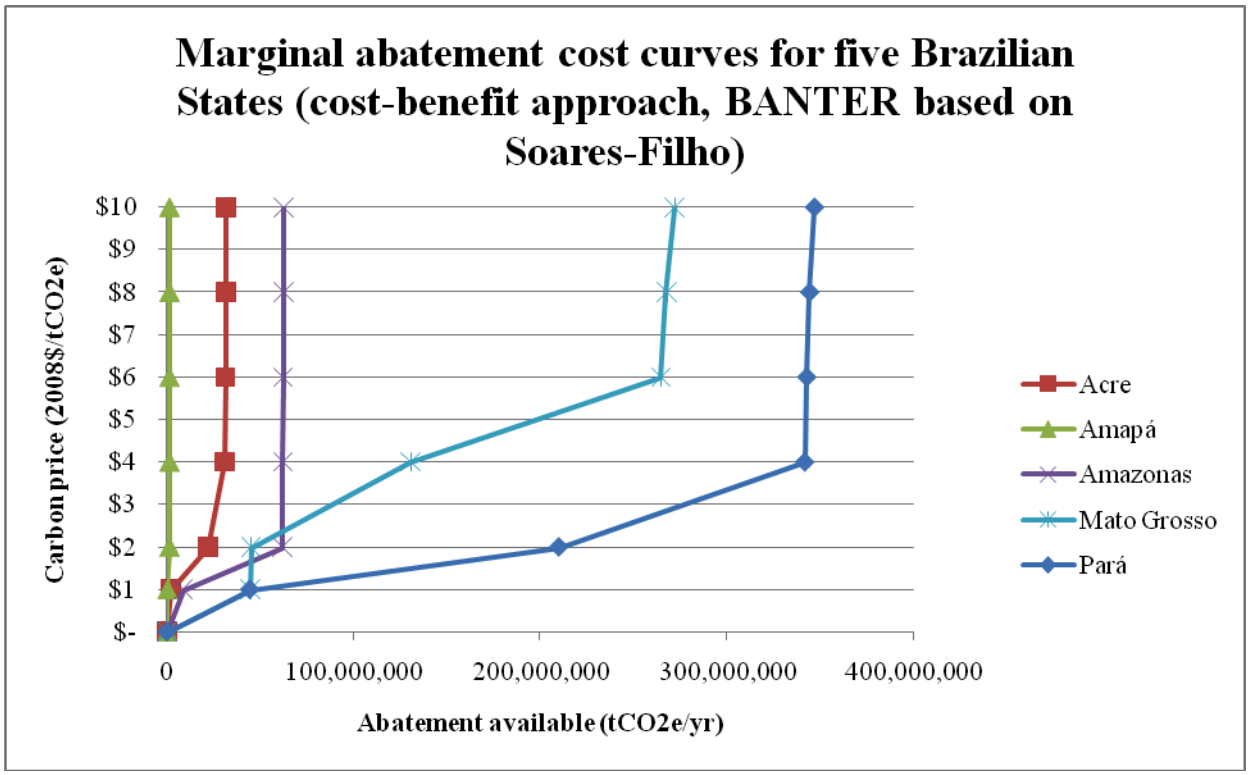


Figure 3

II—REDD represents a relative bargain for California. Even under more realistic assumptions about abatement cost, REDD represents an excellent opportunity for California to achieve cost-effective abatement. Greenhouse gas abatement can be achieved in Indonesian provinces at roughly one-fifth of the estimated abatement cost of comparable levels of abatement in California, although these estimates do not include the implementation and transactions costs of operationalizing reductions in deforestation. See Figure 4.

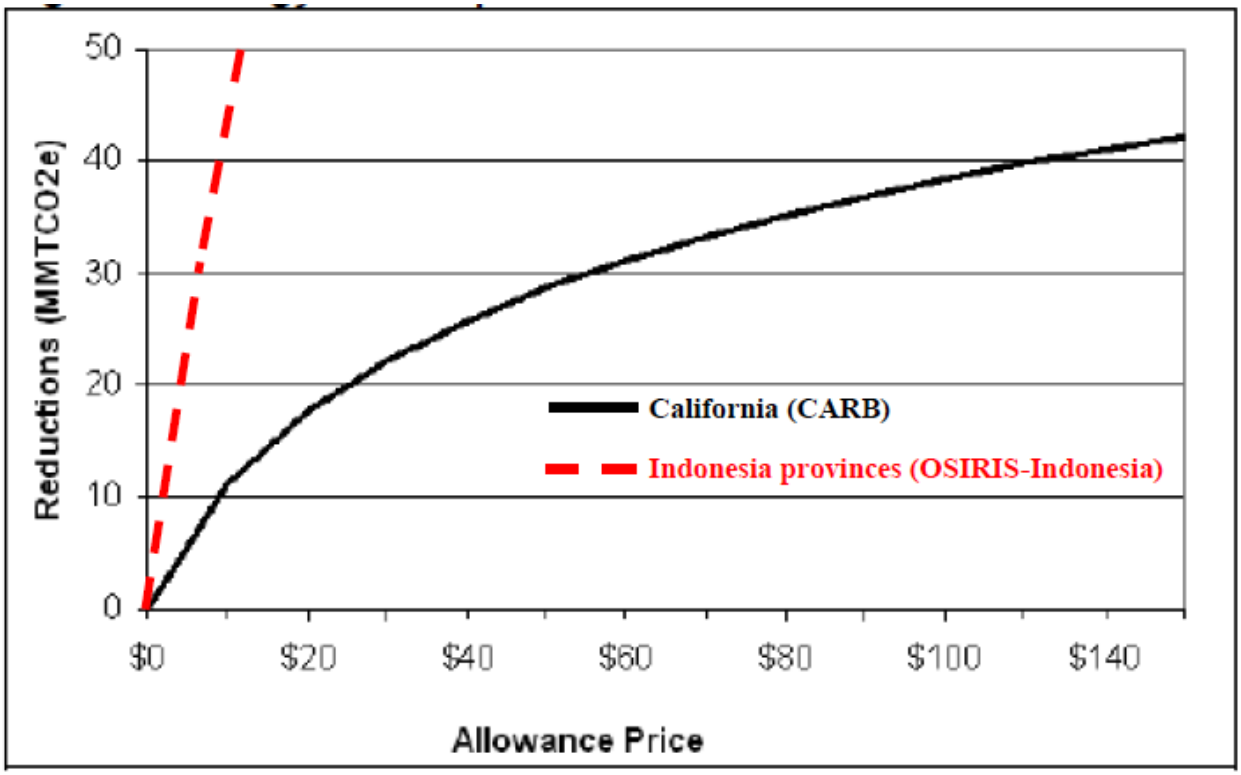


Figure 4

III—Distribution of REDD potential. Historical annual emissions from deforestation for four Indonesia provinces from 2000-2005 were estimated in the OSIRIS-Indonesia model using spatially explicit data on forest cover change (SDSU), biomass (Winrock), soil carbon (GSDTG), peatland extent and peatland emissions (Hoojier, 2010). These emissions represent the maximum potential abatement available from REDD. West Kalimantan holds the greatest cost-effective REDD potential, followed by Papua, East Kalimantan and Aceh (Figure 5).

- Papua: 35.5 $MtCO_2e/yr$
- W. Kalimantan: 58.3 $MtCO_2e/yr$
- E. Kalimantan: 50.9 $MtCO_2e/yr$
- Aceh: 10.7 $MtCO_2e/yr$

Historical annual emissions from deforestation for five Brazilian states from 2000-2005 were estimated in the BANTER model[15] using spatially explicit data on forest cover change (INPE), state-level data on biomass (Soares-Filho) and national-level data on soil carbon (IGBP). These emissions represent the maximum potential abatement available from REDD.

- Acre: 33.3 $MtCO_2e/yr$
- Amapa: 1252.0 $MtCO_2e/yr$
- Amazonas: 63.9 $MtCO_2e/yr$
- Mato Grosso: 337.0 $MtCO_2e/yr$
- Para: 360.2 $MtCO_2e/yr$

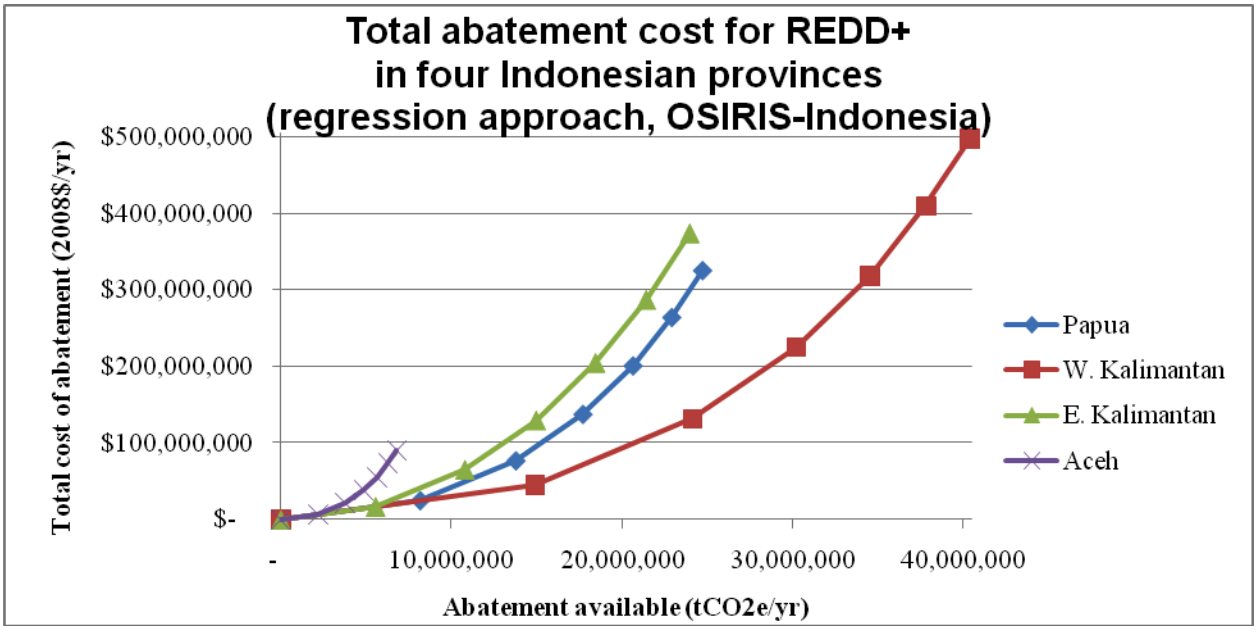


Figure 5

[15] Cattaneo, A., Soares-Filho, , B., Alencar, A., Merry, F., Nepstad, D., Busch, J., Moutinho, P., Stickler, C., Viana Hissa, L., Stella, O., Lima, A. (2010). Brazilian Amazon Negotiation Toolbox for the Economics of REDD (BANTER v1.0).

III—Lowering provincial crediting baselines below the reference levels can leverage uncredited reductions from provinces, but increases the risk that provinces will not participate. The "feasible space" for provinces to participate in REDD indicates the range of reductions where total benefit to the province from carbon payments exceeds total cost to the province of achieving the reductions. That is, where the red/green/purple/light blue/orange benefit curves are above the heavy dark blue cost curve in Figures 6-9 below. Where abatement is profitable overall, the potential exists for revenue-sharing arrangements within the province to make all parties better off. Benefit curves assume $20/tCO2e and a maximum purchase from any province of 8 million tCO2e/yr—considered to be reasonable estimates of potential initial prices and average annual scale of offsets under AB32. Cost curves are based on a regression analysis of potential agricultural revenue on observed deforestation from 2000-2005 while controlling for other drivers of deforestation, as described in (I).

A provincial crediting baseline set equal to a provincial business-as-usual reference level maintains the maximum "feasible space" for REDD for all provinces (red lines above heavy blue lines).[16] By contrast, a provincial crediting baseline that is 50% below this reference level means that no "feasible space" for REDD exists for any province (light blue lines never above heavy blue lines). In intermediate cases, a provincial crediting baseline that is 10% below the reference level maintains a large "feasible space" for Papua, W. Kalimantan and Aceh and a small "feasible space" for E. Kalimantan (green lines above heavy blue lines). A provincial crediting baseline that is 25% below the reference level maintains a very limited "feasible space" for Papua, W. Kalimantan and Aceh but no "feasible space" for E. Kalimantan (green lines above heavy blue lines).

Based on our modeling scenario, a payment system based on tiered crediting baselines with payments that escalate with greater reductions[17] maintains the full "feasible space" for REDD in these provinces, while ensuring additionality by leveraging uncredited reductions (dotted yellow line above heavy blue lines).

[16] For the purposes of this modeling, the business-as-usual reference level was proxied using the five-year historical average deforestation rate from 2000-2005.

[17] In the example shown here, reductions from 0% to 10% below the business as usual reference level are credited at 25%. Reductions from 10% to 25% below the business as usual reference level are credited at 50%. Reductions from 25% to 50% below the business as usual reference level are credited at 75%. Reductions of more than 50% below the business as usual reference level are fully credited. Such a system would not need to be implemented based on a uniform share of reductions relative to the reference level. To provide more flexibility, such a crediting system could be implemented based on the distance between the reference level and a state/province-specific target, which would be tailored to its specific conditions and could increase in ambition over time.

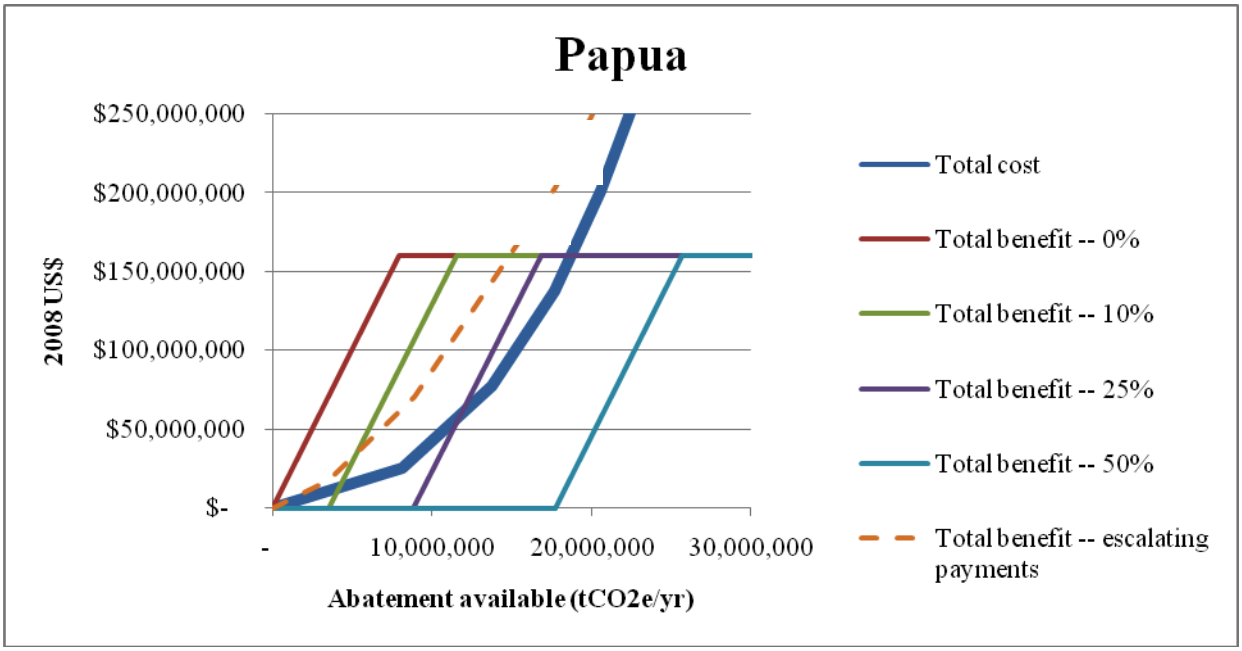


Figure 6

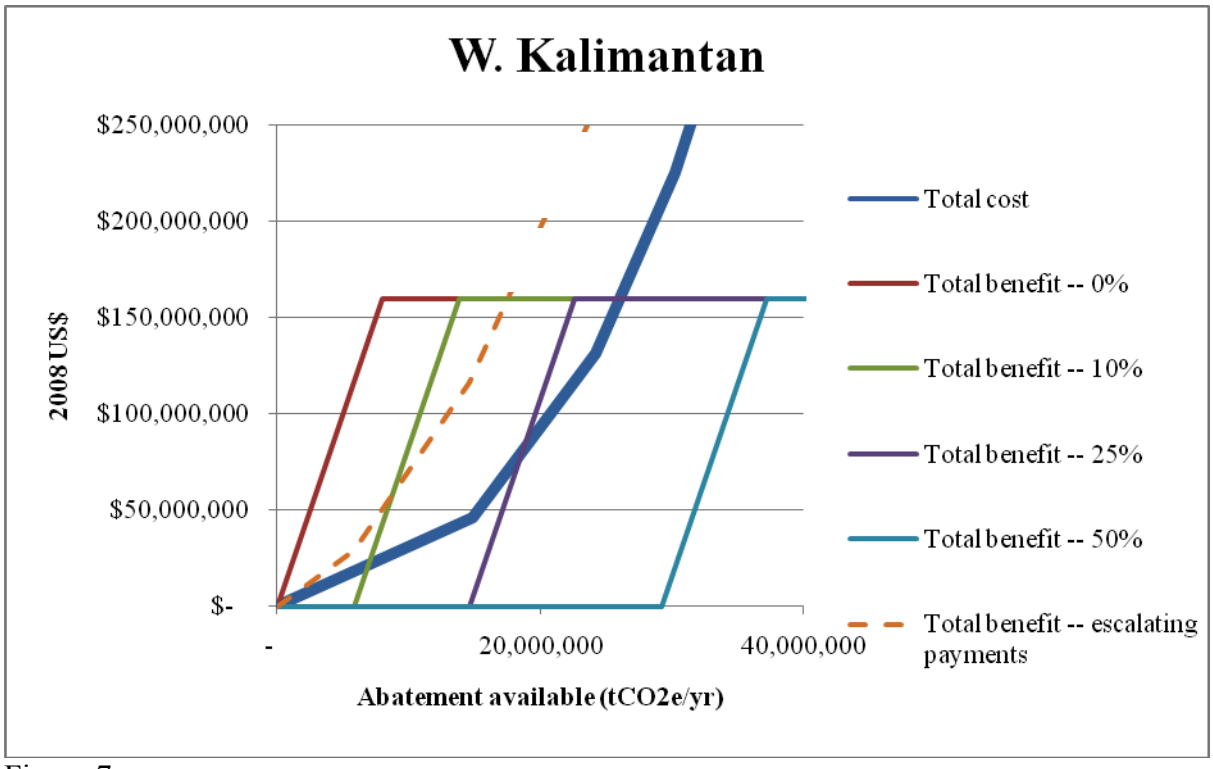


Figure 7

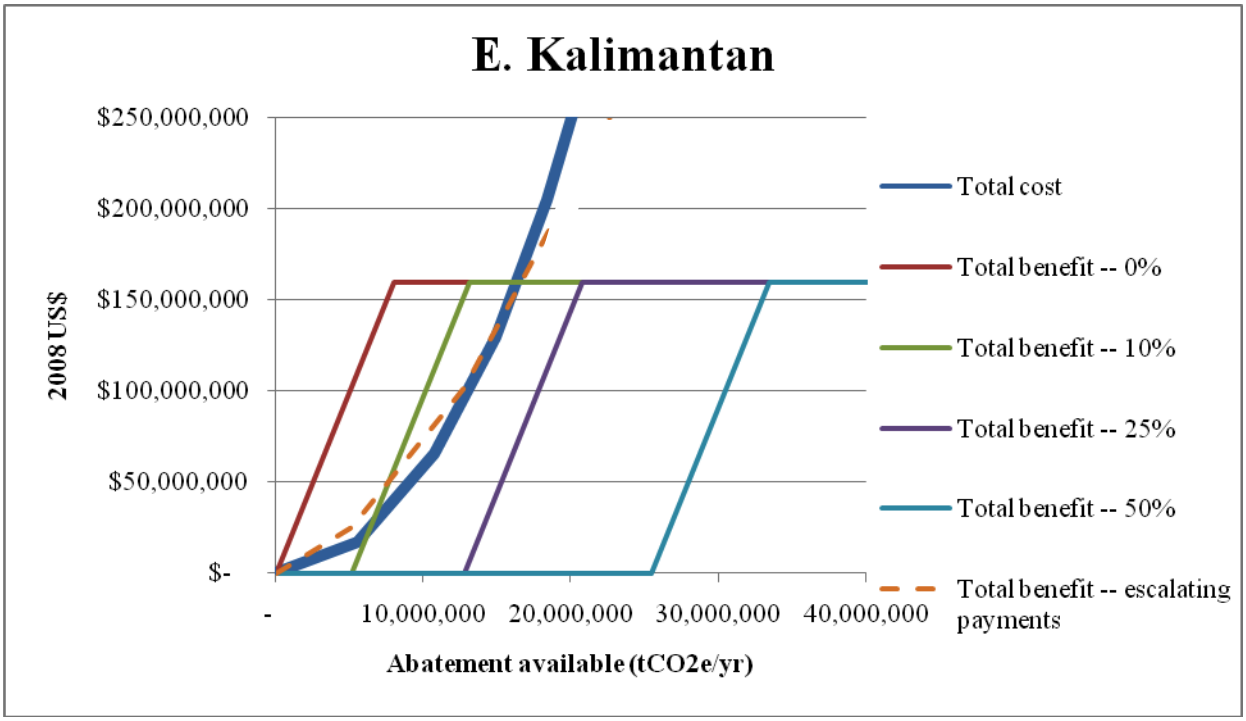


Figure 8

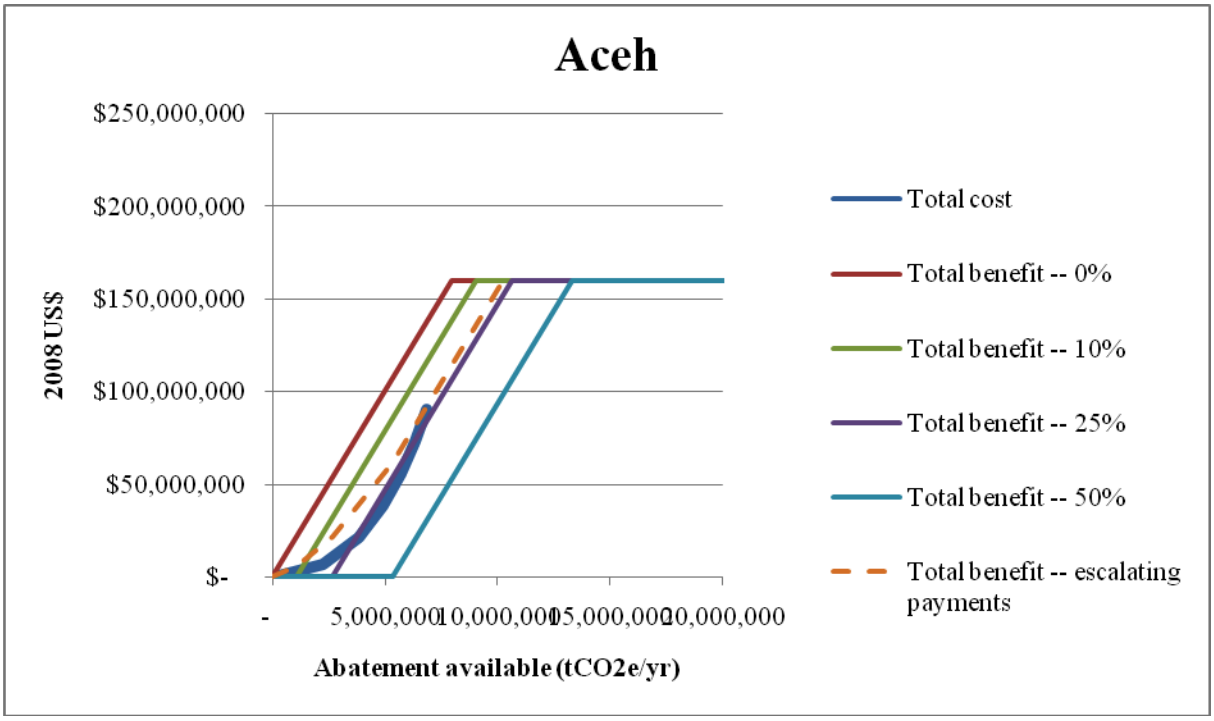


Figure 9