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CARBON SUNK?

The Potential Impacts Of Avoided Deforestation Credits On Emissions Trading Mechanisms

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January 2008

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ACRONYMS USED IN THIS REPORT

AD	Avoided Deforestation
CCX	Chicago Climate Exchange
CCS	Carbon Capture and Storage
CDM	Clean Development Mechanism
CERS	Certified Emission Reductions under the Kyoto Protocol arising from projects under the CDM
ERU	Emission Reduction Unit (generated under the UNFCCC Joint Implementation Programme)
EUAS	European Union Allowance, a permit to emit one ton of Carbon under the ETS
EU ETS	European Union Emissions Trading Scheme
REDD	Reduced Emissions from Deforestation and Degradation
GHG	Greenhouse Gas

ISBN : 978-1-906131-08-1

NOTES ON THE CALCULATIONS AND ASSUMPTIONS USED IN THIS REPORT:

Many of the figures, calculations and 'scenarios' used in this report can only be seen as being ***broadly indicative*** of the relationship between potential volumes of avoided deforestation credits and the wider carbon markets. Both these figures are, in reality, likely to be subject to enormous variation, due to as yet unforeseeable circumstances and political developments.

Certain assumptions and predictions have been made in this report that, if incorrect, are likely to have implications for calculated 'models'. A change to any of the following could substantially affect the estimates and findings:

- Costs of avoiding deforestation
- Carbon credit price
- Post-2012 Annex 1 emission targets, as shown in Table 1
- Ratification of emission reductions by all Annex 1 countries
- No commitment by developing nations to reduce GHG emissions from industrial pollution
- Projections of the potential of other forms of mitigation projects
- Voluntary market volumes

A special note has to be made about the data used for actual current and likely future rates of tropical deforestation. This report uses the figures provided by the UN Food and Agriculture Organisation, though these are certainly not accurate, and possibly substantially overstate the current rate of tropical deforestation.

Also, the report only considers the likely impacts on carbon markets if credits relating to avoidance of deforestation were to be allowed. As forest degradation will certainly be included within the UNFCCC's deliberations, there is the prospect that avoidance of forest degradation could also generate yet more forest-related credits. This would tend to heighten some of the concerns raised in this report about market flooding or crowding.

EXECUTIVE SUMMARY

- There is an expectation amongst some observers - not the least some members of the conservation community - that inclusion of avoided deforestation credits into 'Kyoto II' mechanisms would generate sufficient funds to provide strong incentives to halt tropical forest destruction.

- However, the data in this report suggests that the absorption of substantial volumes of avoided deforestation credits within carbon markets is likely to be highly problematic unless there is a major increase in the markets due to negotiated commitments to very deep emissions reductions by Annex 1 countries.

- Inclusion of forest-based carbon credits in anything like the existing size of carbon markets might, at best, produce too little funding for avoidance of deforestation, too late and, at worst, have the potential to do more harm than good by depressing the price of carbon below a level at which real emissions reductions projects were financially viable.

- A theoretical maximum volume of potential additional carbon credits can be roughly calculated in the event that the following take place: (i) 'Avoided Deforestation' (AD) is brought into the successor to the Kyoto protocol (ii) Avoided deforestation 'credits' are permitted within the carbon market at parity with other forms of credits, and (iii) *All* tropical deforestation is stopped. This is estimated to generate in the order of 7.2 billion additional credits (7,200 $MtCO_2e$). In addition, a further – but as yet unquantifiable - supply of forest-related credits could be generated through schemes to reduce forest *degradation.*

- Under all current projections, supply and demand for carbon credits will remain very finely balanced within the first Kyoto Commitment Period, but this is heavily dependent on huge volumes of eastern European Annual Allowance Units remaining 'dormant' and being rolled into the second Commitment Period. However, these so-called 'hot air' units will remain as a potential supply of cheap emission allowances which might be available to satisfy much of demand in the second commitment period.

- As an indication of the volume of potential AD credits in relation to possible future markets, the theoretical maximum supply of such credits (7.2 billion) could only be exceeded by demand if Annex 1 countries commit to 80% GHG reductions during the same period of time in which the extra AD credits came into the market, if 50% of reductions were allowable in the form of 'offsets', and if all of these 'offsets' consisted of avoided deforestation credits. It is quite likely that *none* of these conditions will be met in the 'Kyoto II' agreement, let alone all of them.

- Adding the potential number of AD credits to the volume of other non-Annex 1 mitigation credits projected by the UNFCCC, (around 5,700 $MtCO_2e$), the total volume of non-Annex 1 credits could be equivalent to 71% of the total 1991 Annex 1 country emissions. Although this is a distant and probably very unlikely scenario, it indicates that, with avoided deforestation included in the markets, mitigation credits could substantially reduce incentives for actual emissions reductions in Annex 1 countries.

- Even assuming that the inclusion of Avoided Deforestation credits within a 'post-Kyoto' agreement can be done in such a way that carbon prices are not drastically reduced, and that it succeeds in reducing current levels of deforestation by around 5% every year thereafter, around 188 million hectares of tropical forest would still be destroyed until the rate of tropical deforestation finally drops to zero in about 25 years time (based on FAO figures for current levels of deforestation). This will release in the order of 100 billion tonnes of carbon dioxide to the atmosphere, which is equivalent to roughly 6 years of total Annex 1 country emissions.

1. INTRODUCTION

Globally, according to the UN Food and Agriculture Organisation, an estimated 13 million hectares of tropical forest are lost annually. This releases vast quantities of CO_2, which account for around 18% of total anthropogenic GHG emissions[1]. As Sir Nicholas Stern has pointed out, new climate change mitigation strategies need to incorporate 'avoided deforestation' (AD), and "action to preserve the remaining areas of natural forest is needed urgently"[2]. It has been suggested that avoidance of deforestation could be one of the cheapest and quickest ways of reducing anthropogenic GHG emissions - though this is almost certainly a view based on under-estimation of the practical difficulties in doing so on any scale and the likely very high costs, particularly in terms of finding and supporting alternative livelihoods for many tens of millions of migrant farmers.

The meeting of the Conference of the Parties of the UNFCC that took place in Bali in December 2007 has resulted in a commitment to consider how avoided deforestation' or 'Reduced Emissions from Deforestation and Degradation' (REDD) could be brought within a successor agreement to the Kyoto Protocol. Governments have recognised that if climate change is to be kept at below a temperature increase of more than 2 degrees centigrade, then unabated land-use changes, (principally, deforestation), in tropical regions need to be curtailed.

The current framework within the Kyoto Protocol does not contain any mechanisms within which protection of existing tropical forests can be financially rewarded. However the 'Bali Action Plan' provides a mandate for land-use changes to be included within the discussions towards a new international climate agreement which should come into affect after 2012.

The Clean Development Mechanism within the Kyoto protocol offers industrialised countries an opportunity to offset emissions by purchasing carbon credits from mitigation projects located in developing nations. A similar mechanism could, in theory, be adopted for inclusion of 'Avoided Deforestation' credits. However, because there are likely to be serious problems of 'leakage' with project-level AD initiatives, where deforestation would simply be displaced to areas outside the project, it is more likely that **national** commitments to reduce deforestation at national level would be used which in turn will require carbon accounting of the entire country's deforestation rates, assessed against historical baselines for area of forest and rate of deforestation, instead of measuring emission reductions from individual projects.

The expectation amongst some observers - not the least some members of the conservation community - is that inclusion of AD credits into 'Kyoto II' mechanisms would generate sufficient funds to provide strong incentives to significantly reduce tropical forest destruction. The 'Forests Now Declaration', which has been signed by scores of rainforest conservation and research organisations, calls for REDD or AD credits to be "*included in all national and international carbon markets, especially those created by the UN Framework Convention on Climate Change*" and to "*Include tropical forest and land use carbon credits in the European Union Trading Scheme*"[3].

Concerns have been raised in relation to many aspects of such a prospect, including:

- How and when the **baselines** (the rate of deforestation below which deforestation would consider to have been 'avoided') would be set;
- 'Leakage';
- The **'permanence'** of AD, especially in a context in which the climatic environment in some tropical regions is likely to change rapidly in the coming decades and may render very large forest areas – such

[1] N. Stern, The Economics of Climate Change - http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/stern_review_report.cfm
[2] N. Stern, The Economics of Climate Change -http://www.hm-treasury.gov.uk/media/4/3/Executive_Summary.pdf
[3] See http://www.forestsnow.org/

as Amazonia – much more liable to fire and degradation. Because of the physical/environmental threats to forests, 'avoided deforestation' is likely to suffer from 'permanent non-permanence';
- Uncertainties concerning how governments will go about **forest conservation** in practice, and how **funding mechanisms** would work (who would actually receive payments?);
- how carbon credits would impact on **land rights** and what impacts this all might have on the livelihoods of hundreds of millions of forest-dependent poor;
- the difficulty of **assessing forest carbon fluxes** with any accuracy;
- The likely **very high transaction costs** associated with reliable forest carbon flux measurement and monitoring project establishment and administration costs, all of which would drain resources away from actual investment in avoided deforestation measures.
- **Risk**; unlike most other forms of carbon credits, those generated through AD would be subject to risk of catastrophic failure and loss of value, such as through major forest fires. This could promote serious volatility in the market, especially as traders sought to replace lost credits.

All these issues are problematic, and will require much discussion in order to resolve: however the research within this report focuses only on the question of what impact avoided deforestation credits might have on carbon markets, the market's capacity for absorbing such credits and generating sufficient funds to make a real impact on global deforestation.

2. DEFORESTATION & AD CREDITS

One of the strongest advocates of schemes for 'Reducing Emissions from Deforestation and forest Degradation (REDD) has been the Coalition of Rainforest Nations, comprising 15 countries including Papua New Guinea, Democratic Republic of Congo and Bolivia (but not Brazil). Under the Coalition's proposals, developing countries would be awarded credits for protecting their forests. Once received, the credits would then be sold via the carbon markets to an industrialised country counterpart attempting to meet their emissions reduction target. Proceeds would then be used as compensation for revenue lost from exploiting that forest land. The degree of 'fungibility' (i.e, tradability) of AD credits with credits from other carbon saving projects or emission allowances (e.g under the European Emissions Trading Scheme) varies according to different proponents and different proposals, but it is generally assumed that AD credits would be fully fungible within the wider carbon markets.

In the most optimistic scenarios, such a scheme would seem *theoretically* achievable at a global scale. Assuming that tropical forests contain, on average, as a conservative value, roughly 150 tonnes of carbon per hectare[5], and that forest carbon enters the market at parity with all other forms of carbon, then 13 million hectares of 'avoided deforestation' would theoretically generate around 7.2 billion credits. Assuming a range of prices from \$15-\$25/tonne CO_2, this could potentially yield \$107 billion - \$179 billion, depending on whether credits were sold through primary or secondary markets[6]. In principle, this would be a 'one-off' benefit, as the assumption has to be made that deforestation would be stopped completely and not simply displaced elsewhere, with 'avoided deforestation' credits then generated a second time. In practice, such payments would be spread over several years or decades.

[4] The setting of the baseline date could be very important due to major temporal fluctuations on deforestation rates, especially in some of the larger tropical forest countries such as Brazil and Indonesia. By picking a year of exceptionally high deforestation as the baseline date could mean that countries could still benefit from AD credits even if their absolute rate of deforestation is still high.

[5] Estimates of the amount of carbon stored in tropical forests generally range from 100 tonnes per hectare to 300 tonnes for tropical high forest. Volumes of below-ground forest carbon and the impacts on its flux with the atmosphere during deforestation are almost completely unknown.

[6] 13m ha x 150 tonnes C/ha = Carbon equivalent. Multiplied by 3.67 to achieve CO2 / Carbon credit equivalent. Total = 7.16 billion which equates to \$107 billion @ \$15 - primary price or \$179 billion @ \$25 - credits in secondary markets.

3. CARBON MARKETS

Estimates of the funds required to stop tropical deforestation cover a large range. Sir Nicholas Stern suggested at the Bali meeting that to halve deforestation would cost $10 - $15 billion per year. It is not clear how these figures are derived, but generally it is thought that initial REDD projects would focus on the cheapest mitigation activities; the figure for complete eradication might be considerably higher, because this would require stopping the conversion of forest land to high value uses, such as soya bean or palm oil production. The World Bank has suggested that as much as $100 billion would be needed.

As the 'highly optimistic' scenario above suggests, even these higher costs could, in theory, be covered by the theoretical potential revenues that could be derived through carbon credits. However, as the rest of this report indicates, this is dependent on some very optimistic assumptions about possible demand for such credits.

Under the Kyoto Protocol, Annex 1 countries (excluding the United States of America), agreed to legally binding commitments to decrease their collective GHG emissions to a level that is 5.2% below their 1990 levels by 2012[7]. The ratification by 169 countries, as of late 2006, led to the creation of the world's largest carbon markets.

In conjunction with the Kyoto accord, governments of European Union member states agreed on a separate cap-and-trade arrangement, the Emissions Trading Scheme (ETS) which will regulate the contribution of high-emitting industries to achieving the Kyoto protocol commitments of the EU. Within this structure, emissions from industrial installations are capped and carbon emissions allowances allocated. Participants are then obliged to meet targets by either reducing their own emissions or by purchasing credits from carbon markets. Surplus credits due to emission reductions beyond the set targets can be sold. The total volume of allocated credits in the ETS is around 1.6 billion (or 1,600 $MtCO_2e$). Rules within the EU ETS and Kyoto Protocol vary slightly although both effectively offer emission reduction targets that can be met locally or, failing that, can be bought from another source through regulated trading mechanisms.

Most relevant to this report and to the possible inclusion of AD into the carbon markets is the Clean Development Mechanism (CDM). This mechanism, established under Article 12 of the Kyoto Protocol, refers to climate change mitigation arrangements undertaken between Annex 1 countries and developing nations. Mitigation projects in developing countries, once certified, receive Certified Emission Reductions which can be used by industrialised counterparts as part of their emissions reduction obligations. This allows Annex 1 countries flexibility in meeting targets although, as some have argued, might act as a

[7] DEFRA - http://www.defra.gov.uk/environment/climatechange/internat/un-kyoto.htm
[8] House of Commons Environmental Audit Committee, The EU Emissions Trading Scheme: Lessons for the Future, Second Report of the Session 2006-07, House of Commons, London.
[9] World Bank - 'State of the Voluntary Carbon Markets 2007' – http://carbonfinance.org/docs/Carbon_Trends_2007-_FINAL_-_May_2.pdf

disincentive to actual emissions reductions at home. There have also been serious criticisms of the effectiveness of the CDM, not the least because of the predominance of hydro-fluorocarbon (HFC) scrubbing projects in China and India, which represented more than half of all CDM projects by 2007, but are believed to have cost vastly more through emissions credits than would have been the case if they had simply been funded through, for example, development assistance.

The fact that emissions have continued to rise in Annex 1 countries gives rise to concerns as to the effectiveness of carbon trading as a means of halting climate change, and the ETS in particular, during its first 'phase', seems to have been almost completely ineffective in reducing emissions, due to poor design and inappropriate levels of credit allocations[8]. It is estimated that all existing CDM projects and the many new projects already in the pipeline will generate potential credits of around 2,600 $MtCO_2e$.

Alongside the regulated markets of the Kyoto Protocol and the EU ETS are the unregulated voluntary markets. Within this category is the voluntary, but for companies that have signed up, legally binding Chicago Climate Exchange (CCX) cap and trade system and the 'over the counter' voluntary offset market. Combined, they had a value of $91 million in 2006, which equates to roughly 2% of that of the CDM[9].

Projections for the voluntary markets are extremely uncertain: future market size depends on the actions of countless individual actors, such as companies and consumers. For this reason, and due to a relatively small market share in comparison to the CDM, the voluntary markets have been excluded as a prospect for generating funds for AD within the remainder of this report – though they could well grow to be an important part of the voluntary market.

4. SUPPLY & DEMAND OUTLOOK FOR 2008 - 2012

An assessment of emission reduction targets and current reduction levels enables a degree of accuracy to be attached to evaluations of the first Kyoto period (2008-2012).

Some caution must however be exercised, due to excess credits held by Russia and other Eastern European countries. These consist of unused supplies of Kyoto Allocated Allowance Units (AAUs) – and are known as 'hot air' - and resulted from the base-line for permitted allowances being set prior to the contraction of manufacturing at the end of the communist era. The numbers of these mostly 'dormant' credits dwarf the actual volume of trade in current carbon markets (see Figure 1), and potentially could be a major determinant in the effectiveness of the markets in the future[10].

The graph (page 10) shows predictions of likely supply and demand for the first Kyoto period.

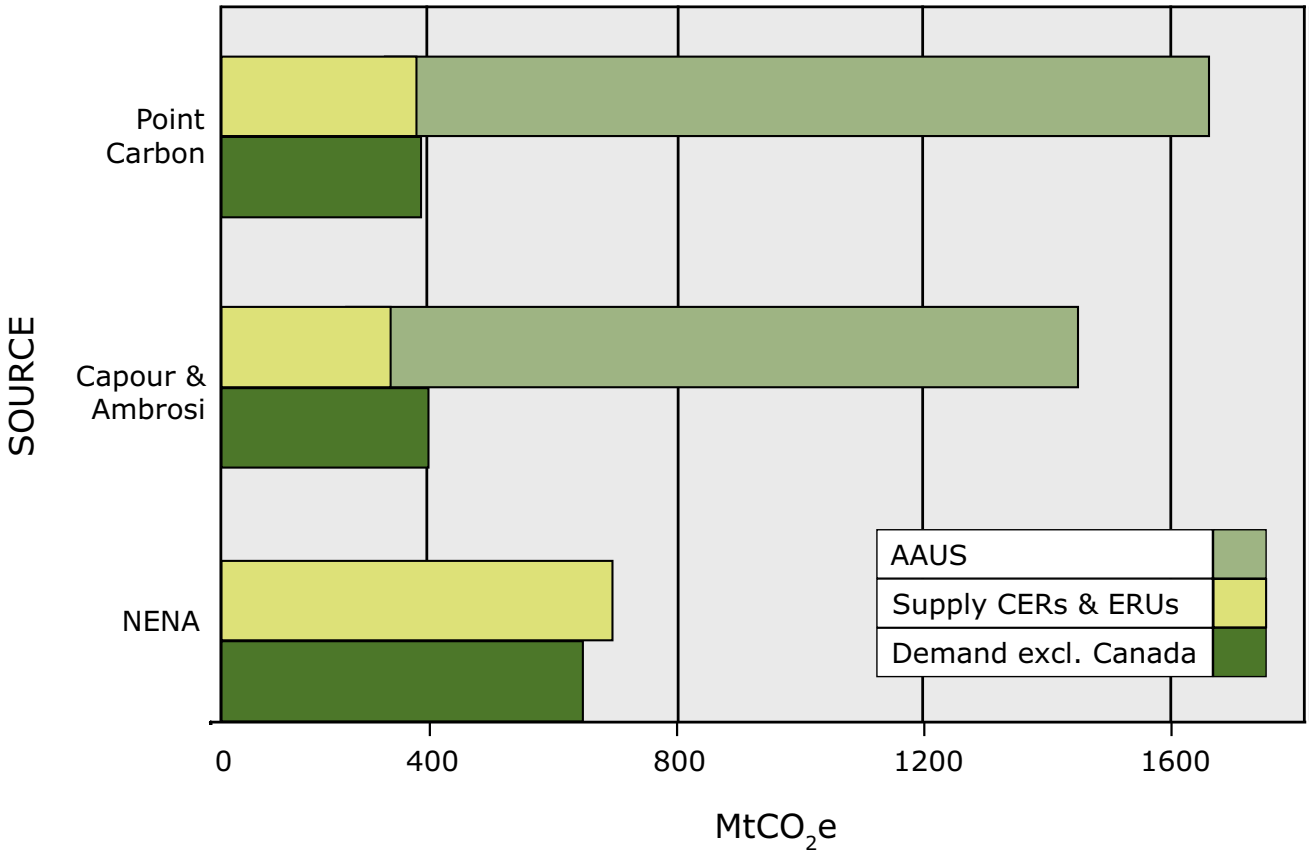
The graph shows that, assuming that 'hot air' AAUs are held back for sale in future periods, and that assumptions that Canada will fail to buy credits to meet its Kyoto commitment are correct, then there will roughly be equilibrium between supply and demand.

The size of the current market is not necessarily an indicator of future markets, but it is worth noting the relative scale of the existing markets – demand for around 400 million credits per year - in relation to potential cumulative supply of avoided deforestation credits, of around 7.2 billion (plus any credits generated for reduced forest degradation). This begins to indicate the scale of expansion of the carbon markets that would be required for any significant number of avoided deforestation credits to be absorbable. It is worth recalling that, in Phase One of the EU ETS, an oversupply of only 173 Mt's of credits prompted a carbon price crash[11], with the value of EU allowances (EUAs) declining from €30 to €10 per ton in 5 days through late April – early May 2006.

[10] To exploit the maximum value, it is thought that possessors of 'hot air' credits are more likely to roll credits over to the following period. In any case, most countries are reluctant to enter into purchase agreements involving Russian and East European 'hot air' credits, due to them resulting from industry contraction as opposed to efficiency improvements. However, whilst dangers surrounding market flooding due to AAU's are largely discounted, uncertainties still remain as to governments' commitments not to purchase these credits.

[11] Carbon Capital Markets - http://www.carboncapitalmarkets.com/files/pdf/news/cnbc_october_issue_8ae44enkw0.pdf

FIGURE 1: Average annual supply and demand of Certified Emission Reductions (CERs) and Emission Reductions Units (ERUs) in the first Kyoto period - (Figures converted to annual averages)



5. SUPPLY & DEMAND OUTLOOK FOR POST 2012

But could any significant volume of AD credits be brought into *future* carbon markets without causing serious destabilisation of carbon prices? An accurate estimation for post 2012 carbon markets is very difficult due to the many variables that are yet to be decided upon – and most of which will be subject to political negotiations within the UNFCCC.

To be able to make any kind of prediction, certain major assumptions must be made. For the purpose of this report, it has been assumed that:

- All current Annex 1 countries, including the USA, will ratify commitments to reductions in GHG's
- Developing nations do not participate in efforts to reduce industrial pollution GHG emissions
- Credits from REDD will be issued on the basis that 1 tonne of carbon saved yields 1 carbon credit

5.1 DEMAND

A policy change limiting the degree to which Annex 1 countries fulfill their emissions reductions commitments by buying overseas mitigation project-based credits would have serious implications for predictions. Unconfirmed reports suggest that the EU is planning a cap of 10% on credits sourced from mitigation projects for the ETS's third phase

TABLE 1: Potential Annex 1 country demand for mitigation project carbon credits

	20% reduction in GHG			**50% reduction in GHG**			**80% reduction in GHG**		
% of 'emission reductions' permissible through offset credits	10	20	50	10	20	50	10	20	50
Max potential demand for offset Credit $MtCO_2e$	362	724	1810	905	1810	4525	1448	2900	7240
Total Funds Raised at primary stage / maturity assuming $15/$25 / tonne ($ billion)	4.8/ 8.1	9.8/ 16.3	24.4/ 40.7	12.2/ 20.4	24.4/ 41	61/ 101.8	19.5/ 32.6	39.2/ 65.3	97.7/ 162.9
Potential demand as a proportion of theoretical maximum supply of 7.2 billion AD credits (%)	5.1	10.1	25.3	12.6	25.3	63.2	20.2	40.5	101.1

post 2012. If true, this would greatly affect the number of offset credits required through non-EU supply - in 2005-2006, EU trade represented 62.5% of the carbon market[12].

Due to the uncertainties surrounding this last point, Table 1 (page 11), which shows the theoretical total potential demand for credits from mitigation projects (including AD), includes a range of values of 10%-50% for the maximum allowable percentage that could be purchased through projects in developing countries. The upper end of this range - 50% allowable demand for such credits – is anticipated in a recent UNFCCC paper[13].

Providing the above scenarios fall within what is actually set out in a future global GHG reduction agreement, then a range of $4.8 billion - $162.9 billion in total could potentially be raised for avoided deforestation from carbon markets - though this assumes that *all* mitigation credits are AD credits.

The huge range of potential funds available from AD credits, as shown above, combined with the $20 – $100 billion[14] cost predicted as necessary for eradication of deforestation, would appear to make any prediction about the sufficiency of AD funds almost arbitrary. The only conclusion that can be drawn is that there is probably the theoretical *potential* for carbon markets to raise sufficient finance to halt all deforestation, but this is highly dependent on which scenario a future global commitment on climate change is adopted, especially by Annex 1 countries, and what avoidance of deforestation actually costs. For the purposes of comparison, even the lowest level of estimated cost of elimination of deforestation ($20 billion) would require an estimated minimum demand for AD credits equivalent to 7.4% of 1990 emission level reductions from Annex 1 countries (assuming that all of this 7.4% 'emissions reduction' were purchased in the form of AD credits)[15].

However, comparison of the potential demand shown in Table 1 with the potential number of forest-based credits provides an indication of the likely ability of future carbon markets to absorb significant volumes of AD credits. Only in one scenario – whereby there is a negotiated commitment to 80% GHG reductions in Annex I countries, and that 50% of emissions reductions can be bought as credits from mitigation projects outside Annex I countries - does the potential demand exceed the total potential supply of 7.2 billion AD credits.

5.2. SUPPLY FROM OTHER MITIGATING PROJECTS

The figures in 5.1, previous page, already show that there are likely to be serious constraints to even the *potential* demand for avoided deforestation credits in relation to the potential supply. But these figures do not take into account that the real demand for this type of credits is likely to be much lower, because there will continue to be substantial supplies of *other kinds* of mitigation projects, such as methane and carbon capture projects, and renewable energy schemes, that will also fill this section of the market. Projections of potential post-2012 supply of offset credits are few, although the following graph used in a recent UNFCCC paper offers one such assessment[16].

The UNFCCC calculates that maximum potential supply from mitigation projects in 2030, excluding AD, is 5,715 $MtCO_2e$. This figure roughly equates to a scenario in which Annex 1 countries purchase credits equal to 60% emission cuts, with a 50% cap on offsets. Whilst this projection relates to a very distant date, it nevertheless suggests that 'non-AD' mitigation project credits are likely to continue to grow to substantial levels, and will therefore fill a substantial part of the market that might otherwise be filled by AD credits.

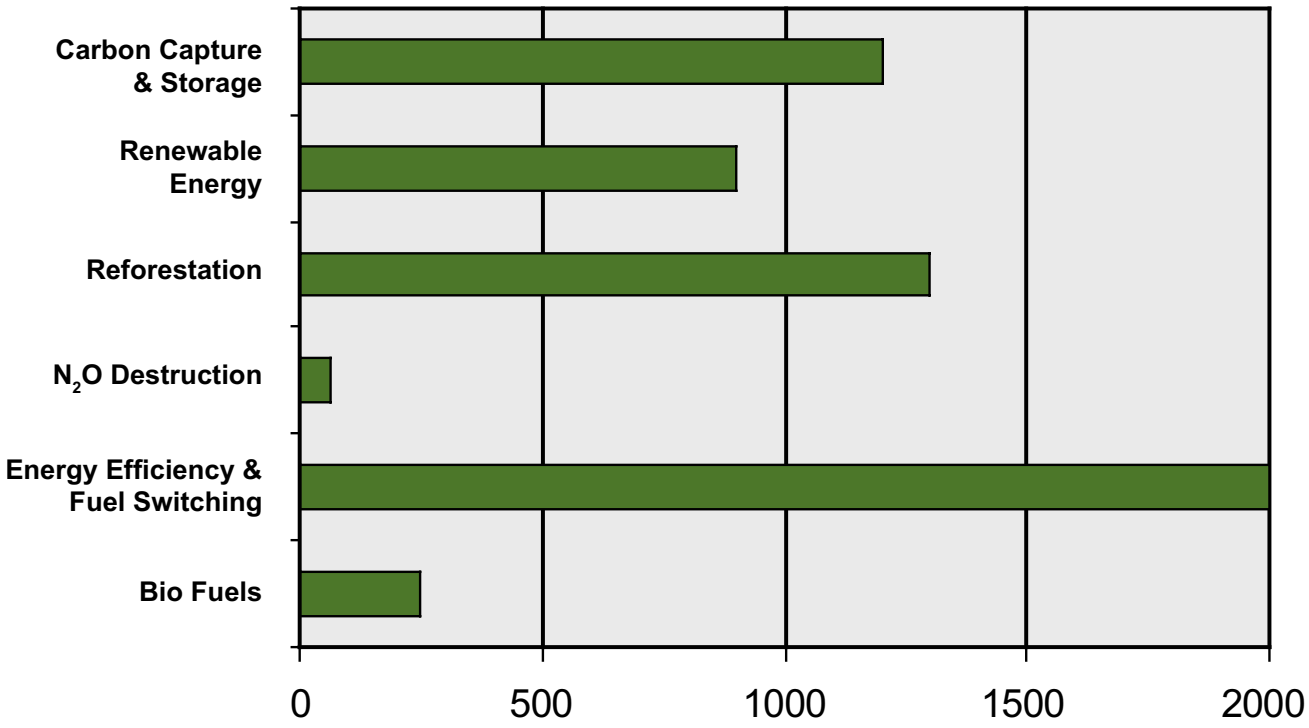
[12] Average of 2005 and 2006 World Bank figures - 'State of the Voluntary Carbon Markets 2007' – http://carbonfinance.org/docs/Carbon_Trends_2007-_FINAL_-_May_2.pdf

[13] UNFCCC – 'Investment and Financial Flows to Address Climate Change' - http://unfccc.int/files/cooperation_and_support/financial_mechanism/application/pdf/background_paper.pdf

The simple conclusion to this is that, all other things being equal, then in all but extremely optimistic demand scenarios, there simply will not be enough demand in the market to absorb all the other forms of mitigation credits *and* significant levels of avoided deforestation credits.

The UNFCCC predicts that, providing the current trend is maintained for a few months to a few years, existing categories of CDM project types could cope with a 20% – 200% increase in demand. If true, this would be sufficient to meet a low demand scenario without diversification into other credit-generating activities such as avoided deforestation. Either way it seems quite plausible that **a high proportion of future demand for offset credits could be met by currently accredited project types**, especially if Carbon Capture and Storage schemes were to be included.

FIGURE 2: Maximum Annual Emmission Potential In Non-Annex 1 Parties In 2030 ($MtCO_2e$)



Source: UNFCCC

[14] The figure of $20 billion being based on Stern's lower estimate of $10 billion for a 50% reduction of deforestation, multiplied by 2.
[15] 7.4% of 18,100 billion (Annex 1 emissions) x $15 (primary carbon price) = $20B (Lowest estimate for AD abatement)
[16] UNFCCC – 'Investment and Financial Flows to Address Climate Change'
- http://unfccc.int/files/cooperation_and_support/financial_mechanism/application/pdf/background_paper.pdf

6. MARKET FLOODING

Volatility within financial markets is mostly caused by the dynamics of supply and demand. An over-subscription of either can cause serious price fluctuations. In the event that demand for credits does not drastically increase, then the addition of AD to the current credit supply pipeline raises serious doubts about the flooding of the carbon markets. A situation where supply of mitigation credits greatly outstrips demand would likely lower the price of carbon, possibly substantially. Whilst being beneficial to Annex 1 countries, as offset obligations would be achievable at a lower price, there could be very serious ramifications – not the least that the funds that would be generated for actual deforestation prevention activities could be much less than some of the current estimates, and possibly less on a per hectare basis than would actually compensate for lost opportunity cost. In other words, the value of cutting forests down would continue to be higher than storing the carbon within them by leaving them standing. This is particularly important at a time when commodity prices – such as timber and palm oil – are rising steadily, and thus the opportunity cost of not exploiting forest land is also increasing: the actual costs of 'avoiding deforestation' could thus be much higher by the time a new climate agreement comes into effect.

There could also be impacts on other mitigation projects in the developing world. For example, in 2006, China was the dominant supplier of emission reduction project credits, with a 53 per cent market share. The country has an informal policy of only approving projects that achieve a minimum of $11.5 – $13 per ton of CO_2e saved[17]. This currently provides price stability within the CDM, but if the inclusion of large amounts of avoided deforestation credits were to depress the carbon price below this level, then there is a risk that the supply of projects addressing industrial emissions in developing countries would simply dry up.

If there is any basis for believing that emission reductions from reduced deforestation really are the least expensive mitigation options available, then clearly, without sufficient demand, other types of more expensive projects are likely to be priced out of the market. More importantly, 'offset' projects of one kind and another, unless limited in the markets, could greatly reduce the incentives for actual emissions reductions in the developed world. Combined, by 2030, avoided deforestation and other emission reduction activities could potentially provide credits equal to 71% of Annex 1 1990 level emissions[18]. This is further evidence that, unless extremely deep cuts are made in current carbon allowances – and that the demand for carbon credits is very substantially increased, then market flooding or crowding through an inclusion of AD would appear to be very probable.

[17] UNFCCC – 'Investment and Financial Flows to Address Climate Change'
[18] 5,715 $MtCO_2$ e (alternative abatement activities) + 7,160 $MtCO_2e$ (AD) = 12,875 credits / 18,100 $MtCO_2e$ (Annex 1 emissions) x 100 = 71%

7. TIME COST & EFFECTIVENESS OF UTILIZING CARBON MARKETS

A further limit on the likely effectiveness of avoided deforestation credits to make much impact on the problem of tropical deforestation is that of the time it will take to get such markets up and running. The earliest that avoided deforestation carbon financing could be raised through regulated markets would be after a successor convention to Kyoto is agreed (assuming it is) in 2012, and possibly later[19]. At the current rate, perhaps another 65m hectares of tropical forest worldwide will be lost during that period.

Second, assuming that avoided deforestation financing could reduce the rate of deforestation annually by 5% of the current level of 13 million hectares per year[20], then roughly an additional 188 million hectares of forest would still be destroyed before the rate of destruction dropped to zero in about 25 years time[21]. This represents an area of forest roughly equivalent to the entire Congo Basin; overall, around 100 billion tonnes of additional carbon dioxide would be released in the period before deforestation was halted.

In practice, there is a very low likelihood that all tropical countries would be willing and able to engage in ambitious avoided deforestation activities within a 'post-Kyoto' policy regime – and the government of Brazil has already stated that it is not in favour of avoided deforestation carbon trading, apparently because it recognises that such schemes potentially compromise the sovereignty of its forest resources.

According to World Bank projections, funds of $1 billion could be raised through carbon markets in 2015 for avoided deforestation[22]. By the Bank's own estimates, that represents only 1-2% of the finance needed to stop deforestation globally. Inevitably, early projects would involve low cost mitigation areas and so a greater proportion of deforestation could be reduced.

This all indicates that substantial measures *other* than avoided deforestation carbon trading are likely to be needed if tropical deforestation is to be arrested with the urgency demanded to prevent continuing climate change.

It also raises serious doubts about the value of the World Bank's Forest Carbon Partnership Facility (FCPF), which was launched in Bali, and which has the aim of 'jump starting' the development of forest carbon markets. The Bank aims to spend around $300 million through the fund in projects to 'ready' tropical countries for the forest carbon trade, but also to establish forest carbon pilot projects, including specifically that 100,000 hectares of tropical forest would be brought into the carbon trading regime. The FCPF could prove to be an extremely expensive and ineffective diversion from the urgent task of stopping tropical deforestation in the short term through known mechanisms. Perhaps even more seriously, inquiries by the Rainforest Foundation have revealed that the Bank has not conducted *any analysis whatsoever* of the likely impact on carbon markets of 'avoided deforestation' credits.

[19] Voluntary AD credits are already starting to be generated, but the voluntary market is always likely to be very small in relation to the scale of the global problem.
[20] On the past evidence of global efforts to reduce deforestation, a reduction of 5%, or around 500,000 hectares annually is achievable, but optimistic.
[21] Working on an annual 5% reduction of deforestation starting in 2013 (from current levels)
[22] World Bank - http://www.fire.uni-freiburg.de/sevilla-2007/groups/Worldbank.pdf

8. SOLUTIONS

Can the problems apparently associated with avoided deforestation carbon trading as set out in this report be overcome? Some possibilities have already been considered by the proponents of AD carbon trading, though as yet not in great detail. These include:

- 'Dilution' or 'gearing' of AD credits: under this concept, 'forest carbon' would in effect be set at less than parity with other forms of carbon. By implementing a weighting factor for credits from AD, of say 1:3, inclusion of many more AD projects in the carbon markets would be possible. However, if this method were to be adopted, then a balance would need to be reached between staying within market capacity, and the generation of sufficient per hectare funding. Too much dilution and per hectare payments would possibly diminish below the point at which sufficient funds would be generated to actually pay to stop deforestation – or would result in reliance on the cheapest possible methods of preventing deforestation, such as the use of armed coercion against forest-dwelling people. The figures in this report suggest that a gearing ratio of at least 5 and possibly 10 or more might be needed for AD credits to be absorbable within prospective future carbon markets without causing major price depression.

- Restricting AD credits' access to markets in order to match demand in the regulated markets; this might overcome the problem of market flooding (and might also reduce or eliminate the need for 'gearing' or 'dilution'), but would probably require complex regulatory measures that might constrain the success of the markets in dealing with other forms of mitigation measures.

- De-linked or partially linked markets: in this option, forest-based credits would either be traded in a separate market, or would only be partially fungible within the existing market.

- Hybrid approaches; which might link formal commitments with one form or another of forest carbon markets. One such proposal is that of Greenpeace's Tropical Deforestation Emissions Reduction Mechanism, under which Annex 1 countries would commit to purchasing an agreed volume of avoided deforestation credits through a special AD market, but such credits would not be fungible within the wider carbon markets[23].

- Use of avoided deforestation targets; whereby countries would be set specific targets for reduction of deforestation, and would be granted credits once these targets had been exceeded.

However, the data in this report suggests that the absorption of substantial volumes of avoided deforestation credits within carbon markets is likely to be highly problematic unless there is a major increase in the markets due to negotiated commitments to very deep Annex 1 country (including USA) emissions reductions – at least by 80% of 1991 levels. If avoided deforestation is to be included in the carbon trading regime, then the most preferable option to allow for this to happen safely would be for it to be conditional upon such commitments being made.

The voluntary markets might offer an alternative, or complement the CDM market, although the scale of available funds is even harder to predict, and probably will only ever be very small in relation to the official markets. In this report, the potential for this sector is partially offset by calculations including the US, which dominates the voluntary sector, with a 68% market share[24]. Failure of the US to ratify a future climate change agreement would decrease projections for demand within the CDM and so largely negate potential voluntary sector purchases omitted from this report. Furthermore a high demand scenario for voluntary credits would presumably result in

[23] http://www.greenpeace.org/raw/content/brasil/greenpeace-brasil-clima/documentos/briefing-em-ingl-s-do-mecani.pdf
[24] Ecosystem marketplace and new carbon finance - http://ecosystemmarketplace.com/documents/acrobat/StateoftheVoluntaryCarbonMarket18July_Final.pdf

an increase of both current and new categories of mitigation projects. An inclusion of AD would therefore raise similar market flooding/ crowding out concerns to those discussed in this report for the CDM.

Alternatively, in order to eliminate any concerns of price stability, market 'crowding' and/or carbon market flooding, avoided deforestation might form part of a separate commitment by Annex 1 countries, which would not necessarily be included in the trading regime but funded through other means. Historical baseline readings could still be taken and measured against. However, instead of raising funds through carbon markets, successful decreases in deforestation could be rewarded by compensation payments by Annex 1 countries, such as through Trust Funds. One avoided deforestation fund, of some $600 million annually, has recently been established by the Government of Norway.

9. CONCLUSIONS

Estimates within this report span a fairly wide range due to previously mentioned limiting factors. Nevertheless, the scenario calculations in this report indicate that raising sufficient finance for extensive reductions in tropical deforestation is theoretically possible, but that if risks of carbon market flooding are to be avoided, then far stricter emission reduction targets for Annex 1 countries would need to be agreed. Inclusion of forest-based carbon credits in anything like the existing size of carbon markets might, at best, produce too little too late and, at worst, have the potential to do more harm than good by depressing the price of carbon below a level at which real emissions reductions projects were financially viable. Dilution and restrictions on quantities of AD credits have potential to address such concerns, though this in turn might lower the funds generated to unattractive or ineffective levels.

This is not to say that the concept of forest-based carbon trading should be completely discarded – though, completely setting aside the concerns noted in this report, the list of problematic issues set out in section 1 might indicate that forest carbon trading is likely to be an extremely circuitous and uncertain route to achieving what have long been well known 'solutions' to the problems of tropical deforestation. But it is clear that harnessing of the potential of carbon trading to prevent deforestation on any scale will require some very particular, and hugely challenging, pre-conditions to be achieved – not least that all Annex I countries agree to deep emissions reduction commitments. The corollary to this is that global attention should probably be focused on ensuring that these conditions are in fact achieved – an unprecedented political challenge in itself - rather than becoming overly absorbed in the probably only marginally effective issue of avoided deforestation credit trading.

To avoid unnecessary risks and maximise GHG reductions, deforestation abatement would be

funded by additional emission cap targets, and would only follow o*nce commitments to deep emissions reductions in Annex 1 countries had been agreed*. This would ensure that AD would both have sufficient demand for credits but also add to emission reductions and not just replace other mitigation activities.

In the meantime, there are many known and possible approaches to prevention of deforestation, including: increases in official development assistance; fund-based mechanisms, with the funds possibly derived through some form of international taxation or a levy of, say, 50 US cents/barrel on global oil sales as has been suggested by Indonesia and other OPEC countries, a scheme which could also easily be extended to coal sales; a percentage of revenue from auctioning off ETS allowances in the third phase of the ETS be paid into such a fund, as the EU is considering; forest-backed bonds, or 'eco-securitisation'; and private/philanthropic financing.

Given the continuing rapid depletion of tropical forests, whatever the sources of finance, this should be targeted towards projects and strategies that have been shown to be cost effective and sustainable in providing long-term forest protection. In particular, this should include securing the tenure and resource rights of indigenous and local forest-dependent communities. Development assistance and micro-finance needs to be mobilized to ensure that these communities are able to establish enterprises that provide decent livelihoods and help to strengthen their incentive for long term sustainable forest management.

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Printed on Recycled Paper
Registered Charity Number 8014356

ISBN : 978-1-906131-08-1