Forest-based carbon mitigation projects: technical options for dealing with permanence (duration)

Draft of 21 May 2002, 17.00 CET

Introduction

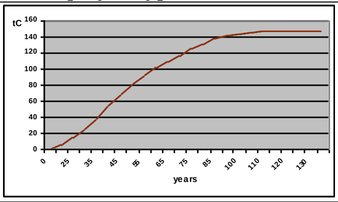
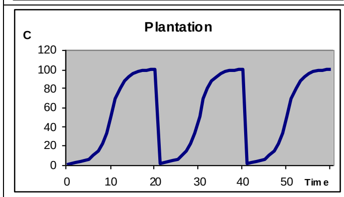
Since the signing of the Kyoto Protocol many options have been proposed to account for emissions and removals from Land Use, Land Use Change and Forestry (LULUCF) and other carbon sequestration projects. Options have attempted to deal with both quantification of benefits and the risk of loss resulting from change of land use or disturbance (by crediting a portion of actual carbon uptake). Many proposals have focused on afforestation, reforestation and deforestation (ARD) examples and the impact of such projects in non-Annex 1 countries under the Protocol's flexible mechanisms; Joint Implementation (JI) and the Clean Development Mechanism (CDM). However, the inclusion of forest management in Article 3.4 at COP7 has resulted in a wider scope of project options necessitating carbon accounting systems that will properly reflect the benefit to atmosphere, permanence, and liability issues, but also provide incentive to implement projects that result in benefits to atmosphere, biodiversity etc. This paper takes representative profiles of carbon uptake from forestry activities, and proposes accounting and liability options to balance these issues.

1. Carbon accounting options: how much and when

1.1 Introducing the hypothetical cases

The diagrams below show four different cases regarding net sequestration of LULUCF projects. With "net carbon sequestration" we mean the difference between project scenario and baseline scenario. We believe that these four cases capture the most important

Table: project types

	**Case 1: Gradual increase of carbon benefits** For example, a~~A~~fforestation/r~~R~~eforestation for conservation (etablishing a forest cover for conservation purposes, i.e. without intent to harvest. The stand sequesters carbon on a sigmoidal growth curve until maturity.)
	**Case 2: Intermittent increase of carbon benefits** (for example, afforestation/r~~R~~eforestation with consecutive wood harvesting ~~(Plantation)~~~~:~~ (~~E~~establishing a short or long rotation forest with harvest cycle. Carbon is sequestered along the growth curve and at harvest is transferred to other carbon pools (wood products, energy, slash) before replanting.) Doug, could you extend all curves out to 120 years?

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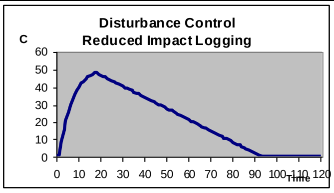
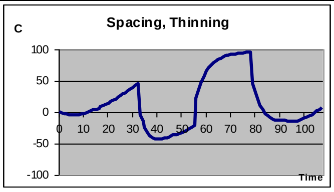
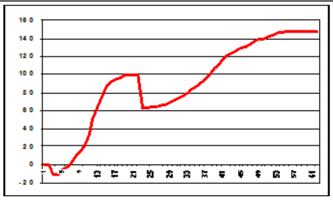
	**Case 3: Carbon benefits that diminish over time** For example, Disturbance control (fire, pest, disease), Reduced impact logging (~~:~~ ~~P~~preventing emissions as a direct result of protection activity. Though the carbon store is preserved and the benefit is long-term, the net benefit of a single project is often impermanent since an unprotected stand would eventually grow back.)
	**Spacing, thinning:** Removing a portion of growing stems to enhance growth of remaining stems, thus shortening rotation and supplying wood demand from a smaller land base. Such operations permanently raise long-term carbon stored despite swings in net emissions caused by early decay of slash and later changes in the rotation length. I still feel that we do not need this case. A project with boundaries as proposed here, and a credit/debit sequence as shown to the left, is unlikely to be accepted by the CDM board, for example. The sequence of credits and debits can as well be found in the second case (afforestation and harvest)although always in positive terrain. As it is said in the text above (marked yellow), the ultimate effect of this project is that a smaller land base is used to provide the same amount of wood. Thus, at the end of the day, this is a forest conservation project, in which leakage is minimized by producing the same goods and services as in the baseline case, but on a smaller unit of land. As such, a forest conservation project would be well represented by case 1. The bottomline is that I suggest dropping this case and leave it at four cases.
	**Case 4: Initial carbon loss followed by long-term carbon benefit** For example, Coppice to high forest (~~:~~ ~~R~~removing all vegetative stems except the best ones on each cut stump at age 25-40).

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1.2 Measurement, Accounting, and Pooling

A key aspect of forest carbon mitigation and trading is measuring changes in stocks accurately. Field measurements are accurate but costly; modeling carbon flows is cost effective, but may be less accurate. The challenge is to balance accuracy and cost. For decades foresters have measured merchantable timber volume and tree growth rates by setting up permanent sample plots and using a combination of modeling and sampling techniques that are well developed and accepted. Timber volume estimates can be converted to carbon using conversion factors and periodically validated. Initially, all relevant forest carbon pools should be measured to determine situations with and without a project. 'Wood products' is an important pool, though not included in the 1st commitment period. For post-project monitoring, it is sufficient to measure only pools where change will be significant (S. Brown 1999). Models and remote sensing are useful tools, particularly where all that need be known is that trees still exist. Enhanced remote sensing now can be done with low-flying planes and videography, which can accurately measure crown density and canopy height. The key is to accept a mix of measurement and modeling with periodic validation with sufficient accuracy to permit crediting and trading, without using costly techniques that prevent projects from happening.

A second challenge is how to ‘account’ for carbon uptake for the creation of credits. Accounting should be conservative enough to reflect inaccuracies in measurement and also take into account permanence- the risk of loss of the benefits through land use change, fire or other disturbance. Equally, accounting methods should reflect the long-term impact on the atmosphere, perhaps disregarding known short-term fluctuations, and should not be a disincentive to positive action. Several methods have been proposed. (1)“Actual stock change” gives credit as carbon is sequestered without regard to measurement error or risk of loss. “Averaging” simplifies and lowers cost by crediting uptake in equal annual amounts, which can either reflect long-term carbon fluxes, or reach a long-term average carbon density. (2)“Buffering” credits a lower amount of uptake than actually occurs to allow for error and loss. “Deferred” crediting only allows credits some time after sequestration. Both of these are a disincentive to project investment. (3) Ton-year and 100-year guaranteed storage approaches are environment protective but are disincentives to action.

Figure 4: Simplified and average crediting regimes

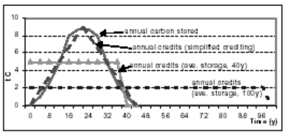


Figure 5: Delayed full crediting and stock change crediting with bu

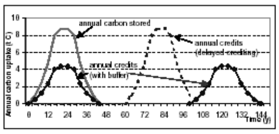
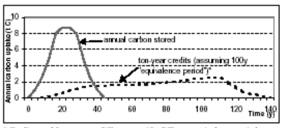
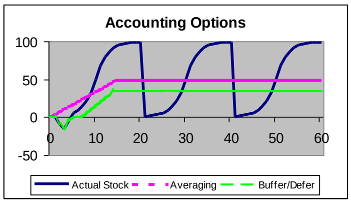


Figure 7: Ton-year crediting



* Credits would accrue at a different rate if a different equivalence period was used.

Three general accounting approaches, illustrated below, will be used to compare methods. A conservative approach, ‘Deferred/Buffered’, recognizes carbon loss from early net emission, credits subsequent uptake with a discount for measurement error and further discounts uptake as a buffer to loss; safe but negative in early years and thus lacking in incentive to action.



‘Actual Stock Change’ reflects the impact on atmosphere, but requires more frequent measurement and incurs greater transaction costs when credits must be sold and repurchased each harvest cycle. ‘Averaging’ ignores the initial carbon loss as irrelevant in the long-term, and credits equal annual amounts up to the long-term carbon density. It risks issuing more credits initially than tons sequestered, but offers incentive to action and reduces cost.

Pooling carbon from many projects is seen as having a central role in carbon markets. Pooling can:

- Provide risk management services against unintended release of carbon from individual projects by fire, pests, disease etc, through retention of a buffer of credits at the pool level.
- Normalise carbon flows by offsetting cyclic gains and losses from individual projects.
- Enable long term obligations to be entered into and met, through longevity of the pool entity.
- Give easy access to the range of professional services required, including verification.
- Aggregate smaller carbon holdings into marketable parcels.

1.3. Markets, Contracts, Renting

While a market for forest carbon exists, volume is too low to set a true market price. Current market entrants take the risk that credits will prove invalid as rules and technical issues continue to be defined. Some rules are in place for trading between Annex 1 countries in 2008-12 and between Annex 1 and non-Annex 1 countries, where credits can be banked for 2008-12. Trades have tended to be plantations and forest protection (Article 3.3) as opposed to forest management (Article 3.4), entrenched at Bonn/Marrakech. A true market requires considerable demand, clear carbon ownership, agreement on what constitutes a viable credit, and knowledge of who bears the liability for loss of sequestration benefits. Clear rights to emission offsets, which may coexist with ownership of land and vegetation, must be established by national legislation.

Currently contracts take many forms. Contracts range from purchasing project sequestration annually based on measured or modeled carbon uptake, even to offset pre-2008 emissions, to buying all annual benefits of a project up front, usually discounting values for future credits. Some buyers, anticipating legislated emission reduction targets in 2008-12, buy "futures contracts" today, obligating the seller to provide and buyer to pay for the offsets at a future date at a specified price. Others purchase "options" to buy carbon offsets at a specified price at some future date (usually in 2008-12) with no obligation to buy the credits. Options dominate today's carbon market, as hedgers seek to maximize protection from an obligation to buy in the future when prices may be considerably higher.

Contracts have tended to be unique, with no consensus on how to deal with permanence. Some have non-delivery clauses that obligate the seller to replace at the sellers cost any purchased credits that are not delivered, or any credits that are later lost. In some cases, the seller can remove a measure of obligation with a force majeure clause, removing obligation resulting from acts of God. Contracts will increasingly have to contend with standards that reflect accepted approaches to permanence.

An alternative to buying is renting carbon credits. Investors would rent credits until expiry and then would be obligated to replace them. This mechanism is practical for entities that either have low-cost offsets planned for the future (or do not need them), but is risky for entities that do not. In CDM situations, a Columbia proposal would require investors to replace expired credits but would release non-Annex 1 countries from obligation to sustain a carbon liability after expiry of a project. Presumably, a rented credit would have a lower value than a purchased one and it is unclear that the investment would be sufficient to start forestry projects.

2 Liabilities (who and at what times)

Define why there is a liability and what are the actors that could be liable. Establish a difference between liability in the Kyoto context (e.g. Annex I parties vs. non Annex I parties), and liabilities in the carbon chain (business, transfers, etc, before CERs enter national accounts). Include the role of insurance (include buyer seller pooling concept). Introduce bottles example. The question of carbon property rights and liability: inscribing this into the land title could be possible in some countries such as the US or Australia, but probably not possible (nor necessary?) in CDM?

Table: overview of liability options

	Liability during 'control period'	Liability after 'control period'
Seller liability	S	S
Buyer liability	B	B
insurance	I	I
Colombian / rental (with options)	S	B
Jackson proposal	S (pool)	S (stocks owner)
Ton year type	none	none

2.1 Seller liability, buyer liability, insurance

Text still to be written

2.2 Ton year accounting

The ton-year approach assumes that the sequestration of 1 t/CO2 for a *given period of time* is equivalent to an avoided emission of 1t/CO2, after which there are *no further liabilities*. Because the Marrakech Accords confirm that release of credited stocks must result in reversal of credit awarded at the appropriate time, the ton year approach is not considered further.

Commented [L1]: Rather than get rid of this method of dealing with liability here… shouldn't it be 'screened out' by the first filter according to point (g)? For example: Using a ton year and equivalence factor approach to dealing with liabilities, results in no liability after a given time period. It therefore does not adhere to requirement (g). Or more simply: Ton-year has time related liability – as a comment in the table. It all depends on the ordering of the text.

2.3 Guaranteed Duration of Storage (GDOS) approach

The GDOS approach defines sequestered carbon property rights as possession of the ability and liability to prevent re-emission of sequestered carbon stocks over a specified timeframe. The owner of the sequestered carbon property rights therefore requires the ability to enforce an agreed Project Plan concerning the land and vegetation.

The Project Plan would generally be registered on the title to the land and vegetation concerned through a covenant or easement (I think this is prescriptive: we cannot force all countries that they must work with land titles. This may work in countries like US and Australia, but not in some others), or use agreed equivalent measures (e.g. legislated Land Use Plans (again, sounds too prescriptive for Kyoto purposes. Non-Annex I countries would start complaining that land-use plans are forced on them) binding future land and vegetation owners, for the agreed term. The Project Plan would give rise to the reasonable expectation of specified changes in landscape carbon density over time.

The approach ~~uses the IPCC Global Warming Potentials~~ it does not use the GWPs, it only uses the assumption that "our timeframe of analysis in the GWP is 100 years), as required in the Marrakech definition of Removal Units, to define 100 years of sequestration as the period over which a credit is earned, but with ongoing liability for release of credited stocks at any time. Who is liable?

Credit is quantified as sequestered carbon is measured and verified, but is based also on the verified ability to guarantee, consistent with the Project Plan, a specified period of storage of the sequestered carbon stocks. Where this period is shorter than 100 years, credit is discounted proportionately. Thus, for example, a fifty-year reforestation and harvest project with no binding commitment to replanting would receive 50% credit for stocks sequestered in year 1 (following verification), 49% in year two etc. On the other hand, a project with a 120-year Project Plan would receive full credit for carbon sequestered (following verification) in the first twenty years, 99% of stock change in year 21, etc. Credit would be reversed in relation to reductions in stocks at any time.I think this proposal would lead to all projects making project plans for 100 years, even if the real intention is only to go for a shorter time. Who cares now if the project stops after 50 years? It is too far in the future. The GDOS may simply lead to all projects pretending to be for the long-run.

The carbon rights owner (either the carbon stocks owner, the project developer or a pool manager, as determined by law and contract) could claim equivalent RMUs under one of the mechanisms, and would bear primary liability for replacing these RMUs in the event of reversal of carbon benefits during the term of the Project Plan. What if the project developer defaults or no longer exists after say 20 years? And Kyoto is a government-level accounting tool. Which government takes the debits? The CDM (non-Annex I host) probably not as they have no commitments. Or would they have to guarantee project success? After expiry of the Project Plan, the liability for existing stocks reverts to their owner, under whatever legal regime covers emissions at that time.

The approach relies on "Carbon Pooling" (would the carbon pooling idea not better belong in section 1.2 as it is generic across options?)to provide advanced products and services that may be required by law, buyers or capital markets. These would include risk management strategies such as retention of a buffer of credits, and could also include averaging or "normalising" carbon flows from harvested forests, rental of credits, sale of futures, put and call options, and aggregation of small credit holdings (this is all generic). Elaboration of further accounting conventions for Carbon Pools would be required to fully optimise these outcomes.

The risk management buffer of credits would be expected to cover normal risk over the timeframes involved, with a further buffer to manage climate change related risk. Again, risk management buffer is generic and could come in section 1 ~~Requiring retention of this buffer to manage climate change impacts could also be considered an adequate offset to any short term benefit from CO2 fertilisation or other indirect human induced effects~~too complex/detailed. The buffer would be progressively disbursed over the project life, as risk is effectively managed, and would provide an ongoing cash stream for monitoring, management and verification. (It would be necessary to convert RMUs to a bankable form of Kyoto Protocol Unit to enable such use in the future). The combination of a buffer (say 100% of project size), plus the fractional accounting (say 50% for 50 year duration) would mean that a good project intended for 50 years would receive only 0.25 tC credit for each ton sequestered?

The approach provides a uniform basis for evaluation, demonstration and verification of the relative sustainability of sequestration, and maximises rewards for verifiably sustainable and sustained LULUCF projects. Accordance with biodiversity conservation and sustainable development strategies will necessarily be primary considerations when evaluating long term Project Plans. This could as well be required of the other options and is thus generic – see SBSTA workshop on environmental and socio-economic issues.

The approach may also help manage the risk of default on financially unsustainable carbon liabilities, built up over decadal timeframes. This is, through minimising credit ~~and debit~~ for relatively short term projects or those which cannot demonstrate sustainability. This risk is otherwise born by Parties to the Protocol and the environment (I think at the end the risk has always got to be borne by at least one party of the Protocol, no matter what the private-level arrangements are – Kyoot is made by governments for governments, and is not about sub-governmental accounting). The approach also supports the requirement for additionality, as long term and sustainable projects are generally beyond "business as usual", which focuses on minimising the time until normal commercial returns.

2.4 Options for temporary CERs or carbon rental

A number of proposals have been put forward that contain the underlying assumption that LULUCF projects are non permanent, and that offset carbon may only be stored for a limited period of time, after which it may be re-released in the atmosphere. Such proposals include expiring CERs (Colombian proposal ref…), carbon 'rental' (Marland et al, 2001) and carbon 'leasing' (Moura Costa, 1996). The CER is therefore temporary and will further be referred to for ease as a tCER. Provided there is ongoing liability, even beyond the specified period of temporary storage, the continued environmental integrity of the atmospheric greenhouse gas benefit is ensured.

The following questions are key to understanding and defining the 'rules' of carbon rental:

1) ***What is the lifetime, expiry date or rental period, of a tCER?***
   a) *A fixed lifetime* – which could be specified and required by the Conference of Parties (COP) to the UNFCCC (a 'top-down' approach), e.g. 5, 10, 20 or 100 years (the same length for all projects);
   b) *A non-fixed lifetime* – which would be proposed by the project developers and therefore can be different lengths of time, (based on project planning and verification visits).

2) ***What happens when the tCER expires?***
   It is agreed that ongoing liability is required and this can be achieved using the following options: extending the tCER on the original project (tCER renewal), or replacing the tCER with either a permanent CER or tCERs from another project. The choice of which option is used could either be specified by the parties to the UNFCCC, proposed by projects, or a combination of both.

3) ***Should there be a minimum lifetime for a LUCF project?***
   Given the temporary nature of the tCER product and therefore the opportunity for projects to sell tCERs for short periods (e.g. 5 years), should there be a restriction put on projects, by COP, in terms of a minimum project lifetime?

4) ***For how long should a project be eligible for producing credits?***
   For energy projects the crediting period is 10 or 7+7+7 years. For LULUCF projects longer crediting periods may be necessary in order to avoid a bioas towards fast-growing monocultures.

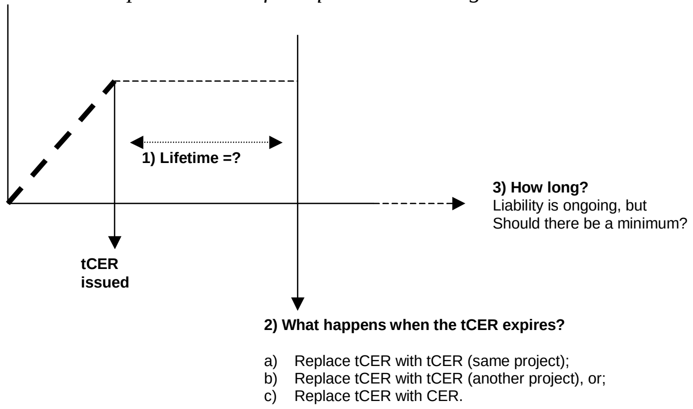
5) ***Should there be a limit to the period over which tCERs can be rented?***
   The maximum rental period must in any event not be longer than the lifetime of the project. Even if the Kyoto-accounted expiry of tCERs is 5 years, the contract between project host and investor could establish longer rental periods.

6) ***Which accounting methodology is used to calculate the number of tCER's generated over the rental period?***
   Refer to Section 1 for descriptions.

7) ***Should tCERs be issued at the time when carbon stocks accumulate, or should tCERs be issued after carbon stocks have been safeguarded for a certain time (e.g., 5 years)?***
   In Article 3.3 (afforestation and reforestation activities) the RMUs are created at the same time when carbon is sequestered. In the case of CDM projects there may be two different options: A) tCERs could be issued at the time when the carbon is sequestered and the expiry would be calculated from this time forward. B) tCERs could be issued ex post for a carbon stock that has

been accumulated since 2000 and kept in place fpr say the last five years. In case A there must be seller liability between issuance and expiry of the tCER, whereas in case B there would not be any seller liability (because a temporary storage is already proven to have been achieved).

Schematic representation of the questions relating to tCERs and carbon rental:



During the workshop a number of different options for regulating the rental of tCERs were proposed, including some discussions of how tCERs would be incorporated into national greenhouse gas accounting procedures. A number of the proposed options are outlined below:

Option 1: The tCER rental period (plus expiry date) is determined by the project developers, based on project planning, verification visits, investor and developer needs, and so on. No specification on the replacement method after expiry is made. No minimum project lifetime.

Option 2: As per option 1, but with a minimum project lifetime specified by COP e.g. of 15 years.

Option 3: The COP specifies a fixed lifetime for tCERs of 5-years. Comment: I think in the French proposal it is not. No specification on the replacement method after expiry is made. No minimum project lifetime. tCERs are used at the time when a stock measurement is done, and expire 5 years later. For example, if a stock measurement is done in 2009, then tCERs can be counted some time in the first commitment period, and expire some time in the second one.

Option 4: As per option 3, but the tCER are issued at the end of each commitment period, and the 5-year duration of tCERs co-inides with the 5-year commitment periods.

Box: Option 4 (issuance of tCERs after 5-year periods "stock-maintenance")

A project would report at the end of each commitment period the amount of carbon that was stored, on average, over the preceding 5 years. This could be done in several ways. One could A) take the arithmetic mean of the net carbon stocks (over and above the baseline scenario) at the beginning and the end of the commitment period, or B) measure the net carbon stocks (over and above the baseline scenario) around the middle of the commitment period. In any case, the goal is to establish a proxy for the time-averaged (over the commitment period) difference between project and baseline carbon stocks.

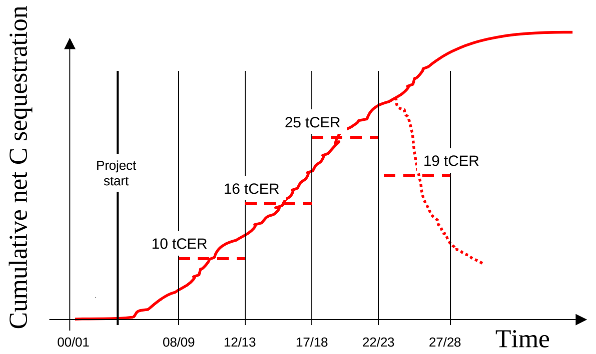


Figure: Cumulative net carbon sequestration over time. This is the net gain of the project scenario over the baseline scenario.

TCERs would be issued at the end of each commitment period, and would reflect carbon benefits over the last 5 years. They would be transferred from the host country to the investor country where they would be converted into AAUs for use in the first commitment period. At the same time, and this is the main difference to energy-type projects, a so-called "Liability Unit" (L-unit) would be created which expires five years later, i.e., at the end of the second commitment period (see Table 1). At the end of the second commitment period the CDM project will most likely create further tCERs. These new tCERs will exceed the tCERs in the first commitment period if the project manages to further enhance net carbon benefits. These new tCERs will again be transferred to the Annex I country and converted into AAUS and L-units. At the same time, the L-units from the first commitment period expire. If the new AAUs exceed the expiring L-units, then there will be a net benefit for the Annex I country.

Table 1: Issuance and transfer of CERs, and issuance of AAUs, in a hypothetical project that produces a net carbon benefit of 1 ton in the first commitment period, and no further benefits thereafter. If this is an energy project, then only the text in regular font applies. If it is an LULUCF project, then in addition the italicised text applies.

	Annex I country	**non Annex I country**
Commitment period 1	• 1 (t)CER issued in non-Annex I country • 1 (t)CER deducted from non-Annex I country	• 1 (t)CER added to Annex I country • 1 (t)CER converted into 1 AAU • *1 L-unit created (5 yr durat.)*
Commitment period 2	• *1 t-CER issued in non-Annex I country* • *1 t-CER deducted from non-Annex I country*	• *1 t-CER added to Annex I country* • *1 tCER converted into 1 AAU* • *1 L-unit expires, and deducted from Annex I country AAU account* • *L-unit created (5 yr durat.)*

Other questions: Bankability pre 2008? If yes: if there is a debit pre 2008, how should it be accounted for?

3. Criteria for evaluating accounting methods and liability options.

In order to unravel the issue of non-permanence in forest carbon mitigation projects, two filter levels were established for testing the applicability of specific circumstances (accounting methods, liability options, and combination of both).

- Filter 1. The overall basis for eligibility will be the 8 principles, in the preamble to draft decision -/CMP 1 of the Marrakech draft accords regarding Land use, land-use change and forestry (http://unfccc.int/resource/docs/cop7/13a01.pdf). None of these 8 principles should be contradicted by any of the suggested options.
- Filter 2. If the options are fulfilling these general principles, they can be further evaluated against [ten] specific criteria set out for permanence.

FILTER 1 Overall basis for eligibility

a) That the treatment of these activities be based on sound science;
b) That consistent methodologies be used over time for the estimation and reporting of these activities;
c) That the aim stated in Article 3.1 of the Kyoto Protocol not be changed by accounting for land use, land-use change and forestry activities;
d) That the mere presence of carbon stocks be excluded from accounting;
e) That the implementation of land use, land-use change and forestry activities contributes to the conservation of biodiversity and sustainable use of natural resources;
f) That accounting for land use, land-use change and forestry does not imply a transfer of commitments to a future commitment period;
g) That reversal of any removal due to land use, land-use change and forestry activities be accounted for at the appropriate point in time;
h) That accounting excludes [specific[1]] removals resulting from:

- elevated carbon dioxide concentrations above their pre-industrial level;
- indirect nitrogen deposition; and
- the dynamic effects of age structure resulting from activities and practices before the reference year;

FILTER 2 Specific criteria for permanence issue

1. Complementary approach : Does it fit with other existing plans and programmes, including [national] strategies, sectoral policies and action plans under the Conventions[2] to Combat Desertification (CCD) and on Bio-Diversity (CBD)?
   [Comment: Reiteration of filter 1e?]
2. Country-level approach : Is it compatible with subnational programmes / is it scalable ?
3. Incentive for action : Is it an incentive for LULUCF projects and /or activities ?
4. Sustainable development : Does it encourage long term activities?
5. Cost effectiveness : Is it cost effective/ are the transactions at a low cost ?
6. Simplicity : Is it easy to implement ?

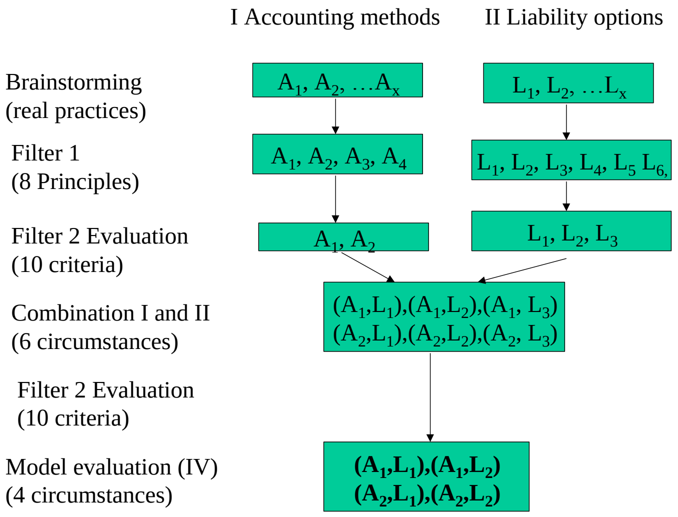
[1] The addition "specific" is meant as a reference to the three subprinciples following principle h; i.e**. accounting excludes specific removals** will be the 'aggregate' in filter 1 (see further at elaboration).
[2] It is important to note that not all Parties to the UNFCCC (Climate Change) have signed the UNCBD (Biodiversity) and/or UNCCD (Desertification) and vice versa.

7. Flexibility further split into the following three "stages" of the Kyoto Protocol:
- Entrance. Does it allow for all kinds of eligible LULUCF projects ?
- Intermediate. Does it allow for fungibility (interchange) of different types of credits (RMU's, AAU's, ERU's, CER's)?
- Final. Does it allow for a (unexpected) withdrawal from the flexible landuse systems ?
8. Environmental integrity : Does it preserve environment integrity of the Kyoto protocol with respect to real GHG emissions and/or removals
[Comment: Reiteration of filter 1c and 1f?]
9. Risk management: Does it include appropriate management tools (financial and technical capability) ?
10. Transferability. How is its compatibility with other systems of trading outside the Kyoto Protocol (assuming that the reference point is trading under the Kyoto Protocol).

Further requirements may apply as modalities are currently being developed in the specific context of articles 6 and 12 of the Kyoto Protocol.

Final elaboration:

The following scheme summarises the proposed evaluation of the permanence issue. It is divided into the following steps:
- *Brainstorming*. Both for accounting methods and liability options, all real practices for forestry projects will be taken into account and grouped under different option patterns.
- *Filter 1*. Only the options that does not contradict the principles in the draft Marrakech accords for LULUCF. It is expected that about 4 accounting methods and 6 liability options will be eligible.
- *Filter 2*. All eligible accounting methods and liability options will be evaluated separately against the [ten] criteria for permanence (first matrix, at each cell a score will be given (+, - or 0) [by all WG2 members] to indicate the applicability of the permanence issue). It is expected that about 2 accounting methods and 3 liability options will be selected for the final stage.
- *Combination* of accounting methods and liability options. A combination of accounting methods and liability options will results in about 6 "circumstances".
- *Filter 2*. All 6 scenario's will be tested against the [ten] criteria for permanence (second matrix, same method as before).
- *Model evaluation*: this final stage will allow to select 4 circumstances to be applied to section IV's modelling for CO_2 equivalents accounting (tons) and value based accounting (Euro).



Scheme. Overview of proposed evaluation of permanence issue.

4 Application of hypothetical cases from section 1 to accounting and liability options from sections 2 and 3

Short model description

Description of model results.

Interpretation of model results.

5 Additional issues

The idea of using carbon removals from the atmosphere (to the terrestrial biosphere) to offset emissions of carbon to the atmosphere (from fossil-fuel burning) is founded on the premise that climate is changed by an increase in the atmospheric burden of carbon as carbon dioxide. Given this premise, the source of additions or subtractions of carbon from the atmosphere is immaterial, what matters is the net flows to or from the atmosphere. This seems a valid approach so long as our interest is in human-caused changes in the climate and adding or subtracting carbon from the atmosphere has no other impact on the climate system. In fact, the Earth's vegetative cover is an integral part of the climate system and changes in terrestrial ecosystems impact the Earth's climate in ways beyond their impact on flows of carbon.

In addition to their impact on greenhouse gas balances, changes in the Earth's surface vegetation can affect the surface albedo and surface energy transfers as latent and sensible heat Changes in the Earth's surface can thus impact both the global radiative balance and the internal distribution of energy; and consequently global, regional, and local climates. The literature on this topic is evolving rapidly, as are the understanding and modeling skills that might permit us to more fully evaluate how changes in terrestrial vegetation impact the climate system. Initial analyses, e.g. by

Betts (2000) and others, still have high uncertainty but suggest that in most environments removal of carbon from the atmosphere into the terrestrial biosphere does yield a global-scale cooling, although often less than would be implied simply by the amount of carbon removed from the atmosphere.

The essential point here is that as understanding improves it may be appropriate to recognize that the net climatic effect of managing carbon in the terrestrial biosphere may be less than implied by the carbon balance alone, and may not be uniform across all places. The importance of land-surface vegetation to the climate system is more important than is recognized in current political negotiations. It does appear clear that protection of the Earth's vegetative cover will prevent further anthropogenic impact on the climate system and that efforts to restore the structure and function of degraded ecosystems will likewise serve to reduce human impacts on the climate system (Marland et al., 2002).

Managing carbon in terrestrial ecosystems also has large potential impact on protecting the Earth's biodiversity and this important connection has been clearly enunciated in international discussions and is enshrined in the Marrakech Accords. It is identified in this paper as an essential consideration of carbon sequestration projects.

Issues of additionality, baselines, and leakage are sometimes listed as obstacles for carbon sequestration projects. On the other hand, it is often argued (see for example Chomitz, 2002) that these issues are not fundamentally more difficult or more complex for sequestration projects than for energy-sector projects and, with the one exception which follows, we do not discuss them further here. The Marrakech Accords have agreed that energy-sector mitigation projects can receive carbon credits for only a limited number of years – for one 10-year period or for an initial 7-year period with the possibility of renewal for 2 additional 7-year periods. This limitation confronts the baseline issue by acknowledging that we do not know where the normal sequence of technological development would have taken us even in the absence of a mitigation project. Such a limitation seems inappropriate, and possibly even destructive, in the land-use sector where management of mature forests and native vegetation requires a longer vision; and limiting the period for credits could give inappropriate advantage to short-lived, fast-growing, plantation forestry.

References

Brown, Sandra. 1999. Guidelines for Inventorying and Monitoring Carbon Offsets in Forest-Based Projects.
Jackson, Mark. 2002. Subnational Entity Accounting for Carbon Sinks and Storage…etc
Blanco, Javier. ???? Special considerations regarding the "expiring CERs" proposal.
Marland, Fruit and Sedjo, Accounting for sequestered carbon: the question of permanence