Danone Fund for Nature (DFN)

Expert Workshop
November 2009

Achieving Carbon Offsets through Mangroves and Other Wetlands

Meeting Report

Ramsar DANONE IUCN

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Danone Fund for Nature (DFN)

EXPERT WORKSHOP:

ACHIEVING CARBON OFFSETS THROUGH MANGROVES AND OTHER WETLANDS

9-11 November 2009
Gland, Switzerland

Meeting Report

Editor:

Nick Davidson, Ramsar Convention Secretariat, on behalf of the DFN partners

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Summary of Main Workshop Recommendations

Establishing a large-scale carbon offset certification methodology for mangroves for 2010

A three-track approach is recommended for developing an offset standard for mangroves, with both VCS and CDM components. The three tracks are:

1. *CDM small-scale methodology (see Annex 6) and Programme of Activities (POA).* Applicable immediately, for the DFN pilot project in Senegal, by applying the existing CDM small-scale methodology. There are restrictions on hydrological interventions (excluding natural revegetation), and it does not include soil organic carbon (SOC) pool or fluxes - only above-ground and below-ground biomass pools. A POA might be appropriate for larger-scale activities and still using this methodology (i.e. bundling different small-scale projects where each activity needs to be "small" but the overall POA can reach >16,000 tCO2e emission removals per year);
2. *Revised small-scale methodology, including the Soil Organic Carbon (SOC) pool* (to optimize carbon revenue). This could be submitted and validated in 2010 under the VCS. It can be submitted to the CDM-EB in April 2010 when the PDD for the Senegal pilot project is ready;
3. *A new large-scale methodology that includes hydrological intervention, all GHG fluxes, soil carbon, dead wood and litter pools*. This is a longer process, one which usually takes several years. Such a methodology can be submitted to the CDM along with a project support or to the VCS alone. The VCS approval process is faster and delivers permanent credits.

Track 1 can be applied immediately, but a number of further steps are needed to implement Track 2, and Track 3 would take the longest lead-time (several years) to develop and obtain approvals. A 'road-map' for progressing the next stages of this work, following the workshop, was developed.

Elaboration of the DFN restoration project guidance documentation for carbon projects

The workshop's Working Group 2 reviewed the materials in the draft project guidance document prepared by members of the DFN Expert Panel. The workshop recommended that:

i. Rather than continue to compile a newly formulated comprehensive guidance document, it would be more efficient, effective and helpful to potential project proponents to prepare a much simpler guidance document for wet carbon projects, ca. 10 pages long, which would explain the DFN procedures and call for a concept note and a proposal outline from project proponents;

ii. The guidance document would use existing adopted guidance standards as the guidance for different aspects of a project proposal (available from the project website on: http://wetcarbon.com/), including:

    a. the Climate, Community and Biodiversity (CCB) standards for socio-economic matters;

    b. the Ramsar guidelines on wetland restoration; and

    c. the VCS/CDM standards for carbon certification; and

iii. To support and inform the preparation of project proposals, a number of additional supporting 'technical guidance notes' should be prepared and provided on the DFN website, some of which could be derived from the original draft guidance document. These could include guidance on:

    - Wetland restoration

- Socio-economic considerations
- Project scenario determinations of carbon stocks/GHG estimates
- Carbon leakage
- BMP for delivering certified GHG reductions and community involvement
- Wetland methodologies for carbon measurement; and
- A list of abbreviations & glossary of terms

A review of the draft 'call for proposals' document was made. This should be finalized and issued, with a deadline for proposals of 31 January 2010. This finalized call for proposals (*Guidance for wet carbon projects: Wet carbon standards and the project idea note*) is now available on: http://wetcarbon.com/docs/dfn-wet-carbon-projects-guidance-feb10.pdf

In terms of the selection process for the next tranche of DFN projects from the project idea notes (PINs) submitted by project proponents:

i. an initial evaluation and screening of PINs should be done to establish if the project proposals are fully in line with the terms of the DFN;

ii. a short-list of appropriate proposals would then be submitted to the DFN Board for approval for further consideration;

iii. once a project has received initial approval from the DFN Board, a "due diligence" visit should be undertaken to the site and project proponents; and

iv. if the evaluation is still positive, the proposal would then go to the development of a full project plan and eventually to a contract.

Identification of the main opportunities for conciliating wetland carbon offsets and social development

A draft 'decision support tool (DST)' for the DFN was developed during the workshop by its Working Group 3 in order to enable the key features and opportunities for carbon offsets in a wide range of different wetland types to be identified comparatively. It provides qualitative information on different wetland types, based on a simple hydrogeomorphic wetland classification, with columns for five categories of information needed to assess the potential opportunities and challenges for different types of wetland in achieving carbon offsets. These categories are:

i. Carbon storage & sequestration characteristics in naturally functioning and degraded wetlands, including artificial wetlands;

ii. Potential for avoided degradation to maintain carbon stocks;

iii. Restoration potential;

iv. Availability of carbon market mechanisms; and

v. Range and importance of ecosystem services to people (needed to ensure that in planning a carbon offset project the socio-economic considerations of the full range of other services delivered by the type of wetland are taken into account).

The recommended next steps are to:

i. Review and recheck the decision-support tool (DST) *qualitative* matrix for different wetland types (by WG3 participants);
ii. Share the DST matrix with all workshop participants, for any comments on its approach and uses as a decision-support tool;
iii. Prepare story-line summaries (carbon, restoration, ecosystem services and market opportunities) for each wetland type (cf. the initial examples prepared and presented in the workshop);
iv. Review by Ramsar STRP of the DST, supporting documentation and story-lines – STRP mid-term workshops, late February 2010 [done]; and
v. Arrange follow-up workshop(s) to compile *quantitative* values, ranges of values, etc., for carbon storage and sequestration in different wetland types – first half of 2010; possibly also extend matrix methodology approach to other non-wetland ecosystems (e.g., forests, grasslands and croplands) for comparison – e.g., to speak to the forest carbon community and to set the potential scale of wetland carbon offsets in their broader ecosystems context. [Note. Further work on quantitative matrix development for different wetland types was undertaken by a small expert group (involving a number of DFN November 2009 workshop participants and other invited experts) during the STRP mid-term workshops in February 2010.]

1. Background

In recent years there has been increasing attention, including through processes implemented under the UN Framework Convention on Climate Change (UNFCCC), to seeking to reduce or offset greenhouse gas emissions through projects designed to restore ecosystems, or maintain existing ecosystems ("avoided degradation"), as carbon stores. Much of this attention has focused to date on forest ecosystems, but there is increasing interest now being shown in wetland ecosystems, particularly peatlands.

There is now increasing evidence, including through recent work undertaken by the Ramsar Convention's Scientific & Technical Review Panel (STRP), that some types of wetlands (both inland and coastal wetlands) are also important in the global carbon cycle, including as carbon stores, especially since a significant proportion of the world's forests are forested wetlands. Such wetland systems include *inter alia* temperate and tropical peatlands and vegetated intertidal wetlands notably salt marshes and mangroves. It is a particular challenge, however, to fully assess and measure carbon in wetlands since a) for many wetlands much of their carbon is in soils (underground) rather than above ground, as for many forests, and b) many wetlands function as 'open' systems with respect to carbon.

In recognition of this important carbon service provided by such wetlands, a number of initiatives are underway or under development to establish and implement mechanisms for achieving carbon offset through carbon markets, including voluntary standards, for wetlands. In October 2008, at the Ramsar Convention's 10th meeting of its Contracting Parties (Changwon, Republic of Korea), a trilateral agreement, the *Danone Fund for Nature (DFN)*, was signed between the Ramsar Convention, IUCN, and the private sector Danone Group to develop and implement a mechanism for financing delivery of carbon offsets for the Danone Group through wetland restoration projects that are in line with the principles and practices of the Ramsar Convention.

In order to inform and guide the identification, development and selection of appropriately designed restoration projects under this mechanism, the DFN needs:

- a set of guidelines and criteria for project selection, covering wetland restoration good practice and assessment of socio-economic services and values,
- an accurate and innovative measure of carbon balance and storage, and
- an understanding of the conditions for achieving carbon offsets through both existing tools of the Clean Development Mechanism (CDM) and Voluntary Carbon Standards (VCS) for different types of wetlands and tools under preparation for the DFN.

These are currently being prepared by a small Expert Panel that was appointed in 2009 to prepare this guidance, which was also designed to provide the framework for the preparation of a call for proposal for new projects under the initiative and help to select these projects for implementation in 2010. The initial focus of attention under the DFN concerns the restoration of mangrove wetlands for carbon storage and offsets.

In relation to this, an initial pilot project on mangrove restoration in Senegal, funded from the initiative, is underway with the aim of providing an initial test of the initiative's approach and to derive lessons learned for the further development of the initiative and its transfer to further restoration projects, which may also give priority to mangrove restoration.

2. Workshop purpose and participation

The November 2009 Expert Workshop brought together those directly involved in the implementation of the *Danone Fund for Nature* with a wider group of experts from other organizations that are working on and/or have expertise in one or more aspects of mangrove restoration, wetland restoration, carbon measurement (in mangroves and other types of wetland), and carbon offsets and markets, for the purpose of reviewing and advising on the further development of the Danone/IUCN/Ramsar initiative in the context of other wetland-related carbon storage and offsets initiatives and projects. The outputs from the workshop are relevant not only to the further implementation of the DFN but also to the work of other organizations and processes addressing issues of carbon and wetlands.

The expert workshop was by invitation only (to organizations and individuals) and was limited to a maximum of 40 participants. Where appropriate, more than one expert from an organization was invited to participate.

The participants in the workshop worked in plenary sessions and in three parallel working groups (see below) to develop their recommendations and outputs. The expert workshop programme is provided in Annex 1.

A total of 36 invited experts participated in the workshop, along with Ramsar Secretariat, IUCN and Danone Group staff. A list of participants, their organisational affiliations and short biographies is provided in Annex 2.

3. Workshop objectives and expected outputs

The overall workshop objectives were, in particular, to:

A. Review the latest knowledge of the role of wetlands in the carbon cycle, good practices in wetland restoration, methods for carbon measurement in different types of wetlands, and current and developing approaches to carbon markets relevant to wetlands;

B. Identify which types of wetland can be readily restored and over what timeframes, as well as which types of wetland current carbon measurement methodologies can be readily applied, particularly in relation to measurements and timeframes required under offset mechanisms;

C. Describe in the light of A) and B) the already-available results and mechanisms that could be used for elaborating carbon evaluation in mangroves;

D. Prepare specific advice and a precise roadmap, in the light of A) and B), for addressing any additional results and mechanisms that are needed for achieving offsets through carbon markets from mangrove restoration; and

E. Review and advise on finalization of the draft guidelines and project selection criteria prepared by the Expert Panel from previous implementation, including the Senegal mangrove restoration project.

The workshop also looked at the potential and conditions for establishing mechanisms for “avoided wetland degradation” (i.e., the equivalent of avoided deforestation under UNFCCC), as an additional opportunity for maintaining existing wetland carbon stores.

Overall outputs which were requested from the expert workshop were:

i. guidance and advice to the initiative and its Expert Panel on finalizing its guidelines and criteria for future wetland project selection and delivery;

ii. specific guidance on achieving carbon offsets through mangrove restoration; and

iii. a published summary report of the presentations, discussions and conclusions of the workshop.

4. Workshop process

The workshop established three parallel working groups through which much of the work was undertaken. The topic coverage of these working groups, and the specific outputs and products which were expected from them, were:

Working Group 1: How to establish a large-scale carbon offset certification methodology for mangroves for 2010

Outputs expected:

- State-of-the-art advice on carbon measurement in mangroves taking into account each component (aerial, soil, aquatic transfer, etc.)
- Roadmap for approval of certification methodology, with available knowledge and knowledge gaps that need to be filled, compiled for each component
- Action plan for achieving methodology approval for mangroves

Working Group 2: Elaboration of the DFN restoration project guidance documentation for carbon projects

Outputs expected:

- Recommended amendments to guidance documentation
- Compilation of knowledge and process gaps
- Action plan for finalizing validated guidance documentation

Working Group 3: Identification of the main opportunities for reconciling wetland carbon offsets and social development

Outputs expected:

- Compilation of options for carbon capture through wetland restoration or protection, including prioritization of opportunities according to feasibility and cost effectiveness
- Compilation of information on social and economical services
- Action mapping plan for 'wet carbon' project development

The detailed tasks and terms of reference for each of the three working groups are provided in Annex 3.

It is anticipated that the outputs from the workshop and its working groups are relevant not only to the further implementation of the *Danone Fund for Nature* but also to the work of other organizations and processes addressing issues of carbon and wetlands.

Each Working Group had two co-leads to guide the process and a working group rapporteur to keep a record of its discussions, conclusions and recommendations, as follows:

Working Group 1:

Co-leads: Josh Bishop (IUCN) & Rebecca D'Cruz (STRP Vice-Chair); Rapporteur: Elodie Chene (IUCN);

Working Group 2:

Co-leads: Frank Vorhies (DFN co-ordinator) & Royal Gardner (STRP expert); Rapporteur: Nathalie Rizzotti (Ramsar Secretariat);

Working Group 3:

Co-leads: Mark Smith (IUCN) & Nick Davidson (Ramsar Secretariat); Rapporteur: Monica Zavagli (Ramsar Secretariat).

5. Workshop outcomes and recommendations

The report of the workshop plenary sessions, prepared by rapporteur Ramsar Secretariat Communications Officer, Dwight Peck, is provided in Annex 4.

5.1 Working Group 1: Establishing a large-scale carbon offset certification methodology for mangroves for 2010.

The Working Group stressed that a major issue is the need to include Soil Organic Carbon (SOC) in methodologies for mangroves since a very considerable portion of carbon in such types of wetland is sequestered and stored below-ground.

In developing an approach to establishing a large-scale methodology, the Working Group identified the following key points and issues that need to be taken into consideration.

A. Scientific requirements for restoring mangroves and for measuring carbon sequestration in mangroves for each component – aerial, vegetal, trees, soil and export

For restoring mangroves, major issues include: that the scope/project boundaries should include the fluxes and secondary production (e.g., through sedimentation, uptake by crabs/shellfish) of carbon; and that hydrological changes are important for the success of a restoration project.

For measuring carbon sequestration in mangroves, there are both possibilities and constraints in the CDM and VCS mechanisms. These include that:

i. the CDM and VCS approach is conservative and only considers carbon pools, not fluxes. Emissions outside project boundaries are only considered for the purpose of assessing leakage;

ii. under the CDM approach, *ex-ante* estimations of future carbon credits for below and above ground biomass are based on "default values". Then during the monitoring, the project developer has to establish the local allometric equations to verify the real emission removals that occurred; and

iii. to date, there is an existing methodology for small-scale CDM projects (i.e., 16,000tCO_2e of emission removals annually), which includes only above-ground and below-ground biomass pools. The key question is whether it is worthwhile, feasible and cost-effective to integrate the Soil Organic Carbon (SOC) pool into the methodology.

Concerning Soil Organic Carbon (SOC):

i. Optimization of carbon revenue from mangrove restoration could be achieved by including soil organic carbon (SOC) pool, but there is a need to review the available scientific data on mangrove SOC to establish if the approach is worthwhile. The trade-off for considering the SOC comes from the benefits in term of carbon revenue versus the additional monitoring costs to take and analyze SOC samples;

ii. The SOC pool can include up to 25% of the carbon; avoided methane emissions are also of importance; and soil carbon increases with sedimentation, and sedimentation increases with sea-level rise;

iii. There is a possibility to add a carbon pool or GHG emissions according to its significance under the existing A/R test for significance (5% of annual emissions removals). But including the SOC pool in the small-scale wetland methodology may increase the scrutiny from the CDM Executive Board (CDM-EB) regarding the measurement of emissions.

iv. If the SOC pool is included, a project is likely to reach the 16,000tCO2e threshold faster, so one benefit is to get a quicker return on investment; and

v. Under the small-scale methodology, is soil carbon worth measuring? During the first years following restoration, soil or below-ground carbon is very low, and accumulates very slowly. But it can be very simple to take soil carbon measurements and, even if it is low, it may be of relevance to take it into account over a 10-year crediting period.

Options and constraints concerning the VCS and CDM:

i. The existing methodology for small-scale CDM projects only includes above-ground and below-ground biomass pools. In addition, this methodology does not allow for change in the hydrological process (i.e., does not allow assisted natural regeneration). The rationale behind this is related to the CH4 and NOx emissions that may be caused by rewetting land. However, a successful mangrove restoration project would require hydrology works which would be regarded as ‘rewetting’;

ii. For large-scale projects (>16,000tCO2e per year), there is no methodology that includes wetlands. By developing a large-scale methodology it would be possible to integrate the soil organic carbon pool as well as hydrological work. For development of such a methodology, further research on other GHG emissions (e.g., NOx, CH4) from land-use change would be needed;

iii. A third option would be to develop a Programme Of Activities (POA) under the small-scale CDM methodology – i.e., bundled different small-scale projects. In this case, each activity needs to be “small” (in the CDM sense) but the overall POA can reach > 16,000 tCO2e emission removals per year.

B. Remaining components of certification methodology to be developed, contrasting VCS and CDM

Considerations regarding submitting a new methodology:

i. Under the CDM, a new methodology needs to be submitted to the CDM-EB along with a project support (PDD);

ii. Under the VCS, a new methodology can be submitted on its own. The methodology is subject to a double approval process and will be assessed independently by two validators. The first validator is contracted by the proponent (in this case DFN) and the second validator is hired by the VCS board;

iii. Submitting a new methodology to the VCS alone is an option for a revised methodology. However, in the case of creating a completely new methodology, such as for a large-scale mangrove restoration methodology, it is advisable to develop it along with a pilot project (in particular here to test flux measurements);

iv. The CDM and VCS cover carbon accounting only, while the CCBS covers project design only, and not the carbon crediting;

v. A revised small-scale methodology including the SOC pool might take time to be validated by the CDM-EB, and it might be costly. It might raise questions from the CDM-EB about other GHG emissions, though additional emissions are unlikely to be the major problem, according to mangroves experts;

vi. The limit between small-scale and large-scale projects (16,000tCO2e/year) represents a restoration project area of 500-1500 hectares. Revision of the small-scale CDM methodology to raise the 16,000tCO2e cap is not an option, as it would be procedurally too burdensome. Instead, a POA is a good alternative in the shorter term, whilst in parallel putting effort into developing a large-scale methodology;

vii. There are low-costs methods to monitor soil carbon, but it is currently difficult to define proxies to monitor it;

viii. It is easier and quicker to validate a revised small-scale methodology under the VCS (double approval process), and this does not preclude a submission to the CDM in parallel. This option is feasible for implementing during 2010 - but project developers will still face the constraint that hydrological modifications must be excluded; and

ix. Developing and validating a consolidated methodology for large-scale projects, including all options for restoration activities and pools, would take longer and cannot be expected to be achievable for 2010.

C. Identification of gaps between what is known and what needs to be known

Considerations include that:

i. If carbon fluxes are accounted for, there will need to be a change in the current system, so that a process approach rather than a project boundaries approach is taken; and

ii. The integrity of the standard relies on the verification feasibility, so it may be more realistic to consider vertical changes in carbon rather than changes in carbon stocks; otherwise an ecosystem approach to measuring carbon can be used rather than working at the mangrove forest level.

Concerning small-scale methodologies:

i. If it is worth revising the small-scale CDM to incorporate the SOC pool, revised guidance needs to be developed for the DFN. The revision would include SOC only (in addition to below-ground and above-ground carbon pools), and future project proponents would need to be alerted that if SOC is included in the proposal, this will require the approval of a new methodology.

ii. the next steps would need to be to compile the relevant guidance and information on SOC to form a new annex to the DPP on mangrove A/R (afforestation/ reforestation), and then also to update the draft document "*Towards defensible estimates of carbon in mangroves*" drafted by Expert Panel member Colin Lloyd.

iii. An outline terms of reference for the preparation of these materials is provided in Annex 5.A.

Concerning large-scale methodologies:

A draft Terms of Reference and a work plan for the drafting process of a new and feasible large-scale methodology was prepared by the Working Group and is provided in Annex 5.B. In developing the methodology the following matters need to be taken into account:

i. How to make existing methodologies "wetland friendly"?

ii. Typically a mangrove restoration project starts with a landscape-level assessment of the degradation causes, and it also needs to consider the different geospatial locations in which different types of mangroves occur - riverine, basin, coastal, fringe.

iii. To define what kind of methodology (AR, RED, IFM) to use, there is a need to clarify the scenario, starting with mangrove restoration. A mangrove restoration project fits under an ARR (afforestation, reforestation and revegetation) project type, which allows assisted natural revegetation.

iv. Other issues to be considered: hydrology, additional GHG emissions, carbon pools, project boundaries, and land cover change, e.g., wood extraction for charcoal.

v. Identify carbon pools: above and below ground biomass, SOC, standing biomass of secondary producers – part of fluxes (import/export), and also addressing changing carbon pools and fluxes.

vi. Boundaries: for verification purposes, boundaries have to be clearly defined and cannot move, but delineation of mangrove boundaries is not always easy, and it needs to consider whether adjacent open salt flats and/or mudflats should be covered?

vii. The carbon export ends in the secondary food chain, so it can be evaluated by proxies (estimating fish population, etc.) or by litter fall, rather than by measuring the fluxes themselves.

viii. Methodology requirements include:

- *Applicability conditions*: mangroves, in any type of soils (candidate mangrove site) – assess degradation reason and whether it can be fixed; and watershed assessment;

- *Additionality*: place where wetlands have been degraded under threats. Focus on project area – how external threats are taken into account, e.g,. dams, climate change;

- *Baseline*: scenario over time without project - what pools are considered - what are the project activities, and how accounting for removal and sinks between baseline and project scenario will be done. Pool, fluxes and interactions between pools and fluxes;

- *Leakage*: displacement of activities. Hence the importance of including communities to control leakage;

ix. The existing small-scale CDM methodology (see Annex 6) serves as a basis to develop the large-scale methodology. The Working Group prepared an annotated version of this methodology, indicating where it needs further development for the large-scale methodology, as guidance for any contractor engaged to develop the large-scale methodology.

Working Group 1: Summary conclusions and recommendations

The Working Group, in the light of its review reported above, recommended that a three-track approach be applied for developing an offset standard for mangroves, with both VCS and CDM components.

The three tracks are:

1. *CDM small-scale methodology (see Annex 6) and Programme of Activities (POA).* Applicable immediately, for the DFN pilot project in Senegal, by applying the existing CDM small-scale methodology. There are restrictions on hydrological interventions (excluding natural revegetation), and it does not include soil organic carbon (SOC) pool or fluxes - only above-ground and below-ground biomass pools. A POA might be appropriate for larger-scale activities and still using this methodology (i.e. bundling different small-scale projects where each activity needs to be “small” but the overall POA can reach >16,000 tCO2e emission removals per year);

2. *Revised small-scale methodology, including the Soil Organic Carbon (SOC) pool* (to optimize carbon revenue). This could be submitted and validated in 2010 under the VCS. It can be submitted to the CDM-EB in April 2010 when the PDD for the Senegal pilot project is ready.

3. *A new large-scale methodology that includes hydrological intervention, all GHG fluxes, soil carbon, dead wood and litter pools*. This is a longer process, one which usually takes several years. Such a methodology can be submitted to the CDM along with a project support or to the VCS alone. The VCS approval process is faster and delivers permanent credits.

The Working Group reported that Track 1 could be applied immediately, but that a number of further steps are needed to implement Track 2, and that Track 3 would take the longest lead-time to develop and obtain approvals.

The Working Group developed a ‘road-map’ for progressing the next stages of this work, following the workshop (Annex 7). Note that the timelines in this road-map were predicated on the next-steps work continuing immediately following the November 2009 workshop, but the relative elapsed time, from when the work is initiated, remains relevant.

5.2 Working Group 2: Elaboration of the DFN restoration project guidance documentation for carbon projects

The Working Group reviewed the materials in the draft project guidance document prepared by members of the DFN Expert Panel. The Working Group concluded and recommended to the workshop that:

i. Rather than continue to compile a newly formulated comprehensive guidance document, it would be more efficient, effective and helpful to potential project proponents to prepare a much simpler guidance document for wet carbon projects, ca. 10 pages long, which would explain the DFN procedures and call for a concept note and a proposal outline from project proponents;

ii. The guidance document would use existing adopted guidance standards as the guidance for different aspects of a project proposal, including:

   a. the Climate, Community and Biodiversity (CCB) standards for socio-economic matters;

   b. the Ramsar guidelines on wetland restoration; and

   c. the VCS/CDM standards for carbon certification.

   These are available from the project website on: http://wetcarbon.com/

iii. To support and inform the preparation of project proposals, a number of additional supporting 'technical guidance notes' should be prepared and provided on the DFN website, some of which could be derived from the original draft guidance document. These could include guidance on:

   - Wetland restoration
   - Socio-economic considerations
   - Project scenario determinations of carbon stocks/GHG estimates
   - Carbon leakage
   - BMP for delivering certified GHG reductions and community involvement
   - Wetland methodologies for carbon measurement; and
   - A list of abbreviations & glossary of terms

The Working Group reviewed and further developed the 'call for proposals' document and recommended that it be finalized and issued, with a deadline for proposals of 31 January 2010. This finalized call for proposals (*Guidance for wet carbon projects: Wet carbon standards and the project idea note*) is now available on: http://wetcarbon.com/docs/dfn-wet-carbon-projects-guidance-feb10.pdf

The Working Group recommended, in terms of the selection process for the next tranche of projects from the project idea notes (PINs) submitted by project proponents, that:

i. an initial evaluation and screening of PINs should be done to establish if a project proposal is fully in line with the terms of the DFN;

ii. a short-list of appropriate proposals would then be submitted to the DFN Board for approval for further consideration;

iii. once a project has received initial approval from the DFN Board, a "due diligence" visit should be undertaken to the site and project proponents; and

iv. if the evaluation is still positive, the proposal would then go to the development of a full project plan and eventually to a contract.

5.3 Working Group 3: Identification of the main opportunities for reconciling wetland carbon offsets and social development

So as to help identify the major opportunities for future programmes of wetland maintenance and restoration for carbon storage, the Working Group developed a draft 'decision support tool (DST)' for the DFN, to enable the key features and opportunities for carbon offsets in a wide range of different wetland types to be identified comparatively.

The tool was developed as a tabular matrix with a row for each wetland type, based on a simple hydrogeomorphic wetland classification, with columns for five categories of information needed to assess the potential, opportunities and challenges for achieving carbon offsets in different types of wetland. These categories are:

i. Carbon storage & sequestration characteristics in naturally functioning and degraded wetlands, including artificial wetlands;

ii. Potential for avoided degradation to maintain carbon stocks;

iii. Restoration potential;

iv. Availability of carbon market mechanisms; and

v. Range and importance of ecosystem services to people (needed to ensure that in planning a carbon offset project the socio-economic considerations of the full range of other services delivered by the type of wetland are taken into account).






In the short time available during the workshop, the Working Group then worked in four sub-groups to undertake a 'best expert' qualitative assessment for each metric within a category across all defined wetland types, with a coding generally from 0 (none) to 3 (high) for each metric. For wetland ecosystem services, values for the matrix were derived largely from those in the Millennium Ecosystem Assessment's 2005 *Wetlands and water synthesis* report, but with values added for a number of other wetland types (chiefly artificial wetlands) not covered in that MA report services tabulation.

The draft compiled DST matrix is provided in Annex 8.

The information compiled in the DST matrix was then used to undertake some initial analyses of the comparative values for each category across different wetland types, and also to demonstrate how simple 'story-lines' for a specific wetland type can be prepared by reading across all categories of qualitative information for that wetland. Results of these initial analyses are presented here.

A. Carbon storage & sequestration in naturally functioning and degraded wetlands, including artificial wetlands

Considerations include that:

i. The justification for using carbon credits to validate restoration of wetlands depends upon the trade-off between gain in sequestration capacity, reduction in the oxidative flux of soil carbon, gain in vegetative carbon stocks, and change in trace gas emissions;

ii. Trace gas emissions, sequestration rates, and carbon stocks differ dramatically among wetland types, and this variation needs to be taken into consideration for carbon methodologies;

iii. The restoration of certain wetland types will likely result in greater trace gas emissions than carbon sequestration, and therefore the restoration of some wetland types is unlikely to justify carbon credits. However, the many other ecosystem services provided by these wetlands do often justify their restoration;

iv. Carbon credits can be justified in different ways, i.e., restoration leading to enhanced sequestration and /or reduced trace gas emissions, or protection to avoid emissions as a consequence of avoided degradation; and

v. Comparing within a wetland type between the carbon storage and sequestration characteristics of naturally-functioning systems and degraded systems is valuable as it provides insights into where major gains may be made through restoration of such degraded systems.

Figure 1 provides an example of how comparative assessment across wetland types can be derived from the DST matrix, in this case comparing the relative carbon store size *per unit area* across wetland types, and between naturally-functioning and degraded systems within each wetland type.

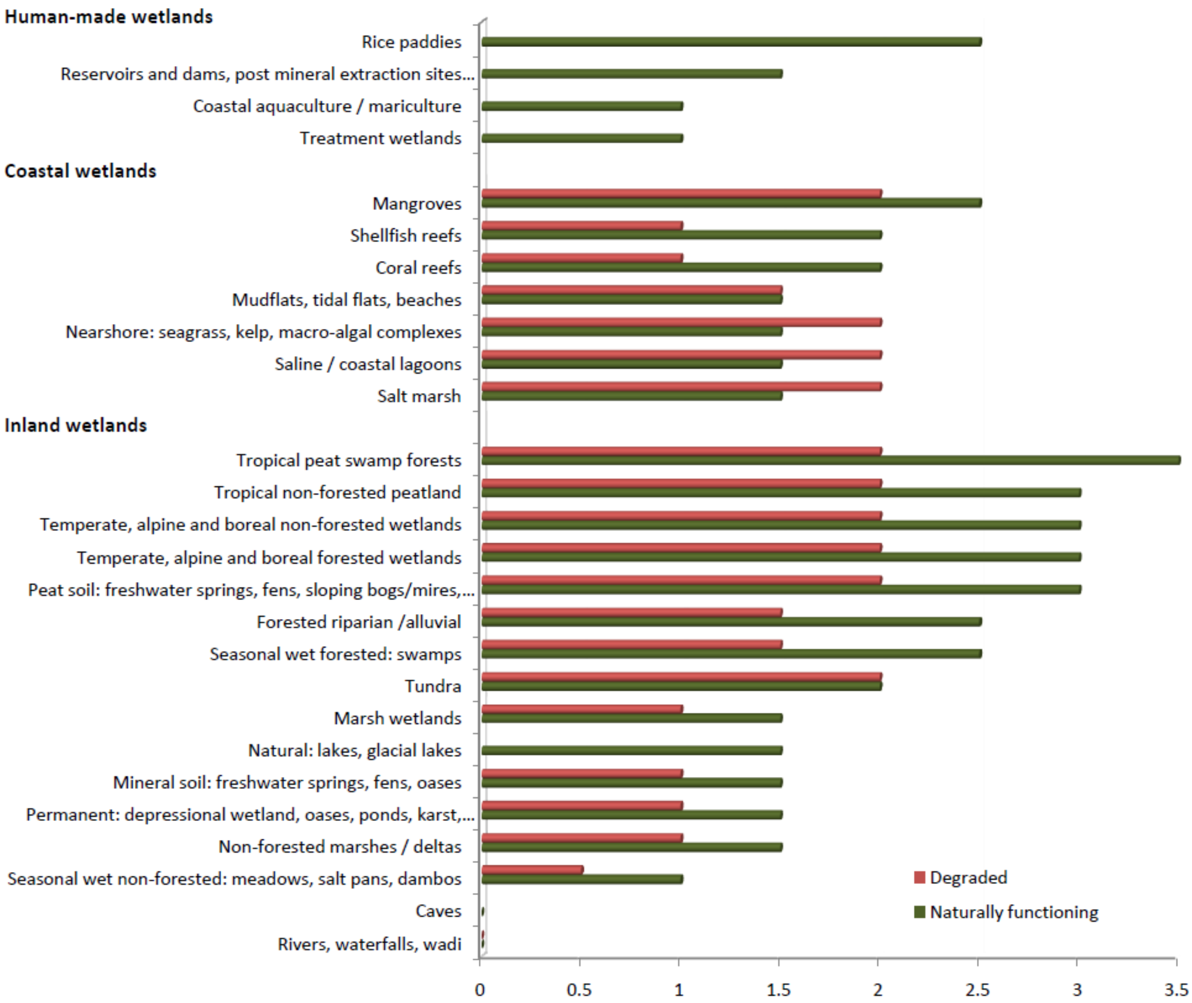


Figure 1. An example of the comparative qualitative assessment of carbon storage capacity across wetland types derived from the DFN Decision Support Tool matrix, in this case comparing the relative carbon store size *per unit area* across wetland types, and between naturally-functioning and degraded systems within each wetland type. Green = naturally-functioning; brown = degraded. Scale is from 0 to 3 (except for tropical peatswamp forest which was scored at 3+). For wetland types with a range of scores, the median score is used in this figure. For human-made wetland types only a single score was allocated, rather than scores for naturally-functioning and degraded systems.

Based upon best current knowledge, the following initial conclusions can be drawn:

i. Low trace gas emissions and high soil carbon sequestration from *mangroves* and *saltmarshes* make a robust case for carbon credit projects;

ii. The case for *peatlands* depends upon the balance of the reduction in soil carbon oxidation and the likely increase in trace emissions from restoration practices. For *tropical peatlands*, the increase in woody biomass will also be important to consider. However, the protection of *all peatlands* because of their very large soil carbon stocks is imperative;

iii. The case for *forested wetlands on mineral soils* depends upon the balance of sequestration in woody biomass versus the likely increase in trace gas emissions from restoration practices. This balance will likely depend on the local hydrology of the site;

iv. The case for *non-forested wetlands on mineral soils* is very difficult to make because of their typically high trace gas emissions with natural hydrology and likely lower sequestration rates. However, the many other ecosystem services these wetlands provide do typically justify their restoration and protection;

v. Trace gas emissions from wetlands depends upon their hydrologic conditions, which can be managed to reduce trace gas emissions but may have negative effects on other ecosystem services; and

vi. Fire management of *peatlands* can have significant positive effects for reducing carbon emissions.

Other relevant issues:

i. Climate change effects on the carbon balance of wetlands are an important concern. Climate effects on wetlands can have positive or negative effects on their carbon and trace gas fluxes to the atmosphere. These effects need to be considered in the management of wetlands into the future.

ii. More research needs to be done to gain understanding of trace gas fluxes and carbon sequestration rates in naturally functioning, degraded, and restored wetlands. Particular deficits in knowledge include:

  a. variation in trace gas emissions under different hydrological and other conditions,

  b. the net carbon sequestration resulting from the import of sediments into different wetland types, and

  c. the fate of exported carbon from different wetland types.

B. Restoration potential of different wetland types in an enabling environment

Considerations include that:

i. For this assessment, restoration is defined as the cessation of degradation and the restoration of structure to facilitate process and function;

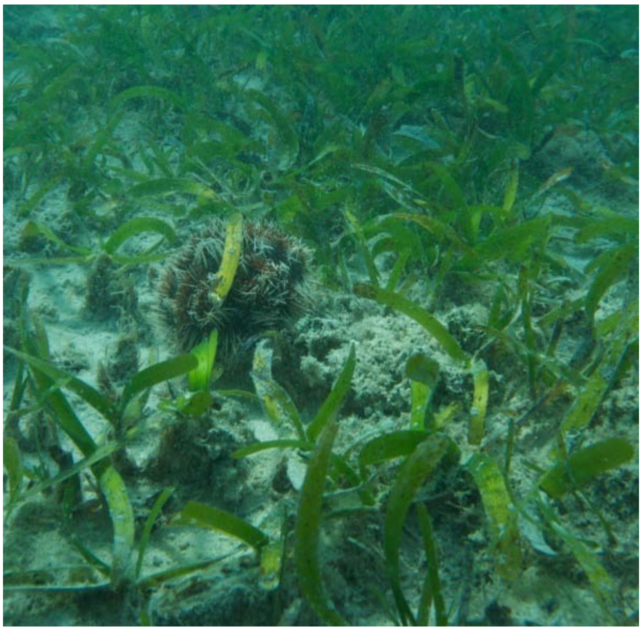
ii. For the qualitative assessments compiled in the DST matrix, the following assumptions were made: 1) there is an enabling socio-economic-political environment; 2) climate remains stable (including assumed climate change); and 3) the aim is to stop degradation and restore natural process and function;

iii. The main issues relate to the difficulties involved in deriving generic values without considering the site specifics and their context;

iv. There will be a continuum in size and also in degree of degradation that will affect costs;

v. There will also be variation across wetland types dependent on site location, including factors such as latitude, altitude, etc.;

iv. assessment of *Permanence* has been based on a generic likelihood of external risk, e.g., natural disaster, drought, fire, tsunami, storm event, etc., but this will also vary in relation to site specifics;



vii. *Leakage* will be dependent on the anthropogenic nature of impact and potential of associated transference;

viii. There will be wetland type and site specific issues which will control the time to stop degradation and then the time to restore processes and natural functioning (especially for carbon-related biogeochemistry);

ix. It may be that the easy/quick/cheap types of wetland to restore may prove to be primarily human-made, e.g., rice paddies; and

x. It is important to consider whether the restoration aim is to return a degraded wetland to its original wetland type or to another type of functioning wetland system.

C. Wetland Ecosystem Services

A summary comparison of wetland ecosystem services across the different DST matrix wetland types is provided in **Figure 2**, for the four categories of ecosystem service defined by the Millennium Ecosystem Assessment (MA) - provisioning, regulating, cultural and supporting.

Based upon best current knowledge, the following initial conclusions can be drawn:

'Non-carbon' ecosystem services:

i. Most types of naturally-functioning wetland, both inland and coastal, deliver a wide range of ecosystem services across all service categories (provisioning, regulating, cultural, and supporting);

ii. Of naturally-functioning inland wetlands, highest scores for services are from rivers, lakes, tropical peatswamp forests, temperate/boreal non-forested wetlands, tropical non-forested peatlands, permanent marshes and wet meadows, and forested floodplains;

iii. Of naturally-functioning coastal wetlands, the highest ranges of services and service scores are for mangroves, saltmarshes, and coral reefs;

iv. Most human-made wetlands deliver a) a smaller range of types of ecosystem service and b) have lower overall services scores; and

v. The highest ecosystem services scores for human-made wetlands are for reservoirs and dams, and rice paddies.

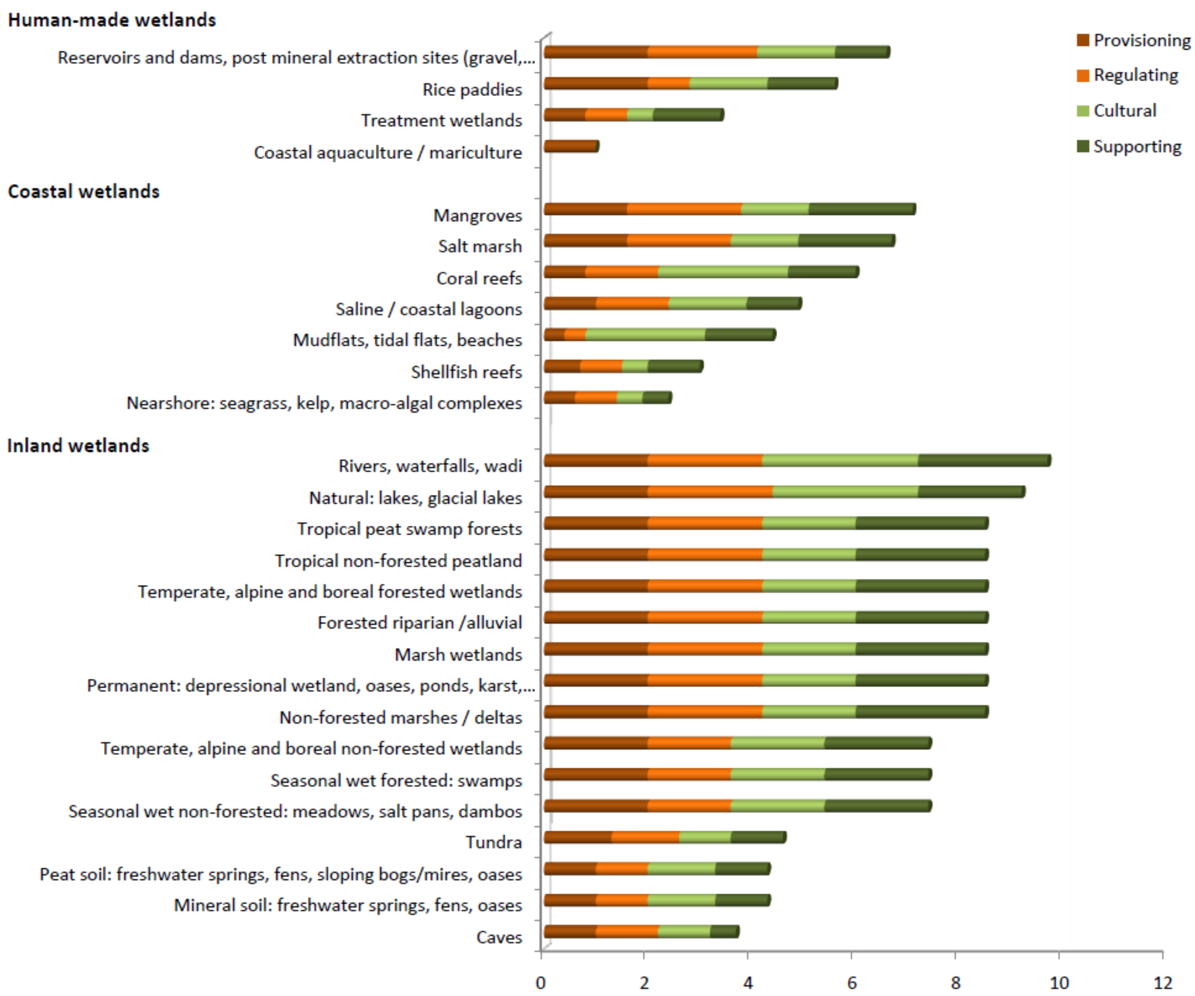


Figure 2. A summary comparison of relative wetland ecosystem services values across the DFN Decision Support Tool matrix of different wetland types, for the four categories of ecosystem service defined by the Millennium Ecosystem Assessment (MA) - provisioning, regulating, cultural, and supporting. Each ecosystem service was scored on a scale of 0-3. Since there are different numbers of services in each services category, the figure shows the average ecosystem service score for each category, the maximum possible score being 12. Data for coastal and inland wetland types were derived from *Ecosystems and Human Well-being: Wetlands and Water Synthesis* (eds. Finlayson, C.M., D'Cruz, R. & Davidson, N.C.), 2005, Millennium Ecosystem assessment: World Resources Institute, Washington D.C.. Comparable scores for human-made wetlands and some other wetland types not covered in that publication were compiled during this workshop.

Ecosystem service values:

i. Ecosystem service scores give an indicative picture of values. Precise values vary greatly by location as well as by type of wetland;

ii. However, the overall message is that the economic value of services from naturally-functioning wetlands is often very high; and

iii. The ecosystem service co-benefits of restoration for carbon gives potential to generate substantial positive economic externalities for local communities, downstream populations, businesses and industry and the national economy.

Examples of high values of services include:	
Provisioning services	i. the value of one **mangrove** area in Sarawak is estimated at around $25 million a year when fishery, forestry and tourism revenues are included; ii. Studies carried out in southern Thailand derive very high values of $27,000 - 35,000 per hectare for the total contribution of **mangroves** to the economy; iii. **Mangrove** forests have been shown to sustain more than 70 direct human activities, ranging from fuelwood collection to artisanal fisheries; iv. Estimates from Thailand cite local use values of between $230/ha/year (Christensen 1982) and $1,200/ha/year, contributing about $1,500 per household in southern parts of the country — equivalent to almost a quarter of per capita GDP; and v. **Mangroves** in Rekawa, Sri Lanka, yield values of over $1,000/ha/year, about three-quarters of which is accounted for by their contribution to lagoonal and near-shore coastal fisheries.
Hydrological regimes	i. In Portland, Oregon, Portland, Maine, and Seattle, Washington, it has been found that every US$1 invested in **watershed** protection can save anywhere from US$7.50 to nearly US$200 in costs for new water treatment and filtration facilities; ii. Through conserving **upstream forests** in the Catskills range, New York City hopes to have avoided investing an extra US$4-6 billion on infrastructure to maintain the quality of urban water supplies; iii. **Forest catchment** protection and erosion control services contribute more than US$100 million a year to the Ugandan national economy in terms of their contribution to water supplies for irrigation, energy, fisheries and water supply sectors; iv. In Mongolia, every US$1 invested in the conservation of the Upper Tuul **watershed ecosystem** would generate additional water benefits of US$15 a year for downstream Ulaanbaatar; v. Work carried out across four **natural wetlands** in the Zambezi Basin in Southern Africa shows that they have a net present value of some US$16 million for groundwater recharge; and vi. In the Lajeado São José **micro-watershed** in Brazil, environmentally sustainable upland management practices save almost US$2,500 per month in downstream domestic water treatment costs;
Pollution control & detoxification:	i. In Vientiane, the capital of Lao PDR, **wetlands** offer flood attenuation and wastewater treatment services to city-dwellers, to a value of around US$2 million per year; ii. Almost a million urban dwellers in Uganda rely on **natural wetlands** for wastewater retention and purification services; one marsh area in the centre of Kampala, the largest city, has been calculated to be worth several thousand dollars per hectare per year in terms of the services it provides in receiving and treating the major proportion of the city's wastewaters; iii. The annual value of the ecosystem services provided by Martebo **mire** in Sweden, including maintaining water quality and supplies, moderating waterflow and processing and filtering wastes, has been calculated at between US$350,000 and US$1 million; and iv. Work carried out across four **natural wetlands** in the Zambezi Basin in Southern Africa shows that they have a net present value of water purification and treatment services to an estimated US$45 million.
Natural hazards:	i. Work carried out across four **natural wetlands** in the Zambezi Basin in Southern Africa shows that they have a net present value of more than US$3 million for reducing flood-related damage costs; ii. **Mangroves** in Rekawa, Sri Lanka, yield values of something over $1,000/ha/year, about a quarter of which is accounted for by erosion control and buffering against storm damage; iii. In Southern Thailand, **mangrove** coastline protection and stabilisation services are thought to be worth up to $3,000/ha/year, and carbon sequestration just under $100/ha/year; iv. The storm protection function of Sri Lanka's **mangroves** was estimated at almost $8,000/km^2/year before the 2004 tsunami; and v. Studies carried out in the south of Vietnam show that the net present value of **mangroves** in protecting against extreme weather events lies at around $5,000/km^2.
Cultural Services:	i. **Mangroves** in Benut, Johor State in Malaysia, have been estimated to generate non-use values of almost $7,500/ha/year — more than five times as much as their combined direct and indirect values.

D. **Markets** (including current markets, markets under development, compliance with UNFCCC markets, existence of emissions / sequestration methodology and risk of current market distorting other ecosystem services)

Questions that are addressed in the DST matrix:

Current markets: Is there any available carbon marketplace where CO_2 credit from the considered wetland type can be traded?

Carbon markets under development*:* Is there any new initiative that may lead to CO_2 credit from the considered wetland type to be traded?

Other markets: Are there other initiatives (not linked to GHG emission reductions) that can generate money out of wetland conservation/restoration?

Methodology: Is there any current approved methodology to measure carbon sinks in the wetland type?

Compliance: Can the GHG emission reductions from the wetland type be traded within the current UNFCCC market?

Current risk: What are the current risks for the carbon market to negatively impact other environmental services provided by the considered wetland type? [Note that the score in this column has been set to zero when there is no (implementation) experience.]

Initial summary conclusions:

i. The current market conditions for CO_2 emission trade are heavily skewed towards forested areas, making it important to distinguish wetland types that can be considered as “forest”, according to the IPCC definition, from other wetland types. Currently, the largest range of opportunities lies with areas that can be classified as “forests”;

ii. From a climate change point of view, carbon sinks are just part of the (market) story; other parts include adaptation services (and associated funds);

iii. The MRV (Monitoring/Report/Verification) framework precludes any attempt to enter the carbon market: there is thus a need to establish and use clear and agreed methodology to monitor carbon, and to be able to report verifiable information;

iv. There is little experience available to evaluate potential risks for markets to distort other environmental services provided by wetlands. Importantly, such risks will be shaped by the type of project implemented and its associated environmental safeguards (e.g., does the funding rely on the project obtaining a given certificate (e.g., FSC, PEFC) or standard (CCB, CarbonFix)?). Environmental evaluation (What are the ecosystem services currently provided? How are they valued by dependent communities?) should be a priority pre-requirement to project establishment, in order to be able to monitor the distortion;

v. The current UNFCCC carbon market is heavily orientated towards forested areas but there might be opportunities for non-forested wetlands in the voluntary market, if there is a robust MRV framework to measure carbon and GHG emission reductions;

vi. Payment for environmental services (PES) approaches offer another possibility to protect/restore wetlands – because of such opportunities, it is important to have a good understanding of the environmental services provided by different types of wetlands; and

vii. The blue carbon fund and peatland-related funds/standards represent the most advanced opportunities for non-forested wetlands to enter the carbon market at present.

E. Examples of initial wetland carbon offsets story-lines derived from the DST matrix for different wetland types

Mangroves:

- Medium-High C storage per unit area, but low total globally;
- High C sequestration rates;
- Low trace gas emissions;
- High restoration potential (if hydrology functional), but Low emissions reduction globally from avoided degradation;
- High ecosystem services at community level;
- Well positioned for market development, so:

  Very High potential offset potential through restoration

Tidal Saltmarshes:

- Medium-High storage per unit area, but low total globally;
- High sequestration rates;
- Low trace gas emissions;
- Medium-High restoration potential, but Low for avoided degradation;
- Very High ecosystem service provision;
- Positioning for market development is weak, so:

  High potential for offsets through restoration, but faces a current market gap

Tropical peatswamp forests:

- High C storage per unit area, but Medium globally by total area;
- Medium sequestration rates (but highly variable);
- Low trace gas emissions;
- Medium-High restoration potential;
- High potential for avoided degradation;
- Medium-High ecosystem service provision;
- Well positioned for market development; so:

  High offset potential, especially through avoided degradation

Temperate alpine and boreal forested wetlands:

- Low-High C storage per unit area, and High globally by total area;
- Low-Medium sequestration rates;
- Medium-High trace gas emissions;
- Medium restoration potential;
- High avoided degradation potential;
- Medium ecosystem services provision;
- Good market positioning for some types; so:

High offset potential, especially through avoided degradation, if there is effective management of trace gas emissions

Such ‘story-lines’, including in the form of short narrative texts, could be prepared for each different wetland type covered by the DST matrix.

F. Recommended next steps

The following next step actions, during late 2009 and 2010, were recommended by Working Group 3 and the workshop:

i. Review and recheck the decision-support tool (DST) *qualitative* matrix for different wetland types (by WG3 participants);

ii. Share the DST matrix with all workshop participants, for any comments on its approach and uses as a decision-support tool;

iii. Prepare story-line summaries (carbon, restoration, ecosystem services, and market opportunities) for each wetland type (cf. the initial examples prepared and presented in the workshop);

iv. Review by Ramsar STRP of the DST, supporting documentation and story-lines – STRP mid-term workshops, late February 2010 [done]; and

v. Arrange follow-up workshop(s) to compile *quantitative* values, ranges of values etc. for carbon storage and sequestration in different wetland types – first half of 2010; possibly also extend matrix methodology approach to other non-wetland ecosystems (e.g. forests, grasslands and croplands) for comparison – e.g., to speak to the forest carbon community, and to set the potential scale of wetland carbon offsets in their broader ecosystems context. [Note. Further work on quantitative matrix development for different wetland types was undertaken by a small expert group (involving a number of DFN November 2009 workshop participants and other invited experts) during the STRP mid-term workshops in February 2010.]

6. Acknowledgements

The costs of the hosting of, and participation in, the expert workshop were provided by the Danone Group through the *Danone Fund for Nature* under contract to IUCN and the Ramsar Secretariat. The *DFN* is most grateful to all those who participated and contributed to an intensive, innovative and successful workshop. We are also grateful to the co-leads of the working groups, to Dwight Peck (Ramsar Secretariat) for rapporteuring the workshop plenary discussions and copy-editing this report, to Elodie Chene (IUCN), Nathalie Rizzotti (Ramsar Secretariat), and Monica Zavagli (Ramsar Secretariat) for acting as Working Group rapporteurs, and to Monica Zavagli for design and layout of the report.

Annex 1 - Workshop Programme

Sunday 8 November

Arrival

Monday 9 November, Morning Session (0900-1300 h)

0815-0900 h: *Registration*

Plenary Session (Chair: Nick Davidson, Ramsar Deputy Secretary General)

0900 h: 1**. Opening & Welcome**

- welcoming statements & introduction to DFN: Danone, Ramsar Secretariat, Ramsar STRP, IUCN

0930 h: 2. **Purpose, process and expected outcomes from the workshop** (Ramsar DSG)

0945 h: 3. **Keynotes** (25 minutes each)

- Integrating ecosystem credits into the global carbon markets (Laura Meadors, Laura Meadors Consulting)
- Opportunities and challenges for wetlands in carbon markets (Eveline Trines, Silvestrum)
- Wetlands and REDD (Pieter van Eijk, Wetlands International)

1115-1215 h: 4. **Setting the scene**: Presentations (10 minutes each) by members of the DFN Expert Panel outlining components of a DFN project and identifying critical guiding questions on key issues and gaps to be considered by the parallel working group sessions:

- wetland and mangrove restoration (Kevin Erwin)
- community co-benefits from "wet carbon" projects (Lucy Emerton)
- measuring and monitoring carbon in wetland restorations (Colin Lloyd)
- lessons from the DFN Senegal pilot project:
  i. monitoring mangrove ecosystem restoration (Remi Gouin, IUCN France)
  ii. measuring and monitoring carbon for a mangrove offset (Laurent Valiergue)

1215-1230 h: 5. **Briefing on draft 'wetcarbon' guidance documents for workshop review** (Frank Vorhies)

1230-1300 h: 6. **Establishment and briefing of the parallel working groups**

- Working Group 1: How to establish a large-scale carbon offset certification methodology for mangroves for 2010
- Working Group 2: Review and elaboration of the DFN restoration project guidance documentation for carbon projects
- Working Group 3: Identification of the current and future opportunities for developing and achieving wetland carbon offsets

1300-1400 h: Lunch

Monday 9 November, Afternoon Session (1400-1800h)

Parallel working groups (1st session) (See Annex for working group terms of reference and tasks)

1830-2000 h**: welcome reception and buffet dinner, IUCN/Ramsar headquarters**

Tuesday 10 November, Morning Session (0900-1300h)

Plenary (Chair: Rebecca D'Cruz, STRP Vice-Chairperson)

7. **Working group progress reports**:

- progress and key questions remaining
- exchange of contributions between groups - i.e. identifying conclusions from each group useful for others

Parallel working groups (2nd session)

1300-1400 h: Lunch

Tuesday 10 November, Afternoon Session (1400-1800h)

Parallel working groups (3rd session)

Plenary

8. **Working group progress reports**:

- draft findings and recommendations from each group

Wednesday 11 November, Morning Session (0900-1300 h)

Parallel working groups (4th session)

Finalisation of working group reports and recommendations

Plenary (Chair: Rebecca D'Cruz, STRP Vice-Chairperson)

9. **Final working group presentations**:

- findings and recommendations
- action plan for each working group topic

10. **Close of the workshop**

Annex 2 - Workshop participants and their biographies

Family Name	Given Name(s)	email	Organisation/ affiliation
Branca	Giacomo	Giacomo.Branca@fao.org	FAO
Bridgham	Scott	bridgham@uoregon.edu	University of Oregon, USA
Chung	Joanne	joannechong.yh@gmail.com; joanne.chong@uts.edu.au	Institute for Sustainable Futures, University of Technology, Sydney, Australia
Coates	David	david.coates@cbd.int	Secretariat, Convention on Biological Diversity (CBD)
Cui	Lijuan	lkyclj@126.com	STRP Invited Expert, China
D'Cruz	Rebecca	dcruz.rebecca@gmail.com	STRP Vice-Chairperson (Malaysia)
Emerton	Lucy	lucy@environment-group.org	DFN Expert Panel member
Erwin	Kevin	KLErwin@environment.com	DFN Expert Panel member. Kevin L. Erwin Consulting Ecologist, Inc., USA
Estrada	Manuel	mporruacop9@gmail.com	TerraCarbon USA: VCS peatland standard development
Gardner	Roy	GARDNER@law.stetson.edu	Stetson University (USA); STRP invited expert
Hanley	John Russell	jhanley@skm.com.au	Sinclair Knight Merz, Australia
Hart	Tracy	Thart@worldbank.org	The World Bank
Hugill	Bryan	bhugill@runbox.com; saafconsult@runbox.com	Natural Resource Management Department, Saafconsult BV, Bangkok
Lin	George Guanghui	lingh@xmu.edu.cn	XMU, China
Lloyd	Colin	colin@environmetrics.co.uk	DFN Expert Panel member
Lugo	Ariel	alugo@fs.fed.us	USDA Forest Service, International Institute of Tropical Forestry, Puerto Rico
Luchessa	Scott	sluchessa@Environcorp.com	Society of Wetland Scientists, Environ International Corp., USA
MacIntosh	Don	secretariat@mangrovesforthe future.org	Mangroves for the Future, Thailand
McCartney	Matthew	m.mccartney@cgiar.org	International Water Management Institute (IWMI), Ethiopia; STRP member
McInnes	Rob	robmcinnes@bioscanuk.com	Society of Wetland Scientists; STRP representative
Meadors	Laura	lmeadors@gmail.com	Laura P. Meadors Consulting, San Francisco, USA
Nawaz	Rab	jejeel3@gmail.com	Indus for All Programme, WWF-Pakistan
Oechel	Walt	oechel@sunstroke.sdsu.edu	San Diego State University, USA
Pettorelli	Nathalie	Nathalie.Pettorelli@unep-wcmc.org	Climate Programme, UNEP World Conservation Monitoring Centre
Poulsen	John	poulsen@iucnt.org	Coordinator, IUCN Indonesia Programme,

			Thailand
Ruitenbeek	H. Jack	ruitenbeek@mac.com	Environmental & Development Economics
Scholz	Sebastian	sscholz@worldbank.org	Carbon Finance Coordinator,Latin America Environment Department,The World Bank
Seeberg Elverfeldt	Christina	Christina.SeebergElverfeldt@fao.org	FAO
Swickard	Naomi	nswickard@v-c-s.org	AFOLU Program Coordinator, Voluntary Carbon Standards Association, Washington DC
Trines	Eveline	Eveline.Trines@Silvestrum.com	DFN Expert Panel member. Sylvestrum, Netherlands
Turpie	Jane	jane.turpie@uct.ac.za	Anchor Environmental, South Africa
Valiergue	Laurent	laurent.valiergue@orbeo.com	DFN Expert Panel member
van Ejik	Pieter	Pieter.vanEijk@wetlands.org	Wetlands International, Netherlands
Vergara	Walter	wvergara@worldbank.org	The World Bank
Vorhies	Frank	fvorhies@earthmind.net	DFN Project Coordinator
Ramsar Secretariat			
Tiega	Anada	tiega@ramsar.org	Secretary General
Davidson	Nick	davidson@ramsar.org	Deputy Secretary General
Rizzotti	Nathalie	rizzotti@ramsar.org	Projects Officer
Zavagli	Monica	zavagli@ramsar.org	Scientific & Technical Officer
IUCN			
Bishop	Josh	Joshua.bishop@iucn.org	IUCN-HQ
Smith	Mark	Mark.smith@iucn.org	IUCN-HQ
Chene	Elodie	Elodie.chene@ramsar.org	IUCN-HQ
Gouin	Remi	remi.gouin@yahoo.fr	IUCN-France
Ninni	Ikkala	Ninni.ikkala@ramsar.org	IUCN-HQ
Danone Group			
Giraud	Bernard	bernard.giraud@danone.com	
Rennaud	Jean-Pierre	Jean-Pierre.RENNAUD@danone.com	

Biographies of participants

Joshua Bishop

Education: PhD in Economics. University College London, UK; Master in Public Policy (MPP). Harvard University, Cambridge MA, USA; Bachelor of Arts (BA) in Literature. Yale College, New Haven CT, USA.

Joshua Bishop is a natural resource and environmental economist whose work focuses on the interface of conservation and development. As Chief Economist of IUCN, Dr Bishop seeks to promote market-based approaches to nature conservation, while also presenting the case for conservation in economic terms. Over the past 20 years Dr Bishop has conducted applied research and policy analysis on a range of topics in the economics of land use change, including studies of macro-economic policy and the environment, timber trade policy, forecasting supply and demand for forest products, valuation of non-marketed forest benefits, the economics of soil conservation, payment for ecosystem services and biodiversity business. Dr Bishop previously directed the Environmental Economics Programme at the International Institute for Environment and Development (IIED) in London, worked in West Africa as a consultant economist to the EC and the World Bank, as a conservation extension agent with IUCN in Mali, and as a development volunteer with the US Peace Corps in Mali.

Giacomo Branca

Giacomo Branca is an Agricultural and Natural Resource Economist of the Agricultural Development Economics Division of the Food and Agriculture Organizations of the United Nations (FAO). He received a doctorate degree in Agricultural Policy from the Tuscia University (Italy) and a M.S. in Agricultural and Resource Economics from the University of Arizona (USA). After working for the Department of Agricultural Economics of the Tuscia University as a post-doctoral fellow for three years, he served as an associate professor of Environmental Economics in the College of Economics. He has undertaken research projects and consulting contracts for various bodies, including Fao, Ifad, the Italian Institutes for Agricultural Economics (Inea) and Agri-food Markets (Ismea) as well as for the Italian private sector. He has also has managed international research programs (6th Framework Program, Leonardo da Vinci projects). He has conducted research and published papers on agricultural sector analysis with emphasis on natural resources management and development economics issues, agri-food markets, policy and value-chain analysis. Recently he has been investigating about the potentials of Payments for Environmental Services (PES) programs to represent incentives for the adoption of improved land management and poverty alleviation in rural areas, with a specific focus on the synergies/trade-offs between Carbon sequestration and food security. He is also contributing to the development of a tool aimed at estimating the Carbon impact of agricultural development projects. He is member of the Italian Society of Agricultural Economists.

Scott Bridgham

Scott Bridgham is a professor in the Center for Ecology and Evolutionary Biology at the University of Oregon. He has been studying wetlands for 20+ years and has published over 70 peer reviewed papers. Most of his research has focused on the dynamics of carbon, nutrients, and trace gases in wetlands, with a focus on freshwater peatlands. He has also studied the effects of climate change on wetlands and other ecosystems. He recently was the lead author on wetlands chapter in *The First State of the Carbon Cycle Report (SOCCR): North American Carbon Budget and Implications for the Global Carbon Cycle*, organized by the U.S. Climate Change Science Program.

Joanne Chong

Jo Chong is a Research Principal at the Institute for Sustainable Futures (ISF), a flagship research consulting institute of the University of Technology, Sydney. As an environmental economist, Jo has worked across the interconnected fields of wetlands and catchment management, waste management, water sensitive urban design, strategic urban water planning, and domestic climate change policy. Prior to joining ISF in 2006, Jo served as a Senior Research Economist providing policy and programme advice for the Australian Government. Jo's work in Australia has included MER of major sustainability and wetlands programmes; developing policy instruments to balance catchment activities with water quality impacts; and designing and facilitating deliberative process to elucidate catchment values. At ISF, Jo is currently managing a project to develop value-based contaminated site remediation approaches in the Asia-Pacific region. Jo has also previously worked for the Asia Regional Environmental Economics Programme of IUCN – The World Conservation Union, where she undertook community-based participatory social research and economic analysis for wetlands management projects in Sri Lanka, Cambodia and Nepal.

David Coates
David Coates graduated in biology from the University of Newcastle upon Tyne, UK, and alsoobtained a Masters from the same university in tropical marine ecology. In the late 1970's heworked on environmental management problems in irrigation schemes in the Nile Basin, Sudan. He went to Papua New Guinea in 1980 where he worked on a wide range of issues but particularly onlarge river fisheries development. He earned his PhD in 1986 as an external student of the OpenUniversity, UK, on the applied biology of tropical freshwater fish faunas based upon studies in Africa and Australia. In the same year he joined the field programme of the FAO where he worked for 11 years, mainly on the management and development of large river fishery resources, including food-security, sustainability and environmental issues. From 1997 to 2001, he worked with the fisheries programme of the Mekong River Commission dealing with water resource management aspects of fisheries in the lower Mekong basin. He then worked as team co-ordinator for a project mainstreaming biodiversity and environmental considerations into the fisheries, agriculture and water resources sectors in the lower Ganges Basin. Dr. Coates joined the Secretariat of the Convention on Biological Diversity, based in Montreal, in August 2003. His main area of work is on biodiversity, water, climate change and sustainable development.

Cui Lijuan
Cui has 19 years of professional experience in the field of wetland ecology, valuation, biodiversity and management; she was STRP member during the 2003-2005 triennium and manager of many wetland projects related to wetland restoration and management including socio-policy issues. She serves as supervisor for doctoral and master candidates and she has been carrying out consulting assignments for on project preparation, implementation, monitoring and evaluation. Project examples include: Sanjiang Plains Wetlands, Baiyangdian Wetland, and Ruoergai Mountain Wetlands. Experience with ADB, WWF, UNEP and other international organizations.

Nick Davidson
Prof. Nick Davidson has been Deputy Secretary General of the Ramsar Convention on Wetlands for nine years, and has overall responsibility for the Convention's global development and delivery of scientific, technical and policy guidance and advice as the Convention Secretariat's senior advisor on these matters. He has over 30 years experience of research on the ecology, assessment and conservation of coastal and inland wetlands and the ecology and ecophysiology of migratory waterbirds, with a 1981 PhD from the University of Durham (UK) on this topic, and continues to publish on these issues. Prior to his current post he has worked for the UK's national conservation agencies, particularly in coastal wetland inventory, assessment, information systems and communications, and as International Science Coordinator for the global NGO Wetlands International. He is also an Adjunct Professor at the Institute of Land, Water and Society, Charles Sturt University, Australia. He has a long-standing interest in, and strong commitment to, the transfer of environmental science into policy-relevance and decision-making.

Rebecca D'Cruz
Ms Rebecca D'Cruz is a natural resources management consultant. She specializes in policy and strategic planning, project/programme planning and evaluation, institutional strengthening and capacity-building, and communications, education and public awareness particularly in the fields of wetland and protected area management. She has extensive international experience of environmental policy and legislation and of working with governments, international organizations, NGOs, local communities and the private sector. She was formerly the Regional Coordinator for Asia and the Pacific at the Ramsar Convention on Wetlands, and a staff member of Wetlands International. She worked on the Millennium Ecosystem Assessment as Co-Chair of the Wetlands Synthesis report, and Co-Author of the chapter on Inland Water Ecosystems. She has worked regularly for international conservation organizations such as IUCN and Wetlands International, regional organizations such as the Asian Development Bank, and on UN-funded projects across the Asia region. She currently serves as the Vice-Chair of the STRP of the (Ramsar) Convention on Wetlands, and is a member of the IUCN Commission on Ecosystem Management.

Lucy Emerton
Lucy has degrees in social anthropology and development economics. She has been working as an environmental economist for the last 20 years in more than 50 countries in Africa, Asia, Australasia, Europe and Latin America, focusing particularly on the valuation of biodiversity and ecosystem services, innovative conservation financing mechanisms, the economics of water and wetlands, and socio-economic aspects of

carbon payments and distribution systems. Between 1990 and 2001 Lucy was based in Africa, where she worked on environmental economics for a variety of bilateral, NGO, UN and private sector organisations. Between 1998 and 2008, she was employed by the International Union for the Conservation of Nature (IUCN), where she established and led environmental economics programmes in East Africa, Asia and at the Global level. Based in Asia since 2001, Lucy is currently Chief Economist at the Environment Management Group, an association of experts providing technical support, business planning advice and research & development services in environmental sustainability to the corporate sector, governments and international agencies.

Kevin Erwin

Kevin is an internationally recognized wetlands ecology expert specializing in wetland restoration and management and has over the past four decades designed, implemented and studied hundreds of wetland and watershed evaluation and restoration projects. His recent work has focused on large-scale wetland/watershed restoration and management to improve the functional capacity of wetlands to implement source water protection, sustainable agriculture and to mitigate the impacts of climate change through wetland restoration (Wetlands and Global Climate Change: The Role of Wetland Restoration in a Changing World; Wetlands Ecology and Management-Feb 2009. In 1996 he developed and continues to instruct a Water Management Wetland Restoration Course for a consortium of Canadian agencies. His most recent projects include: an international wetland restoration and climate change project for IUCN-Ramsar that will establish carbon sequestration protocols for restored wetland habitats worldwide and lead scientist on the Density Reduction-Groundwater Resource area study, a mega-watershed study encompassing 83,000 acres in southwest Florida and the coordination of ecological assessments and coastal wetland restoration efforts following the Indian Ocean tsunami for Wetlands International and its cooperating parties. Kevin is certified by the Ecological Society of America as a Senior Ecologist and by the Society of Wetland Scientists as a Professional Wetland Scientist. He is a member of the Ramsar Scientific & Technical Review Panel filling the thematic expert post on wetland restoration and management, the coordinator of Wetlands International's Wetland Restoration Specialist Group, and serves on Wetland International's Supervisory Council.

Manuel Estrada

Manuel Estrada is an independent consultant, who was previously the lead negotiator for Mexico on Clean Development Mechanism and land use and forestry issues. Manuel also has participated in various working groups to develop methodological advice for land use and forestry projects, including the VCS AFOLU working groups on Afforestation/Reforestation and REDD, Manuel also works as carbon trading and methodology advisor in the land use and forestry area, including the development of standards and methodologies for offset projects in peatlands in Europe and South East Asia.

Royal Gardner

Roy is Professor of Law and Director, Institute for Biodiversity Law and Policy, at Stetson University in Florida. His teaching and research focus on wetland law and policy, with particular emphasis on biodiversity offsets and the Ramsar Convention. He began working on wetland policy at a national level while at the Pentagon from 1989-1993 and served on the (U.S.) National Research Council's Committee on Mitigating Wetland Losses. A member of the U.S. delegations to COPs 8 and 9, Roy participated in COP10 as an STRP member. He is the former Chair of the U.S. National Ramsar Committee and the recipient of the 2006 National Wetlands Award for education and outreach.

Lin Guanghui George

Dr. George Guanghui Lin is a professor and associate dean for the School of Life Sciences, Xiamen University, China. He obtained his BSc. and MSc. degrees from Xiamen University, and his Ph.D. from Miami University, USA. After the postdoctoral training in University of Utah, he worked for Columbia University as an associate research scientist between 1994-2003 for the "Columbia West-Biosphere 2" program before becoming a principal investigator at Institute of Botany, Chinese Academy of Sciences. In late 2007, he was offered with a professorship at current institution. His research areas include wetland ecology, global change biology, ecological and wetland Engineering, etc. He has published more than 90 scientific papers, many of them related to mangroves and salt marshes. Currently, He serves also as the director for the Key Laboratory of the Ministry of Education for Coastal and Wetland Ecosystems, and is in charge of several research projects on mangrove ecosystem functions and coastal wetland restorations. For these projects, his group is operating two eddy flux tower systems in Chinese mangrove forests, which measure continuously net ecosystem exchanges of CO_2 and water between mangrove forests and atmosphere. His group also applies stable isotopes to partition these fluxes.

Russell John Hanley

Russell has over twenty five years experience in Australia and the tropical Indo-West Pacific region as a marine ecologist during which time he has worked as a research scientist, a public servant assessing development proposals, a freelance consultant providing specialist advice, and lately as discipline leader for the Marine and Coastal Science Team at Sinclair Knight Merz.

He has enjoyed work in a number of other countries including Australia, Indonesia, Brunei, PNG, Vanuatu, New Caledonia, New Zealand, China (Hong Kong), Germany, Saudi Arabia, UAE, Nigeria and Ghana.

A major focus of his activities has been mangrove ecology (distributions, diversity and community structure of flora and associated fauna), mangrove habitat descriptions and mapping, pollution studies in mangroves (mine tailings, sewage), assessment of impacts on mangroves (port development, canal estates, reclamation areas, roads and causeways, and agricultural development). He has worked on mangrove reforestation projects in Australia, Indonesia, Myanmar and Nigeria.

Lately he has been investigating the economic valuations of mangrove resources with a focus on comparative land use analyses and the use of HEA to develop environmental offsets for loss of mangrove ecosystem services.

Tracy Hart

Tracy Hart is a Senior Environmental Specialist at the Environmental Department of the World Bank. She currently provides technical guidance globally on water and environmental issues to World Bank Group projects as needed. She also works on areas of new knowledge development, including carbon economic valuation and financing of coastal mangroves, wetlands, and coastal forests; indicator development to measure environmental 'mainstreaming' and impact across all development interventions; and climate change and mitigation aspects of nutrient pollution reduction. She is trained as a water resource economist, with a Ph.D in Agricultural and Resource Economics from the University of California at Berkeley. She also is the World Bank GEF International Waters thematic specialist, providing specialized technical guidance to more than 23 projects totaling $300 million and $750 million of GEF grant and IDA/IBRD lending, respectively. Tracy has lived in Senegal, Mauritania, and Ghana, and worked extensively in sub-Saharan Africa and South Asia. She can speak English, French, Arabic, Spanish, Portuguese, Hausa, Pulaar, Twi, and Wolof -- although not all at the same time. Her interest in this workshop is to expand collaboration across international financial institutions, international non-governmental organizations, researchers, governments, the private sector, and other parties to expand wetland carbon markets for the coastal protection of large swathes of coastal sub-Saharan Africa so as to finance community-level coastal climate adaptation.

Bryan Hugill

Bryan Hugill is a British / South African natural resource management consultant with 12 years of international experience in Southern Africa, Central and Western Europe, and South and Southeast Asia. He is currently the Head of the Natural Resource Management Department of SaafConsult BV (www.saafconsult.com), and is responsible for the implementation of CarboWet, a SaafConsult initiative that initially aims to develop a rigorous methodology for determining carbon sequestration potential in freshwater wetlands. He has worked with numerous conservation and development organisations, as well as the private and public sectors, including, among others, IUCN-The World Conservation Union, UNEP Regional Office for Asia and the Pacific, Wildlife Conservation Society (WCS), WWF Danube Carpathian Programme, International Federation of the Red Cross and Red Crescent Societies (IFRC) and the American Red Cross.

Bryan's areas of expertise are on the design, implementation, management and evaluation of programmes and projects related to species management and forest governance, protected areas management, community-based natural resource management and income generation/poverty alleviation, and sustainable organic agriculture.

Colin Lloyd

Colin Lloyd is currently Director and Consultant, Environmetrics LLP, Wantage, UK and an Honorary Fellow, Centre for Ecology and Hydrology, Wallingford, UK. Colin has a PhD from Edinburgh University on the Micrometeorology of a high Arctic site, and for nearly 40 years he has been involved in the measurement of the micrometeorology of the natural environment in all the world's major biomes - in particular climate change land-surface/vegetation/atmosphere interactions of greenhouse gases. He has conducted fieldwork in tropical, temperate and boreal forests, semi-arid deserts, arctic tundra, wetlands and European agriculture with extensive experience of working in the Amazon, Cameroon, Benin, Mali, Niger, USA, Spain, France, Finland, Sweden, Siberia, Svalbard and the UK. He has authored or co-authored more than 60 scientific journal papers and been Consortium and Task Leader for Multi-national research programmes in the Arctic and West Africa. Colin is also currently DFN Expert Panel Member for carbon measurements and methodology

Scott Luchessa

Mr. Luchessa is an environmental consultant with more than 23 years of experience. He is an expert in freshwater and intertidal wetland ecology and restoration. Mr. Luchessa specializes in managing all elements of permitting and design of wetland restoration projects as well as construction oversight and post-construction monitoring to demonstrate permit compliance and the ecological success of projects. ENVIRON's clientele includes a diverse array of private and public sector clients. Scott has been active member of the International Society of Wetland Scientists (SWS) having served as Executive Vice President and President of the Pacific Northwest Chapter since 2003. As the Pacific Northwest Chapter President, he has been active on the International Board of SWS since 2007. Recently, Mr. Luchessa was voted Chair-Elect of the Global Change Ecology Section of SWS. His duties as a Board member have included contributing to planning technical sessions and symposia at meetings and promoting a more active role of members of SWS in exploring the role of wetlands in carbon sequestration and storage. His interests include carbon storage in peatlands and potential for creation of carbon offsets through estuarine and riparian wetland restoration and reforestation of freshwater wetlands on marginal agricultural lands.

Ariel E. Lugo

Ariel E. Lugo is a native of Puerto Rico and Director of the USDA Forest Service International Institute of Tropical Forestry in Rio Piedras, Puerto Rico. He has a PhD from the University of North Carolina at Chapel Hill and was a former professor at the University of Florida at Gainesville. Lugo was also an Assistant Secretary of the Department of Natural Resources in Puerto Rico, and a staff member of President Carter's Council of Environmental Quality in the 1970s. He is an active scientist in tropical forest ecology with research focused on the effects of disturbances on tropical forests. Lugo is a highly quoted scientist and has to his credit over 400 scientific publications. He is also member of numerous editorial boards of science journals and routinely offers his time for national and international consultations in tropical forestry.

Donald J. Macintosh

Don is working as the Mangroves for the Future (MFF) Coordinator while on leave of absence from Aarhus University, Denmark, where he is professor with special responsibilities. From 1995-2000 he was a Danida funded professor in Environment & Development, also at Aarhus University. Previous to that, he has worked at Stirling University, Scotland and at the Asian Institute of Technology in Bangkok. He holds a PhD in mangrove ecology from the University of Malaya (Malaysia) and a BSc in Zoology from Aberdeen University, Scotland. Don has more than 35 years experience in education, research and international development, including working experience in about 30 countries, plus teaching and research supervision of university post-graduate students from countries in the Caribbean, African, Asian and Pacific regions. He is author of more than 90 scientific publications, including a Code of Conduct for the Sustainable Management of Mangrove Ecosystems. As Coordinator of MFF, Don oversees management of the MFF Regional Secretariat and implementation of the initiative. MFF is a partnership-based and people-centered initiative to promote the health, well-being and security of the coastal communities living in the Greater Indian Ocean region. MFF involves more than 10 countries: Bangladesh, Indonesia, India, Kenya, Maldives, Pakistan, Seychelles, Sri Lanka, Thailand, Tanzania, Viet Nam. While mangroves are the focus of MFF, the initiative deals with all coastal ecosystems and the integrated management needs of the coastal zone.

Matthew McCartney

Matthew is a Senior Researcher with the International Water Management Institute (IWMI). He is a hydrologist, specializing in water resources and wetland and hydro-ecological studies. His experience, primarily in Africa, comes from having participated in a broad range of research and applied projects often as part of a multi-disciplinary team. He joined IWMI in 2002 and was initially based in IWMIs office in South Africa. Here he was involved in water resource modeling, assessing the environmental and health impacts of irrigation schemes and the use of wetlands for livelihood support. In December 2005, he moved to IWMIs office in Ethiopia to participate in projects on water resource development in the Blue Nile, including the use of wetlands for small-scale agriculture. He has been IWMI's representative on the STRP since 2007.

Rob McInnes

Rob has over 18 years experience in environmental reseach, consultancy and conservation. He possesses specialist knowledge on the restoration, eco-hydrology and management of wetland systems and is pasionate about optimising the range ecosystem services delivered by wetlands. He has worked on over 400 wetland-related projects both within the UK and overseas and has knowledge extending across a range of wetland types. He is currently a Director of Bioscan (UK) Ltd, a small specialist ecological and environmental consultancy. Previously he was Head of Wetland Conservation at a UK-based NGO, the Wildfowl & Wetlands Trust (WWT), where he was responsible for the development, co-ordination and implementation of WWT's strategic wetland conservation work; Senior Wetland Specialist at Penny Anderson Associates ecological consultancy; and employed by the Wetlands Ecosystems Research Group, based at Royal Holloway, University of London, where he undertook original research on several projects as well as being project manager on a pan-European project developing functional assessment procedures for wetland ecosystems. Rob has represented the Society of Wetland Scientists (SWS) on the STRP since 2005, having been President of the European Chapter of SWS from 2005-08.

Heather McKay

Dr MacKay is a citizen of Zimbabwe and South Africa, currently residing in the USA. She earned a BSc (Hons) degree from Rhodes University, followed by MSc and PhD degrees in oceanographic sciences from the University of Port Elizabeth (South Africa). Her research publications include work on marine and estuarine hydrodynamics and ecology, water quality criteria for both coastal and inland wetland ecosystems, and river basin management. She served as Assistant Director: Water Policy and Senior Specialist Scientist in the South African Department of Water Affairs and Forestry. She was subsequently appointed to the Water Research Commission of South Africa, where she managed national research portfolios related to water policy and law, institutional development for water management, transboundary river basin management, environmental governance and biodiversity conservation. In 1999, Dr MacKay attended her first Ramsar Conference of Parties as a member of the South African delegation. Since then she has been closely involved with Ramsar. In addition to chairing the STRP in the 2006-08 triennium, she has been a member of the Panel's working group on water resources, helping to prepare guidance on river basin management, environmental water requirements and water quality. She continues to engage in graduate teaching and research activities, and has recently been appointed as a Visiting Scientist in the Faculty of Land and Food Systems of the University of British Columbia, Canada. Closer to home, she works with neighbours, local farmers and landowners on programs related to restoration of riparian habitats.

Laura Meadors

Laura Meadors is the Principal of Laura P. Meadors Consulting, an environmental economics consulting firm with expertise in conservation finance, environmental market design, ecosystem services valuation, renewable energy and carbon markets. She has consulted internationally on sustainable finance strategies for coastal ecosystem services, conducted due diligence on water rights transactions, and assisted the British government with its strategy for attracting the leading US cleantech and renewable energy firms to the UK. Ms Meadors has also served as an Associate at Evolution Markets where she provided brokerage, structured transaction, and environmental finance services for carbon markets, western renewable energy credit (REC) markets and Northern California emission reduction credit (ERC) markets. Ms Meadors also managed a groundbreaking water leasing and banking program for the Deschutes Resources Conservancy in Bend, OR and provided market analysis for a commodity arbitrage hedge fund and a global economic and litigation consulting firm. She holds a master's degree in natural resource economics from Yale University's School of Forestry and Environmental Studies and a bachelor's degree from Wellesley College.

Rab Nawaz (a.k.a Robert Whale)

Rab Nawaz currently works as Coordinator - Natural Resource Management for WWF Pakistan's Indus for All Programme, an ecoregion approach to conserve the lower Indus Basin by addressing poverty-environmental linkages. He has been working with WWF Pakistan for the last eleven years of which most time has been spent planning and implementing Integrated Conservation and Development Projects. Under his current portfolio Rab Nawaz is responsible for overseeing the implementation of natural resource activities and ecosystem restoration initiatives at the four priority site which includes restoring 7,500 hectares of mangroves forests along the coastline and rehabilitating the largest fresh water lake in the country. Rab Nawaz also handles some of the CSR and CDM activities of WWF Pakistan. Previous to this assignment he spent eight years working in the temperate forests of the outer Himalayas. Rab Nawaz holds a masters degree in Business Administration with specialization in Environmental Management.

Walter C. Oechel

Dr. Walter C. Oechel is Head of the Global Change Research Group and Distinguished Professor of Biology at San Diego State University. He has been educating, involved in policy, and conducting research on global change and elevated atmospheric CO_2 for over 30 years. He has conducted research on all continents save Antarctica in areas of ecophysiology, ecosystem metabolism, elevated CO_2 effects, global warming impacts and feedbacks on and from natural ecosystems, especially Arctic tundra, Mediterranean-type ecosystems, desert ecosystems, and tropical and subtropical ecosystems including mangroves. Dr. Oechel has published over 220 scientifically reviewed publications and is an ISI most highly cited author.

With NOAA ATDD, Dr. Oechel's Global Change Research Group has developed a remote sensing, eddy covariance aircraft, the Sky Arrow 650 ERA that has been used successfully for remote sensing and for in measuring CO_2 flux, methane concentration and energy balance in Arctic, chaparral, desert, marine, and mangrove ecosystems among others. Dr. Oechel initially conducted research on the water relations of mangroves in Costa Rica in 1967. Most recently, he has measured greenhouse gas emissions in the mangroves of Magdalena Bay in BCS, Mexico where he quantified net CO_2 and CH_4 fluxes by chambers and tower based eddy covariance, and CO_2 fluxes, energy balance, and hyperspectral reflectance by light aircraft flying at ~10m utilizing the Sky Arrow 650 ERA. Dr. Oechel has served on NAS/NRC standing committees (Polar Research Board and the Ecosystems Panel), has given testimony for the US Senate, FAO, for the German Government, and has twice reviewed the Dutch National Program on Climate Change. A popular account of Dr. Oechel's FACE work can be found in Fortune Magazine (December 8, 1997) and MIT's Technology Review (July 1996).

Nathalie Pettorelli

Nathalie Pettorelli is a French research fellow based at the Zoological Society of London who has worked for the last 10 years on biodiversity monitoring, wildlife management and animal conservation issues. Five years ago she started to work on the use of satellite data in ecology; she wrote a number of articles on the use of the Normalized Difference Vegetation Dynamics (NDVI) in animal population dynamics and its relevance to assess climate change consequences on wildlife. In August 2009 she joined UNEP-WCMC (6 months secondment) to work on UN-REDD and REDD co-benefits. The latest project she is currently involved with aims at reviewing environmental co-benefit criteria in REDD (and REDD relevant) funds/initiatives (a project commissioned by UK Defra). She therefore possesses relevant knowledge in carbon monitoring, MRV issues, REDD landscape structuring and REDD environmental co-benefits.

Nathalie Rizzotti

Nathalie Rizzotti is coordinating the Danone Evian partnership programmes for Ramsar. She implemented the "Ecole de protection de l'eau" initiative and manages the field projects. She also supports the Secretariat in communication and CEPA activities. She has been working in South America in different development projects and for the WWF West Africa Programme, assessing and evaluating community-based natural resource management for their Ron palm forest (Ramsar site) sustainable development project in Gaya, Niger. Previously in her career, she worked as project manager, developing and implementing the programme of river and wetland restoration for the Canton of Geneva. This job involved a lot of stakeholder mediation and negotiation and CEPA work. She was a member of the team writing for a science magazine, 'La Salamandre'. She continues to volunteer with a Swiss NGO "E-changer" to raise awareness in Switzerland of problems in the southern hemisphere. A Swiss citizen, she holds a bachelors' degree in Biology, an International degree in project management, Masters Degree in Engineering and Environmental Management and Masters Degree in International Development Studies.

Sebastian Scholz

Sebastian M. Scholz works as Carbon Finance Coordinator for the Latin America and Caribbean Regional Vice-Presidency of the World Bank. He has been actively involved in the design and implementation of climate change mitigation projects in the land-use sector, amongst them the first CDM-type wetland restoration project funded by the World Bank's BioCarbon Fund. He also works for the Latin American Climate Change Team, currently developing a Program of Wetland Restoration Activities in Colombia. This program will partly be funded by carbon offsets generated through wetland restoration activities. Sebastian has a PhD in Agricultural Sciences / Agricultural Economics and a MSc in Forestry and Natural Resource Management.

Christina Seeberg-Elverfeldt

After having worked for two years on a GEF project on Private Protected Areas in Chile as an Environmental Economist, she did a PhD at the University of Göttingen on Carbon Sequestration Payments for Agroforestry

Systems in Indonesia. This involved a model on the land use decisions of smallscale farmers and an institutional analysis of monitoring systems for PES schemes. During the last year she has been working at FAO on the climate change negotiations (focusing on agriculture), as well as being involved in work on carbon finance schemes for agriculture, agroforestry and forestry.

Mark Smith
Mark is the Head of the IUCN Water Programme. Prior to joining IUCN in April 2006, he was a scientist with areas of specialisation in agriculture, forestry and hydrology. Between 1991 and 2000, his work focused primarily on agroforestry, first in the Sahel in West Africa when he was at the University of Edinburgh, then in Kenya, while working at the UK Centre for Ecology and Hydrology. From 2001 to 2004, he was leader of the interdisciplinary Livelihoods and Environment research group at CSIRO Sustainable Ecosystems in Australia. Mark spent 2005 as policy advisor on climate change and poverty at the UK development NGO Practical Action, and was author of the book "*Just One Planet: Poverty, Justice and Climate Change*". He holds an undergraduate degree in agriculture, Masters in climatology and a PhD in Ecology.

Naomi Swickard
Naomi Swickard is the Agriculture, Forestry, and Other Land Use (AFOLU) Program Coordinator for the Voluntary Carbon Standard Association (VCSA), where she is charged with driving forward the AFOLU program including new guidance and tools, new project types (such as Peat Re-wetting and Conservation and Avoided Conversion of Non-Forest Land), and encouraging the development of new methodologies (in Agricultural Land Management, for example). Previously, she worked on carbon project development in East and Southeast Asia, and with Conservation International's Human Dimensions Program. Naomi holds an M.A. in International Development.

Eveline Trines
Eveline Trines holds a Master's Degree in Environmental Forestry and 20 years of hands-on working experience in forestry, the policy arena (e.g. UNFCCC) and the scientific community (e.g. IPCC). She is co-founder and director of Silvestrum based in the Netherlands (www.Silvestrum.com). Before that and now through Silvestrum, she is active in project development and management in the forestry sector and certification under various standards (*inter alia* VCS, CDM and CCB). The first 8 years of her career she spent predominantly in Latin America and Africa working in forestry and as FSC certification auditor. Since 1996 the prime focus of her work has been on climate change issues, incl working as programme officer at the UNFCCC secretariat on Land Use, Land-Use Change and Forestry (LULUCF). Most recently the focus has shifted to "Ariculture, Forestry and Other Land Use" (AFOLU) in general and to "Reducing Emissions from Deforestation and forest Degradation" (REDD) for the voluntary carbon market, but she also assists UN agencies and the European Commission with developing-country issues (in particular LDCs and SIDS) under the UNFCCC process, including adaptation, mainstreaming climate change, disaster preparedness, capacity building and project development and management.

Jane Turpie
Dr Jane Turpie is a senior lecturer at the Percy FitzPatrick Institute, University of Cape Town, South Africa, Research Fellow of the Environmental Policy Research Unit, UCT, and director of Anchor Environmental Consultants. She obtained a PhD in estuarine ecology and ornithology in 1994 before moving into the fields of conservation biology and resource economics with the benefit of training by the Beijer Institute of Ecological Economics. She has lectured the resource economics module for UCT's Conservation Biology Masters Course for the past 15 years. She has a particular interest in aquatic ecosystems and environmental flows, and has undertaken numerous valuation and ecological-economic modelling studies for a variety of applications. These include valuation studies of mangrove systems of the Zambezi Delta (Mozambique), Rufiji Delta (Tanzania) and Mngazana estuary (South Africa). Her current projects include mapping ecosystem services at national and regional scales, integrating ecosystem service values into conservation and development planning, and assessments of climate change impacts and adaptation and mitigation opportunities for Namibia. Dr Turpie is author of 33 scientific papers, several book chapters, and over 100 technical reports.

Pieter van Eijk
Pieter van Eijk works within Wetlands International as a technical officer under the Wetlands and Livelihoods programme. He currently leads the climate change adaptation work within the organization. In addition he works as a technical officer under WI's climate change mitigation programme and is involved in the development of innovative mechanisms for linking conservation and sustainable development. Pieter holds a

MSc degree from Wageningen University in the Netherlands, specializing in tropical ecology and international nature conservation.

Walter Vergara
Walter Vergara is Lead Engineer in the Environmentally and Socially Sustainable Development Department (LCSES) of the World Bank's Latin America and Caribbean Regional Office. Mr. Vergara works in several aspects of the climate change program and has participated in development of the carbon finance portfolio as well as initiatives on adaptation to climate change, transport and climate change, air quality, application of the Clean Development Mechanism (CDM) to wastewater, solid waste management and renewable energy. Mr. Vergara currently manages an extensive portfolio of climate initiatives in the region. He is a chemical engineer and graduate of Cornell University in Ithaca, New York, and the Universidad Nacional de Colombia in Bogota.

Francis Vorhies
Francis Vorhies is the Director of Earthmind. He has over 20 years of international experience as a sustainability economist. In 2005, Francis followed his wife's career back to Geneva and set up Earthmind, a not-for-profit sustainability network. Since then he has worked on a variety of sustainability issues primarily related to the interface between business and biodiversity. He has worked on assignments for Credit Suisse, Danone, EIB, E.ON, the Global Mechanism, the Governments of the Netherlands and Kuwait, ILO, ITC, IUCN, PERSGA, Shell, the Stockholm Convention, UNEP, UNCTAD, UN/ISDR, the World Bank and Yemen LNG. Previous experience includes: in Oxford, serving as the chief executive officer of the European affiliate of the Earthwatch Institute, managing a unique partnership programme with a group of 40 large multinational corporations in Geneva, establishing new global programmes on economics and business for IUCN, including undertaking joint feasibility studies with the IFC on investing in biodiversity business in Africa and Central Europe in Nairobi, working for the African Wildlife Foundation under a UNDP/GEF grant to build biodiversity economics capacity in the forestry sector in East Africa in Johannesburg, setting up Eco Plus, an innovative consultancy focused on business, economics and the environment, and also ran the first MBA course in the country on environmental management Dr Vorhies has a PhD and MA in Economics from the University of Colorado at Boulder and a diploma in integrated environmental management from the University of Cape Town.

Monica Zavagli
Monica joined the Ramsar Secretariat in 2007 where she worked as Assistant Adviser for the European region for two years; since 2009 she is the Scientific and Technical Officer to support the work of the Scientific and Technical Review Panel of the Convention; After her MSc at the Bologna University specializing in Natural resources management, Monica worked for the Italian Permanent Mission to the UN offices in Geneva and gained experience on marine coastal wetlands conservation with a number of governmental and non-governmental organizations in Jordan and in Costa Rica. Since 2007 she has been also involved in several coral reef resilience assessments with WWF and IUCN in Tanzania and Seychelles.

Annex 3 - Parallel Working Groups: Terms of Reference

	Group 1 **How to establish a large scale carbon offset certification methodology for mangroves for 2010**	***Group 2*** **Elaboration of the DFN restoration project guidance documentation for carbon projects**	***Group 3*** **Identification of the current and future opportunities for developing and achieving wetland carbon offsets**
	Co-leads: **Josh Bishop** (IUCN) **& Rebecca D'Cruz** (STRP Vice-Chair); Rapporteur: **Elodie Chene** (IUCN)	Co-leads: **Frank Vorhies** (DFN co-ordinator) & **Royal Gardner** (STRP expert); Rapporteur: **Nathalie Rizzotti** (Ramsar Secretariat)	Co-leads: **Mark Smith** (IUCN) & **Nick Davidson** (Ramsar Secretariat); Rapporteur: **Monica Zavagli** (Ramsar Secretariat)
Objectives	1.1. Review scientific requirements restoring mangroves, and for measuring C sequestration in mangroves for each component (aerial, vegetal, trees, soil, and export?) 1.2. Identify remaining components of certification methodology to be developed, contrasting VCS and CDM 1.3. Identify gaps between what is known and what is needed 1.4. Create a roadmap for developing an offset standard for mangroves (with VCS and CDM branches)	2.1 Review of existing restoration guidance documentation 2.2 Review DFN draft project standards, including: wetland restoration, C accounting, community benefits 2.3 Review of DFN technical specifications and proposal guidance 2.4 Recommend revisions and identify process and knowledge gaps 2.5 Create a roadmap for filling gaps and document finalisation	3.1 Review of state of the art knowledge of C sequestration in various wetland systems: e.g. mangroves, peatlands, flooded forests, salt marshes 3.2 Identify barriers to development for wetland carbon projects: i.e. what is preventing development of carbon markets for wetland restoration/protection actions? 3.3 Identify what are the success keys for involving local communities and achieving community co-benefits? 3.4 Identify other wetland and carbon offset initiatives and programmes underway and under development. 3.5 Assess and recommend mechanism for achieving maintenance of wetland carbon stores by avoided wetland degradation. 3.6 Recommend actions to develop markets for wetland C offsets, including prioritization according to which options are most feasible and cost-effective.

	Group 1 **How to establish a large scale carbon offset certification methodology for mangroves for 2010**	***Group 2*** **Elaboration of the DFN restoration project guidance documentation for carbon projects**	***Group 3*** **Identification of the current and future opportunities for developing and achieving wetland carbon offsets**
Process	• invited presentations covering objectives 1.1 and 1.2. • facilitated discussion to update information and establish baseline of what is known • facilitated discussion to identify gaps in knowledge • conclusion: roadmap to fill knowledge and process gaps and to have methodology approved.	• presentation of framework for guidance and stepwise review of content • facilitated discussion of process and knowledge gaps • agreement of recommendations and action planning for guidance finalisation	• facilitated discussions on: • 3.1, 3.2 & 3.3 • 3.4, including review of implications of REDD and UNFCCC CoP15 for 'wet carbon' options • Identification of recommendations on necessary conditions for maintaining carbon stores in wetlands through 'avoided wetland degradation' (3.5) • prioritization and recommended actions for (i) general market development and (ii) DFN. (3.6)
Outputs	• Methodology for a) baseline establishment, and b) measuring and monitoring carbon during restoration for mangroves • Action plan for achieving methodology approval for mangroves • Roadmap for approval of certification methodology with available knowledge and gaps compiled for each component. • Publication on scientific facts already agreed	• Listing of key issues to be considered in delivering a successful wet carbon restoration • Recommended amendments to guidance documentation • Compilation of knowledge and process gaps • Action plan for finalizing validated 'wetcarbon' project guidance documentation	• Compilation of options for C capture through wetland restoration/protection, including prioritization of opportunities according to feasibility and cost effectiveness • Compilation of current and upcoming wetland and carbon offset initiatives • Action plan for wet carbon market development • Summary of conditions for maintaining wetland carbon stores through avoided degradation
Group composition	• Mangrove experts • C sequestration experts • Standards and certification experts • DFN Expert Panel members	Small group: • Experts in carbon credit projects and their data needs • Experts in wetland restoration project development and implementation	Experts on: • wetland restoration • wetland economics • carbon dynamics in different wetland systems • REDD • carbon markets (CDM and VCS)

Annex 4 - Report of workshop plenary sessions

Monday, 9 November 2009

Agenda item 1: Opening and welcome

1. **Nick Davidson, Ramsar Deputy Secretary General**, welcomed the participants to the first expert workshop of the Danone Fund for Nature (DFN). He provided background on the purpose and evolution of the Fund, a partnership among the Danone Group, IUCN, and the Ramsar Convention, and said that the chief objective of the present meeting is to investigate how best to achieve carbon offsets for wetlands, especially mangroves.

2. **Bernard Giraud, Danone Group**, thanked the participants for their efforts and explained Danone's expectations from the meeting. He noted that Danone has adopted the aggressive goal of reducing the company's emissions by 30% during 2008-2011 and wishes eventually to offset them all; the Group has decided, however, not just to buy offset credits but rather to work proactively by supporting wetland restoration projects, which supports the company's principles regarding water resources.

3. Danone's plan has been to experiment with a first pilot mangrove restoration and to establish guidelines and a methodology for future projects. Mr Giraud reported on the results of the pilot mangrove restoration in Senegal, a project not without difficulties from which many lessons have been learnt. Regarding the development of a methodology for certifying credits from mangrove restoration, he felt that there was a lot of work ahead of us, and he hoped for significant progress from this workshop.

4. **Mr Giraud** explained that Danone is committed to responding quickly and effectively to the challenges of climate change, and he noted that, following the work with mangroves, we could move on to identifying new pilot projects and processes for other wetland types.

5. **Dr Davidson** complimented the Danone Group on its vision and noted the challenges which it had thrown down.

6. **Anada Tiéga, Ramsar Secretary General**, said that we are fortunate to have so many experts present in order to help us to understand the role of wetlands in relation to climate change. He noted that this is a first step, though an important one, and hoped to continue using this collective knowledge in strategic planning and daily operations. He wished the participants a fruitful meeting and urged them to continue working together and sharing knowledge.

7. **Nick Davidson** explained the role of Ramsar Convention's scientific subsidiary body, the Scientific and Technical Review Panel (STRP), and introduced the Panel's Vice Chair, Rebecca D'Cruz.

8. **Ms D'Cruz, Ramsar STRP Vice-Chair,** apologized for the absence of Heather MacKay, the STRP Chair, due to illness. She stressed the importance of this issue for the STRP, and she welcomed the additional knowledge and experience of the present group as the Panel strives to provide guidance and advice for the Contracting Parties. She noted that it would be difficult to name one Ramsar site in the world that will not be affected by climate change and emphasized that, whilst mangroves are very important, other wetland types are equally important for future work.

9. **Dr Davidson** noted that a key role of the STRP members in the meeting is to ensure that the talks are consistent with the Convention's wise use principle.

10. **Josh Bishop, IUCN**, welcomed the participants on behalf of Julia Marton-Lefèvre, the Director General of IUCN. He noted that the DFN partnership responds to many of IUCN's priorities, including biodiversity conservation and restoration, climate change mitigation and adaptation, livelihoods and

poverty reduction, sustainable energy supply, and mainstreaming ecosystem values into markets and economic policy. He alluded to the many challenges of this partnership, both scientific/technical and cultural, but foresaw that this could be a transformational initiative with great potential impact. He indicated that we are at the beginning of the road and that this meeting must identify key gaps, fill some of them if possible, and define a work plan for the future. He thanked the Ramsar Secretariat for organizing the meeting, Danone for its vision, IUCN France for its work on the Senegal project, Frank Vorhies the project manager, and all of the participants.

Agenda item 2: Purpose, process, and expected outcomes of the workshop

11. **Nick Davidson** made a PowerPoint presentation on the history, scope, and mission of the Ramsar Convention. He indicated that the world's wetlands are doing better than they would if the Convention did not exist, but they are not doing well. There is still a lack of recognition of wetland values among decision-makers in other sectors. He introduced the DFN Expert Panel, who are charged with drafting guidelines and advising on pilot projects.

12. **Dr Davidson** explained that, in order to guide the identification, development, and selection of appropriate restoration projects, we need guidelines and criteria. For this meeting, three Working Groups have been established: 1) on establishing certification methodology for mangroves for 2010; 2) on reviewing draft restoration project guidance; and 3) on current and future opportunities, especially for different wetland types and social and economic development.

Agenda item 3: Keynote presentations

13. **Nick Davidson** indicated that the keynote PowerPoint presentations would be made available for download from the Web.

14. **Laura Meadors** made a presentation on "*Carbon Markets 101: programmes, markets and opportunities to integrate ecosystem credits into global carbon markets*," in which she provided the background to how the carbon offset markets work both in Europe and among North American regional schemes. She distinguished between the UNFCCC/Kyoto Protocol-based Clean Development Mechanism (CDM) and the Voluntary Carbon Standard (VCS).

15. **Eveline Trines** made a presentation on "*Opportunities and challenges for wetlands in carbon markets*", in which she identified the principal challenges as developing workable standards, promoting good projects, delivering all goods, services, and functions, and generating marketable carbon credits, but without suffocating the fund with excessive rules and requirements which would lead to additional costs and huge timetables.

16. It was noted in discussion that changing the rules once they have been elaborated also drives up costs considerably; one must learn to live with the rules, even if they could be improved, for a reliable period of time.

17. **Bernard Giraud** observed that the people on the ground work for livelihoods and not carbon, and thus the importance of socio-economic aspects of projects for engaging people, for involvement and attracting investment.

18. **Peter van Eijk** made a presentation on "*Reducing emissions from wetlands: an overview of policy and practice*", in which he described Wetlands International's work in this area. He also highlighted the achievements of WI's Global Peatland Fund in Southeast Asia in attracting investment in peatland carbon projects and financing community-based conservation and restoration.

Agenda item 4: Setting the scene

19. **Nick Davidson** explained that DFN Expert Panel members would provide brief presentations identifying critical questions on key issues and gaps to be considered by the forthcoming Working Group sessions.

20. **Kevin Erwin, DFN Expert Panel,** made a presentation that explained the background and basic assumptions of the work on wetland and mangrove restoration, noting the working definitions of "wetland restoration", which is different from "wetland creation", and "ecological restoration". He noted that for the present purposes we are not following the Ramsar classification of wetland types (which was developed for Ramsar site designation purposes) but suggested rather a four-cell matrix of forest and non-forested, saline and freshwater wetlands. He emphasized that for carbon offsets to be achieved the restoration projects must be seen to be successful and that restoration is a complex, multidisciplinary affair, requiring sufficient time and money and with no feasible shortcuts.

21. **Lucy Emerton, DFN Expert Panel,** made a presentation on "*Community co-benefits from wet carbon projects*", stressing that the Danone Group's vision for its projects aims not only to achieve carbon offsets but also to bring benefits and improved ecosystem goods and services to the local communities.

22. **Colin Lloyd, DFN Expert Panel,** made a presentation on "*Wetland restoration guidelines: carbon balance monitoring and measurement*", focusing on the need for and difficulties of adequate quantitative measurements of carbon in wetlands for project achievements.

23. **Remi Gouin** of IUCN France presented a progress report on the DFN pilot project in Senegal, where a large number of communities have been engaged in replanting large numbers of mangrove propagules.

24. **Laurent Valiergue** made a presentation on the lessons from the Senegal pilot project for measuring and monitoring carbon for a mangrove offset.

25. **Mark Smith, IUCN**, summarized the key themes and challenges to be drawn from the foregoing presentations. In regard to the specific challenges for the way the wet carbon project scheme could be, he noted that we must identify what we know and what we do not know; that we need to find a way to bring wetland protection into the mix; that we need to ensure that there are benefits for local communities; and that we need to identify practicable measurements for validation.

26. **Mr Smith** observed that, in regard to what the DFN is intending to do, we must take advantage of this meeting to develop specific outcomes; ensure full complementarity with the Ramsar wise use principle; keep our eye on the prize and ensure transformational outcomes; and develop a plan for identifying workable standards without creating a system that suffocates the project proposal process.

27. **Nick Davidson** added that we must arrive at a methodology for mangrove projects that should be transferrable to other wetland types.

Agenda item 5: Briefing on draft wet carbon guidance documents to be reviewed

28. **Frank Vorhies, DFN project manager,** identified the draft documents for review and urged that in working with the required guidance we try to think in terms of what we would need to see if we wanted to invest in carbon offset projects. At the proposal stage, to the question 'what does the fund want to invest in?', we should be able to respond with 'here's what we've got for you' and provide an appropriate concept or project proposal. At the planning stage, we should be able to provide guidance for developing a Detailed Project Plan (DPP), identifying what information we would require, what benefits would ensue, what measurements of deliverables would be needed. He felt that, though ecosystem services and benefits for communities are a valuable part of projects, carbon measurement is more important at this time.

Agenda item 6: Establishment of the parallel Working Groups

29. **Nick Davidson** reviewed the formation and suggested membership of three Working Groups. WG1 will work on how to establish both small-scale and large-scale carbon offset certification methodology for mangroves for 2010 (co-leads Josh Bishop and Rebecca D'Cruz). WG2 will plan the elaboration of the DFN restoration project guidance documentation for carbon projects (co-leads Frank Vorhies and Royal Gardner), and WG3 will seek to identify the current and future opportunities for developing and achieving wetland carbon offsets comparatively across all wetland types (co-leads Mark Smith and Nick Davidson). He outlined the schedule for WG meetings and progress reporting in plenary session.

Tuesday, 10 November 2010, morning session

Agenda item 7: Working Group progress reports

30. **Rebecca D'Cruz and Nick Davidson** invited the co-leads to report back on their Working Groups' progress and identify any gaps or additional expertise they might require.

31. **Jean-Pierre Rennaud, Danone Group,** responded to a question about a geographical distribution of Danone's interest in project venues by noting that, though Danone does have a greater commercial presence in some countries than in others, we should in principle proceed as if there are no geographical preferences. To the question of how much carbon Danone is seeking to offset, he noted a figure for the company's global emissions per annum but said that it is nonetheless impossible to say at this stage how much the Group intends to try to offset, and that amount should not be necessary to know at this point for the purposes of the workshop.

32. **Roy Gardner** reported that Working Group 2 had reached a consensus on the concept of the draft guidelines, including the suggestion that the existing Carbon Community Biodiversity (CCB) standards should be adopted for that part of them. The Group discussed had how to generate more proposals and recognized the need for a more focused, shorter call for proposals, perhaps two pages with links to additional guidance. It noted the need to explain property rights: who owns the carbon offsets? The Group will turn to the longer technical guidance today.

33. **Frank Vorhies** added that the challenge is how best to package the material and said that the Working Group is discussing an approach to point proponents to the right story.

34. **Jean-Pierre Rennaud** expressed the wish to see hectares used to define the scale of projects. Nick Davidson noted that distinguishing between small- and large-scale projects is an issue for the other Working Groups as well.

35. **Mark Smith** reported that Working Group 3 is focusing on a higher-level look at the options for developing programmes for other wetland types, other offset potentials, and their likelihood of market development. The Group created a detailed matrix of wetland types and hydrological parameters and must now undertake a qualitative assessment to prioritize the opportunities for biggest wins, as well as to identify any barriers and the requirements for overcoming them.

36. **Nick Davidson** added that the restoration potential is the difference between the carbon storage and sequestration potential of a wetland in its natural state and one in a degraded state. He noted the desirability of adding some other ecosystem types, such as agricultural lands and forests, for comparison. He reported that the Group did not address the question of what other similar wetland carbon offset initiatives already exist and he urged the participants to inform Monica Zavagli about any others of they are be aware.

37. **Josh Bishop** reported that Working Group 1, tasked with establishing a large-scale carbon offset methodology for mangroves, had discussed the dynamics of carbon storage and sequestration and had assessed the requirements of CDM and VCS schemes relative to mangroves. The Group had divided into two subgroups, one to discuss immediate priorities relevant to the CDM (in effect, small-scale replanting of mangroves); to other to explore the potential to develop new methods for large-scale mangrove restoration under the VCS or CDM. The first subgroup worked towards developing guidance documents for project proponents, as a potential annex to the Project Design Documents (PDD) for CDM small-scale projects.

38. **Kevin Erwin** reported that the second WG1 subgroup focused on large-scale projects appropriate to the VCS and looked particularly at saltwater forests (mainly mangroves). The subgroup decided to focus on carbon pools rather than upon fluxes. The question comes down to how best to package classification into the VCS process; it must be kept simple in order the streamline the proposal review process. The subgroup will today begin to draft a new methodology, at least in outline, in the VCS context, and will deal with emissions from land-use change as well as with carbon stocks. He noted that abandoned shrimp farms are HGH emitters and present an easy win through hydrological interventions. He drew attention to the need to keep in mind the later use of such a methodology for other types of wetlands.

39. **Colin Lloyd** drew attention to the frequently high costs involved in measuring emissions in addition to stocks, and **Jean-Pierre Rennaud** inquired whether it would be possible to develop less costly proxies for measuring emissions. There was discussion of whether those costs always need to be high, considering that measurement for this purpose rather than for scientific research could spot check or monitor proxies (such as hectares of forest) rather than direct measurement. **Eveline Trines** noted that the CDM has developed tools that allow monitoring to omit gas emissions if they can be defined as “insignificant”.

Tuesday, 10 November 2010, afternoon session

Agenda item 8: Working Group progress reports

40. **Rebecca D’Cruz** invited each of the Working Groups to report on their progress during the day and to indicate what still lay ahead for this meeting.

41. **Ms D’Cruz** reported that Working Group 1 had worked on two main areas regarding mangroves: 1) something that can be used quickly as a methodology for small-scale projects, for which a bit more work is needed to incorporate soil organic carbon, and 2) a large-scale methodology, for which it has developed Terms of Reference for a team of writers. The Group will next develop a flow chart of future steps required.

42. **Roy Gardner** reported that WG2 has shifted its thinking on the Detailed Project Plan. Instead of developing new detailed guidance, the agreed approach now is to provide a simpler outline for developing the project concept and specify that the proposal should be consonant with the CDM or VCS standards on carbon, the CCB on community co-benefits, and the Ramsar *Principles and guidelines for wetland restoration* (2002). The group discussed providing standalone technical guidance notes on the Web, made available for project proponents as they become available, some of which can be extracted from the present draft Detailed Plan.

43. **Frank Vorhies** added that we need to define the decision-making process from the Project Idea Note (PIN) to the Detailed Project Plan (DPP). This requires an evaluation form and scorecard to be evaluated by DFN members – he suggested a 3x3 decision matrix whereby project concept notes are rated by Ramsar, Danone, and IUCN according to wetland issues, socio-economic aspects, and carbon benefits. Those concepts that are thus evaluated well would be sent to the DFN Board, which would

decide whether to proceed from concept note to full project proposal. At that point, an independent evaluator would be sent out to do "due diligence", to verify and help the proponents develop their full proposal, identify potential deal-breaker problems, and eventually conclude a contract. This "project manager" would monitor and verify the project's progress, and that role would be budgeted into the project costs. At the same time, however, we need to keep an eye on cost management for this administrative overhead, which should be defined in a practical way.

44. **Eveline Trines** noted that much of this needs further development and will require a timeline.

45. **Nick Davidson** reported that Working Group 3 developed a daunting matrix plotting wetland types against carbon storage value, using 0-3 codes or ranges within them to indicate potential by wetland type. These can be read for natural or degraded wetlands or avoided risk of degradation and to evaluate restoration potential in terms of costs, time required, 'leakage', etc., and for the range and importance of other ecosystem services in each wetland type. The exercise drew upon the Millennium Ecosystem Assessment's scheme of ecosystem services. He foresaw that the next step would be to develop an action plan for further development and verification of the matrix.

46. There was further discussion of the relative importance of accounting for carbon fluxes, carbon moving in and out of the wetland, and carbon storage. Wetlands are frequently more dynamic in the sense of carbon fluxes than are other ecosystems.

47. **Jean-Pierre Rennaud** liked the idea of a matrix that mixes all of these qualitative parameters but stressed the need to understand how to interpret them in order to arrive at a final rating. **Nick Davidson** indicated that the numbers can be translated into a narrative story line across the range of measures for each type of wetland.

48. **Rebecca D'Cruz** invited the Working Groups to report at the end of tomorrow morning on 1) their main findings and recommendations, 2) an action plan and additional gaps to be addressed, and 3) an indication of who needs to do what in future.

49. **Walt Vergara**, **World Bank**, made a presentation on wetlands and climate change in Latin America, and outlined a number of World Bank projects under development designed to maintain or restore carbon stores in wetlands and specifically mangroves.

Wednesday, 11 November 2009

Agenda item 9: Final Working Group presentations

50. **Working Group 1: Rebecca D'Cruz** reported that Working Group 1 proposed a three-track approach to its task:

i) regarding small-scale projects, e.g., the Senegal pilot project on mangrove restoration, to apply the existing small-scale methodology of the CDM approach;

ii) revision of the small-scale methodology of the CDM approach to include Soil Organic Carbon (SOC), to be submitted either to the VCS and/or the CDM; and

iii) development of a large-scale methodology, more traditional and ecosystem-based, to be submitted to the CDM or to the VCS.

She felt that the first track should be easy to deliver, the second hopefully so; track 3 will extend into 2010 but the review can begin sooner than that. She explained the proposed action plan but noted that fixed deadlines were not possible at this point.

51. **Frank Vorhies** applauded this roadmap for the next steps but inquired whether there is any guidance that can now be given to project proponents, such as a guide to carbon measurement. **Ms D'Cruz** indicated that the synthesis of the literature can be got under way right away and the draft TOR for the consultant can be ready by mid-2010.

52. There was renewed discussion of the inclusion of wetlands in the carbon credit system and the idea that the big challenge is to get carbon fluxes included into the bureaucratic procedures. **Ms D'Cruz** promised that that would be taken on board.

53. **Colin Lloyd** drew attention to the fact that there are too few models for some of the parameters and suggested that a large number of models can be ruled out if we focus on CO2 and CH4 and leave aside other matters, e.g., lateral flows. **Kevin Erwin** noted that this issue had been removed from the consultant's TOR and placed in the synthesis part of the action plan for immediate consideration.

54. **Working Group 2: Frank Vorhies** reported that Working Group 2 had outlined the contents of a much simpler guidance document for wet carbon projects, ca. 10 pages long, which will explain the DFN procedures and call for a concept note and a proposal outline. Following evaluation of the concept, if the DFN Board likes the concept there will be a "due diligence" visit, and if the evaluation is still positive, the proposal will go to development of a full plan and eventually to a contract. The CCB standards for socio-economic matters, the Ramsar guidelines on wetland restoration and the VCS/CDM standards for carbon certification, will form the basis of the guidance to be followed by proposed projects.

55. **Tracy Hart, World Bank,** inquired whether wetland protection would be considered as well as restoration. **Mr Vorhies** noted that both would be relevant and that the Ramsar restoration guidelines include a lot of language on protection as well; that relationship could be expressed in an additional technical note for proponents.

56. **Roy Gardner** reported the Group 2 also developed a call for proposals, as the present draft needed finalization and a deadline for submission of proposals; he suggested a deadline of 31 January 2010. He noted that the Group identified a number of 'technical guidance notes' to be prepared and provided on the DFN Web site, some of which could be taken from the present draft document.

57. **Tracy Hart** urged a number of revisions to the language of the call for proposals.

58. **Working Group 3: Lucy Emerton** reported that Working Group 3 had aimed for a decision-support tool for the DFN in order to get the biggest 'bang for the buck' for DFN investments, not only in carbon offsets but also in terms of community co-benefits and biodiversity.

59. **Scott Bridgham** explained that the Group considered peatlands, forested and non-forested wetlands with mineral soils, amongst others, and concluded that, in terms of low trace gas emissions and soil carbon sequestration, salt marshes and mangroves make a good case for carbon credit projects. He noted that more research is needed on trace gas fluxes and carbon sequestration for naturally functioning, degraded, and restored wetlands of different types.

60. **Scott Luchessa** explained the Group's conclusions, assumptions, and definitions on the potential for restoration in various situations and types of wetland.

61. **Lucy Emerton** explained the table showing different wetland types and conditions and their influence upon the ecosystem services aspect of projects.

62. **Rob McInnes** described how the working group had also examined the implications of compiling the much more detailed wetland type categories used in the WG3 matrix into the 4-cell matrix of broad wetland categories suggested as providing a framework for the wetland restoration guidance component in WG2 (see paragraph 20 above). He explained that for three of the four broad categories there are a large number of different wetland types within the category, and that because some of these have, for example, very different carbon storage and sequestration capacities, there is wide

variability in most of the parameters within each of these three broad categories. Only for the 'forested saline wetlands' category was there a high percentage (70%) of a single parameter value, and this was because only mangroves fell within this category. This variability should be taken into consideration in any restoration guidance designed for the purpose of achieving carbon offsets.

63. **Lucy Emerton** noted the challenge of synthesising all of the information categories in the WG3 matrix in order to guide decision-making and prioritisation, through showing the steps or 'story line' for each of the wetland types.

64. **Nick Davidson** observed that as the matrix and story lines had been developed rapidly and "from scratch" in a small group during this workshop, a next step needed would be to further review and verify the qualitative code scores in the matrix. He said that the WG3 carbon subgroup would like a wider expert group to look at its results regarding the qualititative aspects of carbon storage and sequestration and recommended that the STRP should also be invited to consider it, including during its mid-term workshops in February 2010.

65. **Dr Davidson** said that the working group recommends that a next step should be a follow-up expert workshop focusing on refining the carbon aspects of the WG3 matrix, and on compiling and summarizing available quantitative information on the different aspects of the carbon cycle in wetlands. He suggested that as well as a focus on wetlands, this workshop could valuably look comparatively at the scale of carbon storage in wetlands in relation that of other ecosystems, notably forests (since carbon markets now focus on forests) and other systems such as grasslands and croplands. This would be helpful for DFN decision-making and also for project proponents.

66. **Rebecca D'Cruz** summarized that the Secretariat will compile the meeting report and annexes from materials provided by the working groups.

Agenda item 10: Closing remarks

67. **Jean-Pierre Rennaud**, on behalf of Danone, thanked the participants for their work and felt that we can see the way forward for creating value and adding science to the results. He noted that we have developed guidelines and identified the need to develop a simpler decision-making process, and that we need to consider different types of projects, in order to ensure a mix between high-branded projects with important NGOs and more locally-run projects. He indicated that we will be extending the existing methodology for 2010 projects and bringing science to develop a new large-scale methodology.

68. **Mr Rennaud** urged that the time has come to take advantage of this raw material to drive a powerful communication process for supporting the DFN by reaching out to stakeholders. He summarized that we are close to finalizing small-scale proposal procedures and he would like to be able to validate three new proposals within the next three months; that we are developing a large-scale methodology for the Voluntary Carbon Standard; and that we need to begin a communications effort to support the Fund. He observed that the project manager, Frank Vorhies, cannot do all of that by himself, so we need to identify who will be the owners of these different components.

69. **Mark Smith**, on behalf of IUCN, expressed gratitude to Danone for continuing to support the DFN partnership and challenging it to be efficient and innovative. He thanked the Ramsar Secretariat for organizing the meeting and Nick Davidson for leadership, and the participants for coming all this way and contributing so much. He noted that the Danone challenge is not a simple one; we've seen that these are complicated issues, especially translating them into an intelligible process. He felt that this meeting has delivered a huge service in making sense of that complexity. On the critical issue of ensuring a scientific background for all decisions, he felt that we cannot wait for completeness but must see how to proceed carefully. He said that this meeting has expanded the scientific community behind the Danone Fund for Nature by a factor of ten.

70. **Nick Davidson**, on behalf of Ramsar, thanked everyone for their interest and hard work and hoped to continue the involvement of this group in various ways. He thanked the Secretariat staff for their assistance, especially Dwight Peck for rapporteuring the plenary discussions, Catherine Loetscher on logistics and Montse Riera on documentation, and the regional assistants helping the working groups. He thanked the co-leads and rapporteurs of the Working Groups and expressed our gratitude to the IUCN cafeteria staff for keeping everyone supplied with food and refreshments. He looked forward to keeping the momentum going over the next months and to seeing everyone again in the future.

71. **Rebecca D'Cruz** insisted upon having the last word and also thanked all of the participants. She echoed Mr Rennaud's comments on communcations and would like to see all of this work translated into the wise use of wetlands on the ground.

72. **Catherine Loetscher** said that the IUCN cafeteria would welcome the participants for lunch before their return journeys - and thus had the last word.

Annex 5 - Draft terms of reference for preparing revised small-scale CDM and large-scale CDM/VCS methodologies for mangroves

A. Terms of reference for a revised small-scale CDM methodology for mangroves

Background documents available:

- Methodology AR-AM002 related to Soil organic carbon
- CDM AR tool to show emission are not significant
- Colin Lloyd's document justifying the importance of integrating the SOC pool into the project design

Activities:

- Incorporate SOC pool into the existing small scale methodology
- Be involved in the validation process

Other steps:

- Under the validation process, contract validator for VCS validation (DFN)
- Check with the proponent of the existing CDM methodology as to why SOC pool was not been included

Timelines [Note – these timelines were predicated on this work being initiated immediately following the November 2009 DFN workshop]**:**

- Submit the revised methodology to the DFN [by the end of November 2009]
- Submission to the VCS [in January-February 2010] and /or to the CDM-EB [in April 2010] with the Oceanium (Senegal) PDD

B. Work plan to develop a large scale carbon offset methodology for mangroves (CDM and VCS)

Objective and background

Activities

Conduct desk review:

1. of existing methodologies and tools under both VCS and CDM in order to identify those that may (partly) address the needs of a large scale methodology
    - additionality
    - leakage
    - any other tool relevant to the methodology
2. of scientific data on default values for different carbon pools
3. of existing methods for measuring carbon pools
4. to identify mangrove restoration activities relevant to carbon offset.
5. to identify relevant and significant carbon pools, potential emissions and fluxes in mangrove ecosystems;

Assess the impact of restoration activities on the carbon pools and those emissions for carbon pools and develop applicable methodology to measure fluxes.

Identify applicability conditions.

Identify, propose and integrate realistic options into the methodology.

Carbon measurement:
Option 1: use current carbon tools available under CDM and VCS to assess carbon pools as well as GHG emissions.
Option 2: propose adequate cost-effective methodology for measuring vertical fluxes for all GHG.
Option 3: propose adequate cost effective methodology for measuring lateral and vertical fluxes for all GHG. Propose default values to estimate lateral fluxes and their fate.

Monitoring :
Draft monitoring protocols for each of the above-mentioned options chosen for the methodology.

Draft new methodology.

Be available for the validation process of the methodology.

Outputs
- inception report detailing the approach to be taken and identify constraints or other issues in the execution of the proposed activities
- report on desk review results
- report on applicability and feasibility of the three options
- Large scale carbon offset methodology for mangroves (for CDM and VCS)

Timeline and schedule
4 months for drafting the methodology

Qualifications
- Previous experience in writing and/or validating methodologies
- Ability to provide expertise for
  - Lateral and vertical GHG fluxes measurements,
  - carbon measurement and monitoring within an offset methodological framework
  - and mangrove restoration
- Ability to synthesize existing literature related to three areas of expertise above mentioned

Other actions:
- Make available documents concerning the validation process
- The DFN needs to contract a validator (under VCS process) early in the process, as soon as a draft methodology is available
- Submit a draft to the validator to establish contract

Annex 6 - Baseline and monitoring methodology for restoration project activities implemented on wetlands such as mangroves

I. Applicability conditions, carbon pools and project emissions

1. The simplified baseline and monitoring methodologies are applicable if all the conditions (a)-(g) mentioned below are met.

   (a) Project activities are implemented on salt water forests such as mangroves[1]. The DNA of the host country shall provide a statement that project activities conform to national policies and legislation applicable to wetlands. If the host country is a Party to Ramsar or other conventions applicable to wetlands, the DNA shall additionally provide a statement that project activities conform to the provisions of the convention/s.

   (b) Project activities are implemented for restoration through assisted natural regeneration or seeding or tree planting on degraded[2] salt water forests, which may be subject to further degradation and have tree and / or non tree component that is declining or in a low carbon steady-state.

   (c) Direct measures/activities undertaken by the project proponents for the establishment of forest on degraded or degrading salt water forests shall not lead to any changes in hydrology of land subjected to afforestation or reforestation project activity under the control of the project participants. Some examples of direct activities that are not permitted include drainage, flooding, digging or ditch blocking. Therefore, the A/R project activities are specifically restricted to the following wetland categories:

      (i) Degraded intertidal wetlands (e.g. mangroves);

      (ii) Undrained peat swamps that are degraded with respect to vegetation cover[3];

      (iii) Degraded flood plain areas on inorganic soils and

      (iv) Seasonally flooded areas on the margin of water bodies/reservoirs.

   (d) This methodology is not applicable to project activities that are implemented on wetlands where the predominant vegetation comprises of herbaceous species in its natural state.

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[1] In this methodology, "wetlands" are classified as per the definition of the category "wetlands" provided in 2006 IPCC Guidelines for National Greenhouse Gas Inventories, and Good Practice Guidance for Land Use, Land-Use Change and Forestry (IPCC 2003), which includes land that is covered or saturated by water for all or part of the year and that does not fall into the forest land, cropland, grassland or settlements categories. Rice cultivation areas are excluded.

[2] Degraded wetlands in this methodology refers to degradation only with respect to vegetation cover. To demonstrate that the applicability condition (b) is obeyed, prove that the A/R project lands are really degraded using appendix A

[3] Methodology is not applicable to managed peatlands as defined in section 7.1 of IPCC, 2006 Guidelines for National Greenhouse Gas Inventories

(e) Project activities are implemented on lands where in the pre-project situation, areas used for agricultural activities (other than grazing) within the project boundary are not greater than 10% of the total project area.

(f) Project activities are implemented on lands where displacement of grazing animals does not result in leakage (see Section IV). If the possibility of leakage from displacement of grazing animals is not excluded using approach provided in para 19 below, the methodology is not applicable.

(g) Project activities are implemented on lands where <10% of the total surface project area is disturbed as result of soil preparation for planting. However, in project areas with organic soils, site preparation activities such as ploughing and drainage before or after the trees are planted are not allowed.

2. **Carbon pools** to be considered by these methodologies are above- and below-ground biomass (i.e. living biomass) of trees.

3. **Project emissions** attributable to A/R activities implemented on wetlands are assumed to be negligible hence, they are accounted for as zero in this methodology. According to IPCC GPG for LULUCF, GHGs emitted from wetlands may consist of CO_2, CH_4 and N_2O but the applicability conditions of the methodology ensure that hydrology of the project area is not changed as a result of the direct measures/activities undertaken by the project proponents for the establishment of the A/R project activity, therefore the chemical properties of the wetland soils influencing the GHG emissions will not change (Haldon et al., 2004[4]) hence, the above assumption is valid.

4. Before using simplified methodologies, project participants shall demonstrate whether:

(a) The land of the project activity is eligible, using the approach for the demonstration of land eligibility contained in appendix B;

(b) The project activity is additional, using the procedures for the assessment of additionality contained in appendix C.

II. Baseline net greenhouse gas removals by sinks

5. The most likely baseline scenario of the small-scale A/R CDM project activity is considered to be the land-use prior to the implementation of the project activity, that is degraded or degrading wetlands, where, the changes in carbon stocks in the living biomass pools of trees and non tree vegetation under the baseline scenario are expected to be in steady state or declining. Therefore changes in the carbon stocks in the living biomass pool of trees and non-tree vegetation shall be assumed to be zero in the absence of the project activity.

III. Actual net greenhouse gas removals by sinks (*ex ante*)

[4] Holden, J, Chapman, P.J. and Labadz, J.C. 2004. Artificial drainage of peatlands: Hydrological and hydrochemical process and wetland restoration. Progress in Physical Geography 28: 95–123.

6. Stratification of the project area should be carried out to improve the accuracy and precision of biomass estimates.

7. For the *ex ante* calculation of the project biomass, the project area should be stratified according to the project planting plan that is, at least by tree species (or groups of them if several tree species have similar growth habits), and age classes.

8. Actual net GHG removals by sinks consider the changes in above and below ground carbon pools and SOC in the project scenario.

9. Changes in carbon pools should be calculated as follows

$$\Delta C_{PROJ,t} = \frac{C_t - C_{t-1}}{T} \qquad \textbf{(1)}$$

where:

$\Delta C_{PROJ,t}$ = Removal component of actual net GHG removals by sinks at time t; t CO_2-e yr^{-1}

C_t = Carbon stocks in the above and below ground carbon pools at time t; t CO_2-e

T Time difference between t and $t-1$; years

10. Degraded or degrading mangroves may have significant number of trees at the time of start of the project activity. The carbon stocks in the above and below ground carbon pools for trees within the project boundary at the starting date of the project activity[5] ($C_{t=0}$) and for all other years at time t (C_t) shall be calculated as follows:

$$C_t = \sum_{i=1}^{I}((C_{AB,i,t} + C_{BB,i,t}) * A_i * 44/12) \qquad \textbf{(2)}$$

where:

C_t = Carbon stocks in the above and below ground carbon pools for trees at time t; t CO_2-e

$C_{AB,\,i,\,t}$ = Carbon stocks in above-ground biomass of trees for stratum i, at time t; t C ha^{-1}

$C_{BB\,i,\,t}$ = Carbon stocks in below-ground biomass of trees for stratum i, at time t; t C ha^{-1}

A_i = Area of stratum i; ha

i = Index for stratum (I = total number of strata in project area)

For above-ground biomass

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[5] The starting date of the project activity should be the time when the land is prepared for the initiation of the afforestation or reforestation project activity under the CDM. In accordance with paragraph 23 of the modalities and procedures for afforestation and reforestation project activities under the CDM, the crediting period shall begin at the start of the afforestation and reforestation project activity under the CDM (see UNFCCC web site at <http://unfccc.int/resource/docs/cop9/06a02.pdf#page=21>).

11. $C_{AB,i,t}$ is calculated per stratum *i* as follows:

$$C_{AB,i,t} = B_{AB,i,t} * 0.5 \tag{3}$$

where:

$C_{AB,i,t}$ = Carbon stocks in above-ground biomass of trees for stratum *i*, at time *t*; t C ha^{-1}

$B_{AB,i,t}$ = Above-ground biomass of trees in stratum *i* at time *t*; t dm ha^{-1}

0.5 = Carbon fraction of dry matter; t C $(t\ dm)^{-1}$

There are 2 options for estimating aboveground biomass at time *t.* Option 1 shall be used for estimating above ground biomass ($B_{AB,\ i,t=0}$) and carbon stocks ($C_{t=0}$) in trees at start of the project activity.

Option 1:

$$B_{AB,i,t} = \sum_{j=1}^{Sps} B_{AB,i,j,t} \tag{4}$$

$$B_{AB,i,j,t} = SV_{i,j,t} * BEF_{2,j} * D_j \tag{5}$$

where:

$B_{AB,i,t}$ = Above-ground biomass of trees in stratum *i* at time *t*; t dm ha^{-1}

$B_{AB,i,j,t}$ Above-ground biomass of trees of species *j* in stratum *i* at time *t*; t dm ha^{-1}

$SV_{i,j,t}$ = Stem volume of species *j* in stratum *i* at time *t;* m^3 ha^{-1}

$BEF_{2,j}$ = Biomass expansion factor of species or group of species *j* for conversion from stem volume to total volume; dimensionless

D_j = Basic wood density of species or group of species *j;* t d.m. m^{-3}

i = Index for stratum

j = Index for species (*Sps* = total number of species in stratum)

12. Documented existing local species-specific data from peer-reviewed studies or official reports (such as standard yield tables) for $SV_{i,j,t}$ or $SV_{i,j,t=0}$ should be used[6] . At time t = 0, $SV_{i,j,t=0}$ for tree species or groups of species present at the time of start of the project activity shall be used. In the absence of such values, regional/national species-specific data for $SV_{i,j,t}$ or $SV_{i,j,t=0}$ shall be obtained (e.g., from regional/national forest inventory, standard yield tables such as standard yield tables). If regional/national values are also not available, species-specific data from neighbouring countries with similar ecological conditions affecting growth of trees may be used. In absence of any of the above, global species-specific data (e.g., from the GPG-LULUCF) may be used.

[6] Mean annual increments from documented sources may be used in the absence of annual increments.

13. Documented local values for $BEF_{2,j}$ should be used. In the absence of such values, national default values should be used. If national values are also not available, the values should be obtained from literature or data shall be obtained from a region that has similar ecological conditions affecting growth of tree species. If no information is available in the literature the project proponents should conduct sampling to generate such value using common standardized method. Sampling can be done in other locations where such ecosystem exists.

14. Documented local values for *Dj* should be used. In the absence of such values, national default values shall be consulted. If national default values are also not available, the values should be obtained from Reyes et al. 1992; Wood Density database http://www.worldagroforestrycentre.org/Sea/Products/AFDbases/WD/Index.htm or from table 3A.1.9 of the IPCC good practice guidance for LULUCF. If no information is available from any of the above sources, the project proponents should conduct sampling to generate such value using common standardized method.

Option 2:

Alternatively local, national, or regional sources on aboveground biomass accumulation through time for the species planted in the project area may exist and that are fit to standard biomass growth equations (biomass in t ha^{-1} versus time). These can be used directly for $B_{AB,i,t}$:

$$B_{AB,i,t} = \sum_{j=1}^{Sps} B_{AB,i,j,t} \quad \textbf{(6)}$$

$$B_{AB,i,j,t=n} = B_{AB,i,j(t=n-1)} + g * \Delta t \quad \textbf{(7)}$$

where:

$B_{AB,i,t}$	=	Above-ground biomass of trees in stratum *i* at time *t*; t dm ha^{-1}
$B_{AB,i,j,t=n}$	=	Above-ground biomass of trees of species *j* in stratum *i* at time *t=n*; t dm ha^{-1}
g	=	Annual increment in biomass; t d.m. ha^{-1} yr^{-1}
Δt	=	Time increment; years
n	=	Running variable that increases by Δt for each iterative step
j	=	Index for species (*Sps* = total number of species in stratum)

For below-ground biomass

15. $C_{BB\ i,\ t}$ is calculated per stratum *i* as follows

$$C_{BB,i,t} = \sum_{j=1}^{Sps} C_{BB,i,j,t} \quad \textbf{(8)}$$

$C_{BB,ij,t} = B_{AB,i,j,t} * R_j * 0.5$ **(9)**

where:

$C_{BB\ i,\ t}$ = Carbon stocks in below-ground biomass of trees for stratum *i*, at time *t*; t C ha^{-1}

$C_{BB,i,j,t}$ = Carbon stocks in below-ground biomass of trees of species *j* in stratum *i*, at time *t*; t C ha^{-1}

$B_{AB,i,j,t}$ Above-ground biomass of trees of species *j* in stratum *i* at time *t;* t dm ha^{-1}

R_j = Root to shoot ratio for species or group of species *j*; dimensionless

0.5 = Carbon fraction of dry matter; t C $(t\ dm)^{-1}$

16. Documented local or national values for R_j should be used. If national values are not available, a default value of 0.1 should be used.

17. **Project emissions** are assumed to be negligible hence, they are accounted for as zero in this methodology (refer to para 3). The *ex ante* actual net greenhouse gas removals by sinks in year *t* are therefore equal to:

$\Delta\ C_{ACTUAL,t} = \Delta\ C_{PROJ,t}$ **(10)**

where:

$\Delta\ C_{ACTUAL,t}$ = annual actual net greenhouse gas removals by sinks at time *t*; t CO_2-e yr^{-1}

$\Delta\ C_{PROJ,t}$ = removal component of actual net GHG removals by sinks at time *t*; t CO_2-e yr^{-1}

IV. Leakage

18. According to decision 6/CMP.1, annex, appendix B, paragraph 9: “If project participants demonstrate that the small-scale afforestation or reforestation project activity under the CDM does not result in the displacement of activities or people, or does not trigger activities outside the project boundary, that would be attributable to the small-scale afforestation or reforestation project activity under the CDM, such that an increase in greenhouse gas emissions by sources occurs, a leakage estimation is not required. In all other cases leakage estimation is required.”

19. Leakage (L_t) can be considered zero if evidence can be provided that:

(a) There is no displacement, or the displacement of pre-project grazing or agricultural activities or fuel wood collection will not cause deforestation attributable to the project activity, or

(b) Displacement of grazing animals or agricultural activities or fuel wood collection occurs to other degraded non wetlands which contain no significant biomass (i.e. degraded land) and if evidence can be provided that these lands are likely to receive the shifted activities, or

(c) Displacement of grazing animals occurs to other areas such as grasslands (non wetlands) and that the total number of animals so displaced is less than 15% of the average grazing capacity of such area.

Such evidence in (a), (b) can be provided by scientific literature or by experts' judgment and in (c) through sound estimation[7].

20. If the possibility of leakage from displacement of grazing animals is not excluded using approach provided in para 19 above, the methodology is not applicable.

21. In cases, where the possibility of leakage from displacement of agricultural activities other than from grazing is not excluded as provided in para 19 above, project participants should assess the possibility of leakage by considering the area used for agricultural activities within the project boundary displaced due to the project activity.

22. If the area under agricultural activities within the project boundary displaced due to the project activity is lower than 10 per cent of the total project area then for the *ex ante* calculation it is assumed that entire leakage shall be equal to 20 per cent of the *ex ante* actual net GHG removals by sinks accumulated during the first crediting period, that is the average annual leakage is equal to:

$$L_{t\_A} = \Delta\, C_{ACTUAL,t} * 0.20 \qquad \textbf{(11)}$$

where:

L_{t_A}	=	Annual leakage due to displacement of agricultural activity attributable to the project activity at time *t;* t CO_2-e yr^{-1}
$\Delta\, C_{ACTUAL,t}$	=	Annual actual net greenhouse gas removals by sinks at time *t*; t CO_2-e yr^{-1}

23. If the area under agricultural activities within the project boundary displaced due to the project activity is greater than 10 per cent of the total project area then this methodology is not applicable.

24. In cases where the possibility of leakage displacement due to fuel wood collection is not excluded as in para 19 above, leakage shall be equal to 5 per cent of the *ex ante* actual net GHG removals by sinks accumulated during the first crediting period. The 5% value is estimated based on potential fuel wood collection possible from a degraded wetland ecosystem that represents the maximal biomass of fuel wood that is likely to be displaced elsewhere. The average annual leakage is equal to:

$$L_{t\_FW} = \Delta\, C_{ACTUAL,t} * 0.05 \qquad \textbf{(12)}$$

where:

L_{t_FW}	=	Annual leakage due to displacement of fuel wood collection attributable to the project activity at time *t;* t CO_2-e yr^{-1}
$\Delta\, C_{ACTUAL,t}$	=	Annual actual net greenhouse gas removals by sinks at time *t*; t CO_2-e yr^{-1}

[7] See appendix E.

25. Total leakage is calculated as the sum of leakage due to displacement of agricultural activities and displacement of fuel wood collection is estimated as:

$$L_t = L_{t\_A} + L_{t\_FW} \qquad \textbf{(13)}$$

where*:*

L_t		Total leakage attributable to the project activity at time *t;* t CO_2-e yr^{-1}
L_{t_A}	=	Annual leakage due to displacement of agricultural activity attributable to the project activity at time *t;* t CO_2-e yr^{-1}
L_{t_FW}	=	Annual leakage due to displacement of fuel wood collection attributable to the project activity at time *t;* t CO_2-e yr^{-1}

V. Net anthropogenic greenhouse gas removals by sinks

26. The net anthropogenic GHG removals by sinks for each year during the first crediting period are calculated as,

$$ER_{AR\ CDM,\ t} = \Delta C_{ACTUAL,\ t} - L_t + \textbf{avoided emissions} \qquad \textbf{(14)}$$

where:

$ER_{AR\ CDM,t}$	=	Annual net anthropogenic GHG removals by sinks at time *t;* t CO_2-e yr^{-1}
$\Delta C_{ACTUAL,\ t}$	=	Actual net greenhouse gas removals by sinks at time *t*; t CO_2-e yr^{-1}
L_t	=	Total leakage attributable to the project activity at time *t;* t CO_2-e yr^{-1}

For subsequent crediting periods L_t=0.

27. The resulting temporary certified emission reductions (tCERs) at the year of assumed verification t_v are calculated as follows:

$$tCER_{(tv)} = \sum_{t=0}^{tv} ER_{AR-CDM,t} \qquad \textbf{(15)}$$

where:

$tCER_{tv}$	=	Temporary certified emission reductions (tCERs) at the time of assumed verification t_v*;* t CO_2-e
$ER_{AR\ CDM,t}$	=	Annual net anthropogenic GHG removals by sinks at time *t;* t CO_2-e yr^{-1}
t_v	=	Assumed year of verification (year)

28. The resulting long-term certified emission reductions (lCERs) at the year of assumed verification t_v are calculated as follows:

$$lCER_{(tv)} = \sum_{t=0}^{tv} ER_{AR\ CDM,t} - lCER_{(t-k)} \quad \textbf{(16)}$$

where:

$lCER_{tv}$	=	Long-term certified emission reductions (lCERs) at the time of verification *tv*
$ER_{AR\ CDM,\ t}$	=	Annual net anthropogenic GHG removals by sinks in year t; t CO_2-e yr^{-1}
k	=	Time span between two verifications (year)
t_v	=	Year of assumed verification (year)

VI. Simplified monitoring methodology for small-scale afforestation and reforestation projects under the clean development mechanism

A. *Ex post* estimation of the baseline net greenhouse gas removals by sinks

29. The baseline net GHG removals by sinks is estimated at zero in this methodology. Therefore monitoring of the baseline is not required.

B. *Ex post* estimation of the actual net greenhouse gas removals by sinks

30. Stratification of the project area should be carried out to improve the accuracy and precision of biomass estimates.

31. For *ex post* estimation of project GHG removals by sinks, strata shall be defined by:

(i) Relevant guidance on stratification for A/R project activities under the clean development mechanism as approved by the Executive Board (if available); or

(ii) Stratification approach that can be shown in the PDD to estimate biomass stocks for the species or groups of species according to good forest inventory practice in the host country in accordance with DNA indications; or

(iii) Other stratification approach that can be shown in the PDD to estimate the project biomass stocks to targeted precision level of ±10% of the mean at a 95% confidence level.

32. The carbon stocks in above-ground biomass of trees within the project boundary at the starting date of the project activity ($C_{t=0}$) and for all other years at time t (C_t) shall be shall be estimated through the following equations:

$$C_t = \sum_{i=1}^{I} (C_{AB,i,t} + C_{BB,i,t}) * A_i * 44/12 \quad \textbf{(17)}$$

where:

C_t = Carbon stocks in the above and below ground carbon pools for trees at time t; t CO_2-e

$C_{AB,\, i,\, t}$ = Carbon stocks in above-ground biomass of trees for stratum *i*, at time *t*; t C ha^{-1}

$C_{BB\, i,\, t}$ = Carbon stocks in below-ground biomass of trees for stratum *i*, at time *t*; t C ha^{-1}

A_i = Area of stratum *i*; ha

For above-ground biomass

33. For above-ground biomass $C_{AB,i,t}$ is calculated per stratum *i* as follows:

$$C_{AB,i,t} = B_{AB,i,t} * 0.5 \quad \textbf{(18)}$$

where:

$C_{AB,i,t}$ = Carbon stocks in above-ground biomass of trees for stratum *i*, at time *t*; t C ha^{-1}

$B_{AB,i,t}$ = Above-ground biomass of trees in stratum *i* at the time *t*; t dm ha^{-1}

0.5 = Carbon fraction of dry matter; t C $(t\ dm)^{-1}$

34. Estimate of above-ground biomass of trees at the start of the project activity $B_{AB,i,t=0}$ and at time *t* achieved by the project activity $B_{AB,i,t}$ shall be estimated through the following steps:

(a) **Step 1:** Establish permanent plots and document their location in the first monitoring report;

(b) **Step 2:** Measure the diameter at breast height (*DBH*) and tree height, as appropriate and document it in the monitoring reports;

(c) **Step 3:** Estimate the above-ground biomass for each stratum using allometric equations developed locally or nationally. If these allometric equations are not available:

(i) Option 1: Use allometric equations included in **Appendix D** to this report or in annex 4A.2 of the IPCC good practice guidance for LULUCF;

(ii) Option 2: Use biomass expansion factors and stem volume as follows:

$$B_{AB,i,j,t} = SV_{i,j,t} * BEF_{2,j} * D_{,j} \quad \textbf{(19)}$$

where:

$B_{AB,i,j,t}$ = Above-ground biomass of trees of species j in stratum i at time t; t dm ha^{-1}

$SV_{i,j,t}$ = Stem volume of species *j* in stratum *i* at time *t;* m^3 ha^{-1}

D_j = Basic wood density for species or groups of species *j* ; t d.m. m^{-3})

$BEF_{2,j}$ = Biomass expansion factor (over bark) from stem to total aboveground biomass for species or group of species j ; dimensionless

35. Stem volume $SV_{i,j,t}$ shall be estimated from the on-site measurements of diameter at breast height and tree height performed in step 2 above. Consistent application of $BEF_{2,j}$ should be secured on the definition of stem volume (e.g. total stem volume or thick wood stem volume requires different *BEF*s).

36. Documented local values for D_j should be used. In the absence of such values, national default values shall be consulted. If national default values are also not available, the values should be obtained from Reyes et al. 1992; Wood Density database http://www.worldagroforestrycentre.org/Sea/Products/AFDbases/WD/Index.htm or from table 3A.1.9 of the IPCC good practice guidance for LULUCF. If no information is available from any of the above sources, the project proponents should conduct sampling to generate such value using common standardized method.

37. The same values for $BEF_{2,j}$ and D_j should be used in the *ex post* and in the *ex ante* calculations.

38. The above-ground biomass of trees in the stratum shall be estimated as follows:

$$B_{AB,i,t} = \sum_{j=1}^{Sps} B_{AB,i,j,t} \quad \textbf{(20)}$$

where:

$B_{AB,i,t}$ = Above-ground biomass of trees in stratum *i* at time *t*; t dm ha^{-1}

$B_{AB,i,j,t}$ = Above-ground biomass of trees of species *j* in stratum *i* at time *t*; t dm ha^{-1}

j = Index for species (*Sps* = total number of species in stratum)

Below-ground biomass

39. Carbon stocks in below-ground biomass at time *t* achieved by the project activity during the monitoring interval $C_{BB\ i,\ t}$ shall be estimated for each stratum *i* as follows:

$$C_{BB,i,t} = \sum_{j=1}^{Sps} C_{BB,i,j,t} \quad \textbf{(21)}$$

$$C_{BB,i,j,t} = B_{AB,i,j,t} * R_j * 0.5 \quad \textbf{(22)}$$

where:

$C_{BB\ i,\ t}$ = Carbon stocks in below-ground biomass of trees for stratum *i*, at time *t*; t C ha^{-1}

$C_{BB\ i,j,\ t}$ = Carbon stocks in below-ground biomass of trees of species *j* for stratum *i*, at time *t*; t C ha^{-1}

$B_{AB,i,j,t}$ = Above-ground biomass of trees of species *j* in stratum *i* at time *t*; t dm ha^{-1}

R_j = Root to shoot ratio for species or groups of species *j*; dimensionless

0.5 : Carbon fraction of dry matter; t C $(t\ dm)^{-1}$

Documented local or national values for Rj should be used. If national values are not available, the default value of 0.1 should be used.

C. *Ex post* estimation of leakage

40. As indicated in paragraph 19, if it is demonstrated that there is no leakage due to displacement of grazing activities or agricultural activities or fuel wood collection then:

$$L_{tv} = 0 \quad \textbf{(23)}$$

where:

L_{tv} = Total leakage at the time of verification; t CO_2-e

41. In order to estimate leakage due to displacement of agricultural activities, during the first crediting period project participants shall monitor the area used for agricultural activities within the project boundary displaced due to the project activity.

42. If the project participants cannot demonstrate that the displacement of agricultural activities and fuel wood collection does not result in leakage (as provided in para 19) then leakage shall be determined at the time of verification using the following equations:

For the first verification period of the first crediting period:

(a) *Leakage due to displacement of agricultural activity* (L_{tv_A}) equals to:

$$L_{tv\_A} = 0.20 * (C_{tv} - C_{t=0}) \quad \textbf{(24)}$$

(b) *Leakage due to displacement of fuel wood collection* (L_{tv_FW}) equals to:

$$L_{tv\_FW} = 0.05 * (C_{tv} - C_{t=0}) \quad \textbf{(25)}$$

(c) Total Leakage (L_{tv}) equals to:

$$L_{tv} = L_{tv\_A} + L_{tv\_FW} \quad \textbf{(26)}$$

For subsequent verification periods of the first crediting period:

(a) *Leakage due to displacement of agricultural activity* (L_{tv_A}) equals to:

$$L_{tv\_A} = 0.20 * (C_{tv} - C_{tv-k}) \quad \textbf{(27)}$$

(b) *Leakage due to displacement of fuel wood collection* (L_{tv_FW}) equals to:

$$L_{tv\_FW} = 0.05 * (C_{tv} - C_{tv-k}) \quad \textbf{(28)}$$

(c) *Total leakage* (L_{tv}) *equals to:*

$$L_{tv} = L_{tv\_A} + L_{tv\_FW} \quad \textbf{(29)}$$

where:

L_{tv_A} = Leakage due to displacement of agricultural activities at time of verification; t CO_2-e

L_{tv_FW} = Leakage due to displacement of fuel wood collection at time of verification; t CO_2-e

L_{tv} = Total leakage at the time of verification; t CO_2-e

C_{tv} = Carbon stocks in the above and below ground carbon pools for trees at time of verification; t CO_2-e

$C_{(t=0)}$ = Carbon stocks in the above and below ground carbon pools for trees at time t= 0 (calculated as in paragraph 32); t CO_2-e

tv = Time of verification

κ = Time span between two verifications; year

At the end of the first crediting period the total leakage equals to:

$$L_{CP1} = 0.20 * (C_{tc} - C_{t=0}) + 0.05 * (C_{tc} - C_{t=0}) \quad \textbf{(30)}$$

where:

L_{CP1} = Total leakage at the end of the first crediting period; t CO_2-e

C_{tc} = Carbon stocks in the above and below ground carbon pools for trees at the end of crediting period; t CO_2-e

$C_{t=0}$ = Carbon stocks in the above and below ground carbon pools for trees at time *t=0*; t CO_2-e

tc = Duration of the crediting period

D. *Ex post* estimation of the net anthropogenic GHG removals by sinks

43. Net anthropogenic greenhouse gas removals by sinks is the actual net greenhouse gas removals by sinks minus the baseline net greenhouse gas removals by sinks minus leakage as appropriate.

44. The resulting tCERs at the year of verification *tv* are calculated as follows:

For the first crediting period:

$$tCER_{(tv)} = C_{tv} - L_{tv} \quad \textbf{(31)}$$

For subsequent crediting periods:

$$tCER_{(tv)} = C_{tv} - L_{CP1} \quad \textbf{(32)}$$

where:

C_{tv} = Carbon stocks in the above and below ground carbon pools for trees at time of verification; t CO_2-e

L_{tv} = Total leakage at the time of verification; t CO_2-e

L_{CP1} = Total leakage at the end of the first crediting period; t CO_2-e

tv = Year of verification

45. The resulting lCERs at the year of verification *tv* are calculated as follows:

For the first crediting period:

$$lCER_{(tv)} = C_{tv} - L_{tv} - lCER_{(tv-k)} \quad \textbf{(33)}$$

For subsequent crediting periods:

$$lCER_{(tv)} = C_{tv} - L_{CP1} - lCER_{(tv-k)} \quad \textbf{(34)}$$

where:

C_{tv} = Carbon stocks in the above and below ground carbon pools for trees at time of verification; t CO_2-e

L_{tv} = Total leakage at the time of verification; t CO_2-e

L_{CP1} = Total leakage at the end of the first crediting period; t CO_2-e

$lCER_{(tv-k)}$ = Units of *lCER*s issued following the previous verification

tv = Time of verification

κ = Time span between two verifications (year)

E. Monitoring frequency

46. Monitoring frequency for each variable is defined in the Tables 1 and 2.

Table 1. Data to be collected or used to monitor the verifiable changes in carbon stock in the carbon pools within the project boundary from the proposed afforestation and reforestation project activity under the clean development mechanism, and how these data will be archived.

Data variable	Source	Data unit	Measured, calculated or estimated	Frequency (years)	Propor-tion	Archiving	Comment
Location of the areas where the project activity has been implemented	Field survey or cadastral information or aerial photograph s or satellite imagery	Latitude and longitude	Measured	5	100 per cent	Electronic, paper, photos	GPS can be used for field survey
A_i - Size of the areas where the project activity has been implemented for each type of strata	Field survey or cadastral information or aerial photographs or satellite imagery or GPS	ha	Measured	5	100 per cent	Electronic, paper, photos	GPS can be used for field survey
Location of the permanent sample plots	Project maps and project design	Latitude and longitude	Defined	5	100 per cent	Electronic, paper	Plot location is registered with a GPS and marked on the map
Diameter of tree at breast height (1.30 m)	Permanent plot	cm	Measured	5	Each tree in the sample plot	Electronic, paper	Measure diameter at breast height (DBH) for each tree that falls within the sample plot and applies to size limits
Height of tree	Permanent plot	m	Measured	5	Each tree in the sample plot	Electronic, paper	Measure height (H) for each tree that falls within the sample plot and applies to size limits
Basic wood density	Permanent plots, literature	Tonnes of dry matter per m^3 fresh volume	Estimated	Once		Electronic, paper	
Total CO_2-e	Project activity	Tons	Calculated	5	All project data	Electronic	Based on data collected from all plots and carbon pools

Table 2. Data to be collected or used in order to monitor leakage and how these data will be archived.

Data variable	Source	Data unit	Measured, calculated or estimated	Frequency (years)	Proportion	Archiving	Com ment
Area used for agricultural activities within the project boundary displaced due to the project activity	Survey	Hectares or other area units	Measured or estimated	One time after project is established but before the first verification	30%	Electronic	

Table 3. Abbreviations and parameters (in order of appearance)

Parameter or abbreviation	Refers to	Units
$\Delta C_{PROJ,t}$	Removal component of actual net GHG removals by sinks at time *t*	t CO_2-e yr^{-1}
C_t	Carbon stocks in the above and below ground carbon pools for trees at time *t*	t C
T	Time difference between *t* and *t-1*	Years
$C_{t=0}$	Carbon stocks in the above and below ground carbon pools for trees at time of start of the project activity	t C
$C_{AB,\ i,\ t}$	Carbon stocks in above-ground biomass of trees for stratum *i* at time *t*	t C ha^{-1}
$C_{BB\ i,\ t}$	Carbon stocks in below-ground biomass of trees for stratum *i*, at time *t*	t C ha^{-1}
A_i	Area of stratum *i*	ha
i	Index for stratum (I=total number of strata in project area)	
$B_{AB,i,t}$	Above-ground biomass of trees in stratum *i* at time *t*	t dm ha^{-1}
$B_{AB,i,j,t}$	Above-ground biomass of trees of species *j* in stratum *i* at time *t*	t dm ha^{-1}
$B_{AB,j,t=0}$	Above-ground biomass of trees of species *j* at time *t*=0	t dm ha^{-1}
$SV_{i,j,t}$	Stem volume of species *j* in stratum *i* at time *t*	m^3 ha^{-1}
$SV_{j,t=0}$	Stem volume of species *j* at time *t*=0	m^3 ha^{-1}
$BEF_{2,j}$	Biomass expansion factor (over bark) from stem to total aboveground biomass for species or group of species *j*	Dimensionless
D_j	Basic wood density for species or group of species *j*	t d.m. m^{-3}
j	Index for species (Sps= total number of species in stratum)	
g	Annual increment in biomass	t d.m. ha^{-1} $year^{-1}$

Parameter or abbreviation	Refers to	Units
Δt	Time increment = 1 (year)	
n	Running variable that increases by Δt for each iterative step	
$C_{BB,i,j,t}$	Carbon stocks in below-ground biomass of trees of species *j* in stratum *i*, at time *t*	$t\ C\ ha^{-1}$
$B_{BB,j,t=0}$	Below-ground biomass of trees of species *j* at time *t*=0	$t\ dm\ ha^{-1}$
R_j	Root to shoot ratio for species or groups of species *j*;	Dimensionless
$\Delta\ C_{ACTUAL,t}$	Annual actual net greenhouse gas removals by sinks at time *t*	$t\ CO_2\text{-}e\ yr^{-1}$
L_{t_A}	Annual leakage due to displacement of agricultural activity attributable to the project activity at time *t;*	$t\ CO_2\text{-}e\ yr^{-1}$
L_{t_FW}	Annual leakage due to displacement of fuel wood collection attributable to the project activity at time *t;*	$t\ CO_2\text{-}e\ yr^{-1}$
L_t	Annual leakage attributable to the project activity at time *t*	$t\ CO_2\text{-}e\ yr^{-1}$
$ER_{AR\ CDM,t}$	Annual net anthropogenic GHG removals by sinks at time *t*	$t\ CO_2\text{-}e\ yr^{-1}$
$tCER_{tv}$	Temporary certified emission reductions (tCERs) at the time of assumed verification t_v	$t\ CO_2\text{-}e$
t_v	Assumed year time of verification	
$lCER_{tv}$	Long-term certified emission reductions (lCERs) at the time of verification *tv*	$t\ CO_2\text{-}e$
κ	Time span between two verifications	Year
tc	Duration of the crediting period	Years
L_{tv}	Total leakage at the time of verification	$t\ CO_2\text{-}e$
L_{tv_A}	Leakage due to displacement of agricultural activities at time of verification	$t\ CO_2\text{-}e$
L_{tv_FW}	Leakage due to displacement of fuel wood collection at time of verification	$t\ CO_2\text{-}e$
C_{tv}	Carbon stocks in the above and below ground carbon pools for trees at time of verification	$t\ CO_2\text{-}e$
C_{tc}	Carbon stocks in the above and below ground carbon pools for trees at the end of crediting period	$t\ CO_2\text{-}e$
L_{CP1}	Total leakage at the end of the first crediting period	$t\ CO_2\text{-}e$
tv	Time of verification	

Appendix A

Procedure for demonstration of wetlands that are degraded and degrading with respect to vegetation cover

Analyze the historical and existing land use/cover changes in the context of climate and socio-economic conditions for the project area and/or surrounding similar wetlands, and identify key factors that influence vegetation degradation over time. In this procedure project participants may use multiple sources of data including archived information, maps, or remote sensing data of land use/cover to demonstrate the changing status of vegetation occurring over a reasonable period of time since 31 December 1989 as selected by the project participants and before the start of the proposed A/R project activity. Supplementary field investigation, landowner and public interviews, as well as collection of data from other sources may also be used, to demonstrate that the project area is degraded with respect to vegetation cover and is likely to continue to degrade in absence of the project activity.

A degraded or degrading state is confirmed if there is evidence that one or more of the following conditions are commonly present within the proposed project boundary and are likely to continue to occur in absence of the project activity:

Vegetation degradation:

- For degraded condition show that, for example: The cover and/or health of vegetation as determined by visual assessment or similar indicator-based approach has decreased by at least 25% below that of similar undisturbed wetlands with similar ecological conditions.
- For degrading condition show that, for example: The cover and/or health of vegetation as determined by visual assessment or similar indicator-based approach has decreased by at least 25% occurring over a reasonable period of time since 31 December 1989 as selected by the project participants and before the start of the proposed A/R project activity.

Anthropogenic influences leading to degradation, for example:

- There is a documented history of on-going loss of vegetation cover due to anthropogenic influences; or
- Evidence can be provided that anthropogenic actions, which are likely to continue in the absence of the small scale A/R project activity, can be documented as the cause of on-going loss of vegetation cover on similar lands elsewhere.

Provision of any other evidence that transparently demonstrates project lands are degraded or degrading.

Appendix B

Demonstration of land eligibility

1. Eligibility of the A/R CDM project activities under Article 12 of the Kyoto Protocol shall be demonstrated based on definitions provided in paragraph 1 of the annex to the Decision 16/CMP.1 (“Land use, land-use change and forestry”), as requested by Decision 5/CMP.1 (“Modalities and procedures for afforestation and reforestation project activities under the clean development mechanism in the first commitment period of the Kyoto Protocol”), until new procedures to demonstrate the eligibility of lands for afforestation and reforestation project activities under the clean development mechanism are recommended by the EB.

Appendix C

Assessment of additionality

1. Project participants shall provide an explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers:

2. **Investment barriers, other than economic/financial barriers**, *inter alia*:

   (a) Debt funding not available for this type of project activity;

   (b) No access to international capital markets due to real or perceived risks associated with domestic or foreign direct investment in the country where the project activity is to be implemented;

   (c) Lack of access to credit.

3. **Institutional barriers**, *inter alia*:

   (a) Risk relating to changes in government policies or laws;

   (b) Lack of enforcement of legislation relating to forest or land-use.

4. **Technological barriers**, *inter alia*:

   (a) Lack of access to planting materials;

   (b) Lack of infrastructure for implementation of the technology.

5. **Barriers relating to local tradition**, *inter alia*:

   (a) Traditional knowledge or lack thereof, of laws and customs, market conditions, practices;

   (b) Traditional equipment and technology;

6. **Barriers due to prevailing practice**, *inter alia*:

   (a) The project activity is the “first of its kind”. No project activity of this type is currently operational in the host country or region.

7. **Barriers due to local ecological conditions**, *inter alia*:

   (a) Degraded soil (e.g. water/wind erosion, salination);

   (b) Catastrophic natural and/or human-induced events (e.g. land slides, fire);

   (c) Unfavourable meteorological conditions (e.g. early/late frost, drought);

   (d) Pervasive opportunistic species preventing regeneration of trees (e.g. grasses, weeds);

   (e) Unfavourable course of ecological succession;

   (f) Biotic pressure in terms of grazing, fodder collection, etc.

8. **Barriers due to social conditions**, *inter alia*:

   (a) Demographic pressure on the land (e.g. increased demand on land due to population growth);

   (b) Social conflict among interest groups in the region where the project activity takes place;

   (c) Widespread illegal practices (e.g. illegal grazing, non-timber product extraction and tree felling);

   (d) Lack of skilled and/or properly trained labour force;

   (e) Lack of organization of local communities.

Appendix D

Default allometric equations for estimating above-ground biomass

Annual rainfall	DBH limits	Equation	R^2	Author
Broad-leaved species, tropical dry regions				
<1500 mm		Use the biomass expansion approach with volume estimates (see Option 2 in section IV)		
Broad-leaved species, tropical humid regions				
< 1500 mm	5–40 cm	AGB = 34.4703 – 8.0671*DBH + 0.6589*(DBH^2)	0.67	Brown et al. (1989)
1500–4000 mm	< 60 cm	AGB = exp{-2.134 + 2.530 * ln(DBH)}	0.97	Brown (1997)
1500–4000 mm	60–148 cm	AGB = 42.69 – 12.800*(DBH) + 1.242*(DBH)^2	0.84	Brown et al. (1989)
1500–4000 mm	5–130 cm	AGB = exp{-3.1141 + 0.9719*ln(DBH^2*H)	0.97	Brown et al. (1989)
1500–4000 mm	5–130 cm	AGB = exp{-2.4090 + 0.9522*ln(DBH^2*H*WD)}	0.99	Brown et al. (1989)
Broad-leaved species, tropical wet regions				
> 4000 mm	4–112 cm	AGB = 21.297 – 6.953*(DBH) + 0.740*(DBH^2)	0.92	Brown (1997)
> 4000 mm	4–112 cm	AGB = exp{-3.3012 + 0.9439*ln(DBH^2*H)}	0.90	Brown et al. (1989)
Coniferous trees				
Taxodium distichum		AGB = -1.398 + 2.731 log(DBH)	0.99	Brown (1978)
Palms				
n.d.	> 7.5 cm	AGB = 10.0 + 6.4 * H	0.96	Brown (1997)
n.d.	> 7.5 cm	AGB = 4.5 + 7.7 * WD*H	0.90	Brown (1997)
Mangrove (General equations)				
Mangrove	5-42 cm	ln(ABG) = -1.265 + 2.009 ln(DBH) + 1.7 ln(WD), or ln(ABG) = -1.786 + 2.471 ln(DBH) + ln(WD)	0.99	Chave et al. (2005)
Mangrove (Specific equations: Location at 25^o N in South Florida)				
Avicennia germinans (L.): black mangrove	0.7-21.5 cm	Log_{10} AGB = 1.934 log_{10} (DBH) – 0.395	0.95	Smith and Whelan (2006)

Annual rainfall	**DBH limits**	**Equation**	**R^2**	**Author**
Languncularia racemosa (L.): white mangrove	0.5-18.0 cm	Log_{10} AGB = 1.930 log_{10} (DBH) – 0.441	0.98	Smith and Whelan (2006)
Rhizophora mangle (L.): red mangrove	0.5-20.0 cm	Log_{10} AGB = 1.731 log_{10} (DBH) – 0.112	0.94	Smith and Whelan (2006)
Mangrove (Location in Mexico)				
Avicennia germinans (L.): black mangrove	1-10 cm	Log_{10} AGB = 2.507 log_{10} (DBH) – 1.561		Day et al (1987)
Languncularia racemosa (L.): white mangrove	1-10 cm	Log_{10} AGB = 2.192 log_{10} (DBH) – 0.592		Day et al (1987)
Rhizophora mangle (L.): red mangrove	1-10 cm	Log_{10} AGB = 2.302 log_{10} (DBH) – 1.580		Day et al (1987)
Mangrove (Location in Indo-West Pacific; Tropical wet region)				
Rhizophora apiculata	5-31 cm	Log_{10} AGB = 2.516 log_{10} (DBH) – 0.767		Putz and Chan (1986)
Rhizophora spp.	3-25 cm	Log_{10} AGB = 2.685 log_{10} (DBH) – 0.979		Clough and Scott (1989)

Note: AGB = above-ground biomass; DBH = diameter at breast height; H = height; WD = basic wood density

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Appendix E

Calculating average grazing capacity

A. Concept

1. Sustainable grazing capacity is calculated by assuming that the grazing animals should not consume more biomass than is annually produced by the site

B. Methodology

2. The sustainable grazing capacity is calculated using the following equation:

$$GC = \frac{ANPP * 1000}{365 * DMI} \qquad \textbf{(1)}$$

where:

GC = Grazing capacity (head/ha)

ANPP = Above-ground net primary productivity in tonnes dry biomass (t d.m.)/ha/yr)

DMI = Daily dry matter intake per grazing animal (kg d.m./head/day)

3. Annual net primary production *ANPP* can be calculated from local measurements or default values from Table 3.4.2 of IPCC good practice guidance LULUCF can be used. This table is reproduced below as Table 1.

4. The daily biomass consumption can be calculate from local measurements or estimated based on the calculated daily gross energy intake and the estimated dietary net energy concentration of diet:

$$DMI = \frac{GE}{NE_{ma}} \qquad \textbf{(2)}$$

where:

DMI = Dry matter intake (kg d.m./head/day)

GE = Daily gross energy intake (MJ/head/day)

NE_{ma} = Dietary net energy concentration of diet (MJ/kg d.m.)

5. Daily gross energy intake for cattle and sheep can be calculated using equations 10.3 through 10.16 in 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4: Agriculture, Forestry and Other Land Use (AFOLU)[8]. Sample calculations for typical herds in various regions of the world are provided in Table 2; input data stems from Table 10A.2 of the same 2006 IPCC Guidelines. Dietary net energy concentrations as listed in Table 3 can be calculated using the formula listed in a footnote to Table 10.8 of the same 2006 IPCC Guidelines.

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[8] Paustian, K., Ravindranath, N.H., and van Amstel, A., 2007. *2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4: Agriculture, Forestry and Other Land Use (AFOLU)*. Intergovernmental Panel on Climate Change (IPCC)

Table 1. Default estimates for standing biomass grassland (as dry matter) and above-ground net primary production, classified by IPCC Climate Zones (from Table 3.4.2 in the IPCC good practice guidance on LULUCF)

IPCC Climate Zone	Peak above-ground live biomass Tonnes d.m. ha^{-1}			Above-ground net primary production (ANPP) Tonnes d.m. ha^{-1}		
	Average	No. of studies	Error[#]	Average	No. of studies	Error[1]
Boreal-Dry & Wet[2]	1.7	3	±75%	1.8	5	±75%
Cold Temperate-Dry	1.7	10	±75%	2.2	18	±75%
Cold Temperate-Wet	2.4	6	±75%	5.6	17	±75%
Warm Temperate-Dry	1.6	8	±75%	2.4	21	±75%
Warm Temperate-Wet	2.7	5	±75%	5.8	13	±75%
Tropical-Dry	2.3	3	±75%	3.8	13	±75%
Tropical-Moist & Wet	6.2	4	±75%	8.2	10	±75%

Data for standing live biomass are compiled from multi-year averages reported at grassland sites registered in the ORNL DAAC NPP database [http://www.daac.ornl.gov/NPP/html_docs/npp_site.html]. Estimates for above-ground primary production are from: Olson, R. J.J.M.O. Scurlock, S.D. Prince, D.L. Zheng, and K.R. Johnson (eds.). 2001. NPP Multi-Biome: NPP and Driver Data for Ecosystem Model-Data Intercomparison. Sources available on-line at [http://www.daac.ornl.gov/NPP/html_docs/EMDI_des.html].

[1]Represents a nominal estimate of error, equivalent to two times standard deviation, as a percentage of the mean.

[2]Due to limited data, dry and moist zones for the boreal temperate regime and moist and wet zones for the tropical temperature regime were combined.

Table 2. Data for typical cattle herds for the calculation of daily gross energy requirement (derived from Table 10A.2 in *2006 IPCC Guidelines for National Greenhouse Gas Inventories. Volume 4: Agriculture, Forestry and Other Land Use (AFOLU)*

Cattle - Africa								
	Weight (kg)	**Weight Gain (kg/day)**	**Milk (kg/day)**	**Work (hrs/day)**	**Pregnant**	**DE**	**Coefficient for NE_m equation**	**Mix (of grazing)**
Mature Females	200	0.00	0.30	0	33%	55%	0.365	8%
Mature Males	275	0.00	0.00	0	0%	55%	0.370	33%
Young	75	0.10	0.00	0	0%	60%	0.361	59%
Weighted Average	**152**	**0.06**	**0.02**	**0**	**3%**	**58%**	**0.364**	**100%**
Cattle - Asia								
	Weight (kg)	**Weight Gain (kg/day)**	**Milk (kg/day)**	**Work (hrs/day)**	**Pregnant**	**DE**	**Coefficient for NE_m equation**	**Mix (of grazing)**
Mature Females	300	0.00	1.10	0	50%	60%	0.354	18%
Mature Males	400	0.00	0.00	0	0%	60%	0.370	16%
Young	200	0.20	0.00	0	0%	60%	0.345	65%
Weighted Average	**251**	**0.13**	**0.20**	**0**	**9%**	**60%**	**0.350**	**100%**
Cattle - India								
	Weight (kg)	**Weight Gain (kg/day)**	**Milk (kg/day)**	**Work (hrs/day)**	**Pregnant**	**DE**	**Coefficient for NE_m equation**	**Mix (of grazing)**
Mature Females	125	0.00	0.60	0.0	33%	50%	0.365	40%
Mature Males	200	0.00	0.00	2.7	0%	50%	0.370	10%
Young	80	0.10	0.00	0.0	0%	50%	0.332	50%
Weighted Average	**110**	**0.05**	**0.24**	**0.3**	**13%**	**50%**	**0.349**	**100%**
Cattle - Latin America								
	Weight (kg)	**Weight Gain (kg/day)**	**Milk (kg/day)**	**Work (hrs/day)**	**Pregnant**	**DE**	**Coefficient for NE_m equation**	**Mix (of grazing)**
Mature Females	400	0.00	1.10	0	67%	60%	0.343	37%
Mature Males	450	0.00	0.00	0	0%	60%	0.370	6%
Young	230	0.30	0.00	0	0%	60%	0.329	57%
Weighted Average	**306**	**0.17**	**0.41**	**0**	**25%**	**60%**	**0.337**	**100%**
Sheep								
	Weight (kg)	**Weight Gain (kg/day)**	**Milk (kg/day)**	**Wool (kg/year)**	**Pregnant**	**DE**	**Coefficient for NE_m equation**	**Mix (of grazing)**
Mature Females	45	0.00	0.70	4	50%	60%	0.217	40%
Mature Males	45	0.00	0.00	4	0%	60%	0.217	10%
Young	5	0.11	0.00	2	0%	60%	0.236	50%
Weighted Average	**25**	**0.05**	**0.28**	**3**	**20%**	**60%**	**0.227**	**100%**

Table 3. Daily energy requirement and dry matter intake calculation

Cattle																			
Region	**Average Characteristics**							**Energy (MJ/head/day)**										**Consumption**	
	Weight	Weight gain	Milk	Work	Preg-nant	DE	CF	Mainte-nance	Activity	Growth	Lactation	Power	Wool	Preg-nancy	REM	REG	**Gross**	NE_{ma}	**DMI**
	kg	kg/day	kg/day	hrs/day					(note 1)		(note 2)							MJ/kg (note 5)	kg/head/day
Africa	152	0.06	0.02	0.0	3%	58%	0.364	15.7	5.7	1.2	0.0	0.0	0	0.0	0.49	0.26	**84.0**	5.2	**16.2**
Asia	251	0.13	0.20	0.0	9%	60%	0.350	22.1	8.0	2.8	0.3	0.0	0	0.2	0.49	0.28	**119.8**	5.5	**21.9**
India	110	0.05	0.24	0.3	13%	50%	0.349	11.8	4.3	1.0	0.4	0.3	0	0.2	0.44	0.19	**87.6**	4.0	**21.6**
Latin America	306	0.17	0.41	0.0	25%	60%	0.337	24.6	8.9	3.8	0.6	0.0	0	0.6	0.49	0.28	**139.5**	5.5	**25.5**
Sheep																			
Region	**Average Characteristics**							**Energy (MJ/head/day)**										**Consumption**	
	Weight	Weight gain	Milk	Work	Preg-nant	DE	CF	Mainte-nance	Activity	Growth	Lactation	Power	Wool	Preg-nancy	REM	REG	**Gross**	NE_{ma}	**DMI**
	kg	kg/day	kg/day	hrs/day					(note 3)		(note 4)							MJ/kg (note 5)	kg/head/day
All regions	25	0.05	0.28	3.0	20%	60%	0.227	2.5	0.6	1.5	1.29	0	0.2	0.0	0.49	0.28	**25.0**	5.5	**4.6**

Notes. 1. assumes grazing; 2. assumes 4% milk fat; 3. assumes grazing on hilly terrain; 4. assumes 7% milk fat; 5. calculated using equation listed in table 10.8 of *2006 IPCC Guidelines for National Greenhouse Gas Inventories. Volume 4: Agriculture, Forestry and Other Land Use (AFOLU)*

Annex 7 - "Road-map" for further development of the three-track approach for carbon methodologies for mangroves

(Prepared by Working Group 1)

Note that the timelines in this road-map below were predicated on the next steps work continuing immediately following this November 2009 workshop. The relative elapsed times, from when this work is initiated, remain applicable.

	2009		2010										
Tasks	**NOVEMBER**	**DECEMBER**	**JANUARY**	**FEBRUARY**	**MARCH**	**APRIL**	**MAY**	**JUNE**	**JULY**	**AUGUST**	**SEPTEMBER**	**OCTOBER**	**NOVEMBER**
Track 1													
Oceanium PDD													
POA (depends on future projects)													
Projects Selection for tracks 2 and 3													
Request for proposals													
Short list													
Recon													
Selection													

	2009		**2010**										
Tasks	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER
Track 2													
submission of revised methodology to the DFN													
hire validator													
Submission to VCS													
Submission to CDM EB along with Project PDD													
Track 3													
Model literature synthesis													
Review													
Consultant TORs - call for quotation													
Selection of consultants													
Draft methodology													
review													
Selection of a case study to support the draft methdology (Trinidad)													
Submission to VCS										???			
Submission to CDM ??													

Annex 8 - Qualitative 'decision support tool' (DST) matrix for carbon offset potential in different wetland types

Note. The DST matrix was developed during the workshop in the form of a large Excel spreadsheet. For inclusion in this report, it is presented here as a set of tables, one for each major category of information in the matrix. The full spreadsheet matrix is available on request.

A. Carbon storage & sequestration (naturally functioning wetlands, inc. artificial wetlands)

		Carbon storage / unit area	Global total carbon storage	Sequestration rates	Carbon fluxes/area (3=high)	$N2_0/CH_4$ emissions (3=high)	Net CO_2 equivalent seq. (3 = net cooling)
Riverine	River, waterfalls, wadi	0	0	0	3	0	0
	Forested riparian /alluvial	2-3	2	? - 3	3	1-2	1-2
	Non-forested marshes / deltas	1-2	1	?	2-3	3	1
Mineral soil flats & Depressional	Permanent: depressional wetland, oases, ponds, karst, marshes, prairie pothole	1-2	1	1-2	1	3	1
	Seasonal wet non-forested: meadows, salt pans, dambos	1	1	1	1	0-1	0-1
	Seasonal wet forested: swamps	2-3	2	1	2-3	0-1	0-1
Organic soil flats	Temperate, alpine and boreal forested wetlands	3	3+	0-2	1-2	1-3	1-2
	Temperate, alpine and boreal non-forested wetlands	3	3+	0-2	1-2	1-3	1-2
	Tropical non-forested peatland	3	1	0-3	2	2-3	1
	Rice paddies	2-3	2	0-1	?-2	1-3	1
	Tundra	2	2-3	0-1	1	1	0-1
	Tropical peat swamp forests	3+	1	0-3	2	1	2-3
Slope	Mineral soil: freshwater springs, fens, oases	1-2	1	0-1	2	1-3	1
	Peat soil: freshwater springs, fens, sloping bogs/mires, oases	3	1	0-3	2-3	1-3	1-2
Lacustrine	Natural: lakes, glacial lakes	1-2	1-2	1-2	1-2	1-2	?
	Human made: reservoirs and dams, post mineral extraction sites (gravel, mine), aquaculture ponds, treatment ponds	1-2	1-2	1-3	2-3	1-3	1
	Marsh wetlands	1-2	1	2-3	2	3	1
Estuarine &coastal fringe	Salt marsh	2-3	1	3+	3	1	3
	Saline / coastal lagoons	1-2	1	2	3	1	2
	Mangroves	2-3	1-2	3+	3	1	3
	Nearshore: seagrass, kelp, macro-algal complexes	1-2	1	?-2	3	1	?-2
	Coral reefs	2	1	0-1	3	0	1-2
	Shellfish reefs	2	1	0-1	3	0	1-2
	Mudflats, tidal flats, beaches	1-2	1-2	0-2	3	1	0-2
	Coastal aquaculture / mariculture	1	1	?	?-2	?	?
Other	Caves	0	0	0	?	0	0
	Treatment wetlands	1	0	0	3+	3	1

B. Carbon storage & sequestration (degraded wetlands)

		Carbon storage/unit area	Global total carbon storage	Sequestration rates	Loss of C from system if degrading (3=high)	$N2_0/CH_4$ emissions	Net CO_2 equivalent
Riverine	River, waterfalls, wadi	0	0	0	0	0	0
	Forested riparian /alluvial	1-2	1	0-1	3	1-2	1-3
	Non-forested marshes / deltas	1	0-1	0-1	2	0-1	3
Mineral soil flats & Depressional	Permanent: depressional wetland, oases, ponds, karst, marshes, prairie pothole	1	1	0-1	1	1-3	3
	Seasonal wet non-forested: meadows, salt pans, dambos	0-1	0-1	0-1	1	0-1	2-3
	Seasonal wet forested: swamps	1-2	2	0-1	3	0-1	1
Organic soil flats	Temperate, alpine and boreal forested wetlands	1-3	2	0	3+	0-1	1-3
	Temperate, alpine and boreal non-forested wetlands	1-3	2	0	3+	0-1	1-3
	Tropical non-forested peatland	1-3	1	0	3+	0-1	3
	Rice paddies	NA	NA	NA	NA	NA	NA
	Tundra	1-3	1	0	3	0-3	1-3
	Tropical peat swamp forests	1-3	2	0	3+	0-1	1-2
Slope	Mineral soil: freshwater springs, fens, oases	1	0-1	0	1	1	3
	Peat soil: freshwater springs, fens, sloping bogs/mires, oases	1-3	1	0	3+	1	3
Lacustrine	Natural: lakes, glacial lakes	?	1	1-2	1	1-2	?
	Human made: reservoirs and dams, post mineral extraction sites (gravel, mine), aquaculture ponds, treatment ponds	NA	NA	NA	NA	NA	NA
	Marsh wetlands	1	1	0	2	0-1	3
Estuarine & coastal fringe	Salt marsh	1-3	1	0-1	1	1	1
	Saline / coastal lagoons	1-3	1	?	1	1	?
	Mangroves	1-3	1	0-1	1-2	1	1
	Nearshore: seagrass, kelp, macro-algal complexes	1-3	1	?-2	1	1	?-2
	Coral reefs	0-2	1	0	1	0	1-2
	Shellfish reefs	0-2	1	0	1	0	1-2
	Mudflats, tidal flats, beaches	1-2	?	?	1	1	?
	Coastal aquaculture / mariculture	NA	NA	NA	NA	NA	NA
Other	Caves	NA	NA	NA	NA	NA	NA
	Treatment wetlands	NA	NA	NA	NA	NA	NA

C. Avoided wetland degradation

		Degradation risk (3=high)	Importance of avoided degradation for avoiding climate warming (3=important)
Riverine	River, waterfalls, wadi	3	0
	Forested riparian /alluvial	3	2
	Non-forested marshes / deltas	3	1-2
Mineral soil flats & Depressional	Permanent: depressional wetland, oases, ponds, karst, marshes, prairie pothole	3	1
	Seasonal wet non-forested: meadows, salt pans, dambos	3	1
	Seasonal wet forested: swamps	3	3
Organic soil flats	Temperate, alpine and boreal forested wetlands	2-3	3
	Temperate, alpine and boreal non-forested wetlands	2-3	3
	Tropical non-forested peatland	3	2
	Rice paddies	NA	NA
	Tundra	3	3
	Tropical peat swamp forests	3	3
Slope	Mineral soil: freshwater springs, fens, oases	3	1
	Peat soil: freshwater springs, fens, sloping bogs/mires, oases	3	2
Lacustrine	Natural: lakes, glacial lakes	3	1
	Human made: reservoirs and dams, post mineral extraction sites (gravel, mine), aquaculture ponds, treatment ponds	NA	NA
	Marsh wetlands	3	1-2
Estuarine & coastal fringe	Salt marsh	3	1-2
	Saline / coastal lagoons	3	1
	Mangroves	3	1-2
	Nearshore: seagrass, kelp, macro-algal complexes	3	1
	Coral reefs	3	1
	Shellfish reefs	3	1
	Mudflats, tidal flats, beaches	3	1
	Coastal aquaculture / mariculture	NA	NA
Other	Caves	NA	NA
	Treatment wetlands	NA	NA

D. Restoration potential (in an enabling environment)

		Technology (skills & hardware)	Ease of application	Start-up costs	Maintenance costs	Time required (halting degradation)	Time required (natural functioning)	Leakage / displacement	Restoration permanence
Riverine	River, waterfalls, wadi	3	1-3	1-3	1-3	2-3	0-2	1-3	1-3
	Forested riparian /alluvial	3	1-3	1-3	1-3	2-3	0-2	1-3	1-3
	Non-forested marshes / deltas	3	1-3	1-3	1-3	2	1-2	1-3	1-3
Mineral soil flats & Depressional	Permanent: depressional wetland, oases, ponds, karst, marshes, prairie pothole	2-3	1-3	1-3	1-3	2	2-3	1-3	1
	Seasonal wet non-forested: meadows, salt pans, dambos	2-3	1-3	1-3	1-3	2	2-3	1-3	2
	Seasonal wet forested: swamps	3	1-3	1-3	1-3	2	2-3	1-3	2
Organic soil flats	Temperate, alpine and boreal forested wetlands	2-3	2	1-3	1-3	1	2-3	1-3	2-3
	Temperate, alpine and boreal non-forested wetlands	2-3	2	2-3	1-3	1	1-2	1-3	2-3
	Tropical non-forested peatland	2-3	3	1-2	1-3	1	2	1-3	2-3
	Rice paddies	3	3	1-2	1	1	2	1-3	3
	Tundra	2-3	2	1-3	1-3	2	2-3	1	2-3
	Tropical peat swamp forests	2-3	3	1-3	1-3	2	2-3	1-3	2-3
Slope	Mineral soil: freshwater springs, fens, oases	2-3	1-3	1-3	1-3	2	2	1-3	3
	Peat soil: freshwater springs, fens, sloping bogs/mires, oases	2-3	1-3	1-3	1-3	2	2-3	1-3	3
Lacustrine	Natural: lakes, glacial lakes	2-3	1-2	1-3	1-3	2	2	1-3	1-3
	Human made: reservoirs and dams, post mineral extraction sites (gravel, mine), aquaculture ponds, treatment ponds	3	1-3	1-3	1-3	2	1-2	1-3	3
	Marsh wetlands	3	2-3	1-3	1-3	2	1-2	1-3	1-3
Estuarine & coastal fringe	Salt marsh	3	3	1-3	1-3	1	2	1-3	1-2
	Saline / coastal lagoons	3	3	1-3	1-3	2	2	1-3	1-2
	Mangroves	3	3	1-3	1-3	1-2	2	1-3	1-2
	Nearshore: seagrass, kelp, macro-algal complexes	1-2	1-2	1-3	1-3	2	1-2	1-3	1-2
	Coral reefs	1	2	1-3	1-3	2	1-2	1-3	1-2
	Shellfish reefs	3	2-3	1-3	1-3	2	2-3	2	1-2
	Mudflats, tidal flats, beaches	3	3	1-3	1-3	1-2	1	1-3	1-2
	Coastal aquaculture / mariculture	3	3	1-3	1-3	1	1	1-3	1-2
Other	Caves	2	2	1	1	1	1-3	?	3
	Treatment wetlands	3	3	1-3	1-3	1	1	1-3	3

E. Ecosystem Services – Summary (average scores for each ecosystem service category)

		Provisioning	Regulating	Cultural	Supporting
Riverine	River, waterfalls, wadi	2.0	2.2	3.0	2.5
	Forested riparian /alluvial	2.0	2.2	1.8	2.5
	Non-forested marshes / deltas	2.0	2.2	1.8	2.5
Mineral soil flats & Depressional	Permanent: depressional wetland, oases, ponds, karst, marshes, prairie pothole	2.0	2.2	1.8	2.5
	Seasonal wet non-forested: meadows, salt pans, dambos	2.0	1.6	1.8	2.0
	Seasonal wet forested: swamps	2.0	1.6	1.8	2.0
Organic soil flats	Temperate, alpine and boreal forested wetlands	2.0	2.2	1.8	2.5
	Temperate, alpine and boreal non-forested wetlands	2.0	1.6	1.8	2.0
	Tropical non-forested peatland	2.0	2.2	1.8	2.5
	Rice paddies	2.0	0.8	1.5	1.3
	Tundra	1.3	1.3	1.0	1.0
	Tropical peat swamp forests	2.0	2.2	1.8	2.5
Slope	Mineral soil: freshwater springs, fens, oases	1.0	1.0	1.3	1.0
	Peat soil: freshwater springs, fens, sloping bogs/mires, oases	1.0	1.0	1.3	1.0
Lacustrine	Natural: lakes, glacial lakes	2.0	2.4	2.8	2.0
	Human made: reservoirs and dams, post mineral extraction sites (gravel, mine), aquaculture ponds, treatment ponds	2.0	2.1	1.5	1.0
	Marsh wetlands	2.0	2.2	1.8	2.5
Estuarine & coastal fringe	Salt marsh	1.6	2.0	1.3	1.8
	Saline / coastal lagoons	1.0	1.4	1.5	1.0
	Mangroves	1.6	2.2	1.3	2.0
	Nearshore: seagrass, kelp, macro-algal complexes	0.6	0.8	0.5	0.5
	Coral reefs	0.8	1.4	2.5	1.3
	Shellfish reefs	0.7	0.8	0.5	1.0
	Mudflats, tidal flats, beaches	0.4	0.4	2.3	1.3
	Coastal aquaculture / mariculture	1.0	0.0	0.0	0.0
Other	Caves	1.0	1.2	1.0	0.5
	Treatment wetlands	0.8	0.8	0.5	1.3

F. Markets

		Current markets	Carbon Markets under development	Other Markets under development	Existence of emissions / sequestration methodology	Compliance with UNFCCC markets	Risk of current market distorting other ES (cf. CESR)
Riverine	River, waterfalls, wadi	0	0	0	0	0	0
	Forested riparian /alluvial	3	3	3	3	3	2
	Non-forested marshes / deltas	0	0	3	0	0	2
Mineral soil flats & Depressional	Permanent: depressional wetland, oases, ponds, karst, marshes, prairie pothole	0	0	0	0	0	0
	Seasonal wet non-forested: meadows, salt pans, dambos	0	0	0	0	0	0
	Seasonal wet forested: swamps	3	3	0	3	3	2
Organic soil flats	Temperate, alpine and boreal forested wetlands	3	3	3	3	3	2
	Temperate, alpine and boreal non-forested wetlands	0	0	0	0	0	0
	Tropical non-forested peatland	0	3	2	2	0	2
	Rice paddies	0	0	0	0	0	0
	Tundra	0	2	0	0	0	0
	Tropical peat swamp forests	3	3	3	3	3	3
Slope	Mineral soil: freshwater springs, fens, oases	0	0	0	0	0	0
	Peat soil: freshwater springs, fens, sloping bogs/mires, oases	0	2	0	0	0	0
Lacustrine	Natural: lakes, glacial lakes	0	0	3	0	0	0
	Human made: reservoirs and dams, post mineral extraction sites (gravel, mine), aquaculture ponds, treatment ponds	0	2	2	0	0	0
	Marsh wetlands	0	0	3	0	0	0
Estuarine & coastal fringe	Salt marsh	0	0	3	0	0	0
	Saline / coastal lagoons	0	0	3	0	0	0
	Mangroves	3	3	3	3	3	2
	Nearshore: seagrass, kelp, macro-algal complexes	0	3	3	0	0	1
	Coral reefs	0	3	3	0	0	3
	Shellfish reefs	0	0	1	0	0	0
	Mudflats, tidal flats, beaches	0	0	0	0	0	0
	Coastal aquaculture / mariculture	0	0	3	0	0	0
Other	Caves, Treatment wetlands	0	0	0	0	0	0

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Ramsar Convention Secretariat on Wetlands

Rue Mauverney 28
CH1196 Gland
Switzerland

www.ramsar.org

Groupe DANONE

15 Rue du Helder
75009 Paris
France

www.danone.com

IUCN - International Union for Conservation of Nature

Rue Mauverney 28
CH1196 Gland
Switzerland

www.iucn.org