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Carbon Accounts:
Issues arising from the London Meeting

By: *Roy Haines-Young*

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INTRODUCTION

The context for this update note is that at the London Meeting the expert group considered the net carbon balance to be a good proxy for the condition of ecosystem and recommended that the outcome paper on carbon should describe the basic model for the calculation of the net carbon balance, which is common practice. The paper should also describe the links with UNFCCC and IPCC methodologies and issues of scaling.

As a result of this recommendation a number of issues can be identified, and these potentially define the structure of the more detailed outcome paper that is in preparation. The sections below provide a framework that could be developed to take the preparation of this paper forward.

CONTEXT

The work in a carbon account would benefit from agreement about what the purpose of the exercise was, given the widespread interest in the topic from the climate change perspective. Two issues are apparent:

- That any proposed work should not duplicate efforts being undertaken elsewhere, and in particular should not result in methodologies of definitions that conflict with accepted approaches such as those developed in the IPCC process.
- That accounts should, where appropriate, draw on the same data sources as the work on emission monitoring to ensure consistency; it would be particularly important, for example to draw on the same land use/cover change data.

It was noted at the expert meeting that this may be difficult to achieve because the IPCC methodologies may themselves be developing, with the use of stock-based data alongside information on net change in carbon stock be resulting from land use change etc. (Ajani, 2011; Muukkonen, 2011). However, such developments may provide the opportunity for collaboration and it is important to explore the opportunities in order to take accounting approaches forward.

The development of carbon accounts within the experimental approach discussed by the London group will require agreement on their scope and purpose. Stock and change accounts such as those illustrated in the issues paper by Gundimeda (2011) show how the link between timber volumes and carbon stock can be made for the forest sector and how value estimates can be made. These include the impact of losses through, for example, fire on GDP in terms of the amount of carbon released to the atmosphere. This example suggests how a sector-based account of what might be regarded as 'final ecosystem service's (cf. Haines-Young and Potschin, 2011) might be developed and used to trace the implications of ecosystem change on the economic (and potentially the social) system.

In contrast, the work of Weber (2011) describes an approach to carbon accounting that captures a wider aspects of ecosystem integrity based on the notion of a net carbon balance. It seeks to develop indicators of ecosystem structure and function more equivalent to the discussions of intermediate or supporting services that exists in the wider research literatures. In general terms, the indicators concern the proportion of the carbon resource fixed though photosynthesis that is appropriated or consumed by the economic/social system, and therefore what is 'left to nature'. At

this stage it is difficult to see how these carbon balance accounts would like to specific sets of final ecosystem services in the framework provided by Weber (2011), although in general terms it can be done if the proportion of the carbon consumed by different uses can be estimated. Instead the main purpose of the proposal way to show how metrics could provide a way of assessing the scale of the overall impact of people on ecosystem structure and function and some estimate of maintenance and/or restoration costs based on economic and/or other criteria.

- *Clearly, the sector/value and carbon balance approach suggested at the London meeting are not mutually exclusive, and can probably be accommodated in the same accounting structure. Thus while it is recognised that further experimental work is needed to determine how they can be made operational, some prioritisation of effort might be helpful. The work of Hein (2011) confirmed that carbon sequestration was a high priority, but should the focus of future work be on constructing stock and flow accounts that link more to specific economic sectors or activities (i.e. focus on final ecosystem services) or is this better captured through the notion of a carbon balance, following the recommendations of Weber (2011) and Ajani, (2011), and capture more completely issues of ecosystem integrity?*

It should be further noted that:

- *The discussion of the net carbon balance at the London meeting focussed almost exclusively on the terrestrial environment. The extent to which accounting approaches should be extended to the marine ecosystems also needs to be clarified and confirmed.*

DEFINITIONS AND TERMINOLOGY

Ajani (pers comm., 2011) has suggested that while the idea of a carbon balance was accepted at the London meeting as a useful proxy, there was no agreement on its definition. She has suggested some guidance, based on the ecological work being undertaken in Australia (Box 1), but some formal agreement between partners is probably necessary before work proceed further. This could clearly be facilitated by the preparation of the more detailed outcomes paper on carbon, but consultation is needed to ensure that approaches are consistent with wider understandings. The key issue here is how removals by people are treated. For Weber (2011) the Net Ecosystem Carbon Balance is different to the measure suggested by Ajani, being based on NPP less that harvested or lost though human impact over a given period (see also Box 1).

Box 1: Defining the Net Carbon Balance (NCB) (After Ajani, pers comm., 2012)

Net carbon balance (NCB) = NPP – (turnover + heterotrophic respiration)

Where:

- NPP is Net primary Productivity, defined by Gross Primary Productivity (GPP) minus respiration, and GPP is the carbon uptake from photosynthesis over a defined time period (a year).
- Turnover is the emissions from mortality of plants or parts of plants through leaf fall, fine root death etc.
- Heterotrophic respiration is soil microbial respiration

Net Ecosystem Carbon Balance defined implied by Weber (2011):

NCB = NPP - (turnover + heterotrophic respiration) - removals (crops, timber, grazed) - emissions (fires, erosion) + residuals (timber, crops, manure) + existing stock (accumulated in soil and woody vegetation)

The differences between the two positions set out in Box 1 probably reflects different analytical purposes rather than any fundamental difference in approach or understanding. However, if accounts are to be seen as based on rigorous science, then their methodological basis must be clear.

- *Further clarification of these different metrics, their relationships and how they are calculated is therefore needed to take this work forward, and to ensure that the terminology used is consistent with that used in the wider ecological literature.*

It should be further noted that:

- *The notion using measures of ecosystem integrity based the proportion of the carbon resource appropriated by people is clearly similar to the extensive work done by Haberl et al., (2007) and others on Human Appropriated Net Primary Productivity (HANP)[1]; the similarities or differences between this and the notion of the net carbon balance discussed at the London meeting also needs to be clarified.*

DATA SOURCES AND TEST APPLICATION

A final key area where further work is required concerns the availability of the data needed to make estimates of the net carbon balance at different scales. Although conceptual model can be proposed, operationalisation is ultimately a key issue. This topic was not discussed in detail at the London meeting.

Globally the key data sources for NPP are MODIS NPP (Running et al, 2004) and GEOSUCCESS NPP (C-fix model) annual time-series, and the suitability of such resources to prepare accounts now needs to be tested, particularly in relation to the problem of making reliable spatially disaggregated estimates that are consistent with the land cover data/use data derived from other sources used elsewhere in the accounts. Thus

- *Further experimental work is needed to determine the suitability of existing globally available data sources for the preparation of accounts describing the net carbon balance for meaningful spatial accounting units (countries, regions, sub-national administrative units, drainage basins etc.).*

[1] http://www.eoearth.org/article/Global_human_appropriation_of_net_primary_production_(HANPP)

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