**Electronic Supplementary Material to the Article:**

**TURNING THE TIDE: HOW BLUE CARBON AND PAYMENTS FOR ECOSYSTEM SERVICES (PES) MIGHT HELP SAVE MANGROVE FORESTS**

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## A brief review of the Carbon Standards presented in the Table 2 in the main text of the submitted article

## Clean Development Mechanism Afforestation/Reforestation

Clean Development Mechanism projects are different to the other standards considered here in that they are traded only on the compliance market (Lederer 2011). Under the CDM, REDD+ projects are not accepted but afforestation/reforestation (A/R) projects have been accepted since 2004 (Boyd et al.2007).

Projects seeking CDM certification are required to follow specified methodologies. Forestry projects are divided between small and large scale and different methodologies exist within these categories based on land-use (e.g. agricultural land, pastoral land, silvopastoral land) or ecosystem type (e.g. wetlands, grasslands) (Zomer et al.2008). Two methodologies are suitable for mangroves (CDM 2012), one for small-scale A/R on wetlands, that has been eligible for certification since 2007, and one for large scale A/R projects specifically for degraded mangrove habitats. As of October 2011, no registered projects under CDM have utilized either of these methodologies (CDM 2012).

*Verified Carbon Standard (VCS)*

Previously called the Voluntary Carbon Standard, VCS was established in 2005 by The Climate Group, the International Emission Trading Association and the World Economic Forum (Voluntary Carbon Standard 2012). In 2007, REDD+ forestry projects became eligible for certification under VCS, one of five agriculture and forestry project types allowed.

VCS has its own methodologies notably in agriculture, forestry and other land use sectors although VCS projects may also utilize all methodologies developed under the Clean Development Mechanism. Projects can also use all of Climate Action Reserve’s methodologies for achieving certification under VCS, aside from Climate Action Reserve’s Forest Protocol.

In 2011, VCS was the most successful of the various voluntary carbon standards with 34% of the total market and 27.7MtCO2e in transactions (Peters-Stanley et al. 2011).

*Plan Vivo*

Plan Vivo is a charity run by the Plan Vivo Foundation; it was developed by the Edinburgh Centre for Carbon Management in 1994 (Plan Vivo 2012). Plan Vivo projects can undertake afforestation and agroforestry, forest conservation, restoration and REDD+ activities. Plan Vivo is designed to support forestry projects designed and led by communities. Once a Plan Vivo project is certified, a certificate is issued and sold on behalf of producers by the Project Coordinator. Plan Vivo certificates are issued for projects that support long-term sequestration of carbon dioxide plus environmental and social benefits. In 2011, Plan Vivo comprised 1% of the voluntary carbon standard market (Peters-Stanley et al. 2011).

*CarbonFix*

CarbonFix is a not-for-profit organization registered in Germany and is recognized by the United Nations Framework Convention on Climate Change (CarbonFix 2011). Under CarbonFix ex-ante carbon credits (that is, credits for anticipated future sequestration) are generated and registered for afforestation and reforestation project activities. In 2011, CarbonFix had 29 projects registered with a total of 145637tCO2e Verified Emission Reduction Credits registered (Peters-Stanley et al. 2011). CarbonFix expects its certified projects to restore forests whilst also bringing benefits to local people and the environment.

*Climate, Community and Biodiversity Standard (CCB)*

The Climate, Community and Biodiversity standard was established by the Climate, Community and Biodiversity Alliance (CCBA 2008). The CCB Alliance is a partnership of research institutions, corporations and NGOs. The CCB standard does not certify carbon emission reductions; instead, it certifies the co-benefits generated as a result of emission reduction projects (Peskett et al.2011). It is designed to be used in conjunction with other standards, such as VCS or CDM. The standards for CCB have been developed through field testing and revision by the Alliance. There are fourteen required criteria to the standards with three optional ‘Gold level’ criteria (CCBA 2008).

In 2011, CCB was the second most sold credit in the voluntary carbon market with 15.5MtCO2e credits transacted (Peters-Stanley et al. 2011). The popularity of VCS in 2011 is seen as the reason for the high number of CCB transactions since CCB is often ‘bolted on’ to VCS projects (*ibid.*).

*Social Carbon*

The Social Carbon methodology was first developed in 2000 as a voluntary co-benefits standard (Social Carbon 2012). Social Carbon does not certify the emission reductions of a carbon project but rather the project’s contribution to sustainable development. Social Carbon can be applied in conjunction with any other carbon standard (for example VCS, CDM or CarbonFix) and therefore is applicable to most types of projects including hydropower, plants, landfills, fuel switching and forestry (including REDD+).

Social carbon projects must demonstrate improvement of resources through the lifetime of the project. The initial accreditation for a social carbon project is achieved by showing competence in applying the social carbon standard. Retaining accreditation is based on being able to measure and demonstrate the social and environmental gains of carbon projects.

A range of options therefore exist for projects looking to accredit mangrove carbon. Experience has shown the CDM to be unattractive to all but the largest forestry projects. Of the voluntary market options, those that recognize mangroves as forests, that allow REDD+ methodologies, that provide flexible solutions to dealing with permanence and risk and that are simple and cheap enough to permit application to relatively small projects are likely to be most appropriate for community-level mangrove PES.

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