Can botanic gardens play a role in REDD-plus?

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Abstract

Forests are under threat from deforestation and degradation, posing a real danger to species, human livelihoods and our climate. Reducing Emissions from Deforestation and Forest Degradation (REDD-plus) – is an incentive oriented mechanism proposed to facilitate the largest and fastest reduction in global greenhouse gas emissions. The mechanism may also provide conservation opportunities and the delivery of related ecosystem services. There are clear overlaps in the conservation objectives of many botanic gardens and the aims of REDD-plus. This paper considers the role of botanic gardens in supporting the practical implementation of REDD–plus, should the process be adopted by governments.

Key Words

Botanic garden; capacity building; biodiversity; co-benefits; conservation; partnerships; REDD-plus; species identification.

Introduction

Forests provide livelihoods for 1.2 billion people worldwide (World Bank, 2001) and account for 50% of the world's terrestrial carbon (FAO, 2000, cited in CBD, 2009). Extensive forest loss has made a huge impact on forest carbon stocks. Deforestation is the second largest anthropogenic source of carbon dioxide into the atmosphere (van der Werf *et al*. 2009). It is believed that tropical deforestation alone caused one - two billion tonnes of carbon to be released into the atmosphere every year during the 1990s, which accounted for 15-20% of annual greenhouse gas (GHG) emissions (Gibbs *et al.* 2007).

REDD–plus

In an effort to combat this, Reducing Emissions from Deforestation and Forest Degradation (REDD-plus) may provide financial incentives for reductions in deforestation and forest degradation. The proposed REDD-plus mechanism is a climate change mitigation strategy, where efforts are made to reduce GHG emissions into the atmosphere or to sequester those already emitted (von Scheliha *et al.* 2009). Alongside a reduction in carbon emissions, REDD-plus could provide so called "co-benefits" - for example through the conservation of biodiversity. Considering that forests are amongst the most diverse ecosystems in the world - harbouring an estimated 75% of global terrestrial biodiversity - there is great optimism for the additional benefits offered by REDD-plus (von Scheliha *et al.* 2009).

Negotiations to develop a legally binding mechanism for REDD-plus will take place at the Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC) in Mexico, November 2010 (UNFCCC COP16). Some countries have begun to prepare for an international REDD-plus mechanism (UN-REDD, 2009). For example, the UN-REDD Programme in nine pilot countries (UN-REDD, 2009), includes Bolivia, the Democratic Republic of Congo (DRC), Indonesia, Panama, Papua New Guinea, Paraguay, Tanzania, Vietnam and Zambia (UN-REDD, 2010).

Botanic gardens

There are over 2500 botanic gardens around the world (BGCI, 2010). Maintaining more than four million living plant collections from over 80,000 plant species, botanic garden collections contain approximately one third of the worlds known vascular plant species (BGCI, 2010). Botanic gardens are defined as "institutions holding documented collections of living plants for the purposes of scientific research, conservation, display and education" (Wyse Jackson and Sutherland, 2010). Traditionally, many botanic gardens have focused their research activities on taxonomy and biosystematics of plants (Wyse Jackson and Sutherland, 2000). In recent decades, activities have included conservation, education and sustainable development. Most gardens are involved in *ex situ* conservation, for example through the storage of seeds in seed banks and through maintaining living plant collections. Some botanic gardens are also involved in *in situ* conservation. Botanic gardens are therefore repositories of a wide range of skills and expertise related to plant conservation, particularly species identification, biodiversity monitoring, mapping, and habitat restoration, and the collection and storage of specimens (Primack and Miller-Rushing, 2009). Furthermore, many botanic gardens work alongside counterpart institutions in various countries (Primack and Miller-Rushing, 2009). Hence, the far-reaching activity of botanic gardens is easily recognisable (BGCI, 2010).

Botanic gardens are also prominent in international policy. For example, botanic gardens played a leading role in the development of the Global Strategy for Plant Conservation (GSPC) under the Convention on Biological Diversity (CBD) (GSPC, 2002). The Gran Canaria Declaration, drafted by the botanical science community, outlined the importance of a strategy for plant conservation to secure plant diversity for the future. Following the publication of the Gran Canaria Declaration, the GSPC was adopted by the parties to the CBD in 2002. The Strategy consists of 16 targets to be achieved by 2010 and is in the process of being updated for the period 2011-2020. The strategy enables botanic gardens to engage directly with international policy agendas, and puts their work into the context of national conservation strategies. Thus, botanic gardens have the potential to impact high level policy decisions, providing hope that they could mobilise similar initiatives to facilitate their involvement in supporting REDD-plus.

Meeting the technical needs of REDD – plus

In this study, we analysed national REDD-plus pilot project reports and other reviews of REDD–plus to develop an overview of REDD-plus projects and to identify technical barriers to implementation. The reports indicate that priorities and national capacity for implementation of REDD-plus programmes will differ between countries. This paper investigates how the expertise available in botanic gardens around the world can be utilised to address REDD-plus technical capacity gaps. We asked individuals from 11 botanic gardens around the world for information about any existing activities that could relate to the implementation of REDD-plus schemes. An overview of recent or current relevant projects undertaken in eight botanic gardens is outlined in Table 1.

It should be noted that each project overview was developed according to the information provided by each botanic garden at the time that this study was conducted. In addition, case studies in the survey only represent activities from 8 botanic gardens, which is a small proportion of the botanic gardens around the world. Thus, this study does not form a comprehensive summary of all activities within gardens, and how all gardens may be able to support REDD-plus.

Discussion

There are clear areas of strength within botanic gardens that can be used to support the practical implementation of REDD-plus. In the following section, we discuss the ways in which the skills and expertise in botanic gardens may be of direct relevance to address the technical capacity gaps that we have identified as barriers to the implementation of REDD–plus, through our review of pilot project reports.

1. Limited availability of historical carbon and forest area data: most botanic gardens are involved in species identification. Species level information is crucial when measuring forest carbon stock. Botanic gardens can use their expert species identification skills to accurately inform forest carbon stock from both historical and recent data records. Missouri Botanical Garden's carbon mapping project in Gabon for example, provided accurate species knowledge to inform the calculation of forest carbon stocks.

2. Limited human capacity to implement REDD-plus activities: most botanic gardens work extensively through partnerships. The partnerships are currently successful in building capacity for plant conservation worldwide. The skills of staff in botanic gardens could also be useful for addressing the capacity required to implement REDD-plus projects. For example BGT is improving capacity within institutions in Papua New Guinea by training people in tree species identification skills.

3. Poor interpretation or awareness of degradation: extensive species and habitat knowledge within botanic gardens could be used to inform forest degradation assessments. For example, information about plant species found at a site, data about the threat status of plant species, and an understanding of the services that specific plants can deliver, can all be useful in assessing habitat degradation.

4. Limited resource awareness: there is often little consideration for biodiversity in REDD-plus projects (Dooley, 2008). Botanic gardens could help to inform REDD-plus site selection by providing detailed biodiversity data - in order to promote the conservation of biodiversity in REDD-plus schemes and to help ensure that the forest conserved is more stable under environmental stresses.

5. Lack of comprehensive forest assessments: species knowledge can provide information that is vital for forest assessments. Scientists in botanic gardens have advanced fieldwork and research skills that could be highly transferable to REDD-plus related forest assessments. For example, scientists at RBG Kew used a combination of remote sensing techniques and ground truthing to help to inform sites for protected areas in Madagascar. Similar information and skills could be used to help select sites for REDD-plus.

Challenges for botanic gardens in supporting the implementation of REDD - plus projects.

Although there are clear strengths in botanic gardens that could help to deliver successful REDD-plus activities, this study has also identified areas that may hinder the involvement of botanic gardens in such schemes. However, it should be noted, that there may be some activities in botanic gardens that we have not covered in this paper.

1. Awareness of REDD-plus and relevant policy issues: this study finds that there is limited awareness and recognition of the potential role that botanic gardens could play in supporting REDD-plus. Despite this, this study finds that many existing projects in other botanic gardens inadvertently meet REDD-plus objectives.

2. New Partnerships: at present, botanic gardens work in partnership with mainly other botanical institutions. In order to harness the use of knowledge and skills from botanic gardens to deliver co-benefits from REDD-plus, there may be a need for botanic gardens to form more diverse partnerships with other types of agencies.

Many botanic gardens appear to be working in partnership with other organisations nationally. Engaging with REDD-plus may require botanic gardens to share resources and skills through working in partnership with agencies in countries in which REDD-plus projects are active.

3. Limited soil carbon data: This study finds that information about soil carbon is also a technical barrier to the success of REDD-plus at some sites. The strengths of botanic gardens lies in knowledge about plants. Within botanic gardens there is limited capacity to integrate the measurement of soil carbon stocks into projects.

4. Lack of appropriate resources: Some of the work identified in this report is not business as usual for botanic gardens. Engaging in activities to aid implementation of REDD-plus could result in a change in priorities away from classical research, or may require additional resources to supplement this activity.

To help with sharing resources within the botanic garden community, supporting organisations such as Botanic Gardens Conservation International (BGCI) could play a significant role. For example the development of a database of expertise could assist in the development of partnerships and facilitate the communication of botanic gardens REDD-plus strengths. Reviewing the activities of all botanic gardens within their database, BGCI could develop an interactive system for botanic gardens to outline their REDD-plus related expertise, to create and support appropriate partnerships more readily.

Conclusions

The evidence gathered in this study identifies common strengths in botanic gardens to potentially assist in the implementation of REDD-plus. Botanic gardens are home to a vast resource, which as of yet remains untapped by REDD-plus. This paper does not provide a comprehensive overview of the many ways in which botanic gardens could support REDD-plus but could help staff in botanic gardens to consider how their work could support such initiatives.

Despite identified strengths, there are ultimately areas of REDD-plus that cannot be addressed through botanic gardens. This suggests that REDD-plus will likely need to work within a network of institutions and expertise in order for projects to be adequately supported.

There appears to be the variation in awareness of the REDD-plus mechanism amongst the botanic gardens involved in this study, as well as limited resources to support such work, little willingness to engage with REDD-plus as a conservation measure, and limited recognition at the national level as stakeholders in the REDD-plus agenda. This is perhaps unsurprising as REDD-plus is yet to become a legally binding mechanism. The authors of this study hope that this evidence provides an insight for botanic gardens to identify how they could contribute to REDD-plus projects in the future. However, some activities to help implement REDD-plus may require a change in institutional policies and research activities in botanic gardens. If botanic gardens decide to become active in the implementation of REDD-plus, there may be a need to assess their strategic goals and current partnerships to address such global initiatives.

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Table 1: Botanic garden case studies and links to REDD - plus

Botanic Garden	**Recent or Current Projects that could be of relevance to REDD - plus**	**Skills and expertise which could be relevant to REDD - plus**
Botanic Gardens Trust , Sydney (BGT) - Australia	Working partners in Papua New Guinea to provide identification tools to assist with tree identification and documentation.	• expert species knowledge • identification skills • training in the above skills
Rio de Janeiro Botanical Garden - Brazil	Programme Mata Atlantica (PMA) aims to protect 6% of the original Atlantic Forest. The project studies taxonomy, community ecology, ecological anatomy and seed germination to determine species diversity.	• conservation of biodiversity • protection of local livelihoods
South China Botanic Garden – China	Dinghushan Forest Ecosystem Research Station undertakes research into successional processes and area biodiversity to inform forest management.	• forestry research and data provision • forest management skills.
Xishuangbanna Tropical Botanic Garden – China	Scientists at XBG are working to support fellow tropical botanic gardens through capacity development in conservation areas.	• conservation of biodiversity • training in key skills for species identification
Kadoorie Farm Botanic Garden – China	Protecting tropical trtainforest on the Yinggeling nature reserve on the island of Hainan. Comprehensive biodiversity surveys provide an understanding of species diversity within the rainforests.	• training skills in forest monitoring and management

Royal Botanic Garden Edinburgh (RBGE) – United Kingdom	Through the agro-forestry projects in Peru, RBGE scientists taught local communities and organisations working with local communities in small-scale agroforestry projects, to identify and propagate native tree species	• expert species and habitat knowledge • training local stakeholders in the above • local plant identification and research skills.
Royal Botanic Gardens, Kew (RBG Kew) – United Kingdom	Working alongside Malawian partners, the project aims to propagate 50 'useful' tree species that are threatened by over exploitation, and reintroduce species that are valuable to local livelihoods (Sacande, pers. comm. 2010).	• species and habitat level knowledge • conservation of biodiversity • species knowledge to inform forest carbon stock • knowledge about the use of plants to help to protect the livelihoods of local people.
Missouri Botanical Garden (Missouri) – United States of America	With the Gabonese government, mapping the carbon of Gabon's forests. Scientists are ground truthing remotely sensed data by measuring and identifying trees on old transects and in old plots.	• Species knowledge to inform forest carbon stock measurements • species identification • forest monitoring