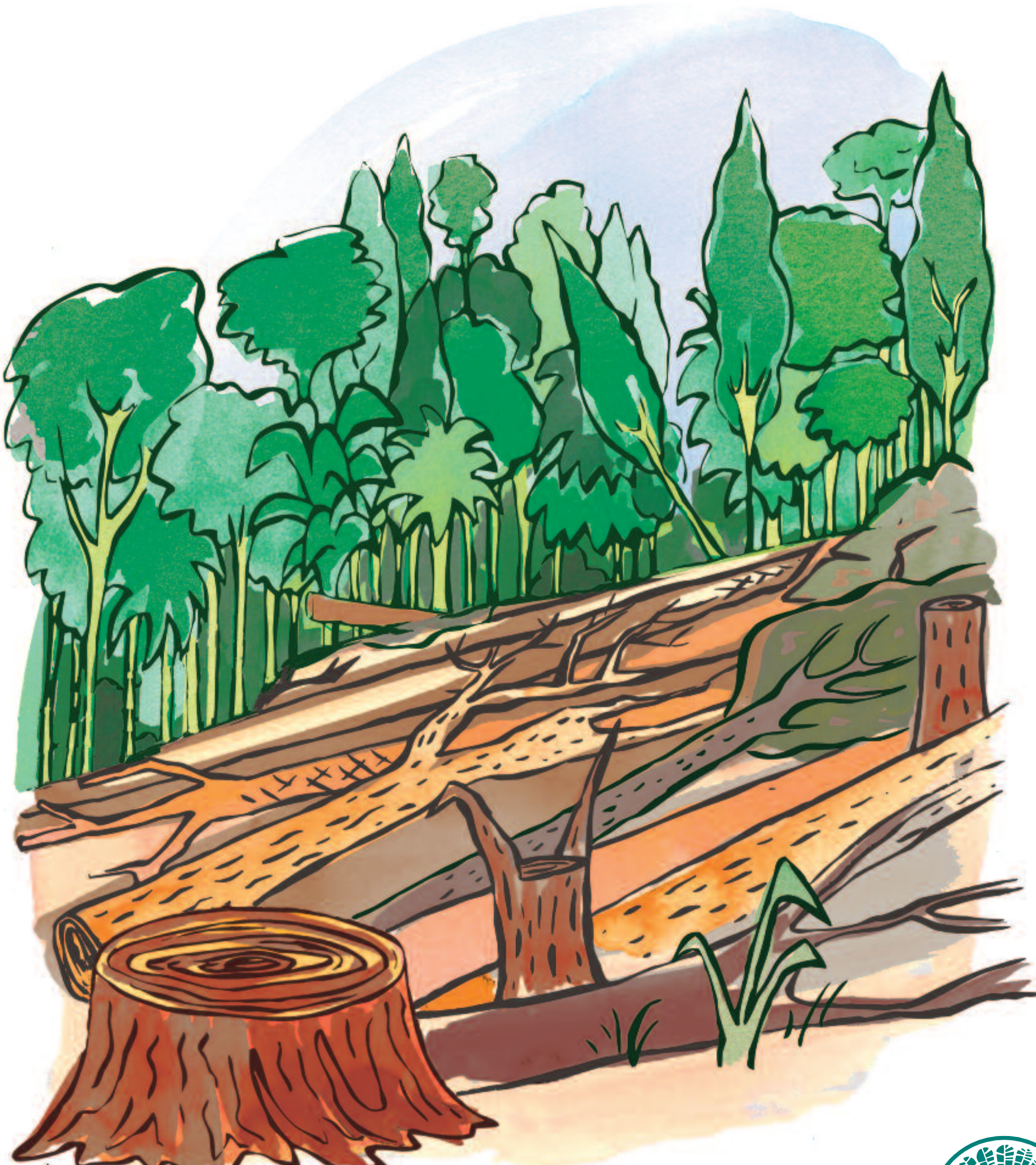
A REDD+ manual for botanic gardens



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Plants for the Planet

A REDD+ manual for botanic gardens

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Contents

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Acronyms and abbreviations

CBD: Convention on Biological Diversity
CO_2: Carbon Dioxide
COP: Conference of the Parties
DRC: Democratic Republic of Congo
FAO: Food and Agriculture Organization of the United Nations
IPCC: Intergovernmental Panel on Climate Change
GHG: Greenhouse Gas
GSPC: Global Strategy for Plant Conservation
MA: Millennium Ecosystem Assessment
MRV: Monitoring, Reporting, and Verification
REDD: Reducing Emissions from Deforestation and Forest Degradation
REL: Reference Emissions Levels
SBSTA: Subsidiary Body for Scientific and Technological Advice
UNFCCC: United Nations Framework Convention on Climate Change

1. Introduction

Forests cover 31% of the world's surface and contain vast carbon stocks (FAO, 2010). However, 13 million hectares of forest are destroyed annually (Scheliha *et al.,* 2009). In recent decades, extensive forest loss has had a huge impact on forest carbon, with deforestation and degradation the second largest source of global greenhouse gas (GHG) emissions, accounting for 17-20% of emissions (UN-REDD, 2009a; UNFCCC, 2008). The world's forests are estimated to store some 50% of terrestrial carbon and the continued damage from deforestation and forest degradation poses a significant threat to our future climate (CBD, 2009). In an effort to combat this, Reducing Emissions from Deforestation and Forest Degradation in developing countries (REDD), which provides incentives and rewards for a reduction in deforestation and forest degradation activities, has the potential to make vast and immediate reductions to GHG emissions (Lubowski, 2008).

Alongside carbon storage, forests also provide important services for the livelihoods of 1.2 billion people, and are vital for the survival of a further 60 million indigenous people, who are completely dependent upon forests (World Bank, 2001). The benefits people obtain from forests in the form of ecosystem services (Box 1) include supporting, provisioning, regulating and cultural services (MA, 2003). Such services are linked to ecosystem biological diversity and therefore ensuring the protection of such diversity within the REDD+ mechanism will be crucial if forest ecosystems are to remain functional service providers.

Traditionally botanic gardens have focused on studying the taxonomy and biosystematics of plants and growing specialist collections for research, teaching and display. In recent decades responsibilities have expanded to include conservation, education and sustainable development and increasingly to link with the livelihood issues of local communities. Botanic gardens working in partnership with organisations such as Botanic Gardens Conservation International (BGCI) have had a significant influence on the development and implementation of international biodiversity policy (see Box 6). Considering their strengths, many unique to botanic gardens, this booklet illustrates how botanic gardens may use their skills to contribute to the REDD process and more specifically to REDD+ projects. With reference to a series of 'capacity gaps' identified from a selection of REDD+ pilot projects, case studies from botanic gardens around the world expose potential opportunities for botanic gardens to support the future implementation of REDD+ projects.

Box 1. Ecosystem services

Supporting services: The services that are necessary for the production of all other ecosystem services including soil formation, photosynthesis, primary production, nutrient cycling and water cycling;

Provisioning services: The products obtained from ecosystems, including food, fibre, fuel, genetic resources, biochemicals, natural medicines, pharmaceuticals, ornamental resources and fresh water;

Regulating services: The benefits obtained from the regulation of ecosystem processes, including air quality regulation, climate regulation, water regulation, erosion regulation, water purification, disease regulation, pest regulation, pollination, natural hazard regulation;

Cultural services: The non-material benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation and aesthetic experiences – thereby taking account of landscape values.

(MA, 2003)

2. Outline of REDD+

The premise behind REDD is to provide incentives to reduce emissions from deforestation and forest degradation activities. Essentially, a site threatened by deforestation and forest degradation is selected and an initial 'baseline' (of emissions) is calculated, to provide a benchmark against which to compare future monitoring. A reduction in emissions through management techniques will generate carbon credits, which will be tradable and therefore are financially valuable (RECOFTC, 2010).

Box 2. The evolution of REDD+

The concept of reducing emissions from forests has evolved from Reducing Emissions from Deforestation in Developing Countries (RED), to also include Forest Degradation (REDD). More recently REDD has been expanded to REDD+ to include "the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries" (UNFCCC, 2008).

Deforestation and degradation

Deforestation is defined in the Marrakech Accords, an outcome of the 7th Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC) as "the direct human-induced conversion of forested land to non-forested land" (UNFCCC, 2001). According to the Food and Agriculture Organization (FAO) of the United Nations, 13 million hectares of land are deforested every year, with net loss greatest in Africa and South America (FAO, 2010). Forest degradation became incorporated into climate change negotiations when it was identified that in some areas of the world, forest degradation posed as much of a problem as deforestation (Wertz-Kanounnikoff and Angelsen, 2009). Forest degradation is defined by the Intergovernmental Panel on Climate Change (IPCC) as "a direct human-induced loss of forest values (particularly carbon), likely to be characterised by a reduction of tree cover" (Scheliha *et al*., 2009). Drivers of deforestation and forest degradation vary and may continue to change in the future; however, the three current global drivers are identified as commercial agriculture, subsistence farming and wood extraction (Robledo and Blaser, 2008).

The development of REDD

Initially proposed during the 1990 Kyoto Protocol negotiations, but subsequently rejected, REDD resurfaced at the UNFCCC COP11 in Montreal. Here, the governments of Papua New Guinea and Costa Rica proposed that REDD be considered for review. As a result at COP13 in Bali 2007, REDD began to be acknowledged and was subsequently integrated into the Bali Action Plan, which outlined negotiations leading up to COP15 in Copenhagen 2009.

Box 3. The United Nations Framework Convention on Climate Change (UNFCCC)

The UNFCCC is an international treaty adopted by 193 Parties in 1992 in an attempt to reduce global climate change. To date (December 2010), 193 Parties have signed up to the Kyoto Protocol, outlining their commitment to combating climate change. Under the Protocol, developed nations (referred to as Annex I counties) made a commitment to reduce GHG emissions by 5% of 1990 levels by 2012. The Parties to the UNFCCC are currently negotiating a post-Kyoto agreement including a REDD+ mechanism to facilitate implementation.

Mitigation, adaptation and resilience

First and foremost REDD+ is proposed as a climate change mitigation strategy, where efforts are made to reduce GHG emissions from being emitted into the atmosphere, or to sequester those already emitted (Scheliha *et al*., 2009). Such efforts to mitigate against climate change are crucial if GHG emissions are to be stabilised and the effects of climate change kept to a minimum.

However, adaptation is equally important in the global fight against climate change. Adaptation is defined by the IPCC as “adjustments which humans and natural systems, make in response to actual or expected climate stimuli” (2007). Two kinds of adaptation relating to forests can be identified: “adaptation for forests”, focusing on increasing forest resilience and resistance against climate change, and also “forests for adaptation”, which focuses on the role forests play in assisting people to adapt to climate change (Scheliha *et al*., 2009).

Resilience is defined as “the capacity of an ecosystem to return to the original state following a perturbation, maintaining its essential characteristic taxonomic composition, structures, ecosystem function and process rates” (Holling, 1973 in Thompson *et al*., 2009). All else being equal, ecosystems with greater plant diversity have a greater capacity to adapt to changing conditions (Tilman *et al*., 2006). Thus any management strategy that maintains or restores the diversity of an ecosystem will have the effect of enhancing its resilience. The development of REDD+ projects that take into account the biological diversity of forests will therefore have the effect of ensuring resilience in the face of climate change and the continued provision of the forest services.

REDD+ and the inclusion of co-benefits

The 2007 Bali Action Plan, which detailed negotiations for a post-2012 climate change agreement, recognised that enhancing the REDD mechanism to REDD+ had the potential to “promote co-benefits and complement the aims and objectives of other relevant international conventions and agreements” (UNFCCC, 2008).

REDD+ therefore provides opportunities for the conservation of biological diversity and the protection of local livelihoods and the rights of indigenous people (Vatn and Angelsen, 2009). For example there is potential for REDD+ projects to be aligned with the Convention on Biological Diversity (CBD) Programme of Work on Protected Areas (PoWPA), which identifies areas of high biodiversity and importance to local livelihoods (CBD, 2008). With high biological diversity and providing key services to millions of people worldwide, integrating protected areas into REDD+ projects could achieve significant co-benefits to biodiversity and livelihoods, in addition to carbon sequestration (UN-REDD, 2009b). Although there has been increased recognition that REDD+ initiatives have the potential to improve biodiversity, whether such activities will be successfully implemented remains to be seen.

An international REDD+ agreement

The outcome of UNFCCC COP15, the Copenhagen Accord, reiterated the important role of forests in the global fight against climate change, and the need to provide positive incentives through the establishment of mechanisms like REDD+ (UNFCCC, 2009). However, the Copenhagen Accord was only “noted” by governments and failed to provide a legally binding mechanism. Instead, governments that backed the Accord pledged their support for a future REDD+ mechanism. Fundamentally, the Copenhagen Accord failed to provide clarity around the exact nature of REDD+ (Minang and Murphy, 2010).

At COP16 (December 2010 in Cancun, Mexico), Parties agreed that the REDD+ mechanism should not only consider reduced emissions, but also maintain existing forests and carbon stocks. The “Cancun Agreements” also encourage developing countries to contribute to mitigation actions by: reducing emissions from deforestation and degradation; conserving forest carbon stocks; sustainable forest management; and enhancing forest carbon stocks.

Furthermore, the Cancun Agreements provide guidance for countries to prepare for REDD+. Parties are encouraged to: develop national strategies or action plans; measure national forest reference levels; develop systems for national forest monitoring; and provide information on how the safeguards (such as provisions for local and indigenous people) may be addressed in implementation.

Clarification of the REDD+ mechanism is still much needed, through definitions of technical terms, developing methods to measure emissions levels, and a finance mechanism. In an effort to resolve some of the outstanding issues, the Parties agreed that the UNFCCC Subsidiary Body for Scientific and Technological Advice (SBSTA) to the Convention should develop a programme to identify certain issues, such as drivers of deforestation and degradation and methodologies for estimating emissions.

Box 4. Forest biodiversity

"Forest biological diversity results from evolutionary processes over thousands and even millions of years which, in themselves, are driven by ecological forces such as climate, fire, competition and disturbance. Furthermore, the diversity of forest ecosystems (in both physical and biological features) results in high levels of adaptation, a feature of forest ecosystems which is an integral component of their biological diversity. Within specific forest ecosystems, the maintenance of ecological processes is dependent upon the maintenance of their biological diversity" (CBD, 1995).

Tropical forests for example, are highly species rich, containing as much as 50% of all recorded terrestrial biodiversity and as many as 1,000 species per square kilometre (Hawkins *et al*., 2008).

Elements of REDD+ projects

The UN-REDD Programme, is a UN collaborative project launched in 2008 to develop appropriate "readiness" in 12 pilot countries: Bolivia, Cambodia, Democratic Republic of Congo, Indonesia, Panama, Papua New Guinea, Paraguay, the Philippines, the Solomon Islands, Tanzania, Vietnam and Zambia. In addition, a further 17 partner countries are currently observing the process in a bid to build networks, share knowledge and supplement existing national initiatives (UN-REDD, 2011). Profiles of REDD+ pilot projects are being compiled by the Institute for Global Environmental Strategies in a database using a common template (http://redd-database.iges.or.jp/).

Some common elements of REDD+ projects:

- **Site identification, measurement and monitoring**

  Information that needs to be collected and recorded includes details of forest area, forest type, management and use context, carbon stocks and rates and drivers of deforestation and degradation. Measurement of carbon stocks may be based on satellite data and/or field inventories and this is used to establish the carbon emissions reference level.

- **Project goals:** These include goals related to:

  - The decrease in the amount of CO_2 emitted, or the increase in the amount of CO_2 sequestered over the project life-span;
  - Maintenance of ecosystem services, such as watershed protection;
  - Local community development and income generation;
  - Biodiversity conservation, with a focus on protecting/restoring threatened species.

- **Implementation strategies:** Such activities need to:

  - Address the drivers of deforestation or degradation;
  - Credibly and verifiably reduce emissions or increase sequestration;
  - Be additional to actions that would happen in the absence of REDD+ financing;
  - Provide for permanent forest protection.

- **Monitoring, reporting and verification (MRV)**

  Monitoring systems that allow for measurement, reporting and verification of REDD+ activities are among the most critical elements for the successful implementation of any REDD+ mechanism. Remote sensing and ground based data can be used to monitor forest carbon emissions, but MRV must also cover monitoring the performance of a country's capacity and governance and the additional benefits that REDD+ can harness.

Box 5. Examples of useful implementation activities

- Establishment of protected areas;
- Improved land tenure;
- Sustainable forest management;
- Reduced-impact logging;
- Forest certification;
- Restoration and regeneration of forests;
- Biodiversity conservation;
- Livelihood enhancement activities.

3. Capacity gaps

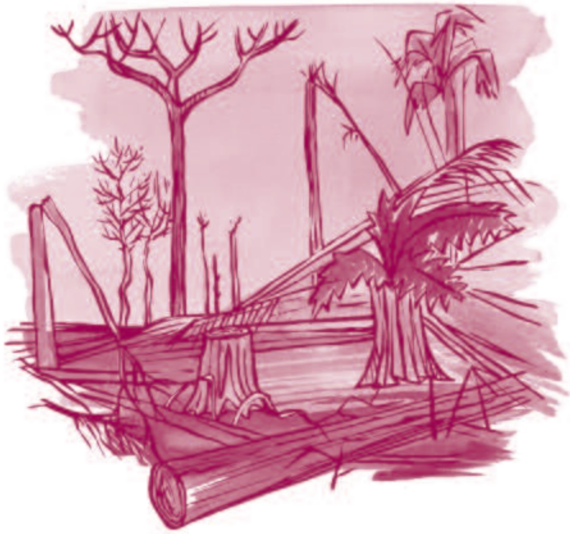
The pilot projects supported through the UN-REDD programme are important to the development of the mechanism, as they have exposed capacity issues which need to be addressed prior to the universal roll-out of the initiative. This booklet outlines the results and recommendations from a study which identified some of the capacity gaps in a series of pilot projects, and investigates whether the skills and expertise within botanic gardens have the potential to address these.

Reviewing a series of pilot projects from the UN-REDD Programme, alongside Herold's paper on '*Recommendations for Capacity Building*' (2009), which identifies capacity requirements for forest and carbon stock monitoring, some common issues were identified as limiting, and subsequently threatening REDD+ implementation. The capacity gaps identified are listed below and are expanded upon in Table 1:

- Availability of historical carbon and forest area data;
- Limited human capacity;
- Interpretation and awareness of degradation;
- Resource awareness;
- Comprehensive forest assessments;
- Knowledge and availability of high quality seed for locally appropriate species.

Table 1. REDD+ capacity gaps, implications and requirements

Capacity gap	Implications	Requirements
1. Availability of historical carbon & forest area data	Baselines/Reference Emissions Levels (REL) might be based on insufficient or inaccurate data, thus threatening future monitoring.	Improved remote sensing techniques to supplement existing data. Training and funding where capacity is limited. Forest inventories are a simple low-technology method that could be used whilst low-cost remote sensing technologies develop, especially where capacity is limited (Gibbs *et al*., 2007).
2. Limited human capacity	Difficulty collating and interpreting remote sensing and GIS data may impact REL and monitoring components. Poor staff training, insufficient staff and with limited experience.	Human and resource capacity development. Funding for equipment and training initiatives.



Capacity Gap	Implications	Requirements
3. Interpretation & awareness of degradation	Insufficient focus on forest quality, drivers and associated GHG emissions.	Increased awareness of degradation as it is often overlooked or neglected. Improving awareness of forest quality will provide links to co-benefits.
4. Resource awareness	Biodiversity and potential co-benefits are not used to inform site selection. This misses opportunities for the achievement of additional co-benefits. Ecosystem services are neglected. Failure to recognize the role of local stakeholders in project development and implementation.	Co-benefits, such as biodiversity, need to be integrated into project planning. "Technical expert groups" from, for example botanic gardens, could produce "how to" tool kits on biodiversity (Karousakis, 2009). Training and capacity development, increasing awareness of ecosystem services will "build a better business case" (Leal pers. comm., 2010).
5. Comprehensive forest assessments	Insufficient data and methods in many countries.	Development of multidisciplinary mapping techniques e.g. forest area, biodiversity, land use etc. Habitat data will provide additional plant conservation benefits.
6. Knowledge and high quality seeds from appropriate species	Insufficient information on appropriate species for afforestation. Poor availability of high quality seeds and seedlings. Lack of knowledge about how to germinate and propagate locally appropriate species.	Ecological and predictive mapping to determine appropriate native species and to build in resilience to climate change. Capacity building in collection, handling and storage of seeds. Germination and propagation protocols and training in their use.

4. The contribution of botanic gardens to the implementation of REDD+

Botanic gardens have a long history of involvement in the exploration and documentation of plant diversity. This tradition continues today, alongside a diverse range of other roles. The *International Agenda for Botanic Gardens in Conservation* identifies the core elements of the work of a botanic garden as: conservation; research, monitoring and information management; and education and public awareness (Wyse Jackson and Sutherland, 2000). With over 2,500 around the world, botanic gardens maintain more than four million living plant collections from over 100,000 plant species, and hold nearly one third of the world's known vascular plant species (Sharrock *et al*., 2010).

As centres for excellence in plant knowledge, botanic gardens play a central role in the *ex situ* conservation of plant diversity, for example, through the storage of seeds in seed banks (such as the Millennium Seed Bank at the Royal Botanic Gardens, Kew). They also have a staff base which is skilled in the propagation and cultivation of plant species. In addition botanic gardens are increasingly involved in *in situ* conservation as a complement to their *ex situ* activities. They are therefore repositories of a wide range of skills and expertise related to plant conservation, such as species identification, biodiversity monitoring and mapping and habitat restoration, in addition to the collection and storage of specimens.

While there may be a global imbalance between the distribution of plant diversity and the location of botanic gardens and their associated skills and expertise (Chen *et al*., 2009), botanic gardens are increasingly working through partnerships and collaborations to address this constraint. Botanic Gardens Conservation International (BGCI), the international body representing the world's botanic gardens works to facilitate extensive skill-sharing and networking, for example through its online databases, publications and capacity building workshops.

Box 6. The wider influence of botanic gardens

Botanic gardens are influential in international policy. They played a leading role in the development of the *Global Strategy for Plant Conservation* (GSPC) under the Convention on Biological Diversity (CBD) (CBD, 2002). Conceived in 1999, pressure from the botanic garden community led to a meeting of major global organisations and institutions in Gran Canaria in 2000, to discuss the urgent need for a global plant diversity agenda. The outcome of the meeting, The *Gran Canaria Declaration* outlined the importance of a *Global Strategy for Plant Conservation* (GSPC) to secure plant diversity. Following the publication of the Declaration, and lobbying from the botanical community, the GSPC was adopted by the CBD in 2002. In 2006 the 'Gran Canaria Group' met again to discuss the issues of plant conservation and climate change further, publishing the Gran Canaria Declaration II (Gran Canaria Group, 2006).

Applying specialist plant diversity knowledge to REDD+

An '*Overview of Selected REDD Proposals*' by Dooley *et al*., (2008), illustrates that not all Parties are making allowances for biodiversity in REDD-related projects. There is therefore a need to increase awareness of the potential to achieve important biodiversity and livelihood co-benefits as identified within the REDD+ agenda. Considering biodiversity issues alongside carbon "can potentially capture two environmental services for the price of one" (Karousakis, 2009). Accurate species and habitat knowledge is therefore a crucial element of REDD+ projects and vital throughout the REDD+ process. The apparent neglect of biodiversity in REDD+ projects and the need for accurate species identification, reveals the potential for botanic gardens to contribute to such projects. For example, many projects within botanic gardens, require specialist species knowledge, a “unique expertise” inherent in botanic gardens (Leal, pers. comm, 2010). Such skills may prove invaluable in the implementation of REDD+ projects.

Table 2 provides an overview of some of the work being carried out by botanic gardens that is relevant to REDD+ projects. This information is derived from a series of case studies carried out by BGCI and does not attempt to provide a comprehensive overview of all the relevant work being carried out by the selected gardens.

In addition to illustrating the close links to REDD+, the case studies also illustrate the extent to which botanic gardens work in partnership to share their expertise and achieve project objectives. Building upon these global partnerships and networks could provide a crucial foundation upon which botanic gardens could develop appropriate strategies to support national REDD+ projects.

Potential contributions to REDD+ could include:

- Informing site selection at the project planning stages by providing detailed species-level data and to inform forest carbon stock calculations;
- Identifying local livelihood issues in proposed project sites and promoting wide stakeholder consultation;
- Carrying out baseline biodiversity and carbon surveys;
- Forest monitoring, including retrospective, ongoing and predictive monitoring;
- Capacity development and technology transfer. Transferable skills include forest survey and mapping techniques, climate modelling, species identification and taxonomy, inventorying, forest management and working with local communities;
- For afforestation programmes, species selection, seed supply and propagation protocols.

Box 7. African trees for forest restoration and carbon sequestration

There are opportunities for conservation organisations such as BGCI to support and enhance the sharing of REDD+ related knowledge. BGCI is working with botanic gardens in Africa to investigate their potential for expanding their work in forest restoration and carbon sequestration. The emphasis is on the use of trees that are threatened in their natural habitats and/or have specific livelihood values. It is intended to link the results of the work, currently focusing on gardens in DRC, Kenya and Uganda, with the REDD+ process. Within Uganda the main botanic gardens have recently formed a coordinating network to share skills and expertise nationally. This will facilitate capacity building in species identification, forest assessment and monitoring, community outreach and the practical conservation of important livelihood species.

Table 2. Botanic garden case studies and links to REDD+

Botanic Garden	Case Study Project	Relevance to REDD+
Botanic Gardens Trust, Sydney (BGT) – Australia	Currently working with local partners in Papua New Guinea to provide tree identification tools. The objective of this long-term collaborative project is to reduce the misidentification of species which can lead to the destruction of non-timber forest species. More information available at: www.rbgsyd.nsw.gov.au/science.	Species identification is crucial to carbon calculations. This information can also improve plant conservation at REDD+ sites.
Rio de Janeiro Botanical Garden - Brazil	The Atlantic Rainforest project (Programme Mata Atlantica, PMA) aims to protect the remaining six per cent of original Atlantic Forest. The project studies taxonomy, community ecology, ecological anatomy and seed germination to determine species diversity. Researchers have integrated local knowledge into project implementation and improved relations with local people (Guedes-Bruni and Sampaio Pereira, 2008).	Working with local communities ensures engagement of local people in implementation. Improved forest management.
South China Botanical Garden (SCBG) – China	Dinghushan Forest Ecosystem Research Station undertakes research into successional processes and local biodiversity to inform forest management. Data at the station dates back to the 1950s, providing a comprehensive overview of research activities. More information available at: http://scib.ac.cn.	Forest data for improved forest management.
Kadoorie Farm and Botanic Garden – China	The Yinggeling nature reserve on the island of Hainan aims to protect tropical rainforests. Comprehensive biodiversity surveys conducted from 2005-06, determine species diversity. More information available at: www.kfbg.org.	Biodiversity survey data and expertise for conservation at REDD+ sites.
Xishuangbanna Tropical Botanic Garden (XTBG) – China	Scientists at XTBG are working with other tropical botanic gardens to build capacity in these conservation skills. More information available at: http://english.xtbg.cas.cn/.	Training and capacity development in key skills.
Royal Botanic Gardens, Kew (Kew) – United Kingdom	Kew's Millennium Seed Bank and their Malawian partners aim to propagate 50 indigenous 'useful' tree species, and to make 100,000 seedlings available for local afforestation programmes. The selected species are threatened by over exploitation. The project addresses livelihood issues through the reintroduction of useful species and offers to offset carbon emissions from employee travel (Sacande, pers. comm. 2010).	Working with local people in project implementation. Understanding services provided by species. Capacity building and training in key skills. Knowledge transfer (e.g. propagation protocols). Seed availability.

Botanic Garden	Case Study Project	Relevance to REDD+
Royal Botanic Garden Edinburgh (RBGE) – United Kingdom	Darwin Initiative funded agro-forestry projects in Peru, identified and surveyed local tree species suitable for agro-forestry. "Non-technical, local language" identification guides were produced for use by the local stakeholders. Sharing species knowledge, scientists taught local communities and organisations, to identify and propagate native tree species. More information available at: http://www.rbge.org.uk/science/tropical-diversity/.	Understanding species composition. Knowledge transfer and engagement of local people in project implementation.
Missouri Botanical Garden (Mobot) – United States of America	Working with the Gabonese government to map 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. (Leal, pers. comm. 2010).	Calculation of carbon stocks.

5. Recommendations and checklist

Botanic gardens are well placed to make a significant contribution to REDD+ projects. Their expertise in the conservation of plant diversity at a practical level is generally unmatched. However, REDD+ is yet to become a feature of botanic garden activities and most botanic gardens remain unaware of the potential opportunities. A lack of awareness of the REDD+ mechanism means that the necessary linkages are not made with existing relevant botanic garden projects.

As resources in botanic gardens are increasingly limited, strategic realignment of activities by botanic gardens could allow existing relevant project objectives to become consistent with REDD+. This may provide opportunities for 'added value' and new sources of support for botanic garden research. As the REDD+ negotiations continue, now is the time for botanic gardens to consider their own contributions and how they may become part of the process by acting both individually and collectively.

Botanic gardens should use their ability to directly influence national and international decision making, to play a crucial role in convincing policy makers of the importance of botanic institutions in implementing REDD+ projects. Furthermore, considering that REDD+ projects will be more prevalent in developing nations, where capacity is frequently limited, the existence of international partnerships and networks, such as those that exist between botanic gardens, will be important. Collectively botanic gardens provide a strong force for forest conservation, restoration and tackling climate change.

A REDD+ checklist for botanic gardens:

The following checklist may help to define an individual botanic garden's response to REDD+:

- Increase institutional awareness of the REDD+ mechanism and begin monitoring the developments. Information is available at http:/unfccc.int/;
- Review existing activities within institutions to identify those that are relevant to REDD+;
- Establish institutional REDD+ research programmes, building on existing REDD+ related strengths;
- Tailor existing programmes to REDD+ and develop REDD+ pilot projects to determine the extent of botanic garden's strengths;
- Establish an institutional policy on REDD+. A consultation report by Kew scientists for the Elisach Review on '*Climate Change: Financing Global Forests*' provides an example of how an institution can review its practices (Moat, 2008);
- Develop in-house departmental REDD+ networks and communication platforms to ensure a harmonized approach;
- Observe and where achievable, contribute to existing pilot projects, for example in UN-REDD nations: More information at www.un-redd.org/;
- Begin institutional and partner discussions with forest agencies, NGOs and other stakeholders to establish how strengths could be drawn together, shared and applied to REDD+. Specifically in partner nations where REDD+ is being developed;
- Publicise the potential role which botanic gardens can play in lending their expertise to the REDD+ process and explain these roles to the wider public;
- Promote the potential for biodiversity and livelihood benefits to be achieved by REDD+;
- Initiate REDD+ discussions with higher level networks, including for example national and international government departments;
- Build more diverse networks and partnerships with organisations and stakeholders working inline with co-benefits other than those addressing biodiversity;
- Share experiences through national and regional and global networks through organisations such as BGCI.

6. Glossary

Additionality: REDD+ projects need to demonstrate 'additionality'. That is, that the carbon gains made through the project would not have occurred anyway in the absence of the project.

Afforestation: The direct human-induced conversion of land that has not been forested for a period of at least 50 years to forested land through planting, seeding and/or the human-induced promotion of natural seed sources.

Carbon pool: A system which has the capacity to accumulate or release carbon. Examples of carbon pools are forest biomass, wood products, soils, and atmosphere.

Carbon sequestration: The process of removing carbon from the atmosphere and depositing it in a carbon pool or reservoir.

Carbon stock: The absolute quantity of carbon held within a pool at a specified time.

Deforestation: The direct human-induced conversion of forested land to non-forested land.

Degradation: A formal definition for forest degradation has not yet been agreed upon by the Intergovernmental Panel on Climate Change. However, it is recognised as the direct, human-induced loss of forest values (particularly carbon) likely to be characterised by a reduction of tree cover.

Greenhouse gases (GHGs): The atmospheric gases responsible for causing global warming and climate change. The major GHGs are carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_20).

Leakage: Net change of anthropogenic emissions of greenhouse gases (GHGs) which occurs outside the project boundary, and which is measurable and attributable to project activity.

Permanence: The longevity of a carbon pool and the stability of its stocks, given the management and disturbance environment in which it occurs.

Reforestation: The direct human-induced conversion of non-forested land to forested land through planting, seeding and/or the human-induced promotion of natural seed sources, on land that was forested but that has been converted to non-forested land.

Sink: Any process or mechanism which removes a greenhouse gas from the atmosphere. Forests and other vegetation are considered sinks because they remove carbon dioxide through photosynthesis.

Source: A carbon pool can be a source of carbon to the atmosphere if less carbon is flowing into it than is flowing out of it.

7. Resources

Useful websites

The UN-REDD Programme:
http://www.un-redd.org/
The UN-REDD Programme is the United Nations Collaborative Initiative on Reducing Emissions from Deforestation and forest Degradation (REDD) in developing countries. The Programme assists developing countries prepare and implement national REDD+ strategies.

The CBD Programme of Work on Forest Biodiversity:
http://www.cbd.int/forest/pow.shtml
At the 10th Conference of the Parties to the Convention on Biological Diversity, the CBD noted the important role of conservation, sustainable management of forests and enhancement of forest carbon stocks in helping achieve the objectives of both the CBD and the UNFCCC.

Carbon, biodiversity & ecosystem services: exploring co-benefits:
http://www.carbon-biodiversity.net/
Provides a link to an Interactive Carbon Calculator, developed by UNEP-WCMC, and CBD Life Web which provides users with initial estimates of carbon values for existing protected areas or any polygon drawn on a global map.

The Forest Investment Program (FIP):
http://www.climateinvestmentfunds.org/cif/node/5
The FIP supports developing countries' efforts to reduce deforestation and forest degradation (REDD) and promotes sustainable forest management that leads to emission reductions and the protection of carbon reservoirs.

Global Terrestrial Observing System:
http://www.fao.org/gtos/index.html
GTOS is a programme for observations, modelling, and analysis of terrestrial ecosystems to support sustainable development.

The Forest Carbon Partnership Facility (FCPF):
http://www.forestcarbonpartnership.org/fcp/
The FCPF assists developing countries in their efforts to reduce emissions from deforestation and forest degradation and foster conservation, sustainable management of forests, and enhancement of forest carbon stocks by providing value to standing forests.

The Global Canopy Programme:
http://www.globalcanopy.org/
The Global Canopy Programme produces a range of resources including The Little REDD+ Book - An updated guide to governmental and non-governmental proposals for reducing emissions from deforestation. Available for download from: http://www.globalcanopy.org/main.php?m=117&sm=176&t=1.

The Climate Community and Biodiversity Alliance:
http://www.climate-standards.org/index.html
The CCBA is a partnership among research institutions, corporations and non-governmental organizations (NGOs) that has developed CCB standards.

Plan Vivo:
http://www.planvivo.org/
Plan Vivo is a system for developing community-based payments for ecosystem services (PES) projects and programmes, with an emphasis on building capacity, long-term carbon benefits, diversifying livelihoods and protecting biodiversity.

Useful resources

Biodiversity and Climate Change Mitigation and Adaptation:
Report of the Second Ad Hoc Technical Expert Group on Biodiversity and Climate Change – CBD Technical Series No 41. Available for download at: http://www.cbd.int/doc/publications/cbd-ts-41-en.pdf.

Forest Resilience, Biodiversity, and Climate Change:
A Synthesis of the Biodiversity/Resilience/Stability Relationship in Forest Ecosystems. CBD Technical Series No. 43. Available for download at: http://www.cbd.int/doc/publications/cbd-ts-43-en.pdf.

Outcomes of the Global Expert Workshop on Biodiversity Benefits of Reducing Emissions from Deforestation and Forest Degradation in Developing Countries. September 2010:
Available at: http://www.cbd.int/doc/?meeting=EWREDD-01.

Linking Biodiversity Conservation and Poverty Alleviation:
A State of Knowledge Review. CBD Technical Series No 53. Available for download at: http://www.cbd.int/doc/publications/cbd-ts-55-en.pdf.

Good Practice Guidance for Land Use, Land-Use Change and Forestry:
Available for download from: http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.html.

Conservation Training:
Introductory Course on Reducing Emissions from Deforestation and Forest Degradation and Conserving and Enhancing Forest Carbon Stocks (REDD+). The Nature Conservancy. Available at: https://www.conservationtraining.org/index.php?page=86.

Making REDD work for the poor:
This publication was prepared on behalf of the Poverty Environment Partnership (PEP) and presents a framework for understanding the linkages between REDD and poverty. Available for download at: http://www.unep-wcmc.org/climate/pdf/Making%20REDD%20work%20for%20the%20poor%20FINAL%20DRAFT%200110.pdf.

A Nested Approach to REDD-plus:
Structuring effective and transparent incentive mechanisms for REDD+ implementation at multiple scales. The Nature Conservancy. Available at: http://www.nature.org/initiatives/climatechange/files/nested_paper_final_60110.pdf.

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PLANTS PEOPLE POSSIBILITIES

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