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BGjournal

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**INTRODUCING
THE GLOBAL
BIODIVERSITY
STANDARD**



UNITED NATIONS DECADE ON
**ECOSYSTEM
RESTORATION**
2021-2030



**BOTANIC
GARDENS**
CONSERVATION
INTERNATIONAL

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Cover image: 12 year old re-established forest in Kenya (Barney Wilczak)

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INTRODUCING THE GLOBAL BIODIVERSITY STANDARD



The Global Biodiversity Standard

Welcome to this special edition of BG Journal focusing on afforestation, reforestation and restoration and the need for positive biodiversity outcomes. Critical to achieving these is being able to measure impacts on biodiversity – positive and negative – and in this edition we introduce the Global Biodiversity Standard and Certification announced by BGCI and partners at COP-26 in November last year.

We start on page 14 with an introduction to the Global Biodiversity Standard (GBS) – why it is needed, what it will entail and the next steps in its development. Over the past year or so, BGCI and members of the Ecological Restoration Alliance¹ of Botanic Gardens (ERA) have been thinking about ways in which we can combine the survey and inventory skills of botanical institutions with our ecological restoration skills, not least our ability to grow a very wide range of plants – including around 18,000 tree species. The result is a new ERA Strategy (see page 41) and at its centre, the Global Biodiversity Standard which will combine biodiversity impact assessment and mentoring of restoration practitioners for better biodiversity outcomes. In addition to the 43 institutional members of ERA, the GBS has been enthusiastically endorsed by BGCI's Board, its International Advisory Council² and by Elizabeth Maruma Mrema, the Executive Secretary of the Convention on Biological Diversity, amongst others.

Of course, we need to get the Global Biodiversity Standard up and running as quickly as possible, and I am very glad to welcome Galena Woodhouse, our interviewee on page 12, as BGCI's newest staff member tasked with developing the methodology and business model of the GBS.

I am delighted to say, also, that we have been joined in developing the GBS by the Society for Ecological Restoration, the World

Agroforestry Centre, Ecosia, Plan Vivo, 1t.org, TRAFFIC and IUCN SSC's Plant Conservation Committee. In fact, many of those partners have contributed to this issue, and you can read about their perspectives over the next few pages.

One of our first new partners, Ecosia³ – the search engine that plants trees, has planted 140 million trees across more than 30 countries. Ecosia state that 'even the most determined and well-intentioned reforestation and landscape restoration initiatives will not achieve [their] ambitious goals, if they are not designed to protect, enhance and restore biodiversity' and in their article on page 17, they explain how they are going about ensuring this happens.

Plan Vivo⁴ is an internationally recognised standard in the voluntary carbon market, existing to support smallholders and communities at the forefront of the climate crisis. On page 21 they make the case for an inclusive and holistic approach to certification in order to deliver sustainable impact for biodiversity, communities, and climate through nature-based solutions. To this end, they are partnering on the development of the Global Biodiversity Standard with BGCI, sharing the learning and experience they have developed over the past 25 years working in the voluntary carbon market, and looking at ways in which the GBS can be integrated into their standard covering carbon and livelihoods.

The 24 members of the 1t.org Corporate Alliance⁵, including Amazon, Bayer, EY, Nestlé, Salesforce, SAP and Unilever (see page 25), have responded to the World Economic Forum's Global Risk Report, which identifies biodiversity loss as the third most severe risk after climate action failure and extreme weather, by founding the LEAF Coalition – alongside the Norwegian, UK and US governments – to help mobilise financial

support to preserve tropical forests. By partnering with jurisdictional governments implementing forest protection, members of the LEAF coalition are contributing to green and resilient growth through sustainable investments. The LEAF Coalition recently celebrated its first USD1 billion in investment – demonstrating enthusiasm for high-quality jurisdictional approaches. BGCI has also briefed 1t.org's corporate alliance on the forthcoming Global Biodiversity Standard.

Investing in Government initiatives requires robust policy frameworks, and the policy frameworks related to ecological restoration are comprehensive (see page 29). They also transcend the large multilateral conventions, including the CBD, UNFCCC, UNCCD and SDGs, feeding into National Biodiversity Strategies and Action Plans and climate related Nationally Determined Contributions.

However, intending to create biodiverse, restored landscapes is very different from actually doing it, and there are many practical impediments to success that will need to be addressed through sharing knowledge, data and expertise as well as developing new infrastructures and value chains. One major impediment is the lack of diverse, genetically appropriate planting material. On page 32, our partners at the World Agroforestry Centre (ICRAF) provide a case study from Ethiopia on the benefits of an efficient network that can supply high quality, diverse tree planting material where and when it is needed.

Last but not least, our featured garden is Bogotá Botanical Garden in Colombia, which is already benefiting from its new Tropical Glasshouse which is a magnificent resource for the conservation of Colombia's plants from the dry and humid, and the hot and very cold ecosystems of Colombia.

Happy reading!

ENDNOTES

¹ Ecological Restoration Alliance of Botanic Gardens | Ecological Restoration Alliance (erabg.org)

² BGCI International Advisory Council | Botanic Gardens Conservation International

³ What is Ecosia? - The search engine that plants trees

⁴ Plan Vivo Foundation – For Nature, Climate and Communities

⁵ 1t.org Corporate Alliance | 1t.org

FEATURES

NEWS FROM BGCI
CUTTINGS

PLANT HUNTING TALES
**REDISCOVERY AND CONSERVATION
OF *PRIMULA FILCHNERAE***

FEATURED GARDEN
**NEW DISTRICT'S TROPICAL
GLASSHOUSE: BROADENING
CONSERVATION PERSPECTIVES OF
THE BOGOTÁ BOTANICAL GARDEN**

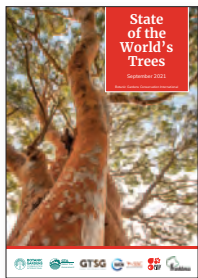
INTERVIEW
GALENA WOODHOUSE

NEWS FROM BGCI

CUTTINGS

Here we present a selection of the most recent news stories from BGCI. Please browse our website to keep up-to-date with the latest news and events from BGCI and the botanic garden community: www.bgci.org

State of the World's Tree Report



In September 2021, BGCI launched the first ever report on the State of the World's Trees. The report, which generated unprecedented media attention, revealed that a third of all world's tree species

are at risk of extinction. It also provided an in-depth analysis of which countries need to take further action to protect their threatened trees. While many countries have a large number of threatened native tree species, the report found that island tree species are proportionally most at risk. This is particularly concerning as many islands have species of trees that can be found nowhere else. Brazil, which has some of the most biodiverse forests in the world, has the highest number of tree species (8,847) and also the most threatened tree species (1,788). The report is the culmination of five years of research through the Global Tree Assessment bringing together over 60 institutional partners and more than 500 experts, and is one of the first global assessments of the world's threatened trees.

Find out more: [Global Tree Assessment | Botanic Gardens Conservation International \(bgci.org\)](#)

Global Tree Portal

Following the launch of the State of the World's Trees report, BGCI launched the Global Tree Portal which provides access to the detailed information used to compile the report. With access to information on the world's nearly 60,000 tree species, the

Portal provides a major new tool to support forestry, biodiversity conservation and climate change policy and action for tree species. The portal provides information at the species, country and global levels and links to BGCI's other global databases

Find out more: [GlobalTree Portal | Botanic Gardens Conservation International \(bgci.org\)](#)

Securing a Future for the World's Threatened Trees – A Global Challenge



Following fast on the heels of the State of the World's Trees, this companion report calls for the mobilisation of new players and the scaling up of global efforts to conserve threatened trees. Securing a

Future for the World's Threatened Trees — A Global Challenge sets out tried-and-tested approaches from across the Global Trees Campaign partnership. Examples of effective tree conservation are illustrated by projects involving a wide range of partners coming from across the world. These range from on-the-ground survey work that led to the rediscovery of species previously thought to be extinct in Peru and East Africa; to threat-reduction actions to protect wild trees and promote natural regeneration in Vietnam and Kyrgyzstan. Other highlighted approaches include targeted capacity building in Bhutan and more effective conservation action in China.

Find out more: [New report documents two decades of best practices in tree species conservation | Botanic Gardens Conservation International \(bgci.org\)](#)

BGCI announces the Global Biodiversity Standard

At the Climate Change COP-26 in November, BGCI announced the Global Biodiversity Standard, the world's first and only standard to specifically recognise and promote the protection, restoration, and enhancement of biodiversity. Announced the day after global



The Global Biodiversity Standard

leaders discussed nature-based solutions at COP-26, the Standard aims to encourage a move away from carbon solutions that 'plant a tree at any price' and instead promotes a long-term solution to the climate crisis that puts the right tree in the right place and combines the considerations of biodiversity, local communities, and carbon capture. The Standard is being developed as a response to the climate crisis and the damaging impact tree planting schemes are having on global biodiversity. By promoting the mass planting of non-native species, many well-intentioned land management initiatives are leading to the extinction of species around the world, by introducing new pests, diseases and alien species to ecosystems.

Find out more: [BGCI Announces The Global Biodiversity Standard at COP26 | Botanic Gardens Conservation International](#)

New website for the Global Conservation Consortia



GCC

Global Conservation Consortia

Together with several partners, BGCI has launched a new website for the Global Conservation Consortia (GCC). The GCC is a collective effort which aims to mobilise a coordinated network of institutions and experts to collaboratively develop and implement comprehensive conservation strategies for priority threatened plant groups. The GCC website will host consortium-specific materials including:

- news of forthcoming events
- funding opportunities
- current consortia activities
- essential resources that guide the work of individual Consortia

The website also hosts the new sign-up mechanism for people to join each of the Consortia.

To date, Consortia have been established in collaboration with several organizations for eight highly threatened plant groups: Acer, Cycads, Dipterocarps, Erica, Magnolia, Nothofagus, Oak and Rhododendron.

Find out more: **Global Conservation Consortia – A coordinated network of institutions and experts collaboratively developing and implementing comprehensive conservation strategies for priority threatened plant groups.**

BGCI's latest Technical Review published:



The next instalment in BGCI's Technical Review series is now available: The susceptibility of botanic gardens, and their responses, to natural and man-made disasters

This Review looks at the nature, frequency and impacts of natural and man-made disasters in botanic gardens over recent years. It informs about how such disasters are managed, including sources of assistance, management actions and future adaptation to more resilient infrastructures and practices. Building technical capacity to manage and reduce the impact of future disasters is a principle that cuts across all stages of disaster management planning. This Review aims to provide guidance for institutions to develop and/or enhance their disaster management planning.

Read the Review here: **BGCI Technical Reviews | Botanic Gardens Conservation International**

The Kew Declaration on Reforestation for Biodiversity, Carbon Capture and Livelihoods

Over 3,000 global experts and concerned citizens from 114 countries have supported and signed a key Declaration that aims to promote the long-term protection and restoration of natural forest ecosystems worldwide.

Published in the journal *Plants, People, Planet*, the 'Kew Declaration on Reforestation for Biodiversity, Carbon Capture and Livelihoods' encourages policies and frameworks to protect intact forests and ensure effective restoration strategies to safeguard biodiversity, mitigate climate change and improve livelihoods.

Tree planting is often touted as an easy answer to the climate crisis as well as a convenient way for corporate companies to mitigate their carbon emissions. However, inappropriate tree planting can cause more harm than good to both nature and people.

The Declaration is based on a synthesis of evidence, discussions and conclusions presented at the Reforestation for Biodiversity, Carbon Capture and Livelihoods conference, hosted by Kew and BGCI early in 2021.

Read the Declaration here: **Kew declaration on reforestation for biodiversity, carbon capture and livelihoods - - - PLANTS, PEOPLE, PLANET - Wiley Online Library**

New papers highlight the conservation role of botanic gardens

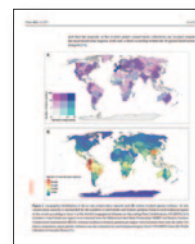
Botanic Garden Collections – An Under-Utilised Resource

A paper has been published showing that botanic garden collections are an under utilised resource in the conservation and sustainable use of socio-economically important species. 86.7% of 6,941 species identified as socio-economically important are known in at least 1 botanic garden ex situ collection and 45% are found in 11 or more. This is more than in the crop and forestry community collections.

Hudson, A., Smith, P., Gori, B. and Sharrock, S. (2021) Botanic Garden Collections—An Under-Utilised Resource. *American Journal of Plant Sciences*, **12**: 1436-1444. doi: 0.4236/ajps.2021.129101

Plant Diversity Conservation Challenges and Prospects—The Perspective of Botanic Gardens and the Millennium Seed Bank

This paper reviews the contribution that living collections and seed banks based in botanic gardens around the world make to wild plant



conservation and to tackling global challenges. The focus is particularly on the work of BGCI and the Millennium Seed Bank of the Royal Botanic Gardens, Kew, with its associated global

Partnership. The advantages and limitations of conservation of plant diversity as both living material and seed collections are reviewed, and the need for additional research and conservation measures, such as cryopreservation, to enable the long-term conservation of 'exceptional species' is discussed.

Breman, E.; Ballesteros, D.; Castillo-Lorenzo, E.; Cockel, C.; Dickie, J.; Faruk, A.; O'Donnell, K.; Offord, C.A.; Pironon, S.; Sharrock, S.; et al. Plant Diversity Conservation Challenges and Prospects—The Perspective of Botanic Gardens and the Millennium Seed Bank. *Plants* 2021, **10**: 2371. <https://doi.org/10.3390/plants10112371>

BGCI Accreditation



BGCI
Accreditation
Scheme

The following gardens have achieved botanic garden accreditation since the last issue of BGJournal. Congratulations to all:

- Bergius Botanic Garden
Sweden
- The Peel Mansion Museum & Heritage Gardens
United States
- Bickton Park Botanical Gardens
United Kingdom
- Sukkulenten-Sammlung Zürich
Switzerland
- Los Angeles Dodgers
United States



A cultivated *P. filchnerae* population in Gan's experimental garden (Qiliang Gan)

PLANT HUNTING TALES

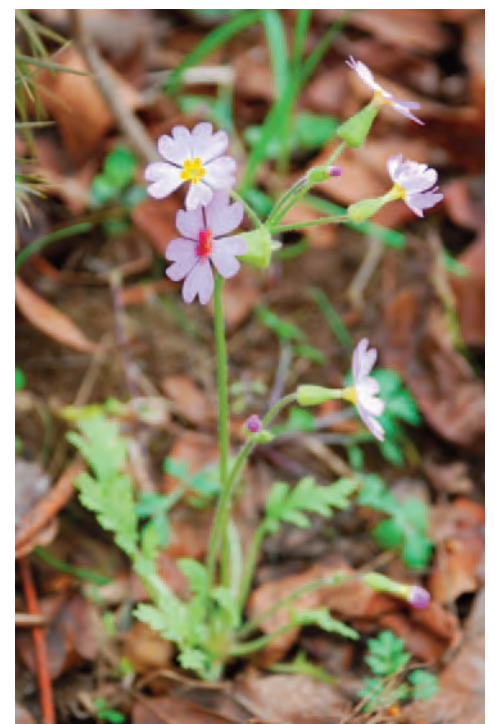
REDISCOVERY AND CONSERVATION OF *PRIMULA FILCHNERAE*

Reappearance of *Primula filchnerae*

In 1905, Knuth & Diels published a description of *Primula filchnerae*, which they sampled from Tsingling Mountains in Shaanxi, China. Until recently, no further individuals of this species had been found and it was thought to be extinct in the wild (Hu, 1990).

This was until Qiliang Gan began his botanical studies. In his childhood, Gan, the

second author of this paper, collected different kinds of plants in the mountains in Zhuxi, Hubei, China, for food and medicine and he developed a great interest in wild plants. In 1999, Gan retired from his TV station position, and began to study extensively and with great enthusiasm the flora of West Hubei. In 2005 and 2011, Gan published *Flora Zhuxiensis* and *Flora Zhuxiensis Supplementum*, respectively; and in 2016, Gan published *Hubei Zhuxi Traditional Chinese Medicine Resource Records*.



A plant of *P. filchnerae* in Xinzhou, Zhuxi, Hubei, China (Qiliang Gan)



Neotype of *Primula filchnerae* (Xiaodong Li).

On 17 March 2006, during a botanical exploration in Xinzhou, Zhuxi, Hubei, China, Gan found an unusual *Primula* species in the shrub along a mountain ditch. Later, Gan collected a specimen and sent it to Prof. Chiming Hu of the South China Botanical Garden Herbarium (IBSC) and Hu confirmed the specimen belonged to *Primula filchnerae*. This was the first time that *P. filchnerae* had been rediscovered in China in the wild. In April 2006, Gan drove his car from Zhuxi to Wuhan and during a break in his journey, he accidentally encountered a population of *P. filchnerae* on the mountain slope along the road in Chengguanzhen, Zhushan, Hubei, China. Until now, only those two populations have been found in Hubei Province, China. Unfortunately, the population in Zhuxi was inundated due to the construction of a hydroelectric power station in 2009, and that in Zhushan possesses less than 100 individuals. Gan & Li (2015) designated a neotype for *P. filchnerae*. On 24 March 2015, Zhang et al. (2015) detected a natural population of *P. filchnerae* in Yangtian, Yangxian, Shaanxi Province, China.

Reproduction and conservation of *Primula filchnerae*

Gan collected about ten seeds from the Zhushan population in 2006. Starting from these seeds, by 2009 Xie et al. (2010) had successfully turned them into quite a large



A cultivated *P. filchnerae* individual in Gan's experimental garden (Qiliang Gan)

population. At the present time, the population in Gan's experimental garden can now successfully reproduce without artificial interference. And this species has also been transplanted into other sites in Zhuxi for ornamental purposes.

In 2013 and 2016, Gan sent more than 20,000 seeds of the cultivated *P. filchnerae* to the Germplasm Bank of Wild Species of Kunming Institute of Botany, CAS. Seeds of

the population in Yangxian, Shaanxi, China were collected in 2017 by Prof. Ying Zhang and seedlings were cultivated successfully in Xi'an Botanical Garden. In 2021, Prof. Ying Zhang kindly sent some seeds to Wuhan Botanical Garden, CAS, and the population of *P. filchnerae* seedlings was also grown in Wuhan Botanical Garden, CAS.

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A cultivated *P. filchnerae* population in Wuhan Botanical Garden, CAS (Xiaodong Li)



The Tropical Glasshouse is made up of six glass domes with three ecosystem collections

FEATURED GARDEN

NEW DISTRICT'S TROPICAL GLASSHOUSE: BROADENING CONSERVATION PERSPECTIVES OF THE BOGOTÁ BOTANICAL GARDEN

The Bogotá Botanical Garden complements the living collections thanks to the new Tropical Glasshouse where plants representative of dry and humid, hot and very cold ecosystems of Colombia are kept and exhibited.

Introduction

The importance of botanical gardens in Colombia has increased during recent decades. Currently there are 20 botanical gardens located across most of the natural regions of the country, providing

space for the conservation of plant species, generating awareness, education and botanical knowledge and promoting practices for sustainable development (Castellanos-Castro et al., 2017). Despite these apparently well represented collections of flora, most of them work with limited resources and only a

few have achieved relevant conservation outcomes for plants. The botanical garden of Bogotá is the largest in the country, with an area of 19.5 ha. It is one of the best equipped gardens and is located within the city at 2600 m.a.s.l., with outstanding collections of Andean and páramo floras, but with limited conditions for low altitude species.

In order to broaden its conservation strategy, the Bogota Botanical Garden renewed the previous Tropical Glasshouse to exhibit plants, both from tropical lowlands and highlands with an ecosystem perspective. Glasshouses have their origin in Renaissance Europe, established to cultivate and exhibit tropical plants. Nowadays, big glasshouses can be found in many botanical gardens both from temperate and tropical regions (Desmond, 1995; Rudolph, 1991; Lindsay & Middleton, 2018).

The District's Tropical Glasshouse is the biggest in South America, its construction started in 2016 and it opened to public in 2020. Designed by the architects Jorge Buitrago and Jaime Cabal, the project was awarded the world prize of the Pan-American Biennial of Architecture in Quito (BAQ) in 2020.

The District Tropicario offers the public a short journey into what possibly was experienced by José Celestino Mutis during the Royal Botanical Expedition to New Granada, and Alexander von Humboldt on his journey through the Colombian territories.

Collections of plants of the District's Tropical Glasshouse

The Tropical Glasshouse is made up of six glass domes with three ecosystem collections: Tropical Rainforest, Tropical Dry Ecosystem, and Superparamo; one thematic collection of Useful Plants and one specialized collection of threatened groups (Specialized Collections for Conservation). Each dome has a specific artificial climate and humidity conditions, and together they house around 300 plant species and approximately 1,300 individuals in 2,721 m². Additionally, it has an exhibition dome named Biodiversario, for events and expositions.

Tropical Rainforest collection - In here both Colombian Amazon and Biogeographical Chocó's are represented in terms of species, ecosystems and climate (high relative humidity and rainfall). This dome has an artificial mangrove, a lake and a section with mainland species. Some of the most iconic

species exhibited here are the "Abatiyu" (*Victoria amazonica*) cataloged as the largest lotus in the world, the "Caoba (*Swietenia macrophylla*), the biggest tree in the Neotropics, the "Mangle rojo" (*Rhizophora mangle*), distinguishable through its unique prop roots system and viviparous seeds, and the "Tigrehuasca" (*Aristolochia grandiflora*), an antiophidic medicinal plant with spectacular big flowers.

Tropical Dry Ecosystem collection - This dome has elements of the tropical dry forest and subxerophytic shrublands, complemented with species of the Cactaceae family from different parts of Central and South America. One of the most striking species planted in this environment is the "Barrigón del Chicamocha" (*Cavanillesia chicamochae*), an endemic and Endanger (EN) species from the Colombian dry valley of Chicamocha, which belongs to the same family as the Baobab tree (Malvaceae).

Superparamo collection - The temperature of this dome ranges from 4 to 10°C. It has a sturdy landscape with an architectural and museographic design which aims to represent the tropical Andean mountains over 4100 m.a.s.l. and under the glacial limit. Very little is known about the propagation of the species



Tropical Rainforest collection. A, B - Amazon plants; C - Chocó biogeographic plants.

of the "Superparamo" ecosystem, so this collection is fluctuating and requires the continuous acquisition and replacement of plants. Nevertheless, currently there are representative species of this ecosystem such as the "Árnica" (*Senecio nivoeaureus*), the "Lítamo real" (*Draba litamo*) and the "Colorado" (*Polylepis quadrijuga*).



Tropical Dry Ecosystem collection. A - plants from subxeriphytic area; B - plants from Tropical Dry Forest.



Superparamo collection- A, B - Representative plants of Asteraceae and Cyperaceae (Left), and *Polylepis quadrijuga* (Right); C - Overview of the collection.



Useful plants collection. A - mighty plants; B - fiber plants.

Useful plants collection - This collection is characterized by the display of species with some relevant use, illustrating plant-human relationships. It is organized into use categories, such as food, medicinal, materials and sacred or mighty plants.

Stand out plants include the “Hayahuasca” or “Yagé” (*Banisteriopsis caapi*), a sacred plant of the Amazonian indigenous cultures, the “Teocintle” (*Zea perennis*), the primordial corn, and the “Canelo de los Andaquíes” (*Ocotea quixos*), an American tree similar to cinnamon used as a spice and for medicinal purposes and which is Endangered (EN) according to the IUCN (Cárdenas & Salinas, 2007).

Specialized Collection of threatened families

- The Specialized Collection is intended for the exhibition of endangered plant families which need urgent conservation action. Some examples are Bromeliaceae, Heliconiaceae, Orchidaceae, Passifloraceae and Zamiaceae. The Zamiaceae collection has many endemic and critically endangered species such as *Zamia encephalartoides* and *Z. montana*. Likewise, the orchids collection includes the emblematic *Cattleya trianae*, the official nation flower of Colombia.

Education, outreach and networking

The District Tropical Glasshouse’s pedagogical strategy is based on the National Strategy for Plant Conservation and the National and District Environmental Education Policy (Castellanos-Castro et al., 2017). In addition, strategies on social appropriation of knowledge have started with educational actions based on guided tours, signage and infographic installations including information about the species and the conservation status of the ecosystems. In addition, some virtual activities have enhanced detailed information of ecosystems, in order to give the visitor a closer view of the diversity of plant species. Visitors are not only informed about the biological aspects of plants and ecosystems, but also on cultural diversity and the multiple ways of understanding and appreciating nature. The importance of recognising environmental impacts in the country is also featured.



Specialized Collection on Threatened families. A – Bromeliaceae; B . Araceae and Orchidaceae family; C - aquatic plants; D - Cycads group.

Future prospects for the conservation of plants in the District’s Tropical Glasshouse

The next phase will focus on the collection of new native plants and building an understanding of how the environmental conditions recreated under greenhouse conditions affect their growth. This will strengthen *ex situ* conservation strategies in the short and long term. Also, the next phases in education will involve strengthening the interaction between researchers in taxonomy and conservation biology with the general public through events developed around the collections.

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INTERVIEW

GALENA
WOODHOUSE

You have only just joined BGCI so I am sure we would all like to know a bit more about yourself and your background.

I was born in Kenya and grew up travelling and living in different African countries, Tanzania, Ghana and Ethiopia mainly. From early on I was interested in learning the names of plants and would spend as much time as I could outside or in the botanical gardens in Dar es Salaam. I decided at age 16 to study horticulture and progressed from college to the BSc in horticulture and plantsmanship at RBG Edinburgh, where in my honours year I sequenced DNA and created a phylogeny of *Dalbergia* species from Belize. From there I volunteered and worked at botanic gardens and historical gardens around the UK, in Laos, Thailand and finally back in Kenya. I conducted field work in highly threatened forest patches along the Kenyan coast for my MRes. I collected herbarium vouchers, made full species inventories, and mapped botanical hotspots. I was very lucky to have added new records for the region and to have seen some incredibly rare plants in their natural habitat. This was a really important point for me. Since then, I have been working with organisations and initiatives focussed on best practise and community-engaged botanical conservation. It may be no surprise that I spend my spare time helping in a walled garden filled with heritage fruit and vegetables and have recently become interested in growing cut flowers.

You are going to be developing the new Global Biodiversity Standard for tree planting and forest restoration schemes. Why do you think it is important to have such a standard?

With so much recent focus and investment in tree planting and forest restoration projects globally, I hope that the standard can help direct these projects to have significant

impact on conserving and promoting botanical diversity rather than just focussing on a simplistic monoculture approach. The standard is needed to assure investors, policy makers and the public that the projects they are supporting are working to protect and restore biodiversity and avoid detrimental impacts. The standard will also help these projects to gain status and access to a range of resources and knowledge networks.

Tree planting has become a panacea for many of our global issues, namely climate change and biodiversity loss. This has led to numerous regional and global challenges and commitments. However many involve monoculture plantations, often with economic gain as the main priority. In some cases, schemes have accelerated biodiversity loss, where monocultures are deemed more profitable and native forest is cleared for this purpose. Bold targets can hide the reality of what restoration entails such as long-term monitoring and resourcing. There are still very significant opportunities for conserving remaining forests and for example shaping the future direction around the 10 golden rules for restoration. The full involvement and leadership of local communities is a key component in the success of these projects and long-term restoration goals.

Overall the standard should provide the assurance that protection and enhancement of biodiversity is at the forefront of forest restoration initiatives.

What do you think will be the major challenges in developing the Standard?

Incentivising the protection of biodiversity, particularly plants, has always been a challenging area. Thankfully action to protect biodiversity is at the forefront of many decision makers' and government agendas and the need for their support has never been greater. This does not mean that it is an easy thing to achieve. It is one thing to create a great standard and another to ensure that it is adopted and carried out long term to meet and keep ambitious targets. Through a collaborative process this standard can grow and develop where each project, partner and supporter has a sense of ownership in its success.

I think that tree planting has been seen as a quick fix to solve a deeply complex issue. Working to change this silver bullet approach,

particularly within the emerging carbon market will present some additional challenges. I believe that by sharing and promoting success stories from the standard as well as having a strong network of advocates for biodiversity we can bring about a sea change.

BGCI is a botanic garden organisation. Where do botanic gardens fit into all this?

Botanic gardens are at the forefront of preventing botanical diversity loss. BGCI is made up of an incredible global network of botanical gardens. The sharing of expertise, lessons learned and data regarding species conservation and restoration is fundamental to diversifying large scale global restoration initiatives. Botanic gardens can inform, guide and be local representatives of the standard. Through this network we can ensure that key experts and practitioners as well as local knowledge can drive forward the standard globally.

Finally, on a more personal note, do you have a favourite botanic garden, and if so, which one is it and why?

I think this is an unfair question as all botanic gardens have something truly wonderful to offer!! I have found that each garden tells a story of place, plants, and people.

RBG Edinburgh naturally holds a very special place for me as its herbarium, library, and glasshouses nurtured my passion into a career and allowed me to travel the world through its plant collection. Kirstenbosch Gardens in South Africa stand out as some of the most beautiful and their representation of the diverse South African flora is superb. However, it is often the smaller gardens that really capture me the most. I recently worked with Pwani Botanical Garden in coastal Kenya, whose staff, despite limited funds and resources are working to conserve critically endangered species, often through creative improvisation and tenacious determination. Their work and that of others is driven by a true love of plants and their habitats and that inspires me daily.

A student from Pwani University in Kilifi Kenya takes part in a tree planting event organised by the LEAF charity (Alfie Simatwa Ngachie)

ARTICLES

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THE GLOBAL BIODIVERSITY STANDARD

Quercus robur. This single native species is recorded as being important to the life cycles of at least 2,300 other species, including mammals, birds, invertebrates, fungi and lichens. (Paul Smith)

The world's only international certification that recognises and promotes the protection, restoration, and enhancement of biodiversity.



The Global Biodiversity Standard

Introduction

Over the past few years, the botanical community has become increasingly concerned about tree-planting programmes, carried out primarily for carbon sequestration and human livelihoods, that do very little for biodiversity and – in some cases – are actually detrimental to biodiversity and native species. Our involvement in this issue has comprised discussions with, and

attempts to influence, a wide range of large scale tree planting initiatives, including the IUCN Bonn Challenge Secretariat, The Nature Conservancy, Gold Standard, the Forestry Stewardship Council, 1t.org, Trillion Trees, the Global Evergreening Alliance, Crowther Labs, the World Agroforestry Centre, Ecosia, Plan Vivo and various corporate entities. In all cases, we have encouraged organisations to incorporate native tree species and, where possible, threatened native tree species, into their tree planting programmes by supplying them with data and access to expertise. Through this process it has become apparent that, unlike carbon and livelihoods, there are no financial mechanisms that reward positive impacts on biodiversity, and therefore there

is little incentive to incorporate native species into planting programmes. Furthermore, the imperatives to sequester carbon as fast as possible and/or to quickly deliver income benefits through fast growing cash crops means that exotic tree species are almost invariably favoured over native species.

By promoting the planting of non-native species that displace or damage biodiversity, tree-planting schemes may be accelerating the extinction of species and in many cases, increasing CO₂ emissions.

It has also become apparent in our discussions with these organisations, including certification organisations such as Gold Standard, Forest Stewardship Council and Plan Vivo, that no international biodiversity certification exists.



Furthermore, in our discussions with some potential corporate partners, it has become clear that, in lieu of financial incentives, certification assessing impacts on biodiversity would be highly valued as assurance that biodiversity was not being harmed – a key risk for many organisations. In addition, like BGCI's existing botanic garden accreditation scheme, this could be a combined mentoring/certification scheme that incorporates training opportunities, provision of advice etc. that would enable more positive biodiversity outcomes.

BGCI provides the secretariat for the Ecological Restoration Alliance of Botanic Gardens (ERA), and BGCI and its partners have over 15 years of experience carrying out tree species recovery through the Global Trees Campaign (GTC). In addition, BGCI leads the Global Tree Assessment (GTA), which is generating the most accurate and comprehensive data on global tree diversity available. The GTA, ERA and the GTC have helped BGCI and its partners to develop and support a substantial knowledge base and expert network covering restoration and plant species recovery in >50 countries. BGCI's broader membership includes >650 botanical and forestry technical partners in nearly every country in the world.

The botanical community's access to high quality tree data and expertise, our global network of botanical expertise and our neutral political status means that ERA and BGCI's broader membership has high scientific credibility and reputational advantages in this space and, inarguably, is the best qualified network in the world to set up an international biodiversity certification scheme specific to tree planting and plant diversity. Our recent co-authorship of the 10 Golden Rules paper¹ and co-hosting of the Reforestation Conference with Kew and CIFOR-ICRAF has enhanced our profile in this area, and the 10 Golden Rules paper makes an excellent basis for such a certification scheme.

The concept of a Global Biodiversity Standard

The **aim** of the GBS is to halt the loss of biodiversity. We want to challenge the 'any tree at *minimal cost*' solution to climate change mitigation and adaptation, and replace it with long-term, best practice sol-



Well-adapted, native, dryland tree species are more resilient to drought and irregular weather patterns than introduced, exotic species (Paul Smith)

utions that combine the considerations of biodiversity, local communities, and carbon capture.

Our near-term **ambition** is to create a mechanism by which positive impacts on biodiversity are recognised in tree planting and restoration programs, and negative impacts are discouraged. Our longer-term ambition is that biodiversity will become a central consideration to all land management solutions that seek to address climate change and poverty reduction, from tree planting to food production. The values of the Standard are:

- To protect and restore biodiversity;
- To deploy the knowledge of trusted local biodiversity experts;
- To be objective and independent;
- To be accessible and equitable.

We will achieve this by creating the world's only global biodiversity standard and certification that is focused entirely on biodiversity, and that specifically recognises and promotes the protection, restoration, and enhancement of biodiversity. It will provide assurance that land management interventions such as tree planting, ecological restoration and agroforestry practices undertaken by organisations and governments are protecting, safeguarding, and restoring biodiversity, rather than inadvertently causing harm. The standard will also bring together the tried and tested expertise of the global botanical community, with the knowledge of local communities, to tree planting and restoration sites across the world. Specifically, the Standard will provide:

- **Recognition:** Recognising projects that have a positive impact on biodiversity;



Aloidendron dichotomum (Quiver tree). This dryland species is in decline throughout much of its range due to climate change. Translocation may be required for its survival (Paul Smith)

- **Incentives:** By publicly recognising best practice, we will provide incentives for organisations to incorporate native species into planting and land management programmes;
- **Assurance:** Providing assurance to governments, financiers of large-scale tree planting, and the public that initiatives are promoting and protecting biodiversity, not contributing to its decline;
- **Knowledge:** Providing knowledge, data, and mentoring for policymakers, financiers, brokers, and tree planting groups to develop land management practices that protect, restore and enhance a biodiverse world.

How the Global Biodiversity Standard will work

This is a site-based assessment and certification. All land management initiatives, including habitat restoration, tree planting and agriculture initiatives, will be eligible for certification, enabling organisations to demonstrate to the world that their climate solutions promote biodiversity and do not accelerate its decline.

Organisations will be able to apply for sites to be certified and, depending on their impacts on biodiversity, receive certification measured against a tiered standard.

Sites will be assessed against the following eight criteria, and will need to show that they:

1. Protect existing ecosystems and biodiversity;
2. Carry out interventions in appropriate areas without displacing native biodiversity;
3. Manage biodiversity in partnership with local communities and stakeholders for equitable, long-term social and economic benefits;
4. Aim to maximize biodiversity recovery through appropriate forest restoration approaches, including assisted natural regeneration;
5. Refrain from planting invasive species;
6. Use native species in planting, including threatened and rare species wherever possible and appropriate;
7. Use plant material that is genetically diverse, appropriate, and resilient;
8. Implement robust monitoring, evaluation, and adaptive management.

The criteria above are based on the 10 Golden Rules for Reforestation paper which outlines how to deliver reforestation that promotes biodiversity recovery, carbon absorption, and socio-economic benefits to local communities.

Site assessments will be carried out through a combination of (1) Review of questionnaire responses, uploaded evidence and data, (2) Remote sensing assessment of project footprint, and (3) Site visits by local biodiversity experts certified by the GBS. The last step is the most important element of the assess-



Cupressus cashmeriana, Bhutan. This tree is highly valued economically and culturally, and is becoming scarce due to its use in constructing monasteries. It is now being cultivated by local communities (Paul Smith)

ment methodology and will also create opportunities for mentoring tree-planting/restoration practitioners and long-term partnerships for better biodiversity outcomes.

Next steps for development and timeline

The development of the GBS was announced at COP-26 on November 7th 2021 at a joint event held with our partners Ecosia and Plan Vivo. The website was launched at the same time². Other partners working with BGCI and the botanical community on the development of the GBS are the Society for Ecological Restoration, the World Agroforestry Centre (ICRAF), TRAFIC and 1t.org's corporate alliance.

The next steps are as follows:

1. Development, testing and finalisation of a scientifically credible, objective, accessible Global Biodiversity Standard and certification methodology (1-2 years);
2. Hubs of expertise and data established to support GBS assessments and forest restoration mentorship in highly biodiverse countries (1-3 years);
3. A self-sustaining business model and plan for scaling up the GBS developed (1-3 years);
4. The GBS certification adopted and used by policymakers, financiers and practitioners of tree-planting, reforestation and forest restoration managing at least 250 sites over the next 5 years.

All of the above is funding-dependent, but we have a number of funding proposals submitted as well as some initial corporate sponsorship from Etihad Airways.

If you would like to participate in the development of the Global Biodiversity Standard or simply be kept up to date with developments, please contact galena.woodhouse@bgci.org

Paul Smith
BGCI
UK

ENDNOTES

¹ Ten golden rules for reforestation to optimize carbon sequestration, biodiversity recovery and livelihood benefits - Di Sacco - 2021 - Global Change Biology - Wiley Online Library

² www.biodiversitystandard.org.

WHY BIODIVERSITY IS IMPORTANT IN TREE PLANTING PROGRAMMES

Losing forest means losing critical plant and wildlife species, which further accelerates the deterioration of landscapes and ecosystems, with dire consequences for life on Earth. Ecosia is dedicated to ensuring its tree planting programmes go hand-in-hand with protecting and enhancing biodiversity.



Brazil, April 2021: Spotted Jaguar Tracks in one of our corridors under restoration where we are working on the Corridors for Life Project to restore forest remnants in the Atlantic Rainforest

Introduction

Trees play a crucial role in protecting the Earth's biodiversity. In turn, trees need the rich diversity of the planet's plant, animal, fungi and bacteria (among others) species to thrive. It is estimated that 80 percent of terrestrial species live in forests (Global Forest Watch), and that every native tree has thousands of other species that depend on it for their survival.

Each tree species plays a unique role in its ecosystem, and the loss of a single species can have a domino effect of extinctions, threatening habitats of animals and plants and the overall resilience of an entire ecosystem (Burchard-Levine, 2021). Losing a single plant species from an ecosystem can result in the loss of up to 30 other plant and animal extinctions (Global Forest Watch, n.d.). For example, according to the Woodland Trust, the Oak tree alone supports 2,300 species, of which 326 species depend entirely on the oak tree for their survival.

The past few decades have witnessed a tremendous drop in biodiversity, fueled by anthropogenic activities, distorted incentives and a changing climate. Wildlife corridors are increasingly fragmented, disrupting food chains, while a soaring population is resulting in much of the formerly forested land being converted to agricultural land and urban areas.

The acceleration of deforestation and landscape degradation is followed by an accelerated loss of planetary biodiversity. This interdependence between trees and other species becomes visible in efforts to protect endangered trees, as habitat needs or reliance on now-extinct animals to disperse seeds can mean that some tree species will not simply bounce back on their own and instead require targeted actions.

The biodiversity of our planet is highly dependent on the way that we interact with our forests. Forests and biodiversity are closely intertwined. And tree planting initiatives must necessarily be designed to ensure the protection of biodiversity.

FAO and UNEP, 2020

A surge in tree planting programmes

Enthusiasm for tree planting initiatives has seen a dramatic surge in the last few years. Studies elevating reforestation as the most effective way to counteract the impacts of climate change (such as Bastin et al., 2019) have come to the forefront, and tree planting has become known as a panacea for many of today's complex challenges Martin et al., 2021. This has fueled a growth in both private and public initiatives to accelerate the rate of tree planting on the planet. According to the study by Martin et al., the number of organizations involved in tree planting has increased by 288% in the past 30 years.

Yet this enthusiasm was also met with some concerns from scientists warning that tree planting should not be viewed as a simple solution (Martin et al., 2021) The study by Holl and Brancalion (2020) warned that overzealous tree planting initiatives can result in more harm than good, especially if

they are treated as simplistic solutions, without consideration for more nuanced factors such as dealing with the underlying causes of deforestation, and ensuring long term monitoring.

While the speed of deforestation and severity of landscape degradation makes human intervention a necessity, it is clear that even the most determined and well-intentioned reforestation and landscape restoration initiatives will not achieve these ambitious goals, if they are not designed to protect, enhance and restore biodiversity.

In many ways, the surge in interest in tree planting programmes, and the interdependence of trees and species diversity is reassuring and can be seen as a tremendous opportunity to protect and enhance the biodiversity of our ecosystems, but how do we make sure we get it right?

Right tree, right place; the more species the better

To maximise biodiversity impact when designing tree planting initiatives, the more similar the planted forest looks to the original forest, the more it will contribute to enhancing biodiversity. Planting diverse species not only improves resilience, protecting against disease, pests, and fires, but results in better outcomes for biodiversity. And in turn, the more diversity, the healthier and more resilient the overall landscape.



Indonesia, Dec 2021: At the Sangkapane landscape, some animals are returning to the areas we are restoring with the Leuser Conservation Forum/Wildlife Asia, the team has found footsteps that indicate *Panthera tigris* footsteps.

A recent study by Wang et al (2021) found that reforestation using mixed native species has a greater impact on improving biodiversity, compared to planting exotic species in monocultures. Since a single tree, such as the oak, can support thousands of species, the more different tree species there are in an ecosystem, the more niches it will provide, and the more resilient it will become. At the same time, planting exotic species can run the risk of wreaking havoc on the balance of an ecosystem. By planting a diversity of local native species, the entire ecosystem thrives.

Yet at the moment, despite the increased enthusiasm in tree planting efforts, very little diversity of tree species are actually planted. According to Martin et al.'s study, almost 1.4 billion trees have been planted since 1961, yet only 59% of the 102 organizations included in the study actually reported on the tree species planted, and with varying degrees of detailed information. The few that did report species information, reported planting almost 700 species in total. However a much smaller number of species were widely planted across these organisations. The study showed that a mean of 12 species and 10 genera were planted in each scheme, with the most frequently reported species being commercial or utilitarian; the top five included cacao, teak, moringa, mango and coffee.

The older, the better

Plant diversity is crucial as it results in healthier and better functioning forests and ecosystems. According to a study by Chen et al., 2018, plant diversity increased soil carbon storage, and that biodiversity is significantly higher in reforestation by planting mixed native species compared to more intensively managed plantations.



Brazil: Our partners at CEPAN¹ use the Muvuca/direct sowing method, which consists of a mix of native and non-native seeds that will simulate the natural succession of the forest



A farmer is harvesting from the nutritional gardens we work with in Ghana with TreeAid² where we are working with communities along the Daka River growing trees that will provide nutritious food and incomes, and help restore the river as a reliable source of water, all year round.

The most reliable way to restore biodiversity rapidly is to mimic primary forests as close as possible. (Wang et al., 2021).

The study by Wang et al. also confirmed that the older and more mature the forest, the greater the biodiversity. Planting trees and increasing canopy cover provides habitats and shelters for fauna, which in turn increases faunal diversity. Tree planting, when carried out appropriately, improves overall plant biomass, soil health and water availability and results in a well-functioning food chain providing conditions for millions of species to proliferate.

Therefore, as part of enhancing biodiversity through tree planting, incentives to keep trees growing for as long as possible need to be integrated into the design of interventions. Tree planting organisations should be encouraged to develop programmes that ensure the long-term survival of trees in a way that benefits both people and the natural environment.

Trees as a proxy for biodiversity

We have reached a critical point in the loss of species diversity on our planet, yet we continue to lack methodologically sound means to effectively measure, monitor and quantify biodiversity (Brunbjerg et al., 2018).

Here, trees provide another interesting opportunity. Vascular plants, and thereby trees, are a quick and efficient means to gain

an estimate of the overall diversity in an ecosystem. As the population biologist John Harper put it, unlike other species, vascular plants “stand still and wait to be counted” (Ejrnæs et al., 2018).

*“Vascular plants are strong indicators of total biodiversity across environmental gradients and broad taxonomic realms and therefore a natural first choice for biodiversity monitoring and conservation planning.”
Brunbjerg et al., 2018*

Creating the right incentives

Trees are multifaceted and provide numerous benefits for nature and human society. They sequester carbon, prevent soil erosion, replenish water supplies, provide food and nutrition, and their timber can be used for shelter and infrastructure, or as fuel for cooking. As a result, human society is deeply intertwined with forests. Since humans are stewards of the earth, they play a vital role in the survival of trees and can make or break reforestation efforts. Trees that have a function for humans are more likely to be taken care of, and therefore creating a symbiotic relationship between humans and trees and articulating the long-term benefits of their survival is key.

We are more likely to achieve this by understanding the local context. To begin with, supporting local knowledge and wisdom to

collect, sow and grow the optimal seeds for diverse species and with genetic diversity can have a great impact on improving biodiversity in an area.

Amongst others, conversion to agricultural land is one of the major drivers of deforestation. As the world’s population continues to surge, further risk is posed by land conversion. In this case agroforestry can provide an opportunity, allowing smallholder farmers to increase tree cover on their land, while at the same time producing food and diversifying their diets. A win-win scenario.

Agroforestry, or increasing tree cover in agricultural landscapes can support plant and invertebrate biodiversity and significantly improve ecosystem functions (Barrios et al., 2017). At the same time, agroforestry can bring about an important source of income. Farmers and landowners who plant a diversity of tree species, and preferably native species, in a way that benefits biodiversity over the long run, should be rewarded.

Signs of success

At Ecosia, we recently reached a milestone where our user’s searches helped us plant 140 million trees across more than 30 countries. In the past years, we have been lucky to celebrate a number of milestones, yet nothing causes more excitement than reports of animal or plant species returning to a site we are helping restore, as it is likely the most rewarding sign that we are doing something right with our tree planting projects.



Brazil: Mixed Rocambole Scientific Methodology (ROMI) developed by the Espinhaço Institute. Consists of a “roll” with seedlings 80% of filling species and 20% of diversity species.

In April 2021, Ecosia's partners at Instituto de Pesquisas Ecológica, working on connecting corridors in the Atlantic Rainforest reported Jaguar paws while monitoring a site; our partners at CEPAN spotted Blond Capuchins dwelling in one of the sites we are restoring; and recently, this past December our partners working in the Leuser Ecosystem in Indonesia, found footprints that indicate *Panthera tigris* presence in the area.

Conclusion

While it is promising to see a growing interest in tree planting, it is equally important to ensure that it is done correctly. Not only by planting the right species in the right place at the right time, but also taking into account socio-economic and cultural interdependencies and ensuring that measures are in place to protect and enhance biodiversity. This is no easy feat, but working with local partners and ensuring suitable long-term growing conditions and adequate monitoring over time are steps in the right direction. Finally, the closer we can get to mimicking the old growth or original forests that once thrived in the areas, the better the outcomes for biodiversity.

Tree planting programmes rely on biodiversity to thrive and survive, and in turn there is a significant opportunity to conserve and enhance biodiversity via the current excitement fueling the proliferation of tree planting programmes all over the world. Enhancing biodiversity and tree planting must necessarily go hand in hand, otherwise this unique opportunity will be lost.

About Ecosia

Headquartered in Berlin, Germany, Ecosia is the world's largest not-for-profit search engine. In 2014 Ecosia was accredited as a B Corporation and in 2017 it built the first of its four solar plants to ensure it is 100% renewable, reaching more than 200% renewable in July 2020. In 2018 Ecosia gave away its shares to the Purpose Foundation, to assure that it can never be sold and that no one, including the founder, can profit or receive dividends from the company. Ecosia was founded by Christian Kroll in 2009.

Ecosia has planted over 140 million trees in more than 32 countries with over 60 partners. Visit <https://info.ecosia.org/> to learn more.



Planting seedlings using the ROMI methodology in Brazil

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Antonia Burchard-Levine
Ecosia

ENDNOTES

¹ <http://www.cepan.org.br/>

² <https://www.treeaid.org/get-involved/corporate-partnerships/ecosia/>

WHY AN INCLUSIVE AND HOLISTIC APPROACH TO CERTIFICATION IS IMPORTANT TO DELIVER SUSTAINABLE IMPACT FOR BIODIVERSITY, COMMUNITIES, AND CLIMATE.



Above and left: the Drawa project (Fiji)



Through participating in the development of the Global Biodiversity Standard with BGCI, Plan Vivo hopes to share the learning and experience developed over the past 25 years working in the voluntary carbon market, while benefitting from access to a globally recognised quality assurance scheme for our tree planting activities

Introduction

The scale and challenge of the climate emergency we are facing is now clear and widely accepted. Without significant changes to how we live our lives we are on course to reach 1.5 degrees Celsius of warming within the next two decades¹, the impacts of which could be catastrophic for both human wellbeing and the conservation of the Earth's biodiversity. This impact is already being felt by millions of people

across the world, but especially climate vulnerable communities living in poverty, with limited resources. According to the World Bank, "...recent estimates indicate that between 68 million and 132 million people could be pushed into poverty by 2030 because of the multiple impacts of climate change"². Data from the 'Living Planet Report'³ highlights an average loss of biodiversity (in terms of wildlife populations) of almost 70% decline between 1970 and 2016, and according to BGCI's 'State of the

World's Trees'⁴, 30% of tree species are currently threatened with extinction. These numbers can be overwhelming, and one can be forgiven for asking 'how do we even start to tackle the issues?' These trends highlight something important that many of us probably already knew:

People, planet and nature are all interconnected, interdependent and symbiotic.

If the climate is in bad shape, then those living in it and dependent on it are too. But conversely, if we can heal the planet, in a sustainable, inclusive, and holistic way, then we can heal ourselves, and the other complex and diverse species that make up this planet we call Earth.

A holistic approach

At Plan Vivo we advocate this holistic approach and truly believe that nature-based solutions can collectively deliver real and additional climate impact, whilst simultaneously restoring and protecting important habitats for biodiversity. Additionally, this approach can enable sustainable socio-economic development and crucially build collective resilience. However, this can only be achieved by reflecting on what we are doing, challenging the 'norms' and collaborating broadly to develop and offer pragmatic solutions.

Plan Vivo is an internationally recognised standard in the voluntary carbon market, existing to support smallholders and communities at the forefront of the climate crisis. We are known for our robust, inclusive and holistic approach to project certification, and a focus on ensuring small holders and communities receive equitable benefit sharing of fairly traded carbon finance. Under the Plan Vivo model, tree planting is typically undertaken by small holders to enhance their agro-ecosystems, or by communities as part of their forest restoration and conservation efforts. Based on over 25 years' experience of working with projects across the world, at Plan Vivo we strongly believe that the key to tackling climate change is through empowering communities and smallholders as custodians of the environment. The Plan Vivo network has already



Plan Vivo's Khasi Hills Project in India

had significant impact (see Figure 1) and based on this approach and these values, our mission at Plan Vivo is to increase our impact for climate, people and nature.

Action on the ground

While the impact in numbers is important, it only highlights part of the picture. Behind each of the statistics are real people working in collaboration to improve their lives and the opportunities of others, while at the same time helping to tackle the climate crisis

and contribute towards halting alarming trends of biodiversity loss. For example, within the Drawa project⁵ the Plan Vivo model provides indigenous people in Fiji with a viable alternative to unsustainable logging, which is driving the deforestation of over 4,000 ha of pristine rainforest. These landowners (indigenous clans) have given up rights to logging timber in exchange for the opportunity to sell rainforest carbon offsets – an alternative way of generating revenue for local economic development.

The Drawa project helps Fijian clans to protect their rainforests, therefore providing greater resilience against climate change, and also form community businesses including honey enterprises.

The project also enables governance and management support, and capacity building for community enterprises at Drawa - including a business producing and selling rainforest honey. The forest provides habitat for the endangered Fiji Ground Frog (*Platymantis vitiana*) and several other endemic plant and animal species. In terms of resilience, the Drawa rainforest provides valuable protection from cyclones, floods and droughts for the Drawa community and those living downstream in their catchment.

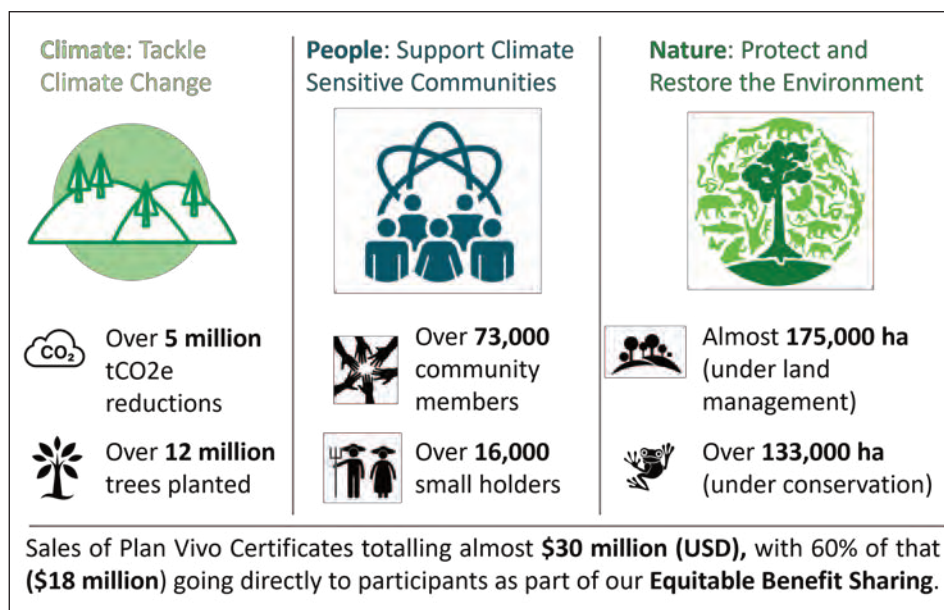


Figure 1: Plan Vivo Impact (as of 2021)

The importance of this was sadly underlined when Fiji was hit by two category 5 cyclones, 'Yasa' (Dec 2020) and 'Ana' (Jan 2021), leaving tens of thousands of people displaced and in need of emergency aid.

The Khasi Hills Community REDD+ Project is India's first community-based REDD+ programme and will protect and restore 27,000 ha of cloud forest, in addition to preserving sacred groves and watersheds.

The Khasi Hills Community REDD+ Project⁶ in Meghalaya, India engages ten indigenous Khasi governments (*hima*) with 62 villages. The area was chosen on the grounds of established Khasi traditions of forest conservation and legal right for natural resource management. This project aims to slow, halt and reverse the loss of community forests by providing support (e.g., establishing fire breaks), technologies (e.g., cookstoves) and financial incentives to conserve existing forests and regenerate degraded forests. The project intervention area is a global biodiversity hotspot, providing habitat to many endangered species, where the project is using planting of native tree species as part of a strategy to improve forest connectivity, in order to establish wildlife corridors by regenerating and linking degraded open



The endangered Fiji Ground Frog (*Platymantis vitiana*)

forestlands. Another primary objective of the project is to deliver long-term strategies to address extreme poverty facing rural families, for example the establishment of women-run microfinance institutions.

The Global Biodiversity Standard

Plan Vivo is extremely excited to partner with BGCI on the development of the Global Biodiversity Standard (GBS). Whilst the Plan Vivo Standard already requires project participants to 'maintain or enhance biodiversity

and key ecosystem services' in project areas, we are keen to strengthen the social and biodiversity impacts (or 'co-benefits') that our projects deliver. This is increasingly important as Plan Vivo projects start to operate at significant scale (e.g., the ComuniTree project⁷ in Nicaragua and through ACORN⁸, our collaboration with Rabobank which aims to support agroforestry schemes for 15 million smallholder farmers over the next 5 years) and as the demand for carbon accreditation of tree planting schemes increases.



The Khasi Hills Project (India)



Participants in the Drawa project (Fiji)

The massive scale and speed at which tree-planting has gained momentum during the past few years has led to some great initiatives but also unfortunately to many poorly designed projects, with challenges, and failures for biodiversity as well as for livelihoods. As per the Plan Vivo Standard requirements, our projects must demonstrate their positive social and biodiversity impacts and differentiate themselves from less well-designed projects. This enables Plan Vivo projects to command a higher market price (associated with higher value 'co-benefits') in addition to just delivering climate change mitigation.

The potential for scaling some of our projects is currently limited by the expertise and costs associated with designing, monitoring and

auditing biodiversity and social impact. We are aiming to tackle this by developing practical impact monitoring tools and capabilities within projects, as well as building a network of regionally based validation and verification bodies (VVBs). Through participating in the development of the GBS with BGCI, we hope to share the learning and experience we have developed in different landscapes across the world. The outputs from this collaboration will also enable Plan Vivo projects to access local biodiversity and assessment expertise, eco-regionally relevant and accessible methodologies, and significantly bring down the cost of designing and monitoring positive biodiversity impact. It will also provide projects with access to a globally recognised quality assurance for their tree planting activities,

thereby strengthening the market value of their Plan Vivo certificates. For interested projects, the GBS could be embedded into a new Plan Vivo 'Biodiversity+' Standard.

“We believe this initiative has the potential to have an enormous impact on biodiversity, as well as poverty alleviation and locally-driven economic development across our growing network of projects.”

As part of the collaboration, a selection of interested Plan Vivo projects will pilot and test the GBS methodology. Plan Vivo will also advise on criteria relating to community engagement and socio-economic impact and contribute our 25 years' experience in certification of ethically robust tree planting projects, to develop a viable GBS business model, in collaboration with project partners. We are committed to enabling project participants, which seek additional guarantees on biodiversity conservation, to access a new Biodiversity Standard that will differentiate their projects, and the impact they deliver in the carbon market.

The climate, biodiversity and social challenges facing us are immense. As Greta says the time for “blah, blah” is over, we need action now. The challenges can only be tackled when we accept that they are not separate issues but the same one and when we decide to take an integrated, multi-disciplinary, inclusive and holistic approach. We feel the GBS is a great example of that potential, and we look forward to working with BGCI and the project partners over the coming months and years to maximise impact for nature, climate and communities across the world.

**Keith Bohannon –
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The Khasi Hills Project (India)

ADDRESSING COMMON CONCERNS ABOUT CORPORATE NET-ZERO INVESTMENTS IN FORESTS



Planting forest saplings along the Kinabatangan River in Sabah, Malaysia, as part of Nestlé Malaysia's RiLeaf reforestation programme. (Nestlé Malaysia)

The need to achieve ambitious carbon reduction targets while at the same time conserving biodiversity is fuelling large-scale corporate investment in tree conservation and restoration activities. It.org is committed to work with the private sector to raise the bar on the scale and quality of their investments.

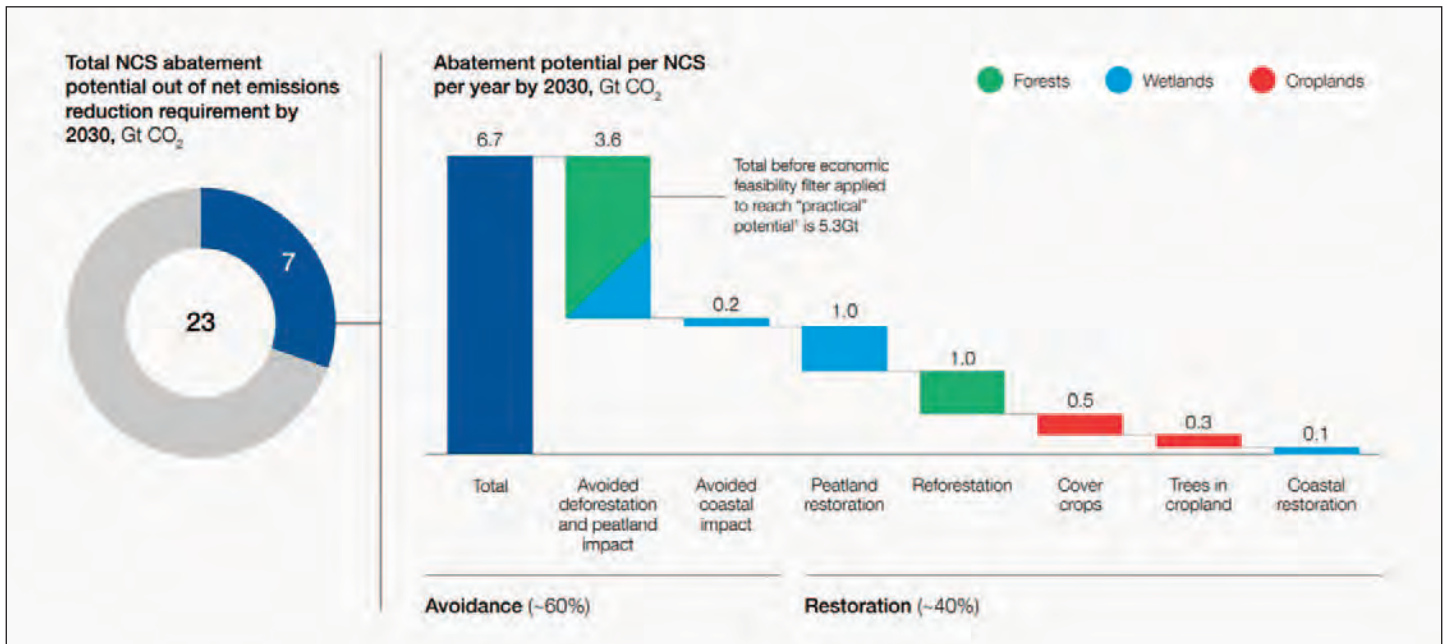
Introduction

Securing global net-zero emissions by mid-century while conserving and restoring nature is a tall order. COP-26 reminded us that rapid decarbonization is needed from all industries with at least a 50% reduction in absolute greenhouse gas emissions by 2030. This includes addressing

deforestation and land-use change which currently account for about one quarter of global emissions. Meanwhile, the planetary crisis of biodiversity loss is also alarming, and requires urgent action to avoid the disruption of essential ecosystem services. Nature-based solutions (NBS) have the potential to support reaching the global objective of a net zero, nature-positive future.

NBS, notably in the form of natural climate solutions (NCS), can deliver up to one third of the net emissions reductions¹ required by 2030 to be on track for no more than 1.5C degrees of warming. They are lower cost and more immediately available than technological solutions. As the planet enters the Anthropocene and we are faced with an impending 6th Mass Extinction, natural climate solutions play a key role in maintaining the balance of life on Earth, supporting both climate and nature.

The role of nature in addressing climate change was central to discussions at the UN Climate Change Conference in Glasgow (UNFCCC COP-26)², which followed the High-Level Segment of the UN Biodiversity Conference (CBD COP-15), where some countries have committed part of their climate funds to support biodiversity³.



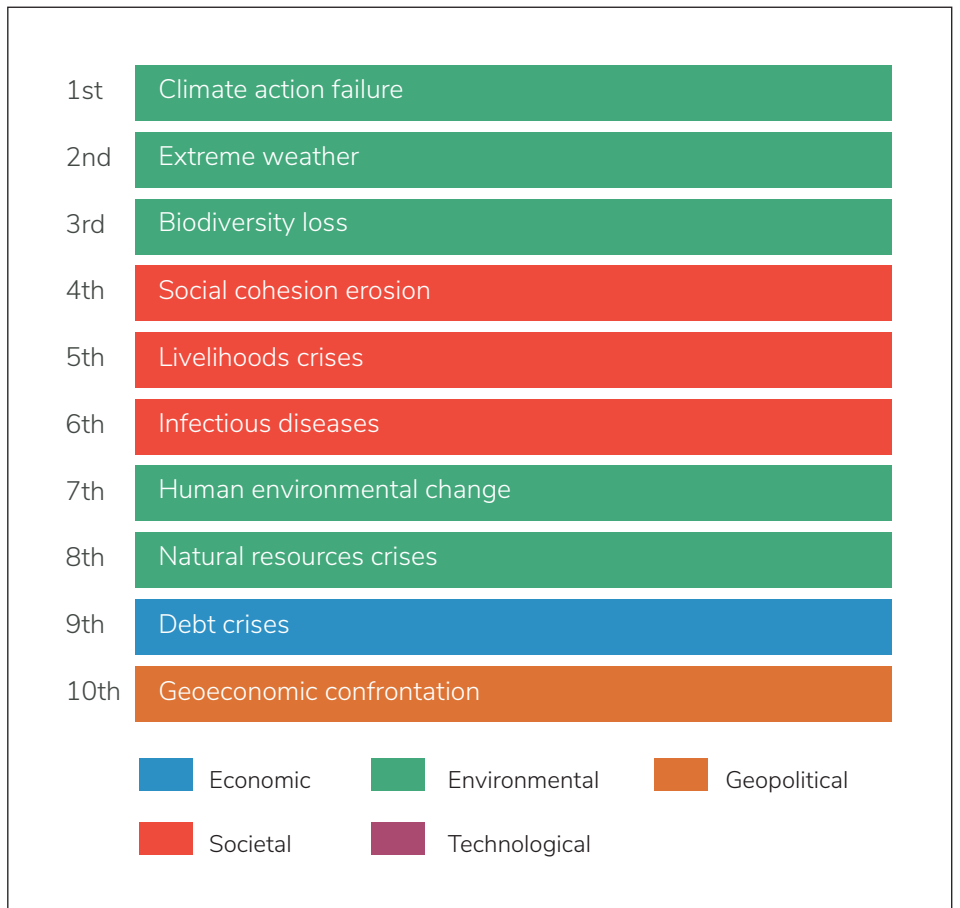
NCS could deliver up to one-third of net emission reductions required by 2030

Source: Consultation: Nature and Net-Zero, January 2021, World Economic Forum in collaboration with McKinsey & Company

This showed the growing recognition of the interconnections between the climate and nature agendas. However, national government commitments are not enough.

Companies and sub-national governments also recognize that nature is a good climate investment. This includes conserving intact forest ecosystems – which avoid and reduce emissions from deforestation – as well as reforestation commitments that remove and sequester greenhouse gases already in the atmosphere. Nature provides other valuable benefits and resilience, such as the protection of ecosystems and endangered biodiversity, restoration of degraded lands and the support of livelihoods. This forms the basis of a stable and prosperous sustainable economy.

Since 2020, the World Economic Forum's Global Risks Report⁴ has identified biodiversity loss as one of the 5 top perceived global risks by likelihood and impact, climbing to the 3rd most severe global risk in the 2022 report. Investing in NCS can address this risk, in tandem with the most severe perceived global risk of climate action failure and build resilience against the increasing frequency and severity of extreme weather events.



Addressing common concerns

Some stakeholders have legitimate concerns about tree-related initiatives from organisations that disregard their own climate

impacts or the needs of the local environment and its peoples. How NBS are planned and implemented is therefore critical to achieving the highest potential impact for both climate and nature.

Top 10 Global Risks by Severity (Over the next 10 years)

Source: World Economic Forum Global Risks Report 2022



A Nepalese woman holds Kher (*Sengalia catchu*) seedlings to be planted at a community forest project near Ruchang, supported by Eden Reforestation and tentree. (tentree)

Concern #1: Companies investing in offsets without credible efforts to reduce and avoid emissions

Investing in conserving, restoring and growing trees without setting a net-zero emissions strategy such as swiftly avoiding and reducing emissions in corporate supply chains, is greenwashing. However, when a company commits to an ambitious climate goal, it is appropriate to also compensate for current and future residual emissions that cannot be avoided. As trees take time to grow, investing in conservation today offsets future emissions. Companies can learn valuable lessons with pilot programmes, that can inform their offsets strategy in the years to come.

Concern #2: Science-based targets don't allow for offsets

The new Science-Based Targets initiative Net-Zero Standard⁵, advises companies across all sectors to both halve emissions by 2030 (including forest, land-use and agriculture emissions) and invest in a portfolio approach to offsets and removals including protecting, restoring and sustainably managing land and nature. Natural climate solutions should never become a distraction from efforts to cut operational emissions,

and are seen “as well as” never “instead of” emissions cuts. They are essential to achieve “net” of “net zero” goals.

Concern #3: Investing in NBS exclusively for carbon

Trees that are irresponsibly planted simply to capture carbon emissions can result in low survival rates, risk bringing invasive species into local ecosystems and provide few long-term benefits for local communities. Identifying potentially suitable locations to implement NBS, whether through conservation or restoration, and the decision-making process for the type of activities to be undertaken from an ecological and social perspective, requires a coordinated, evidence-based and inclusive approach. The two principal concerns that stem from an exclusively carbon approach to restoration are:

3a. Insufficient consideration of ecological factors

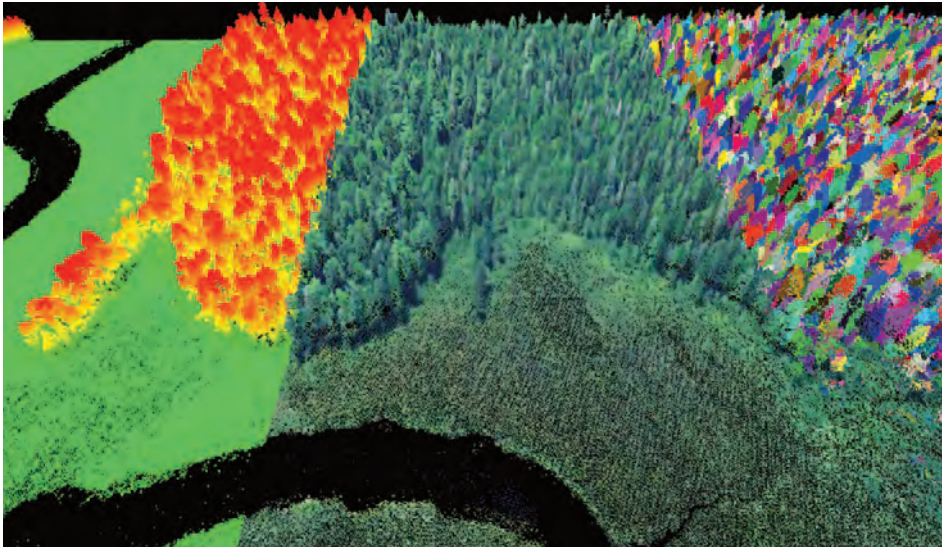
Determining a credible baseline in a project intervention area, including the types of native species present and the area's overall health, lays the groundwork for an ecologically responsible intervention. Planting the right tree in the right place at the right time

helps ensure that a diverse mix of native species, endangered species and those resilient to changing climatic conditions can flourish. Such approaches help avoid the unintentional planting of invasive species or large-scale monocrop plantations.

Restoration activities can be assessed and supported by independent third parties to provide credibility. For projects intended to generate carbon credits, examples of relevant third-party certification schemes are Verra, ART TREES, or the Gold Standard. The Global Biodiversity Standard, coordinated by BGCI, is a valuable certification scheme that provides assurance that tree planting, habitat restoration and agroforestry practices are protecting, restoring, and enhancing biodiversity.

3b. Lack of engagement with local communities

A forest is more likely to reach maturity and remain standing in the long-term if communities in their surroundings value their presence. Where sustainable livelihoods can be assured, and those communities who stand to benefit are able to exercise culturally appropriate free, prior and informed consent in the design and implementation of restoration, local ownership acts as a forest guardian.



LiDAR, satellite and AI applied to analyze a forest in the northeast of the United States. (Pachama)

When developed in partnership with indigenous peoples and local communities, many projects have delivered improved long-term environmental and socioeconomic outcomes⁶.

Securing indigenous people's land-rights can also enhance protection of forests. For instance, deforestation rates in the Amazon on securely held indigenous lands is 50% lower⁷ than deforestation rates on similar land without security. Conversely, the costs of securing indigenous lands in the Amazon as a percentage of total benefits derived from these lands is just 1%.

Concern #4: Lack of transparency into progress and results of tree investments

An integral part of a credible tree investment strategy is monitoring and reporting. To make credible claims on the carbon and socio-ecological benefits resulting from NBS investments, companies need to include a long-term monitoring, reporting and verification system.

The use of geospatial data, remote sensing and on-the-ground data collection tools and methods, help to provide more confidence in the additionality of investments, the survival and growth of trees over time, and refine carbon and other measurements. Likewise, platforms that transparently present commitments and report on progress foster greater accountability that is needed to assess impact. The baseline infrastructure for trust and transparency of 1t.org is being developed under the UN Decade on Ecosystem Restoration, through global partnerships⁸.

Corporate forest conservation and restoration investments

Just a few months after the global 1t.org corporate pledge launch⁹ during the World Economic Forum's Sustainable Development Impact Summit, 1t.org commitments have grown over 40% with 33 companies committing to conserve, restore and grow more than 3.6 billion trees in over 60 countries¹⁰. All companies are required to have a net-zero emissions target and to outline their socially and ecologically responsible approach for the purposes of transparency.

The 24 members of the 1t.org Corporate Alliance¹¹ are committed to taking leadership on this agenda. Companies meet to learn from experts and share experiences with peers. Guidance such as the reports Investing in Forests: The Business Case¹² and Natural Climate Solutions for Corporates¹³ help raise corporate ambition while putting in place guard-rails to help ensure credible restoration.

Companies are registering their commitments to invest in NCS through the NCS Investment Accelerator¹⁴, which will help aggregate the corporate demand signal for 1 Gigaton of high-quality NCS by 2025. A strong demand signal for high quality credits could unlock the supply pipelines for NCS needed to meet global net-zero announcements and build confidence with policymakers as they roll out new compliance and jurisdictional schemes.

Meanwhile, 1t.org pledging companies including Amazon, Bayer, EY, Nestlé, Salesforce, SAP and Unilever are founding members of

the LEAF Coalition – alongside the Norwegian, UK and US governments – to help drive unprecedented financial support to preserve tropical forests. By partnering with jurisdictional governments implementing forest protection, members of the LEAF coalition are contributing to green and resilient growth through sustainable investments. The LEAF Coalition recently celebrated its first USD1 billion in investment – demonstrating enthusiasm for high-quality jurisdictional approaches.

These initiatives are part of a broader movement in support of the UN Decade on Ecosystem Restoration by accompanying the private sector to raise the bar on the scale and quality of their investments in natural climate solutions. There will be lessons along the way as each company pilots approaches and learns from experience. More than ever before, the restoration movement needs leadership, action, integrity, transparency and shared learning as humanity seeks to restore balance in the face of our unprecedented natural and climate crisis¹⁵.

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Geneva, Switzerland (Lead)**

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- ¹⁵ 1t.org Corporate Alliance | 1t.org

ECOSYSTEM RESTORATION: THE POLICY PERSPECTIVE



Ecosystem conservation and restoration forms the central pillar of a number of international environmental policies and agreements. But what are these and how are they being implemented? Are policy responses sufficient and what are the challenges facing countries as they strive to meet their national and international commitments.



UNITED NATIONS DECADE ON
**ECOSYSTEM
RESTORATION**
2021-2030

Introduction

Ecosystems and their biodiversity underpin economic growth, sustainable development and human wellbeing. Overexploitation of natural resources and land use change throughout centuries have widely upset the equilibrium within ecological systems, disrupting eco-

systems and the services they provide worldwide. As noted by others writing in this issue of BGJournal, the well-being of the world's population in the coming decades will in large part depend on the conservation and restoration of ecosystems.

Activities related to the conservation and restoration of ecosystems are incorporated into a suite of global environmental and development agendas. Importantly, ecosystem restoration is the common thread that links the three major international agreements that were agreed at the UN Conference on Environment and Devel-

Above left: Development Goal 15 Action Card. Above right: Development Goal 15 Why It Matters 2020 Information Card.

opment (UNCED – or the Rio Earth Summit) which was held in Rio de Janeiro in 1992. These three conventions are:

The Convention on Biological Diversity (CBD):

The Vision of the CBD is: "Living in Harmony with Nature" where "By 2050, biodiversity is valued, conserved, **restored** and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people."

The United Nations Framework Convention on Climate Change (UNFCCC)

The ultimate aim of the UNFCCC is preventing "dangerous" human interference with the climate system. **Ecosystem-based adaptation** is seen as part of an overall approach in national climate change adaptation and development strategies.



The United Nations Convention to Combat Desertification (UNCCD)

The UNCCD aims to improve the living conditions for people in drylands, to maintain and restore land and soil productivity, and to mitigate the effects of drought.



The Sustainable Development Goals

The need for a greater focus on restoration is also highlighted by Sustainable Development Goal 15 of the 2030 Agenda which aims to “protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss”. In support of this, Global Forest Goal 1 of the UN Strategic Plan for Forests 2030 is to reverse “the loss of forest cover worldwide through sustainable forest management, including protection, restoration, afforestation and reforestation, and increase efforts to prevent forest degradation and contribute to the global effort of addressing climate change”.

The important role that protecting and restoring ecosystems plays in enhancing people's livelihoods, counteracting climate change, and stopping the collapse of biodiversity has been further recognised by the United Nations which has declared 2021-2030 the **UN Decade on Ecosystem Restoration**, a key aim of which is to halt and reverse ecosystem degradation by 2030.

Global targets – national actions

The global targets set through the Conventions highlighted above can only be achieved through actions taken at the national level. As Parties to these multilateral agreements, governments are expected to set national targets in line with the global goals. But what are the expectations under the three Rio Conventions and what progress has been made?

Ecosystem restoration under the CBD

Article 8 (f) of the Convention states that: “Each Contracting Party shall, as far as possible and as appropriate, rehabilitate and

restore degraded ecosystems and promote the recovery of threatened species, inter alia, through the development and implementation of plans or other management strategies.”

In 2010, the CBD Parties adopted the Strategic Plan for Biodiversity 2011-2020 and the Aichi Biodiversity Targets. Through Aichi Biodiversity Target 15, Parties agreed that “by 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks will have been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.”

The actions reported by Parties to reach the CBD's Aichi Target 15 include reforestation, natural regeneration, increasing habitat connectivity, the rehabilitation of heavily-degraded sites and promoting urban green infrastructure.

A review of progress towards this target carried out in 2020, noted that overall, the target had not been achieved. In particular, it reported that progress towards restoring 15 per cent of degraded ecosystems by 2020 was limited. Nevertheless, the report did highlight ambitious restoration programmes that are under way or proposed in many regions,

with the potential to deliver significant gains in ecosystem resilience and preservation of carbon stocks. About 50% of Parties had established national targets towards Aichi Biodiversity Target 15 and included them in their National Biodiversity Strategies and Action Plans (NBSAPs). Of these, about 17% meet or exceed the 15% target¹.

Negotiations on the post-2020 Global Biodiversity Framework are presently underway, with a draft target for 20% of degraded ecosystems to be under restoration by 2030.

Nature-based solutions and the Climate Change Convention

In the 2015 Paris Agreement on Climate Change, countries made commitments to help limit global warming to 1.5C over pre-industrial levels. Nature-based Solutions (NbS), which are centred on the protection, restoration and sustainable management of the world's ecosystems, are said to have the potential to provide up to 30% of the of the climate change mitigation needed to achieve this target².

NbS are becoming an increasingly important part of countries' new Nationally Determined Contributions (NDCs) to the Paris Agreement. According to a report launched by the World Wildlife Fund (WWF) at COP26 in 2021, 92% of NDCs now include measures to tackle nature loss, including restoration activities, up from 82% earlier in the year.

Nature-based solutions:
Actions to protect, sustainably manage and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits.
International Union for Conservation of Nature (IUCN)³

Also at COP-26, 140 nations reaffirmed via the Glasgow Forest Declaration their “commitments to sustainable land use, and to the conservation, protection, sustainable management and restoration of forests, and other terrestrial ecosystems.”



Development Goal 15 Infographic

Land Degradation Neutrality under the UNCCD

A key component of the UNCCD 2018-2030 Strategic Framework is a comprehensive global commitment to achieve Land Degradation Neutrality (LDN). The Land Degradation Neutrality (LDN) response consists of a hierarchy of avoiding degradation, reducing degradation and restoring degraded land.⁴

Land Degradation Neutrality (LDN) has been defined by the Parties to the Convention as:

A state whereby the amount and quality of land resources, necessary to support ecosystem functions and services and enhance food security, remains stable or increases within specified temporal and spatial scales and ecosystems⁵.

Under the United Nations Convention to Combat Desertification (UNCCD), over 120 countries have set voluntary targets to achieve land degradation neutrality (LDN) and many have secured high-level government commitment to achieve LDN.

International initiatives and pledges

However, despite the fact that almost all countries in the world are Parties to these Conventions, and most have set targets to implement them through national actions, ecosystem degradation and deforestation continues, with profound negative consequences for human well-being and survival.

Recognising the lack of progress in achieving national and global ecosystem restoration targets and the need for more urgent action, a number of additional high-level initiatives have been launched over the past decade. These have ambitious targets for forest and landscape restoration (FLR) and aim to engage civil society, indigenous organisations and private entities as well as national governments.

The Bonn Challenge

Aligned with the Sustainable Development Goals (SDGs), the Aichi Biodiversity Targets, the Land Degradation Neutrality (LDN) goal, and the Paris Climate Change Agreement, the Bonn Challenge launched by IUCN and the Government of Germany in 2011, aims to bring 350 million hectares of degraded and deforested landscapes into restoration by 2030.

The New York Declaration on Forests

Announced in 2014, this non-legally binding political declaration grew out of dialogue among governments, companies and civil society. For the first time, world leaders endorsed a global timeline to cut natural forest loss in half by 2020 and strive to end it by 2030.

Amongst the commitments agreed to in this Declaration was a commitment to restore 150 million hectares of degraded landscapes and forestlands by 2020 and significantly increase the rate of global restoration thereafter, which would restore at least an additional 200 million hectares by 2030.

Policy responses

In response to these international targets and challenges, a plethora of pledges, mainly focused around tree-planting and forest restoration, have been made by countries and organisations. Such actions are aimed to address the combined threats of climate change and biodiversity loss while also delivering benefits for local communities and wider society.

Countries have set ambitious targets to restore tens of millions of hectares of degraded land and plant billions of trees. Cities have committed to massive tree planting schemes and organisations and individuals are supporting tree planting programmes for carbon offsetting purposes.

City responses (C40 Cities)⁶:

- Houston, Texas – pledging to plant 4.6 million trees in the next 10 years
- Rio de Janeiro – doubling tree cover in the city's streets, squares and parks
- Milan – planting 220,000 new trees

Implementation challenges

There are unfortunately significant gaps between these policies and pledges and action on-the-ground. Deforestation continues with the proportion of forest area falling from 31.9 per cent of the world's total land area in 2000 to 31.2 per cent in 2020⁷. This translates to a net loss of almost 100 million hectares.

Even just tracking the world's various restoration commitments is difficult. As noted in a recent report⁸, many countries have for example, pledged to restore forests under the Bonn Challenge and the New York Declaration on Forests, while also making restoration commitments as part of their emissions reductions plans under NDC's. But in many cases, countries have not followed up by releasing details on how they plan to honour their commitments, where and when restoration projects will happen, and the actual results.

Furthermore, where restoration is taking place, it is often not achieving its goals. A recent study of four Asian countries (India, Malaysia, Indonesia and the Philippines) has shown that their pledges to restore millions of hectares of degraded land by 2030 could be derailed by a lack of good-quality and genetically diverse native seeds. The study found that practitioners regularly planted seedlings of unknown origins, with trees planted in unsuitable conditions and dying without ever growing into resilient forests. Lack of suitable planting material means that reforested areas often end up as low biodiversity tree plantations, rather than thriving natural forest ecosystems, and these fail to deliver promised socioeconomic and environmental benefits.

It is clear that policy responses must not just be about the numbers of trees planted or hectares restored, but about the long-term outcomes for climate mitigation and biodiversity benefits. The Global Biodiversity Standard will provide the key certification needed to ensure that tree planting and forest restoration delivers on its promises to provide a better future for us all.

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OVERCOMING PRACTICAL IMPEDIMENTS TO BIODIVERSE TREE-PLANTING

Juniperus procera breeding seedling orchard at Yerba, Amhara Region, Ethiopia (Eyob Getah)

Introduction

Around the world, we see massive tree planting initiatives taking place. These are part of nature-based solutions that are generally acknowledged to have a significant role to play in solving some of today's most pressing global problems. These challenges include climate adaptation and mitigation; sustainable and nutritious food supply; and the restoration of forests and degraded lands coupled with biodiversity conservation. A common problem, however, is that tree planting has had only limited success in achieving the anticipated benefits. For example, restoration targets have failed because many planted trees do not survive. This is because the species and provenances used have been poorly chosen for the environment of the planting site. Compounding this, the seedlings have been insufficiently cared for, as local people have not seen the benefits of doing this, since the planted trees do not provide them with the products and services that they most need.

Trees are being planted on a massive scale around the world. However, the benefits such planting schemes are expected to provide are severely compromised by inappropriate species selection and poor survival rates. A programme in Ethiopia is demonstrating the benefits of an efficient network that can supply high quality, diverse tree planting material where and when it is needed.

Tree-based restoration requires the use of many tree species at the same time.

A major challenge of tree-based restoration work is that effective action generally requires the use of many tree species, often native, at the same time. This is hard enough to achieve when restoration is based on natural regeneration, but when planting is

necessary, it is far from straightforward to obtain a broad spectrum of genetically diverse, healthy and productive tree species' seeds or seedlings. This is largely due to their **limited current availability**. Addressing this availability bottleneck is a major challenge that current global and national restoration plans need to overcome if they are to be widely successful. Here, we outline some of the problems faced and practical solutions, based on a case study from Ethiopia.

Bottlenecks to tree seed and seedling supply

Traditional tree seed (and seedling) supply programmes focus on only a few species, with the material used often of unknown genetic quality, with only limited knowledge of its adaptation to site conditions and the local community's needs. The lack of matching of planting material to planting site leads to huge lost opportunities. Most of the seeds (and other forms of germplasm) procured by tree seed traders are collected from poorly-characterised trees in plantations, farmlands and household compounds, for which the genetic quality and origin of the seed is not known. The performance is generally suboptimal when compared to seed deliberately chosen to match a planting site.

When planting trees is necessary, a supply of genetically diverse, healthy and productive tree species is generally not easily available.



Hagenia abyssinica at Suba, Oromia (Abayneh Derero)

One factor behind the limited current availability of appropriate tree seed for planting is the **lack of knowledge** of the many opportunities for choice of species that exists, with planting programmes only considering the species they know well. This lack of demand for the trees is inter-related with the difficulty of getting hold of the planting material, which may simply be **unavailable**. Limited access to sources of tree seeds or seedlings, insufficient knowledge of propagation and broader tree management methods (and the absence of trained workers to put this knowledge into practice) and the lack of **finance** may all play a part. The suboptimal outcome is that often 'choice' is guided by what is available from local seed collections, in local nurseries or from the global seed market, rather than by any properly informed demand.

Another way to look at the problem is to think of seed supply as part of a broader value chain with different stakeholders involved at different positions along the chain. To make a diversity of planting

material **more accessible** to a range of users, the role of each of the value chain actors needs to be properly considered.

Supporting solutions to the supply problem

To improve the current supply situation, it is necessary to realise the potential of many more rural organisations, small-scale private nurseries and local communities to effectively participate in tree seed systems. In this way, responses to a relevant and more diverse demand of tree species can be met with a greater variety of supply. To do this, 'formal' and 'informal' approaches to tree seed supply need to be integrated. A key step is to support the development of informal suppliers into a well-functioning business sector that makes use of public-private partnership arrangements. These informal suppliers need business training, support in the provision of 'founder' planting material and technical guidance.

Traditional supply programmes focus on relatively few species, most of them of unknown genetic quality, often accompanied by insufficient knowledge of adaptation to site conditions and adaptability to climate change.

A crucial step in doing things better is to make the 'business case' for finance to support the tree seed sector, not only in terms of economic value but based on other values too, such as cultural and environmental ones. Analysis of returns on investment have been carried out, and these show that finance ought to be the least difficult impediment in reaching solutions. For example, conservative calculations based on African Forest Landscape Restoration Initiative (AFR100) activities suggest that an extra cost per tree seedling of less than 5% invested in improving genetic quality, under modest assumptions of uptake in the use of better planting materials, would generate more than US\$ 5 billion of additional income for tree growers, sequester 19 million more tonnes of carbon every year, and annually save 4 million more tonnes of soil from erosion. The additional investment would need, first, to cover communication of what trees to plant where for what purpose and, second, the availability of the appropriate tree seeds and seedlings for planting.

The first point requires species and seed source descriptions, including information on how different provenances perform in different environments, and management prescriptions to improve use and performance. These currently exist for relatively few tropical tree species. The second point includes the basic infrastructure for collection, storage, conservation and distribution, focusing on regions where planting should be prioritised. It also includes determining the priority demands of users and the supply capacity of producers.

Supporting tree seed supply in Ethiopia

The kind of work described above is presently being implemented in a national programme for Ethiopia. This programme is supported by the Provision of Adequate Tree Seed Portfolio in Ethiopia project (PATSPo) that is designed to support the nation's forest landscape restoration target – 15 M ha of degraded land restored by 2030 – which is the most ambitious of any country in the AFR100. The need to improve tree seed sourcing in Ethiopia was identified during earlier restoration activities, which were hampered by the lack of an efficient network for supplying tree planting material, and by the low quality and limited diversity of the tree seeds that were available.

PATSPo will support the Government of Ethiopia in promoting and strengthening existing tree-seed organizations and support the establishment of additional private and government seed dealers.

PATSPo has, with support from the Ethiopian government and the Norwegian International Forest and Climate Initiative (NICFI), been running since 2017. Its aim is to ensure access to high-quality seeds of the most important tree species used for forest landscape restoration and all other tree-planting activities in Ethiopia. PATSPo has identified stakeholders in the Ethiopian tree seed sector, promoted collaboration among them and built their capacity. Among the specific achievements to date are the establishment of a national Tree Seed Network, a climate atlas for over 120 tree

species, a web portal providing guidance on what tree to plant where in the nation (with information on associated seed sources), and the establishment of over 30 breeding seedling orchards (BSOs) of tree species prioritised by communities and government. These BSOs fulfil multiple functions: not only do they produce tree seed per se, but they support the selection and evaluation of genotype-by-environment interactions in tree performance that allow locally-adapted, genetically-diverse tree seed for growers to be identified. They also act to conserve the tree germplasm. For these purposes, each BSO is generally composed of multiple tree provenances, each represented by several families (a family = progeny from the seed originally collected from individual 'mother' trees). The description and registration of more than 200 tree seed sources has also taken place under PATSPo, mostly of indigenous trees, as well as the training of more than 1,300 stakeholders in tree seed collection and procurement methods. Online decision-support tool platforms for tree planting have also been built with PATSPo funding, including the Global Tree Knowledge Platform (Kindt et al., 2021) and the Resources for Tree Planting Platform (Schmidt et al., 2021). These platforms are of broad utility for tropical tree planting.

Although it is too early to fully evaluate how effective PATSPo will be in improving the quality of the trees planted in Ethiopia, it has



Faidherbia albida BSO, Mojo, Ormia, Region (Eyob Getahun)

worked closely with the Ethiopian government to develop policies to support the involvement of the private and informal sectors in tree seed supply. The proposed continuation of the programme 2022 to 2025 emphasises the priority it is assigned by the Government of Ethiopia.

Future prospects

Establishing tree seed supply systems to support biodiverse, including genetically diverse, tree-planting is not straightforward and is still in its infancy for most tropical trees. Devising a well-functioning system relies on users being able to express effective demand, based on access to knowledge;



Grevillea robusta BSO at Suba (Eyob Getahun)

effective production and distribution systems, reaching users with a wide variety of planting material; supportive rules and regulations for local commercial seed dealers and nursery entrepreneurs; and public investments for sustainably conserving and developing tree genetic resources. These requirements extend beyond the basic remit of most planting and restoration projects. However, PATSPO provides a good example of what can be done with modest investments. Practical planning means considering issues of tree quality at the earliest possible stage of tree planting projects' design, while at the same time not allowing the perfect to be the enemy of the good – that is, any improvement of quality is a desirable characteristic, even if this is an incremental process.

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There are many ways in which botanic gardens can engage in ecological restoration but what are the barriers and how can these be overcome?



Denver Botanic Gardens Chatfield Farms (Colorado, USA), a 700-acre working farm on the outskirts of the metro area, incorporates research and habitat restoration into its land management. (Denver Botanic Gardens. © Scott Dressel-Martin)

BIODIVERSE RESTORATION IN PRACTICE – THE ECOLOGICAL RESTORATION ALLIANCE OF BOTANIC GARDENS

Introduction

Restoring functional (ecological and social), and diverse (species and stakeholder) ecosystems, will provide us with the resilience we need to adapt to climate change and respond to biodiversity loss. Addressing degraded and damaged ecosystems and habitats is one of the critical challenges for the 21st century, a century defined by the realities of the

Anthropocene. For example, an IPBES report suggests that 3.2 billion people on the planet are affected negatively by land degradation (IPBES, 2018); this number is rising daily as we continue blindly along a path of exponential capital growth. Some areas are so degraded that rewilding and natural regeneration is compromised by limited remaining natural seed banks. Often it is the rare and threatened species that suffer the most as invasive species take over.

Society for Ecological Restoration (SER)
Definition of Ecological Restoration
www.ser.org

Ecological restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed.

Due to rapid urbanisation and conversion to agriculture (predominantly tea and the associated exotic tree plantations to provide fuel to dry the tea), 99% of the natural vegetation of the surrounding area has been lost. The project aims to show what is possible by creating a model indigenous forest and a site of restoration expertise and propagation material for other reforestation projects within this region of Kenya.

Initially the project introduced seedlings and wildlings from similar ecological zones (1500m - 3500m with 500mm - 1500 mm annual rainfall), collecting propagation material from ecosystems under threat, especially from areas of high endemism such as the Kenya part of the Eastern Arc mountains. The collection now includes a range of trees, lianas, shrubs and ferns, with a focus on threatened species on the IUCN Red List. Examples of these include Endangered *Vitex keniensis*, Critically Endangered *Euphorbia cussonioides* and Critically Endangered *Embelia keniensis* (a climber with only five adult specimens known, which has now been used for reintroductions within the region).

After 20 years, a closed canopy exists in the original plantings, with natural succession taking place, with many pioneer trees (e.g.

Box 2: New partnership between BGCI and Terraformation

BGCI has partnered with Terraformation, a global reforestation company which partners with communities worldwide to solve climate change by rapidly scaling up native ecosystems. The new partnership will increase access to good quality seeds by equipping botanic gardens with new modern seed banks, thereby addressing one of the key bottlenecks to restoration. The seed banks are stored in recycled shipping containers and contain software applications to track seed collection and organise species. Through greater distribution of seeds, the partnership will increase the availability of a wider diversity of native tree species, as well as increasing the representation of threatened tree species, which is vital in maintaining levels of biodiversity.

the Endangered *Polyscias kikuyuensis*) starting to come to the end of their life cycle, creating disturbance and opportunities for some climax species. Continued surveys indicate that further seedling recruitment of some of the target species has shown signs of the forest becoming self-sustaining. The impact of the restoration is being studied by a collaborative research partnership with both national and international universities.

The biodiversity benefits created through this project have been significant; bird species numbers have increased from 40 at the start of the project to c.200 today and the return of colobus monkeys (*Colobus guereza ssp. kikuyuensis*) has become an attraction for visitors. There are still 8 years

of the initial 30 year project to run and this will focus on secondary understory planting, duplicate collections of plants to broaden genetic diversity of ex situ collections, greater outreach and education and expanding the forest into neighbouring communities. We have seen a dramatic increase in interest in the forest since the initial outbreak of COVID-19 with more individuals, families and schools desiring to spend time within nature. With a tree nursery of over 50 indigenous species and a proposed Terraformation Seed Bank¹ (Box 2) we are able to support other restoration projects, for example, a flagship project with SUGi² and two local schools in engaging, implementing and trialling the Miyawaki method of restoration.



An aerial shot showing phase 1 - 65 acres at the Pandalgudi project in India (Paul Blanchflower)



Aerial view of the Brackenhurst restoration project. (Jonathan Jenkins)

The Miyawaki method is based on natural reforestation principles, i.e. using trees native to the area and replicating natural forest regeneration processes. It also uses very high planting densities (2–4 trees/m²) to get quick results

Auroville Botanical Garden, India

Auroville Botanical Garden was established in response to the disappearing Tropical Dry Evergreen Forest in South India. The garden is situated within a monsoon climate, with the climax tree species not reaching more than six metres due to the evolutionary pressure of cyclones. With growing land degradation and forest fragmentation within the region, Temple Groves (protected forests) are used as a reference ecosystem to provide information on historical vegetation composition. The garden started with a strong focus on education and ecological restoration and now hosts c.300 species of trees and c.1,300 plant species altogether.

Partnering with the mining industry has allowed the area under restoration to expand and has provided funding to undertake long term research. In a recent project in collaboration with Ramco Cements, Auroville Botanical Garden is restoring 200 acres of degraded mined land in Pandalgudi, India.

The project started in October 2019 and the results after 18 months have been recorded on a video³. The project is ongoing and over the next 5 years will cover over 800 acres of worked-out mines. So far over 200,000 trees and shrubs have been planted, which will rise to 1,000,000 when the project is completed. Over 80 species of native species and shrubs are being planted as part of the restoration work.

Within an educational context, the garden runs several programmes including a local schools' program (within 50km) with a focus on the practical skills needed for restoration. In addition, a yearly horticulture course gives students both a theoretical and practical insight into all elements of the garden (for example, tree nursery management, grafting and seed collection).

Denver Botanic Garden, USA

Denver Botanic Gardens, located in Denver Colorado, USA, like many botanic gardens around the world, is located within close proximity to an urban area. Historically urban gardens have not been greatly engaged with ecological restoration. However, the team at Denver Botanic Garden is using their 700-acre working farm on the edge of the urban area to explore how ecological restoration can be linked to the regenerative agriculture movement. The focus is to restore all areas

that are not actively part of the sustainable farm back to a functioning, native grassland, while improving riparian areas at the site as well. The site also aims to serve as a hub for demonstrating good restoration science, including looking at ways to reduce chemical-herbicide use and create more native pollinator habitat.

A further aspect of the project is seed conservation. Some of the common issues surrounding seeds for restoration include, quality of seeds, sourcing seeds, site matching, and phytosanitary considerations (pest and disease-free). The garden is working with the United States Federal Government on seed collection and research as well as collaborating with partners in a regional seed network with the goal of improving the availability of seed for restoration.

Further examples of the work of ERA members can be found here: <https://erabg.org/projects/>.

Overcoming barriers

A recent survey of respondents identified over 200 barriers for botanical institutions that limit engagement in ecological restoration.

The greatest barrier identified was funding. This is both restoration-specific funding and, more generally, a lack of institutional funding,

which has been further compounded by COVID-19 and the loss of admittance revenue as well as other sources of funding (Corlett et al., 2020).

The overall lack of funding for specific restoration projects can be attributed to generic limited funding and the limited awareness of restoration managers to what available funding sources currently exist. A recent review showed that ecological restoration is far more expensive than traditional conservation (Brancalion et al., 2019). It is hoped that the Global Biodiversity Standard (GBS) being developed by BGCI and partners will encourage more funding to be directed towards projects that will deliver strong biodiversity outcomes. Furthermore, the opportunity to get involved in assessing restoration projects on the ground, and supporting projects to achieve higher levels of certification, will help to diversify income streams for botanic gardens.

The increasing demand for larger-scale restoration and the cost benefits of implementing such projects often require engaging a larger range of stakeholders (Pinto et al., 2014). A lack of collaboration and conflicting interests are indicated by respondents as barriers within the social-cultural section of the survey. While it tends to be the role of national or local governments to facilitate large-scale ecological restoration, there is considerable scope for botanic gardens to get involved, for example, supplying rare and threatened species, provision of training, or supporting farmers to use native agroforestry species to increase biodiversity on farms.

Conclusion

While there are both challenges and opportunities for botanic gardens to engage with ecological restoration, there are many examples from within this community demonstrating that botanic gardens have many relevant skills that can positively impact restoration outcomes and that a high biodiversity approach is both possible and rewarding. Ecological restoration deployed correctly can make significant gains in reversing the world's biodiversity crisis, create tangible benefits for people and sequester optimal carbon. How we fulfil these commitments is of vital importance not just to our generation, but for generations to come.

Finally, I would like to thank the many individuals who have worked tirelessly over many years to create ex situ collections, researched propagation protocols, and created partnerships with the public and the local communities they have worked with on restoration projects. It is on this basis that gives us the opportunity and experience to be included in discussions on restoration.

If you are interested in finding out more about ERA and would like to join the community, please get in touch with BGCI (erabg@bgci.org). If you are not a botanic garden, you can seek support from ERA members to improve the biodiversity outcomes of your restoration work, e.g. via the GBS or a botanic garden local to your restoration site.

Useful resources

- BGCI and IABG's Species Recovery Manual: https://www.bgci.org/wp/wp-content/uploads/2019/04/Species_Recovery_Manual.pdf
- The SER International Standards for the Practice of Ecological Restoration: <https://www.ser.org/page/SERStandards>
- ERA website: <https://erabg.org>
- SER membership information: <https://www.ser.org/page/Membership>
- Restoration Ecology Special Issue: Standards for Native Seeds in Ecological Restoration: <https://onlinelibrary.wiley.com/toc/1526100x/2020/28/S3>

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ENDNOTES

- ¹ <https://www.terraformation.com/>
- ² <https://www.sugiproject.com/>
- ³ <https://vimeo.com/258575105>



THE ECOLOGICAL RESTORATION ALLIANCE OF BOTANIC GARDENS IN THE UN DECADE ON ECOSYSTEM RESTORATION

ERA mission:

To mobilize botanic gardens, arboreta and seed banks to carry out science-based ecological restoration by marshalling their expertise, networks, and resources to help achieve the restoration outcomes needed for human well-being and a sustainable future for life on Earth.

**ERA**Ecological Restoration
Alliance of Botanic Gardens

ERA strategy 2021 – 2025

GOAL 1:

Develop and implement the Global Biodiversity Standard certification to influence ecological restoration policy and practice at large scale, ensuring there is a strong focus on biodiversity and the use of appropriate plant materials for restoration

A1.1: Develop the Global Biodiversity Standard certification methodology that builds on the 10 Golden Rules paper and that specifically recognises the value of incorporating native (and threatened) species and creates an incentive for the protection of existing habitats, and incorporating native plant species into restoration





A1.2: Use the Global Biodiversity Standard certification as a vehicle for deploying BGCI and ERA expertise at scale through:

- Carrying out site visit assessments for certification applicants
- Providing mentoring services to practitioners of large scale restoration, reforestation and agroforestry
- Establishing training hubs of expertise available to practitioners of large scale restoration, reforestation and agroforestry (see Goal 2)

A1.3: Use the Global Biodiversity Standard certification scheme to:

- Develop strategic partnerships with other certification agencies, e.g. SER, FSC, Plan Vivo
- Develop strategic partnerships with large scale restoration and tree planting programmes, including corporate entities, NGOs and GOs
- Seek endorsement and partnership with other conservation organisations interested in promoting biodiversity conservation and recovery at scale

GOAL 2:

Build ecological restoration capacity in botanic gardens, local communities, academia, industry, government, NGOs and international bodies

A2.1: ERA project sites and expertise are used for training a diverse mix of people undertaking ecological restoration or other restorative activities, particularly to ensure they consider biodiversity and incorporate an appropriate mix of native species

A2.2: Establish national or regional restoration training hubs

- Identify locations for the regional hubs, based on priority areas for restoration
- Conduct skills, resources and capacity gap assessments for each regional hub
- Support collaboration between botanic gardens to enable regional hubs to offer comprehensive training courses

A2.3: Ensure members are represented on BGCI's ecological restoration expertise directory to facilitate partnership development and consultancies

A2.4: Support botanic gardens to adopt a stronger focus on ecological restoration, particularly those in areas where there are not currently ERA members

- Determine the barriers preventing more botanic gardens being involved in ecological restoration via a survey to BGCI network
- Offer mentorship, partnership and training to build capacity within botanic gardens

A2.5: Provide an open access online knowledge hub for ecological restoration, available in multiple languages and for different ecosystems

- Collate ecological restoration training resources from the ERA network and ensure these are accessible online, including addition of propagation protocols to BGCI's PlantSearch database
- Collate project examples that show best management practices for different ecosystems
- Develop resources to fill gaps, including online training modules

A2.6: Support the development of supply chains to provide appropriate material for restoration

- Address research problems (e.g. germination and propagation protocols)
- Provide training in practical aspects of native plant seed collection, seed processing, seed storage, seed germination, nursery establishment, etc.
- Support botanic gardens to scale up seed producing capacity (increased seed testing and seed processing capabilities) and scale out number of seed sourcing centres (training and potential to franchise nurseries).





GOAL 3:

Work with partners to set up, maintain and document a series of **long-term sustainable restoration projects** in diverse biophysical, political, and cultural contexts around the globe that demonstrate the value of a carefully designed, science-driven approach to sustainable ecological restoration.

A3.1: Continue to **develop a portfolio of restoration projects** that adhere to best practice, in a diverse range of ecosystem types and cultural contexts. Projects will;

- Be ecological restoration projects that incorporate a wide mix of native species
- Or projects delivering supporting services that substantially contribute to biodiversity conservation and ecological restoration practice

A3.2: Seek opportunities to **scale up projects & mainstream biodiversity into national / regional / large-scale approaches** (e.g. agroforestry, FLR).

- Deliver joint projects with larger restoration players (e.g. government, World Bank, etc.)
- Develop partnerships with governments that have made large scale commitments to restoration

GOAL 4:

Build recognition of the value of involving botanical organisations, botanical expertise and biodiversity in ecological restoration

A4.1: **Publish the Kew Declaration** and seek signatures throughout the UN Decade

A4.2: Continue to **expand the evidence base** for best practice ecological restoration

- Publish research from ERA projects and sites

- Collate research articles and make them accessible via the ERA website

A4.3: Continue to **grow ERA membership** to ensure we have a strong voice on every continent and for a diverse range of ecosystems

A4.4: **Provide a voice for biodiversity and promote the role of botanic gardens in ecological restoration** in the UN Decade.

- Develop a suite of materials throughout the Decade that promote the importance of biodiversity and the role of botanic gardens in ecological restoration, including revamping the ERA website, running webinars and developing a social media kit
- Seek opportunities to publish ERA news and stories via other channels, e.g. SER, Ecosia
- Promote biodiversity and the role of ERA at conferences and meetings, including holding annual symposia or thematic conferences

Images from ERA member restoration projects





**BOTANIC
GARDENS**
CONSERVATION
INTERNATIONAL

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INFLUENCE & ACTION

Botanic Gardens as Agents of Change

Join us for the 7th Global Botanic Gardens Congress (7GBGC) which will be held in Melbourne Australia from Sunday 25 - Thursday 29 September 2022.

Whilst our ability to meet has been limited recently, it is now time to bring our community together and experience real people, real connections and real gardens.

Influence and Action: Botanic Gardens as Agents of Change will explore how botanic gardens can play a greater role in shaping our future. With accelerated loss of biodiversity across the globe, increased urbanisation, population growth and climate change, our need to work together to find new solutions for the future has never been greater.

7th Global Botanic Gardens Congress

25–29 September 2022
Melbourne Australia

Join inspiring speakers, fascinating workshops, panel discussions, and symposia, in addition to a designated Education and Engagement Day, field visits and an evening program designed to showcase the vibrant contemporary creative and food scenes for which Melbourne is globally renowned.

Explore our most liveable city and Royal Botanic Gardens Victoria's stunning and contrasting landmark gardens at Melbourne and

Cranbourne. Immerse yourself in natural areas of coastal heathland or towering hardwood forest, visit regional botanic gardens and enjoy 'The Art of Botanical Illustration' Exhibition incorporating works from renowned artists from around the globe.

There is so much on offer. Visit the Congress website for more information on registration and call for abstracts to ensure you take advantage of this valuable opportunity.



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