Plantations for people, planet and prosperity

10 years of the New Generation Plantations platform 2007-2017

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Dedicated to all who believed.

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Disclaimer
This publication was developed by the New Generation Plantations (NGP) platform Participants, in consultation with academia and WWF. It aims to present an overview of NGP's experiences over the last 10 years, and ideas for its future. It does not necessarily represent the views and policies of any of the participating organizations.

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Contents

Introduction

The first steps of the New Generation Plantations (NGP) platform can be traced in a WWF briefing paper dating back to 2005.

"WWF has recently committed to work proactively on plantations," it reads. *"As preparation for this work a group of WWF staff and representatives from four companies involved in plantation forestry undertook a one-week study tour of South Africa in April 2005 to exchange ideas on key issues associated with plantation forestry. The intention was not to develop a common vision, but to create a forum for understanding of the realities and issues associated with plantation forests, in order that there could be a better understanding of the various viewpoints."*

The companies involved – Mondi Group, Portucel Soporcel, Stora Enso and UPM – and WWF considered the study tour a success: *"There was common consent that the study tour was the start of a 'positive process'. There is value in having an open-minded constructive dialogue, but it needs good quality time to succeed."*

That "forum for understanding" was launched in 2007, as the New Generation Plantations project. Ten years later, NGP has many successes to show – but the need for open-minded and constructive dialogue remains as great as ever.

This book covers NGP's 10-year journey. In Part A we look at the development of the NGP concept: why this work matters, the principles behind "new generation plantations", and how the NGP process has evolved. Part B showcases stories of the role plantations are playing around key issues: forest restoration, water stewardship, socio-economic development, climate change and sustainable intensification. In Part C we look to the future, considering how plantations can contribute to major global agendas such as the Sustainable Development Goals and the Paris Climate Agreement, the possibilities of new technologies, and how NGP itself needs to evolve to rise to these challenges.

Throughout, the book is illustrated with real-world examples from NGP participants. These are drawn from published reports and case studies, experiences shared on NGP study tours, and personal communication with NGP participants. Further case studies, stories, ideas and inspiration can be found on the NGP website.

newgenerationplantations.org

Foreword from the founders

NGP Founders at the Edinburgh Study Tour, October 2007. From left to right: Daniel Arancibia, Antti Marjorkorpi, Luis Silva, Rudolph Zuniga, John Payne, Martha Mondragon, Peter Gardiner, Paula Guimarães, Han Zheng, Nuyun Li, Peter Lagan.

"It always seems impossible until it's done."

This famous quote from Nelson Mandela has always been a source of inspiration for me, and is very applicable to the challenges we face in the world of plantation forestry. For far too long, a gulf has existed dividing the anti-"green-desert" campaigners and the out-of-touch industry elites, locked in a deaf dialogue. Mandela led by example, building understanding and bringing people together where before existed a long-divided country, using tolerance to give people hope in a better future. It was in South Africa where the idea of NGP was first conceived, and I like to think it has been nurtured in line with Mandela's values since its early days.

But can we really use Mandela's learnings and apply them in our plantation forestry reality? Well, that's precisely the story we have to tell you in this book. How a small group of organizations has decided to take a less obvious route, often finding themselves arriving at even less obvious crossroads, following the only certainty that unites us. If we want to be honest with the ambition of building a better world for future generations, we have no alternative but to work together, whatever the cost. And that's what we decided to do.

Ten years ago, our dream of a new generation of plantations that benefit people and nature might have seemed impossible. Today, we believe it can become a reality. This is the story of how this happened.

Luis Neves Silva
NGP Lead, WWF International

Since the first phase of the project, when the base concepts were developed and the first technical papers were issued, a lot has happened: a project that grew into a global platform; the impacts, opportunities and benefits of plantations being openly discussed in all sorts of ecological, economic and social landscapes around the world; engagement and sharing experiences giving room to a new generation of plantations to face future challenges of forest products supply.

Being a founder member of NGP, we have witnessed how this initiative has put plantations on the agenda in a multi-cultural, cross-stakeholder, pragmatic and professional manner. And this is the only way to influence responsible land use and planted forest management, and sustain the inevitable and important role plantations can (and will) play in the times to come, as part of a bio-based society and a fourth Industrial Revolution.

Paula Guimarães
Head of Certification and Conservation, The Navigator Company

Fibre-based renewable products derived from sustainably managed plantations are essential elements of the bio-economy and circular economy. NGP has been a brave and timely response to the obvious need to recognize the increasing role of tree plantations in global wood supply and act upon the megatrends influencing the world's forests. We have witnessed the project evolving from a visionary idea to a global platform for sharing experiences and promoting better plantation forestry. This development was made possible by openly questioning the traditional ways of thinking about tree plantations while recognizing the realities in which plantation managers – whether smallholders, governments or companies – operate. NGP has learnt a great deal from a wide variety of plantation operations around the world.

Antti Marjokorpi
Head of Forests, Plantations and Land Use, Sustainability, Stora Enso

Hurray, here we are to celebrate the 10th anniversary of NGP! As a representative of the State Forestry Administration of China, I am very proud to be a founder of this exciting learning platform.

NGP has given China a lot of successful examples. In the last 10 years, I have witnessed its progress. Since I have been in charge of national afforestation management at SFA, I have explored plantation models from different continents with NGP participant companies and received excellent updated sustainable forest management procedures from the UK and WWF regional offices. My team and I have collected many practical management models into a book entitled *Sustainable Forest Cultivation and Management*. Meanwhile, I also have created the China Green Carbon Foundation (CGCF), affiliated to SFA, which is China's first national non-profit foundation for addressing climate change by increasing the carbon sink and reducing carbon emissions. Both SFA and CGCF will definitely continue to support the work of NGP, and I am quite sure that we will gain more knowledge and creative models from NGP, and contribute our own, in the future.

I wish all the best to NGP and all our peers on this platform.
I believe NGP will have a bright future.

Nuyun Li
State Forest Administration, China

Mankind has been using and converting forests since the beginning of time. The introduction of high-yielding exotic forestry plantations at the turn of the 20th century set astonishing new norms for forest production – and unfortunately, through poorly located plantations and a focus solely on production, extensive environmental degradation. This led many to brand plantation forestry as unsustainable and a destructive land use.

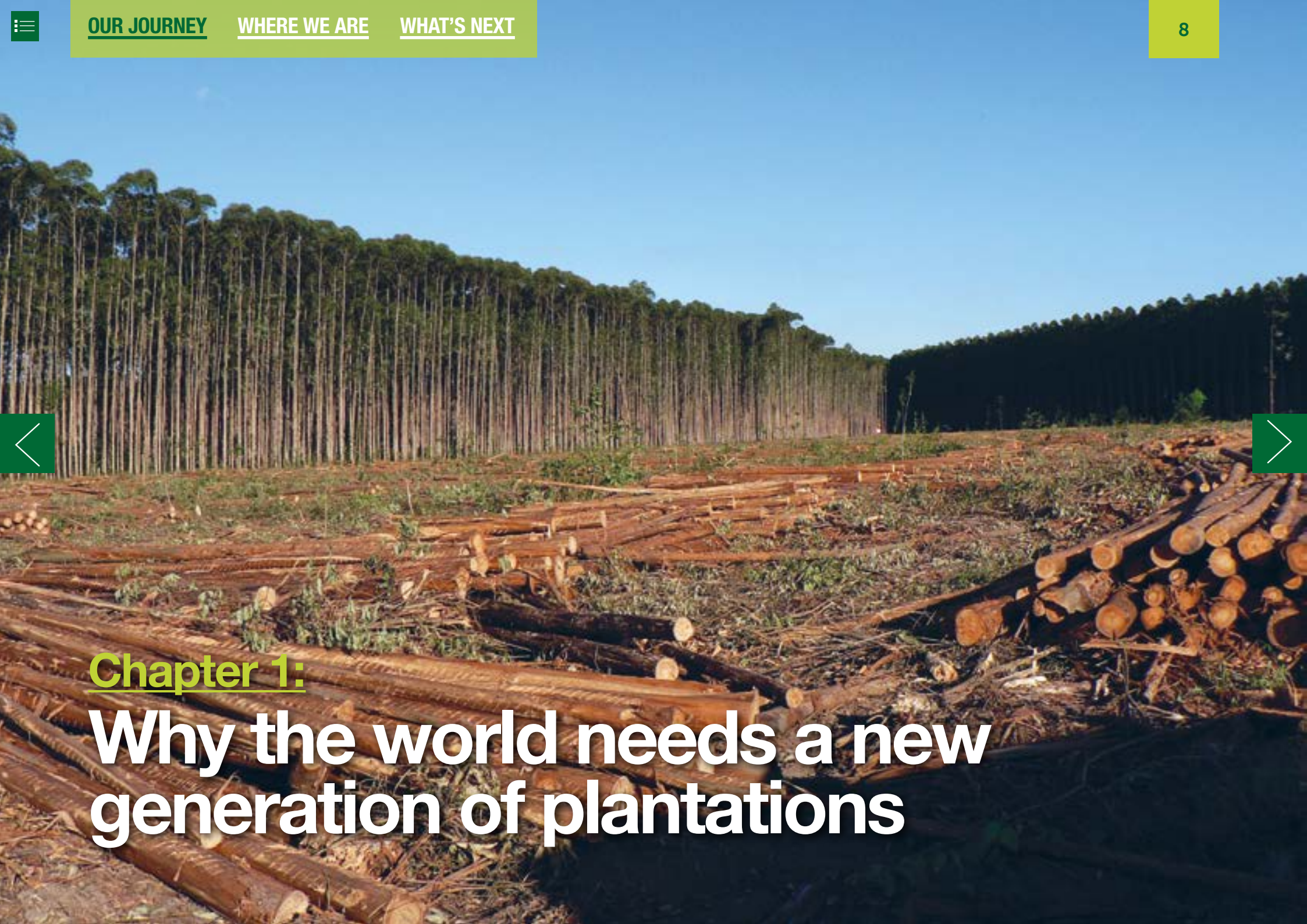
In 2005, WWF and leading companies visited South Africa to assess the progress in forestry plantations since their introduction to the country. The visitors witnessed a refreshing new generation of plantations, fully FSC certified, bringing economic growth, exceptional production and substantial social and environmental benefits. This was enough for WWF to realize that plantations are an important part of the global forestry equation, and to make the bold move to launch the NGP platform.

What NGP has done is to provide credibility for responsible land use with forestry as the leader, through global sharing and learning leading to improved social and environmental outcomes. The concept of optimizing productivity while conserving ecosystems and improving the well-being of people also has a big contribution to make in other land uses, notably agriculture.

Peter Gardiner
Group Natural Resources Manager, Mondi

Part A:

Our journey

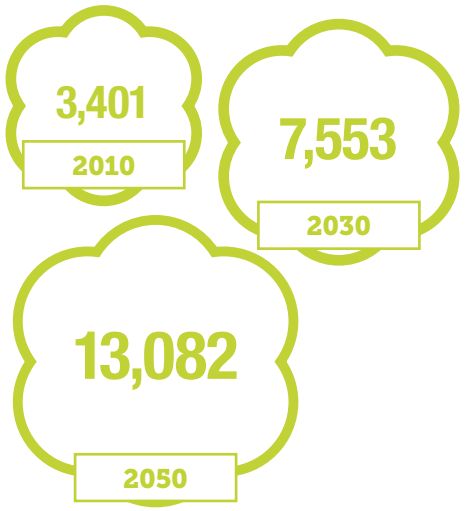


Chapter 1:

Why the world needs a new generation of plantations

Wood is good. It's a renewable resource with an extraordinary range of uses. Building and furnishing our houses. Cooking our food and heating our homes. Disseminating ideas and improving sanitation and hygiene. To imagine day-to-day life without wood and paper is practically impossible.

Projected global timber demand (in million m^3)



Over the coming decades, demand for wood-based products will grow to unprecedented levels. By 2050, the world's population is projected to reach 9.7 billion[1] – more than one extra person for every three people alive today. But rising numbers of people are only part of the story: at the same time, economic growth, urbanization and increasing prosperity are driving greater consumption. In 2009, the "global middle class" or "consumer class" numbered around 1.8 billion; the Organisation for Economic Co-operation and Development (OECD) projects this rising to 3.2 billion by 2020 and 4.9 billion by 2030, with the largest growth in emerging economies in Asia.[2] Meeting the needs and the growing demands of nearly 10 billion people will increase the already huge pressure on the world's natural resources – and wood is absolutely no exception.

WWF's Living Forests Model projects that wood harvesting will more than double by 2030, and almost quadruple by 2050: from 3,401 million cubic metres in 2010, to 7,553 million cubic metres in 2030 and 13,082 million cubic metres by mid-century.[3] Much of this increase will be driven by a massive expansion in the volume of wood used for bioenergy – whether in the form of solid logs, pellets burned in power stations to generate electricity, or second-generation biofuels derived from cellulose and lignin. Global demand for wood pellets as a renewable, low-carbon fuel is projected to more than triple in the next decade to 50 million tonnes.[4] Bioenergy will be a vital component in any future low-carbon, renewable energy mix – but even without more ambitious efforts to move to a fossil-fuel-free global energy supply, modelling suggests that demand for energy wood by 2050 will be twice as great as total global wood use today due to rising energy demands and energy security considerations.[5]

But it's not just bioenergy use that will expand. The Living Forests Model projects a near doubling in global demand for logs for timber and paper products, from 1.5 billion cubic metres in 2010 to around 2.8 billion cubic metres in 2050; this will be largely driven by emerging economies. And this doesn't attempt to account for potential new uses of wood. Serious action on climate change could drive an increase in the use of timber as a substitute for energy-intensive materials like concrete (responsible for around 5% of global carbon emissions) and steel, while wood-based biomaterials offer a renewable, biodegradable alternative to fossil-fuel-based plastics. Technological advances are already enabling innovative materials derived from wood to be used in a diverse range of sectors, from textiles and electronics to food and pharmaceuticals.

There are various measures that societies could, and should, employ to reduce the need to harvest trees – including more efficient saw mills and pulp mills, greater recycling, less wasteful consumption in rich countries and energy-efficient improved wood stoves in developing ones. But these will have only a limited impact. The bottom line is that we will be using more wood than ever before.

Seeing the wood for the trees

So where is all this wood going to come from? While deforestation and forest degradation are a massive global challenge, there's no physical shortage of timber in the world's forests: the estimated growing stock globally was 430.55 billion cubic metres in 2015,[6] and total harvesting at 3 billion cubic metres annually accounts for less than 1% of this. But there are limits to how much wood can be harvested from natural forests. Well-managed logging can help reduce deforestation, by enabling standing forests to hold their own economically against competing land uses like agriculture. However, sustainable management is far from the norm. In some cases, the pulp and paper industry has been responsible for clearing large areas of forest.[7] Illegal and unsustainable logging has also led to widespread forest degradation, bringing a loss of biodiversity, increased fires, pollution and invasive pests, among other impacts.[8]

Forests are not simply timber factories: they provide a habitat for four-fifths of all land species, from charismatic wildlife to medicinal plants.[9] They are home to 300 million people, and nearly one-fifth of the world's population depend on them for their livelihoods.[10] Many more of us rely on the services that forests provide – from supplying clean water to preventing erosion and regulating the climate. Doubling, tripling or quadrupling the world's timber supply would require more intensive logging in natural forests that are currently managed for production, as well as expansion into untouched forests. Doing this on the scale required in an environmentally sustainable, socially acceptable and economically viable way would be an immense challenge.

Plantations can be part of the solution. Planted forests make up only around 7% of forest cover worldwide, but supply a third of the total global production of industrial roundwood.[11] Intensively managed commercial plantations in tropical regions can produce wood fibre particularly efficiently: where a semi-natural conifer forest in Scandinavia requires 720,000 hectares to produce a million tonnes of pulp a year, a eucalyptus plantation in Brazil can produce the same amount on just 100,000 hectares.[12]

Do plantations take pressure off natural forests?

In theory, plantations can take pressure off natural forests by providing large quantities of wood in a relatively small area. The limited research to date supports this hypothesis.

Buongiorno and Zhu (2014) found that planted forests reduced the amount of wood harvested from natural forests by 26%. They also brought significant benefits to consumers, reducing the prices of forest products by 24-37%, and of manufactured products by 4-14%.[13]

An exhaustive review by Pirard et al. (2015) found evidence of reduced degradation of natural forests with the expansion of tree plantations. However, the same paper highlights the risk of potential increased deforestation if the market value of natural forests falls in the absence of logging, or if plantations displace other land uses. A promising way forward could be to promote highly productive plantations in strategic areas, in conjunction with efforts to protect forests at risk of conversion.[14]

According to forestry consultancy Indufor, industrial fast-growing forest plantations covered an area of 54.3 million hectares worldwide in 2012, and supplied just over 500 million cubic metres of industrial roundwood. They project that the plantation area will increase to 91 million hectares by 2050, and that overall output will triple as breeding, growing and harvesting techniques improve.[15] WWF's Living Forests Model projects an even greater increase in plantation area, suggesting that, even with increased harvesting in natural forests, up to 250 million hectares of new plantations will be required to meet demand by 2050 – an area twice the size of South Africa.[16]

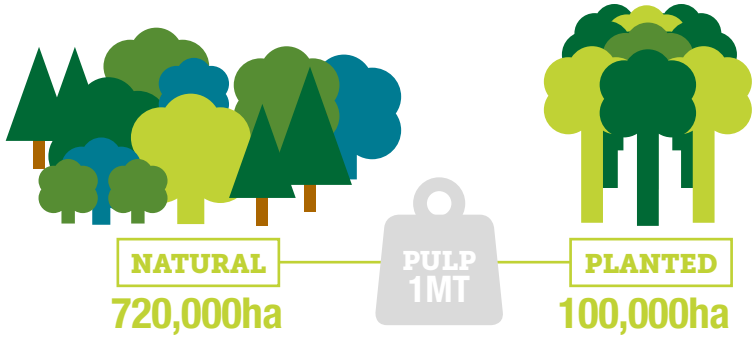
While the precise figures may be uncertain, what is clear is that plantations are going to need to play an increasingly important role in the world of the future – so it's vital to get them right.

UP TO

250

MILLION HECTARES OF NEW PLANTATIONS WILL BE REQUIRED TO MEET DEMAND BY 2050 – AN AREA TWICE THE SIZE OF SOUTH AFRICA

To produce a million tonnes of pulp a year requires 720,000 hectares of semi-natural forest in Scandinavia, but just 100,000 hectares of eucalyptus plantation in Brazil.



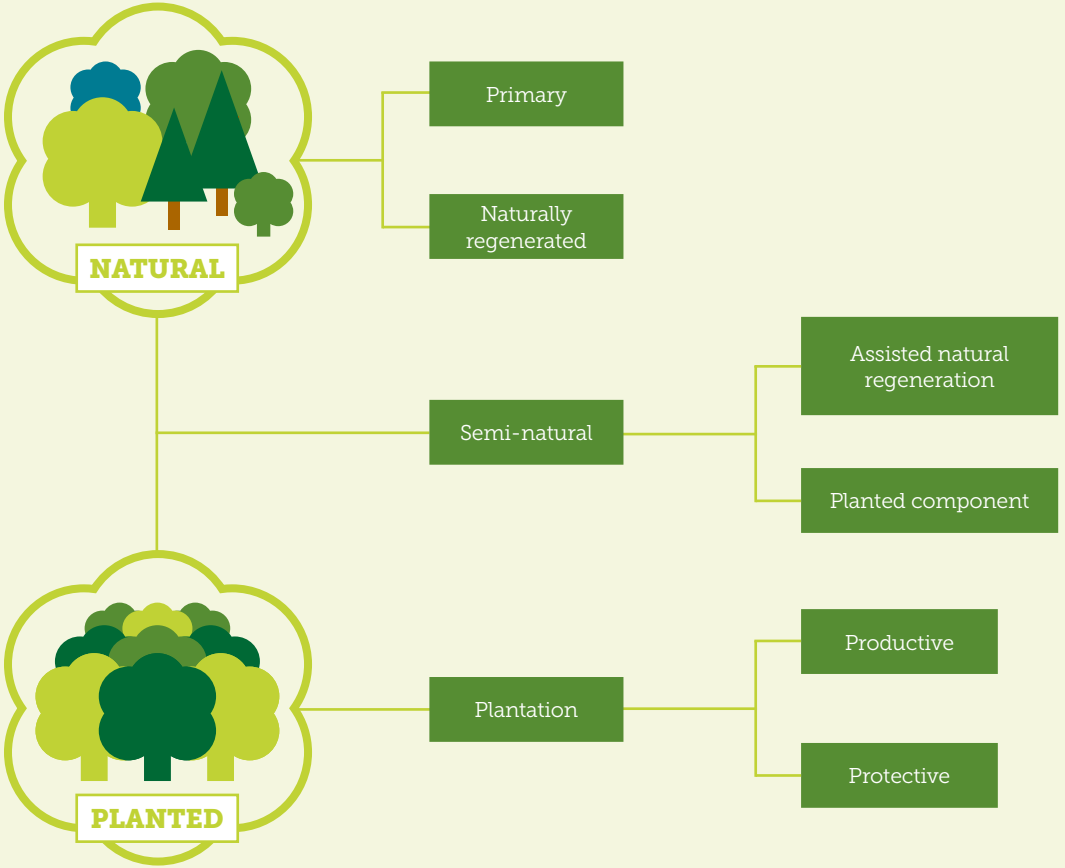
PLANTATIONS MAKE UP 7% OF GLOBAL FOREST COVER BUT PROVIDE 33% OF COMMERCIAL TIMBER

What is a plantation?

The Food and Agriculture Organization of the United Nations (FAO) distinguishes between natural forests (primary forests and naturally regenerated forests) and planted forests. The latter includes planted components in semi-natural forests, where the growth of native species has been assisted through planting, seeding and coppicing, and plantations of native or introduced species. These in turn can be classified as productive plantations for producing wood and non-wood products, and protective plantations to provide services such as erosion control.

The New Generation Plantations platform focuses mainly on productive plantations, although protective plantations and replanting and/or assisted regeneration of natural forests also form part of the conversation. In this publication, "plantation" generally refers to plantations of a single genus (most often eucalyptus in warmer climates, and pine in cooler ones), which are managed intensively in order to maximize fibre production. We don't cover plantations of agricultural crops or non-forest trees (such as oil palm or fruit trees), although many of the principles and good practices discussed could also be applicable in these cases. A landscape will often contain several types of forest. An NGP participant's property might combine productive plantations with conservation areas of primary and naturally regenerated forest, linked by corridors where native species have been planted to assist regeneration.

Figure 1. Types of forest, after FAO. See www.fao.org/forestry/plantedforests/67504/en

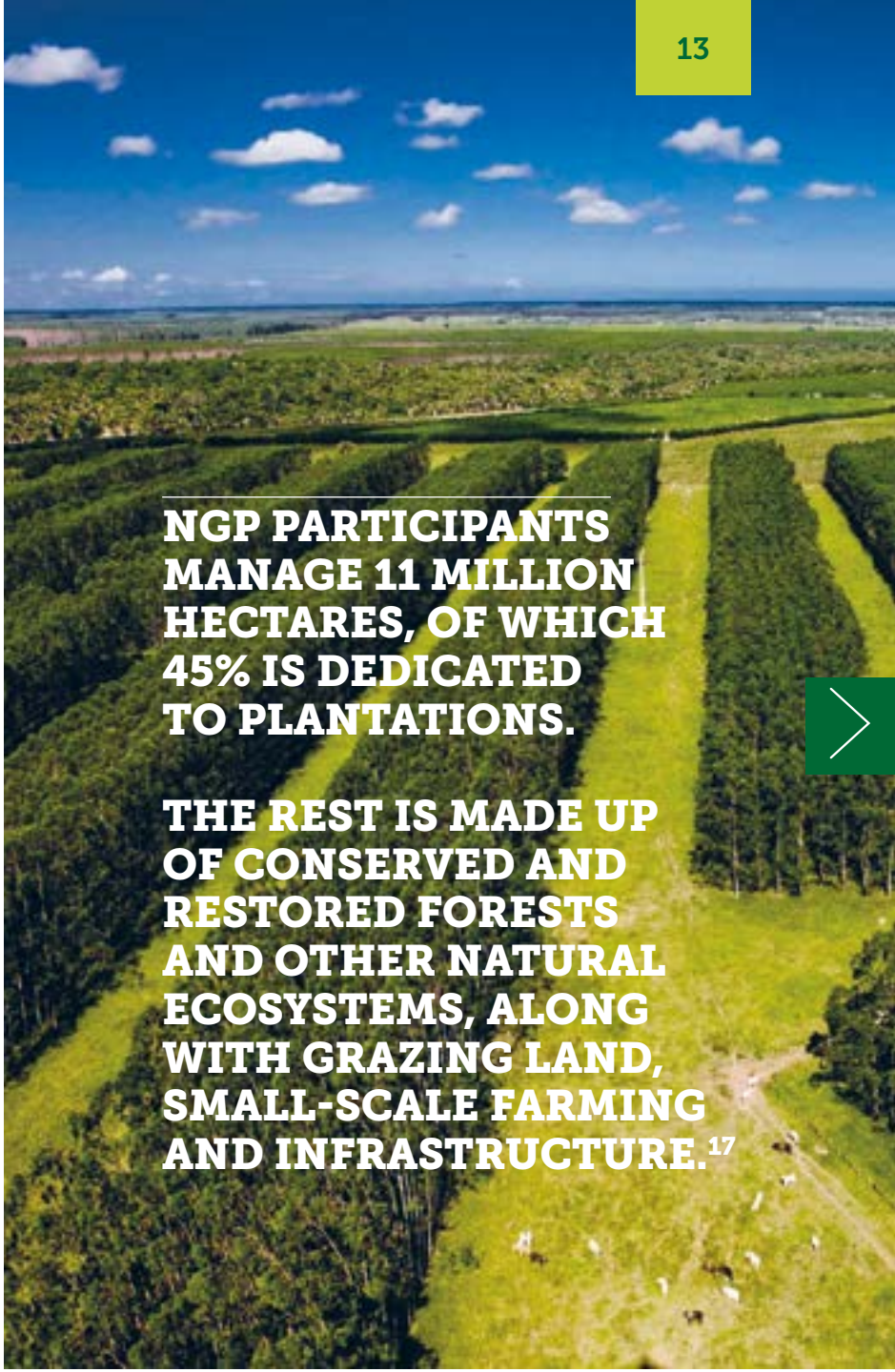


A new generation of plantations

Ten years ago WWF launched the New Generation Plantations platform, with the participation of a number of companies and government forest departments that manage plantations. The idea was to identify and promote better practices for plantation design and management, learning and sharing experiences from around the world. Although they approach the issue from different perspectives and contexts, participants share a belief that as tree plantations grow over the coming decades they can – and must – bring real benefits to people and nature.

This has not always been the case. Plantations have been heavily criticized in the past, and at times with good reason. Many companies – including those participating in the NGP platform – have faced protests, conflicts and legal challenges. There are examples from all over the world of natural forests, as well as other important ecosystems like wetlands and grasslands, having been converted to plantations – biodiverse ecosystems replaced with so-called "green deserts". Even plantations established on marginal or degraded land can have adverse impacts on biodiversity, soil and water if they are not well planned or managed.

There are social controversies too. Often, plantations have been established without the consent or the involvement of people affected by them. Local people may receive little share in the economic benefits; worse, instances exist of indigenous peoples and local communities being displaced or losing access to land for food production. Yet plantations don't have to be like this. Located in the right places, managed in the right fashion, plantations can make a positive contribution on many levels and in many ways. By meeting a large proportion of the growing global demand for wood fibre, they take pressure off natural forests. With competition for land becoming increasingly intense as populations and consumption grow, intensively managed plantations can produce wood in a relatively small area, freeing up land for other purposes such as food production and nature protection.



Despite the current huge pressure on land resources, large areas of land are in a degraded state – global estimates vary from almost 1 billion hectares to more than 6 billion hectares.[18] Forest plantations can be an effective way to bring degraded land back into productive use. In Brazil's Atlantic forest, for instance, a landscape mosaic model combines eucalyptus plantations with rainforest restoration on former cattle pasture (see Chapter 4: Rainforest restoration in Brazil's Atlantic forest). A different method for reviving productivity on degraded pastures is the integrated crop-livestock-forest (ICLF) system pioneered by the Brazilian agricultural research organization Embrapa, where rows of trees are combined with grazing and crops: among other benefits this can restore soils, sequester carbon, improve animal welfare, produce more in a smaller area and improve incomes for farmers.[19] In China's Gansu province, meanwhile, tree and shrub plantations are being established on arid lands to stop the encroachment of the desert, while providing an income for local farmers.[20]

Plantations can bring degraded land back into productive use, alongside restoring natural ecosystems and the services they provide.

Clockwise from top: a mosaic of plantations and forest restoration in Brazil's Atlantic forest; integrating forestry and livestock in Mato Grosso do Sul, Brazil; combating desertification in Gansu, China.

Critics claim that plantations are not forests – and it's true that a monoculture plantation managed for intensive production can't possibly provide the same rich range of habitats and ecosystem services as a natural forest. However, plantations that follow established principles of sustainable forest management avoid wall-to-wall planting for timber production, and are managed as part of a larger forest management unit, incorporating ecosystem functions, natural habitats and socio-cultural components. Even intensively managed plantations within these areas tend to provide greater environmental and social benefits than agricultural and pasture land – including sequestering carbon, purifying air and water, controlling erosion, providing species habitats and offering recreational opportunities.[21] These benefits are amplified when plantations are managed as part of larger forest landscapes and in balance with other ecosystems and land uses.

In South Africa, Mondi's SiyaQhubeka plantations form part of the buffer around the iSimangaliso Wetland Park, a World Heritage Site, and are fenced into the Park. Both the unplanted and planted areas provide shelter, habitat and grazing for the Park's wildlife, including large mammals such as elephants, rhinos, zebras and giraffes.

With good management, plantations can also benefit the people living alongside them. At the very least, they can provide jobs and income and help fund local infrastructure, often in remote areas where economic opportunities are few. Plantations that follow Forest Stewardship Council (FSC) principles and criteria help to clarify land rights, uphold the rights of indigenous peoples, and maintain or enhance the social and economic well-being of forest workers and local communities. When companies that manage plantations truly engage with local communities they can be channels for inclusive green development: numerous examples exist of companies helping to create and support local enterprises and increase local food production.[22]

Giraffes graze in a firebreak in eucalyptus plantations in iSimangaliso Wetland Park, South Africa.

Plantations tend to provide more ecosystem services than pasture and agricultural land, including carbon sequestration, freshwater provision, soil protection, species habitats and recreation.

Figure 2. Ecosystem services from plantations, in relation to other ecosystems and land uses.
Source: Baral et al. 2016. A proposed framework for assessing ecosystem goods and services from planted forests.

Ecosystem services	Provision of ecosystem services from planted forests in relation to:			
	Native forests	Native grasslands	Managed pasture	Agriculture
Provisioning services				
Food production	↓	↓	=	↓
Timber production	↑	↑	↑	↑
Medicines	↓	↓	↑	↑
Freshwater	↓	↑	↓	↑
Regulating services				
Fresh air regulation	↓	↑	↑	↑
Carbon sequestration and storage	↑	↑	↑	↑
Groundwater recharge	↓	↓	↓	↑
Natural hazard regulation	↓	↑	↑	↑
Water purification	↓	↓	↑	↑
Disease regulation	↓	?	↑	↑
Pollination	↓	↓	↓	↑
Erosion prevention and soil protection	=	↓	=	↑
Habitat or supporting services				
Habitat for species	↓	↓	↑	↑
Maintenance of genetic diversity	↓	↓	?	↑
Cultural services				
Spiritual and religious values	↓	↓	?	?
Aesthetic values	↓	↓	?	?
Recreation and ecotourism	↓	?	↑	↑

Sustainable forest management and forest certification
The last 25 years have brought growing consensus on the need for sustainable forest management, described by the UN as "a dynamic and evolving concept ... intended to maintain and enhance the economic, social and environmental value of all types of forests, for the benefit of present and future generations". This is reflected both in government policy and legislation, and in voluntary action by the forestry industry.

Independent certification has become an important tool to promote sustainable forest management, chiefly through the Forest Stewardship Council (FSC) and the Programme for the Endorsement of Forest Certification (PEFC). The area covered by these two schemes grew from 14 million hectares in 2000 to more than 438 million hectares in 2014: 58% PEFC and 42% FSC.[23] WWF and other environmental organizations consider FSC to be the most credible standard for sustainable forest management.

NGP participants' plantations are near 100% FSC certified.

The last decade has brought considerable progress as "new generation plantations" have started to become a reality. In Chile, the major forestry companies have achieved FSC certification, begun restoring previously converted areas of native forest, and transformed the way they engage with local communities. In South Africa, best practices developed to minimize the impact of plantations on wetlands have been adopted across the forestry sector. In China, large-scale afforestation is benefiting smallholders and the climate alike. NGP study tours have witnessed first-hand examples of past conflicts – with indigenous communities, with conservationists, with cattle ranchers – that have been resolved into opportunities for cooperation. At the same time, a growing demand for credible certification and deforestation-free supply chains provides companies with a strong market incentive to operate responsibly and sustainably.

Of course, there's still plenty of room for improvement. It's essential that companies, NGOs, governments, researchers and civil society continue to discuss, share, learn, plan and work together to enhance the contribution plantations make to the landscape, society and the economy. Just as tech companies are already researching and developing 5G mobile phones, the NGP platform must work toward the next generation of plantations to meet the sustainability challenges of tomorrow.

Chapter 2:

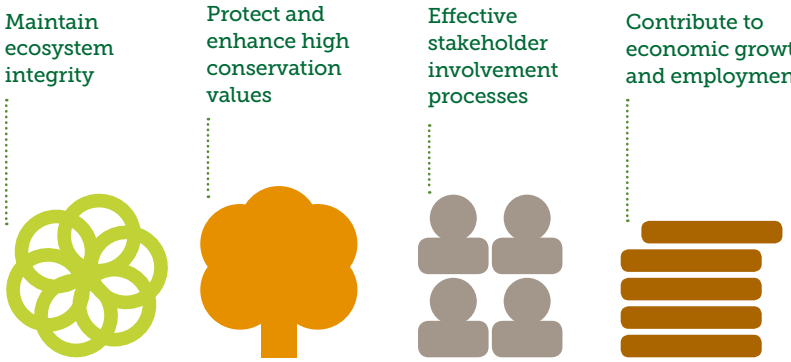
The NGP concept

What should a new generation plantation look like?

That was the question posed during the first phase of NGP. From 2007 to 2009, representatives from six companies, three government forest departments and WWF met several times to explore the idea, attending study tours to Scotland, Brazil, China and Colombia. They shared case studies and developed technical papers summarizing various good practices.

While the participants operated in diverse ecological, social and environmental contexts, they identified four key principles that have been at the heart of the NGP concept ever since, agreeing that plantations should:

- Maintain ecosystem integrity
- Protect and enhance high conservation values
- Be developed through effective stakeholder involvement processes
- Contribute to economic growth and employment.



Over the last 10 years we've seen real progress as participants have put these principles into practice. This is not to say that all NGP participants always live up to this ideal. Nor do companies and governments need to participate in the NGP platform in order to apply these principles: many examples of good plantation practice exist outside the NGP platform. NGP isn't about setting a standard and specific requirements – tools like FSC certification already exist to do this. Rather, it's about a vision to aspire to, and a vehicle to drive positive change. Increasingly, this means looking beyond the plantation and the forest management unit, to the wider environmental and social landscape.

The following chapter looks at some of the progress made over the last 10 years under each of the four NGP principles.

Ecosystem integrity

For ecosystems to continue to provide the services that human beings depend on, key ecological processes need to be able to function. These include the natural cycles of water, nutrients, carbon and biodiversity. Depending on where they are located and how they are managed, plantations can have negative or positive impacts on these cycles.

Evidence from NGP participants suggests that well-designed plantations can be part of healthy, resilient landscapes – and can in fact strengthen ecosystem integrity and enhance ecosystem services in degraded landscapes. In the Atlantic rainforest and the Cerrado savannah in Brazil, for example, former cattle pastures have been transformed into mosaics of intensively managed plantations interspersed with diverse restored natural vegetation – with benefits to water, soils, carbon and biodiversity. In South Africa, Mondi's investment in "ecological networks" has helped maintain ecosystem functions alongside productive plantations in a biodiversity hotspot.

Ecological networks[24]

Plantation models in South Africa used to pay little attention to ecosystem integrity. The aim was to plant as many trees as possible, often leading to intensive wall-to-wall forestry with only a few areas set aside for their ecological value, usually due to legal restrictions. This had significant negative impacts on wildlife, natural vegetation and ecological processes such as water cycles.

Over the last 20 years, this approach has been transformed. NGP participant Mondi has led the way by pulling out of wetland areas and carrying out research into ecological networks. Studies have demonstrated that these interlinked areas of high-quality habitat can conserve important landscape features and connect conservation areas, enabling wildlife to move freely and natural processes to function.

The South African timber industry has around 500,000 hectares of unplanted areas in and around its tree plantations. These include riparian zones of native vegetation on either side of rivers, and buffers around wetland soils. Strips of native grassland form firebreaks between plantations, while also providing wildlife corridors and grazing.

Research has proved that, when these networks are well managed and connected, they can be an effective way of conserving biodiversity and ecosystem services within an economically profitable production landscape.

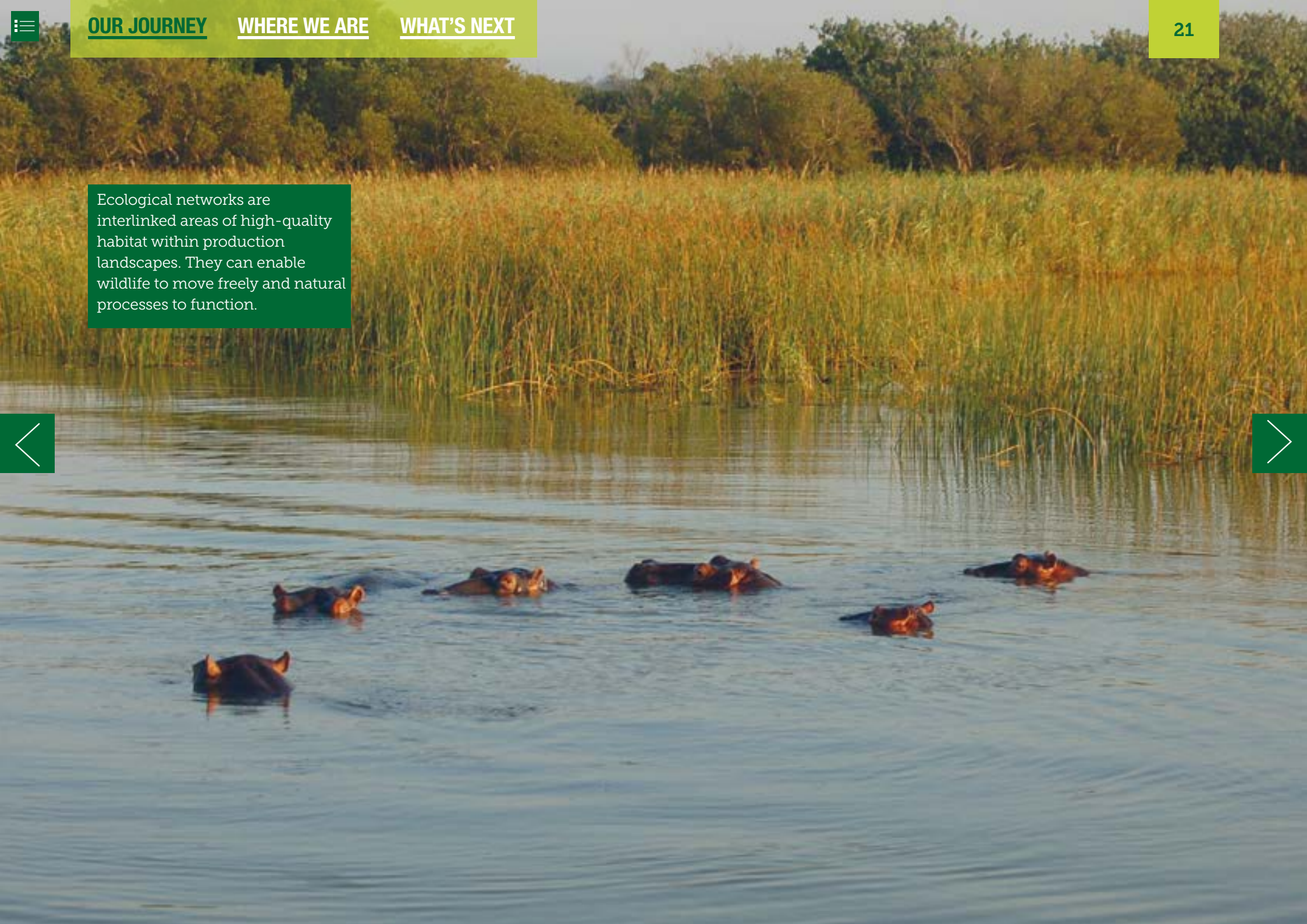
One way of assessing the effectiveness of ecological networks is to compare their biodiversity value with that of protected areas – and the comparisons are striking:

- Still water bodies in ecological networks and protected areas shared 74% of all dragonfly species (an indicator of freshwater ecosystem health), and an equal number of range-restricted species.
- After riparian zones were restored, dragonfly abundance in rivers increased six-fold and species richness increased three-fold.
- Protected areas and ecological networks had equivalent numbers of butterflies, dragonflies and other arthropods.
- Corridors more than 250m wide effectively served as natural habitats, while narrower corridors served as conduits for many species.
- Where there are no fences between protected areas and ecological networks in production landscapes, large mammals freely roam between them. Species recorded at study sites include African elephant, white rhino, African buffalo, giraffe, zebra and blue wildebeest.

These results are especially significant as the study areas in question are located in a globally significant biodiversity hotspot (Maputaland-Pondoland-Albany) – regions especially rich in biodiversity that have lost at least 70% of their natural habitat. Moreover, the region is affected by El Niño events: ecological networks appear to underpin ecosystem resilience in the face of these extreme climatic conditions. This suggests that they can play a similar role in supporting resilience and adaptation to the inevitable impacts of global climate change.

"Overall, these ecological networks provide a win-win situation where conservation and agroforestry production can operate in the same overall space for the benefit of both."

Professor Michael Samways and James Pryke, Department of Conservation Ecology & Entomology, Stellenbosch University



Ecological networks are interlinked areas of high-quality habitat within production landscapes. They can enable wildlife to move freely and natural processes to function.

Water cycles

Water issues are a key concern in many regions – particularly in the case of fast-growing intensively managed plantations. In water-stressed South Africa, forestry is classified as a "stream flow reduction activity" under the country's National Water Act, and plantations need a licence for their water allocation. Impacts on water sources have also been a source of conflict with local stakeholders in Brazil, Chile and elsewhere.

Research suggests that in most cases afforestation will reduce local water flows, but that the impact on downstream water resource security and freshwater ecosystems is generally low unless large areas have been planted.[25] In some cases, the reduction in water flows can be positive, reducing the risk and impacts of flooding. Well-designed and managed plantations on degraded agricultural land can, in some cases, recharge groundwater by improving infiltration, and reduce erosion and runoff of sediment and nutrients into river systems – although sediment and agrochemical runoff can be a threat to water quality when site preparation and planting operations are managed poorly.

NGP participants employ a number of good management practices to maintain water cycles, and are carrying out research to better understand their water impacts. At the site level, management practices include precision application of fertilizer and irrigation water during planting, reducing the use of chemicals, and restricting the circulation of heavy machinery near watercourses. Larger-scale plantation design measures include conserving or restoring native vegetation in riparian zones and important watersheds; research has shown that mosaic landscapes that combine plantations with natural vegetation can stabilize water flow and reduce potential negative environmental and social water impacts.[26] Increasingly, companies are also working with other stakeholders in their river basins to address shared water risks and responsibilities (see Chapter 5: Water connections across a South African landscape).

Nutrient cycles

Poorly managed plantations can have negative impacts on soils and the nutrients they contain, through soil disturbance during planting and harvesting, too much biomass removal and leaching of fertilizers and pesticides. However, good management practices can address potential negative impacts: this is in everyone's interests, as maintaining fertility is essential to a plantation site's long-term productivity. While there is limited long-term data on how repeated rotations affect soil and site quality, management recommendations have been developed to minimize risks and adverse impacts.[27] [28] Research also suggests that intensively managed plantations can indirectly improve soil quality as their rapid growth rates increase organic matter, particularly through increased production of coarse roots; this can lead to long-term improvement in soil quality and site productivity, especially on degraded soils where plantations are often established.[29]

Growing trees on degraded pasture can help to improve soil quality and fertility, while making beef production more efficient. This farm in Mato Grosso do Sul in the Brazilian Cerrado supports two cows per hectare, alongside 400 trees – compared to an average of 0.3 cows per hectare in the vast areas of degraded pasture in the state. The trees improve animal welfare, so the cows grow faster and fatter, and provide a valuable second income for the farmers.

Measuring circumference to calculate carbon sequestration in a bamboo plantation during an NGP study tour to Anji, Zhejiang province. Carbon is also stored in roots, soil and wood-based products.

Carbon cycle

The effects of plantations on the carbon cycle depend on where plantations are established, how they are managed, and the products they produce. Plantations that replace natural forests or disturb high-carbon soils such as peat are likely to lead to a net increase of CO_2 in the atmosphere. By contrast, plantations established on degraded pastures will sequester considerably more carbon than the previous land use – not just in the visible portion of the trees, but also in their root systems and leaf litter that can increase the carbon content in the soil. Management practices such as leaving branches and twigs on site after harvesting, and reducing disturbance when soils are prepared for planting, can also increase amounts of carbon stored in the soil. In addition, conserving and restoring natural forests alongside plantations has a significant positive impact on the carbon cycle.[30]

Assuming that forests are well managed, the biomass they produce should be carbon neutral or carbon positive. As trees grow, they absorb carbon from the atmosphere. In the case of disposable paper products or bioenergy, much of this carbon will only be stored temporarily before being returned to the atmosphere – but it will be reabsorbed as the forest regenerates. In fast-growing plantations this cycle is rapid, taking less than 10 years. For timber products, the carbon may remain locked up for many years. Added to this, wood-based materials can have a positive climate impact by acting as substitutes for fossil-based products.

Soil carbon in China

An analysis of China's "Grain for Green" reforestation programme found that planting trees on croplands greatly enhanced the organic carbon content in the soil. Since the project was initiated in 1999, carbon levels have increased by half at depths of 0-20cm and by a quarter at 20-60cm, and research shows that carbon continues to accumulate over time.

Bamboo plantations had particularly high levels of soil carbon sequestration. While most plantation forest management requires soil preparation at the end of each rotation, leading to the loss of soil carbon through oxidization, bamboo simply regrows from its rhizome (underground stem), and the carbon remains in the soil.[31]

Carbon balance

Most NGP participants measure their carbon balance, and are committed to improving it.

- Fibria estimates that the pasture lands where its plantations were established used to store a total of 9.9 million tonnes of CO_2 equivalent. With the development of its eucalyptus plantations and restoration of natural forest, the company increased this carbon stock to 90.9 million tonnes through the increase in biomass above and below ground, and plant litter. The company has a positive annual carbon balance of nearly 7.3 million tonnes of CO_2e, and is aiming to increase this to 11 million tonnes by 2025.[32]
- Suzano calculates that its eucalyptus forests removed 18 million tonnes of CO_2 from the air in 2015.[33]
- APSD estimates that its renewable energy power plant in Ghana will reduce CO_2 emissions by 200,000 tonnes per year. The 23,000-hectare plantation supplying this unit will permanently store 2 million tonnes of carbon.

CARBON STORAGE ON FIBRIA'S LANDS HAS INCREASED FROM 9.9 MILLION TO 90.9 MILLION TONNES OF CO_2 EQUIVALENT

Biodiversity

Monocultures in general do not support anything like the same range of plants and animals as diverse natural ecosystems. Plantations established in place of natural forests or grasslands will lead to losses in the abundance and variety of wild species, and poorly designed and located plantations can increase habitat fragmentation, with further impacts on wildlife. Even when established on farmland, single-species plantations can have negative impacts on biodiversity: a recent analysis of China's massive "Grain for Green" reforestation programme showed that monocultures of bamboo or eucalyptus generally resulted in net losses of bird diversity, and overwhelming losses of bee diversity, compared to the cropland they replaced – although the same study suggested that adding a mix of species to these plantations could have significant biodiversity gains at little cost.[34]

However, while intensively managed plantations may have little biodiversity value at the site level, they can have important positive impacts on biodiversity at a larger landscape scale. Plantations established on degraded land can provide new habitats and create suitable conditions for natural regeneration. Companies are also involved in active conservation and restoration of forests and other ecosystems on their estates. Good plantation design can help to create linkages between conservation areas or provide a protective buffer alongside natural forests that may be at risk of conversion to other land uses.

Plantations can provide new habitats: Bonelli's eagle nesting in eucalyptus in The Navigator Company's plantations in Portugal (top); elephants graze in a firebreak in Mondi/SQF's plantations in South Africa (below).

Improving connectivity at a landscape level is of paramount importance in enabling species to adapt to climate change by dispersing into new areas.

Biodiversity monitoring

Suzano, Brazil
A monitoring project in 2016 found 30 endangered species in Suzano's preservation areas in the state of São Paulo, Brazil. In total, the study identified 21 species of mammals, 291 birds and 32 plants, many of them endemic to the region. Threatened species included the maned wolf, wild cats including ocelot, puma and jaguarondi, and the giant anteater.

UPM, Uruguay
Some 1,200 species of plants have been recorded on UPM' s land in Uruguay – around half the country's flora. These include many rare and endemic species, several species never before recorded in Uruguay, and even a type of cactus previously unknown to science. Of the 544 species of birds, mammals, reptiles and amphibians found in the country, 371 have been recorded on UPM properties in Tacuarembó and 357 on its properties in the coastal region. The distribution of some species has expanded.

Fibria, Brazil
Fibria's species database listed more than 700 bird species in 2015. These numbers have increased with every new monitoring process.

The Navigator Company, Portugal
The Navigator Company carries out annual biodiversity surveys on its properties in Portugal. Of 236 animal species observed, 97 are protected under the European Union Nature Directives, as are 71 out of 700 species of plants.

Arauco, Chile and Brazil
Through its Bioforest research centre, Arauco is leading a project to conserve the Darwin frog (*Rhinoderma darwinii*), which is endemic to Chile and threatened with extinction. The aim is to enable the frogs to reproduce in a controlled environment, then be reintroduced into suitable habitat. In Brazil, meanwhile, Arauco has identified 20 species of mammals (including 13 threatened species) and 173 species of birds (23 threatened). They include the endangered southern muriqui (*Brachyteles arachnoides*), a type of woolly spider monkey endemic to the Atlantic forest; as few as 1,000 individuals remain in the wild.

Blue-and-yellow macaws (left) and ocelots (above) are among the species found in Suzano's preservation areas in Brazil.

97

ANIMAL SPECIES FOUND ON THE NAVIGATOR COMPANY'S LAND IN PORTUGAL ARE PROTECTED UNDER THE EUROPEAN UNION NATURE DIRECTIVES

Changing ecosystems: positive impacts of plantation development in Ghana

APSD has helped reverse declines in biodiversity around its plantations in the Brong Ahafo region of Ghana. Before the project, the area was classified as degraded, comprising scattered woods, grass and shrubs – the result of recent unregulated forest exploitation for timber and charcoal, and poor agricultural practices. Loss of habitat had led to large declines in wildlife numbers; nevertheless, at least eight species of global conservation concern and 14 species of national conservation concern were present on the property.

Strongly influenced by NGP principles, APSD planned a mosaic of plantations, agroforestry and conservation areas across its 23,000 hectare concession. All areas of high biodiversity or located close to water resources are conserved and, where necessary, restored (at least 20% of the total area) and linked by biodiversity corridors. Six dams have been created which, along with the riparian and protected areas, have provided suitable habitats for many water-loving plants and animals including crocodiles, fish, amphibians and crustaceans. Many species of birds and some land-based terrestrial animals also come to these areas for cooling, resting and drinking.

The company has set up an environmental management team that works closely with all other departments to ensure the conservation areas are protected from encroachment.

Other measures include the planned development of a corridor linking APSD's conservation areas with the neighbouring Digya National Park, and community education programmes on bush-burning and hunting. The Nature and Development Foundation, a Ghanaian NGO, has provided invaluable support throughout the process.

6

DAMS HAVE BEEN CREATED FOR MANY WATER-LOVING PLANTS AND ANIMALS INCLUDING CROCODILES, FISH, AMPHIBIANS AND CRUSTACEANS

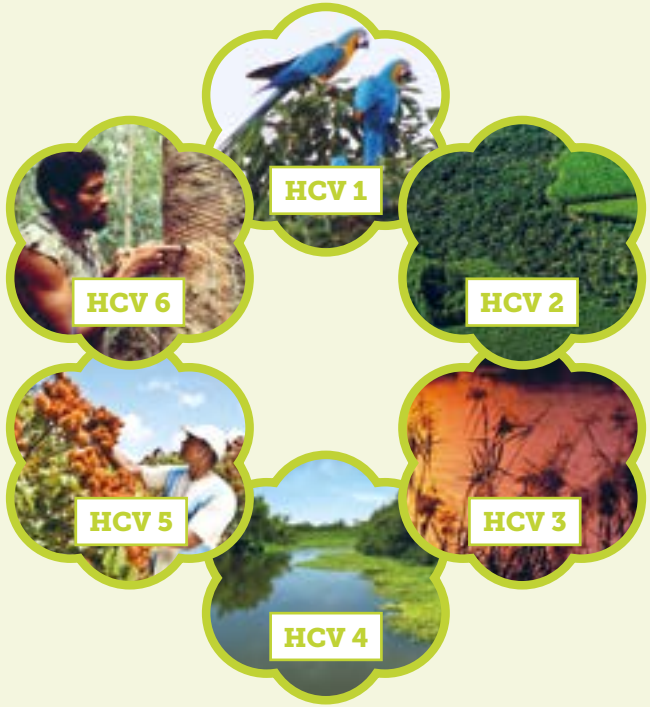
APSD's concession area in Ghana includes a mosaic of plantations, agroforestry and conservation areas, including new aquatic habitats for species such as crocodiles.

High conservation values

Beyond maintaining ecosystem integrity, new generation plantations also protect and enhance high conservation values, or HCVs – biological, ecological, social or cultural values of outstanding significance or critical importance. These might include rare or threatened species, intact landscapes, crucial ecosystem services, or sacred or historical sites. The concept of maintaining and enhancing HCVs was first introduced by FSC, and has since been adopted by several other certification schemes, as well as private sector buyers and financial institutions. This makes it both a familiar practice in the forest sector, and a common language for engaging with other actors in the landscape.

FSC certified companies must work with local people and other stakeholders to identify HCVs in their management units, and to develop, implement and monitor management plans for maintaining and enhancing them. By doing this, NGP participants are contributing to conservation work on a significant scale.

Figure 3. The six high conservation values



HCV 1
Concentrations of biological diversity including endemic species, and rare, threatened or endangered species, that are significant at global, regional or national levels.

HCV 2
Landscape-level ecosystems and mosaics. Intact forest landscapes and large landscape-level ecosystems and ecosystem mosaics that are significant at global, regional or national levels, and that contain viable populations of the great majority of the naturally occurring species in natural patterns of distribution and abundance.

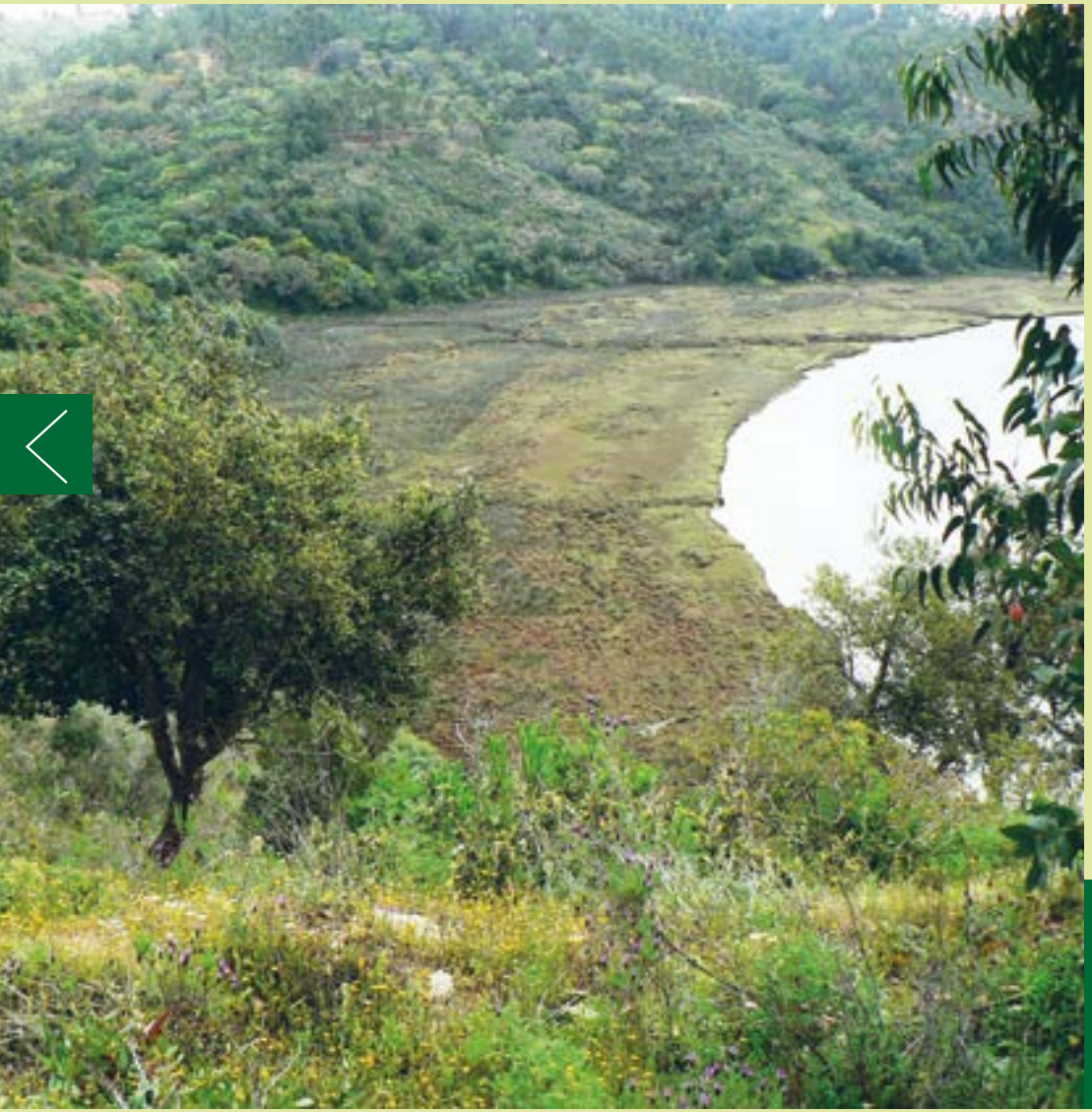
HCV 3
Rare, threatened, or endangered ecosystems, habitats or refugia.

HCV 4
Basic ecosystem services in critical situations, including protection of water catchments and control of erosion of vulnerable soils and slopes.

HCV 5
Sites and resources fundamental for satisfying the basic necessities of local communities or indigenous peoples (for livelihoods, health, nutrition, water, etc...), identified through engagement with these communities or indigenous peoples.

HCV 6
Sites, resources, habitats and landscapes of global or national cultural, archaeological or historical significance, and/or of critical cultural, ecological, economic or religious/sacred importance for the traditional cultures of local communities or indigenous peoples, identified through engagement with these local communities or indigenous peoples.

HCVs in a diverse landscape



The Navigator Company manages around 120,000 hectares of plantations and native forest in Portugal, dispersed over more than 1,300 management units. The company has classified approximately 10% of its estate as "zones with interest for conservation", and for each of these it has a conservation action plan, with defined management and monitoring measures.

These measures cover 41 classified habitat types, including eight priority habitats such as temporary Mediterranean ponds, endemic juniper forests and alluvial forests of alders and Oleaceae. Other significant habitats include forests of deciduous oaks, cork oaks and Mediterranean oaks, and riverbank gallery forests, dominated by willows and poplars.

With the scale and diversity of these operations, identifying and managing areas of high conservation value has been a major undertaking.

The company has worked with expert partners and local stakeholders to develop a tailor-made approach. As well as rare and threatened habitats (HCV3), the company is helping to maintain important riverbanks (HCV4) and areas of cultural and historical significance (HCV6), such as remnants of ancient beehive keeping walls that were used in the Iberian Peninsula centuries ago.

While some of the HCV areas are located wholly on the company's estate, others overlap with sites forming part of the national network of protected areas and the EU-wide Natura 2000 network. This means The Navigator Company is able to contribute to biodiversity conservation and maintaining ecosystem integrity at both a local and a landscape level.

Oak forests and juniper shrubs: priority habitat types protected on The Navigator Company's land.

Plantations and World Heritage sites

World Heritage sites contain some of our planet's most priceless natural treasures. But recent research by WWF has revealed that half of all natural World Heritage sites are under threat from industrial-scale activities like mining, oil and gas drilling, and construction of major infrastructure. By contrast, NGP has showcased examples of how plantations can contribute to conserving World Heritage sites while meeting local needs and contributing to economic growth:

- SiyaQhubeka Forests (SQF), a partnership between Mondi and local community organizations, transferred 4,500 hectares of commercial plantations to the iSimangaliso Wetland Park, a World Heritage site in South Africa. The land has been restored to natural vegetation, helping regenerate important wetlands and grasslands. Through a partnership between SQF and the iSimangaliso World Heritage Authority, a further 14,200 hectares of SQF's plantations and conservation areas are officially incorporated into the park, extending the habitat for wildlife such as elephants and rhinos and providing a buffer around the Park's core areas.
- Illegal timber harvesting for charcoal is one of the biggest threats to Virunga National Park in the Democratic Republic of Congo. WWF's EcoMakala project works with local people living on the edge of the Park to plant fast-growing woodlots to provide an alternative source of timber. More than 10,000 hectares have been planted to date, helping to meet energy needs and improve livelihoods locally while taking some pressure off Virunga's forests.
- Veracel manages a large protected area extending to more than 6,000 hectares, known as the Estação Veracel Private Natural Heritage Reserve. It is one of 25 protected areas that make up the Atlantic Forest South-East Reserves natural World Heritage site. Veracel and other companies in the region are contributing to efforts to restore and connect these areas.

Clockwise from top: woodlots outside Virunga National Park; ecotourism in the Atlantic Forest; Lake St. Lucia in iSimangaliso Wetland Park.

114

OUT OF 229 NATURAL WORLD HERITAGE SITES ARE UNDER THREAT FROM DEVELOPMENT

HCVs: more than just forests

The HCV concept originally focused on forests, but has broadened to include other ecosystems which often receive less attention and protection. In Uruguay and Argentina, NGP participants have been actively conserving important grasslands and savannahs. The region's grasslands contain unique biodiversity, with thousands of species of plants, 500 bird species and nearly 100 different mammals. While some areas can match tropical forests for plant species richness, grasslands receive very little official protection.

UPM has been working with NGO partners to conserve and manage valuable grasslands on its property, including conservation projects for grassland-dependent species such as the Capuchino bird.

Palm savannahs once covered much of Uruguay, but large areas have been lost through intensive grazing and conversion to agriculture. With less grazing, disturbance and herbicide use, plantations provide conditions where endemic yatay palm trees can regenerate.

UPM has worked with local experts on a palm conservation strategy in its plantation design. By protecting young and mature trees and connecting isolated patches of palms, it aims to help to preserve and restore the integrity of the palm savannah ecosystem. Maintaining the palm trees creates structural diversity within plantations, benefiting biodiversity, with the palm fruits providing a source of food for numerous animal, bird and insect species.

In 2015, one of the HCV areas voluntary identified by UPM was officially included in Uruguay's national system of protected areas – the first time this happened with an area belonging to a single private owner. Working with environmental NGOs like Vida Silvestre Uruguay and Aves Uruguay has significantly improved UPM's management of conservation areas. This is the result not just of expert input, but also of land managers learning more about conservation, biodiversity and related issues.

Palm savannahs (above) and grassland conservation areas (below) on UPM's land in Uruguay.

Stakeholder involvement

NGP participants recognize that having a "social licence" to operate is fundamental to their long-term success – and over the last 10 years, the principle of stakeholder involvement has become increasingly prominent. While the environmental issues around plantations remain highly pertinent, many can be resolved by following best practices in precision forestry, land-use planning, HCV identification and so on. Such technical solutions are harder to find when it comes to working with people.

In many countries, environmental and social impact assessments are a legal requirement for large-scale projects such as plantation developments, and will usually involve consultation with stakeholders. Stakeholder involvement is also inherent in FSC criteria relating to workers' rights and employment conditions, indigenous peoples' rights and community relations, among other areas. Most responsible companies recognize also that it makes good sense to have positive relationships with stakeholders and to avoid social conflicts: land occupations, legal disputes and negative publicity can all have a material impact on the bottom line.

Various tools exist to support effective consultation and stakeholder involvement processes, and NGP participants have developed and shared a number of good practices. But operators that treat stakeholder engagement as a box-ticking exercise or an obligation that has to be discharged are likely to encounter problems. Plantation operations that want to protect their social licence to operate and achieve the biggest social impact need to treat local communities, workers and other stakeholders as true partners.

This remains an ongoing challenge. However, NGP has seen striking examples of how real and potential conflicts have been overcome, to mutual benefit. Perhaps the most important lesson the NGP process has taught us is the importance of coming together on a human level – of building trust, of actively listening to and trying to understand others' viewpoints, and working together to find solutions.

New models in land acquisition

Rice growing between rows of eucalyptus in Stora Enso's plantations in Laos.

In previous decades, plantations were usually developed in a top-down manner. Companies leased large concessions from governments, with little consideration for the rights of traditional owners or the needs of local people. "Land grabs" remain a thorny problem, and many companies are still dealing with the legacy of past conflicts. NGP participants today are much more likely to take a bottom-up approach to ensure new plantation projects are developed with the free, prior and informed consent (FPIC) of indigenous peoples and local communities.

This is an approach Stora Enso has been trialling in Laos. Land in Laos is owned by the state, and the traditional rights of local communities aren't always well documented. Working with a local NGO, Stora Enso consults with communities and the district government to see whether suitable land is available for planting. Their aim is to lease land for a long period – 30-50 years – with rental money shared by the government and the community to support local development projects. Every project is designed by the village, in partnership with Stora Enso, then approved by the district.

Laos was heavily bombed during the Vietnam war, so before any planting Stora Enso must clear the area of any unexploded bombs – both in the plantation areas and in surrounding land. To ensure villagers have enough land to grow the food they need, Stora Enso has developed a unique plantation model. Eucalyptus trees are usually grown in rows three metres apart, but here a spacing of nine metres is left between the rows. This enables people to grow crops between the rows on a shifting cycle – rice during the first two years, moving to crops like cassava as the trees grow and cast more shade, then finally grass or rattan until the trees are harvested after seven years.

With the introduction of better agricultural practices and different rice varieties, the villagers obtain better rice yields than through traditional shifting cultivation.

By dividing the plantation area into plots of different ages, Stora Enso aims to ensure local people have labour opportunities, rice and other crops every year.

In Ghana, most land is owned by the people, and acquiring land for development is a complex and sensitive issue. In order to minimize the potential of future conflicts, APSD built the principle of stakeholder involvement into its land acquisition process from the very beginning. The company began by consulting with traditional tribal chiefs, but soon realized that it was important to engage directly with the local population so that everybody knew and understood what the project was about. There has been no involuntary relocation of any villagers. APSD created a farm belt around the boundaries of their concession area, and most farmers agreed to relocate to these areas; in a few cases farmers opted to relocate to other areas, where the company prepared new farmland for them. APSD provides agricultural support, including using its equipment to plough the land. APSD has appointed a liaison officer who local people can approach with any grievances or questions they may have. To date, the company has avoided any significant conflicts, and the project is widely supported by the local population.

Forest school in the community-run plantation on the Isle of Mull; timber sales help fund community initiatives.

In Scotland, the Forestry Commission has supported a community on the Isle of Mull to take over a former state-owned plantation. The community now owns the land and manages the forestry operations, with revenues going into community initiatives such as affordable housing, renewable energy schemes and educational activities.

Competition to cooperation

Cattle ranching is deeply ingrained in Uruguayan culture, particularly in rural areas. Cattle graze extensively and feed on grass all year round; for centuries, good husbandry has enabled cattle to be produced more or less in balance with the natural grassland environment.

But this way of life is changing. In recent years, there's been huge foreign investment into large-scale agriculture (such as soy production) and plantation forestry in the region. Hundreds of thousands of hectares of rangelands have made way for crops and trees, and land prices have increased substantially. Understandably, many cattle ranchers were initially hostile to the newcomers.

By engaging with local cattle ranchers, NGP participants have turned competition for land into a mutually beneficial relationship. UPM and Montes del Plata (a joint venture between Arauco and Stora Enso) have both reached agreements with cattle ranchers to offer affordable grazing rights in their plantations and the natural grasslands conserved within their landholdings. Meanwhile, UPM and Montes del Plata are also assisting cattle producers to grow trees within their ranches, providing an extra source of income for the farmers and fibre for the pulp mills.

Grazing around forest plantations has significant advantages for both activities. The trees provide shade and shelter for cattle, increasing productivity and animal welfare, while keeping down the weeds and vegetation through grazing reduces the risk of fires spreading to plantations.

About 480 farmers graze 70,000 cattle on UPM-managed land. At the start of 2017, Montes del Plata's "Alianzas" programme had grazing contracts with more than 220 cattle producers, including small-to-medium-sized producer cooperatives, covering 122,000 hectares of forested or set-aside land.

It's a model that offers the potential to enhance local people's livelihoods, use land more efficiently and improve relationships, opening the possibilities for wider cooperation on conservation and development at a landscape level.

Economic growth

Plantations often operate in rural areas with high levels of poverty and unemployment. By bringing jobs and investment into these areas, they have the potential to make a significant contribution to economic growth. Farmers and communities can also make a good living from growing trees on their own land.

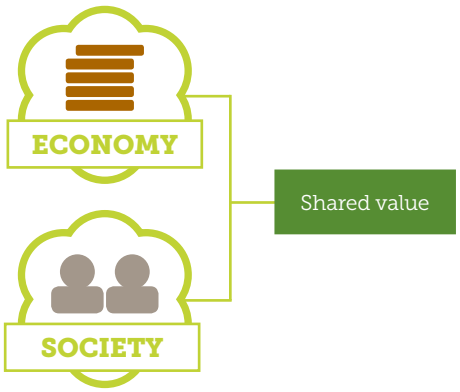
The vast majority of bamboo in China is grown by smallholders, supporting an industry that by 2020 is expected to be worth almost US$50 billion and employ 10 million people.

Creating shared value, clockwise from left: collecting bamboo tops to make brushes in China, beekeeping in Brazil, berry orchards in Chile.

Plantations can't be environmentally sustainable and socially acceptable if they aren't also economically viable. But there's a world of difference between a company that extracts value and one that creates it. A plantation company can deliver value to its shareholders while depriving local people of resources, paying low wages, increasing inequalities and externalizing various environmental and social costs. In contrast, new generation plantations aim to foster inclusive, sustainable development by creating shared value for the company and society.

Creating shared value (CSV) – *"generating economic value in a way that also produces value for society by addressing its challenges"*[35] – is a business philosophy that's gained considerable traction within NGP, with several participants explicitly integrating it into their operations. CSV goes beyond traditional approaches to corporate social responsibility by building social and environmental values into the business strategy: addressing risks and challenges becomes an opportunity that enables the company to reduce costs, increase revenue or enhance competitiveness.

Creating shared value = generating economic value in a way that also produces value for society



Beyond providing employment in forestry operations, NGP participants have helped to create shared value in a number of ways, including:

- Supporting local people to develop forestry and other businesses – building local people's skills and opportunities, improving health and safety and working conditions, and ensuring the company can employ reliable local contractors
- Enabling local smallholders to become wood suppliers and to achieve forest certification – improving local incomes while increasing supplies of timber to company mills
- Marketing non-timber forest products – such as honey, fruits, seeds, plants, mushrooms and cork – to provide additional income for local people while increasing the value of plantations and conservation/restoration areas
- Investing in infrastructure – in a way that benefits both the plantation operations and the local area.

Creating shared value

The Navigator Company's outreach work has supported local small forest owners to achieve FSC certification.

Certification support for smallholders

FSC certification is important for market access, particularly in the pulp and paper sector, but the costs for small growers can be prohibitive. Companies have a vested interest in supporting their smaller suppliers to achieve FSC certification. Suzano has helped groups of smallholders in Brazil become certified, improving management practices covering 22,400 hectares of plantations and 13,000 of natural rainforest to date. In the same region, Veracel has supported more than 50 tree farmers on over 27,000 hectares to achieve certification. The Navigator Company has helped small private forest owners in Portugal achieve certification through outreach work and by paying a premium for certified wood: this has contributed to improved incomes for growers and a significant increase in certified area in the country. Outreach work includes promoting certification within industry associations, running training sessions for contractors and running demonstration activities for forest owners and forest association staff to showcase and transfer forestry technology and know-how.

Food4Forests

Mondi was concerned that many of its forest workers weren't consuming enough calories during the working day – resulting in poor health, fatigue, accidents and reduced productivity. In response, it set up a feeding programme, Food4Forests, which now serves a nutritious, high-energy hot meal to its forestry workers every day. According to Mondi's surveys, the workers are happier and healthier as a result. The programme has also developed local community entrepreneurs to become food service providers. The programme created new jobs and business opportunities in catering and food production.

Growing for the grid

APSD is growing eucalyptus plantations to generate renewable power for Ghana's electricity grid, which will contribute significantly to the country's development. APSD is the major employer in the area where it operates, employing over 1,000 workers directly, who in turn support their children and families; around 40% of employees are women. This has helped to stem rural-to-urban migration and has had a multiplier effect on the local economy, enabling existing businesses to grow and local entrepreneurs – especially women – to create new ones.

Honey production causes a buzz

Eucalyptus has a long flowering season and makes excellent honey with medicinal properties. Several NGP participants now encourage beekeeping within their plantations, and provide support to help local producers sell their honey and beeswax products. In 2013, Fibria's Beehive Programme produced 881 tonnes of honey – or around 2 million jars. Much of it is certified organic, and exported to Europe and the US. In Bahia, Brazil, 73 families earned an extra income of around R$780 (US$260) per month from participating in Suzano's Sustainable Beekeeping Programme in 2016.

Chapter 3:

The NGP process

"If you want to travel fast, travel alone; if you want to travel far, travel together."

This African proverb, encountered on a study tour to South Africa midway through the first decade, has become something of a motto for the NGP platform. NGP has certainly travelled a long way over the last 10 years – and travelling together has been at the heart of it.

The first phase of the NGP project, from 2007 to 2009, was limited to a small group of participants. Discussions weren't always easy. Even then, the forestry sector was more advanced than other sectors when it came to social and environmental concerns, with standards like FSC helping to promote multistakeholder dialogue and strengthen management systems. Still, many within WWF remained deeply suspicious of plantations, while companies were sceptical of conservationists interfering in their business, and wary of sharing potentially sensitive information with competitors. And while companies were happy to show off their success stories, they were less likely to want to open up about problems and uncertainties.

Through a number of study tours that showcased examples of good plantation practices, participants developed a series of technical papers (on ecosystem integrity, HCVs and stakeholder engagement) and a synthesis report bringing together key findings. These helped to promote best practices in plantation management, and to articulate the NGP concept.

But, as long-term participants recall, producing these documents was a tortuous process: a single phrase or word would trigger lengthy discussions and negotiations worthy of a United Nations treaty process.

Over time, however, a deep sense of trust began to develop between participants. This enabled open and transparent discussions around critical environmental, social and economic issues and potential solutions. As discussions evolved, NGP opened up, and more participants joined. Study tours introduced a changing cast of characters – representatives from forestry companies and other sectors, staff from every corner of the WWF network, government personnel, NGOs and academics, along with the farmers, community members, forest workers and others we met along the way. Public events, including the two-day annual meeting and half-day conferences to launch each study tour, brought together a wide range of stakeholders with presentations, panel discussions and workshops.

IN ITS FIRST 10 YEARS, NGP ORGANIZED 25 EVENTS, ATTENDED BY MORE THAN

1,500

PEOPLE FROM OVER 40 COUNTRIES

During the last three years, the NGP platform has enthusiastically embraced the concept of "social learning"– learning that happens not through traditional instruction, but through more organic interactions. This type of shared learning and discovery is particularly vital in the field of sustainability, where challenges are constantly changing, and where solutions can often come about only through working together.

The NGP platform brings together people with different viewpoints, backgrounds and interests in an environment that fosters listening, sharing and collaboration. It encourages people to reflect on and question their own views, attitudes and actions. Effective social learning needs to take place in a setting where people feel comfortable expressing their views. Trust, respect and honesty are essential, but disagreements are welcomed – discussing divergent views can bring alternative or new insights and new ways forward.

NGP events are carefully designed to cultivate an environment where social learning can thrive. Anyone who has attended an NGP study tour or the annual encounter will know what a dynamic, energizing (if exhausting) and rewarding experience it can be. Before each event, a "think piece" poses key questions which participants interrogate during the event.

Far from being show-and-tell sessions, field visits are the focus for practical tasks, discussions and the exchange of ideas.

Practical tasks: identifying grasses in Uruguay (above), planting seedlings in Brazil (right).

Social learning techniques

Tapping bamboo wine in China (above); conversation buzzes at the World Café (below).

Active listening
A good one to do on the tour bus... Get into pairs. One person spends five minutes telling the other about themselves, without interruption – then swap. As well as helping people get to know each other as individuals, it's a great way to practise both listening and speaking (often in a second language). This helps ensure everyone gets to express their views, and that discussions don't become dominated by a vocal few.

Hands-on learning
On recent study tours, participants have assessed water quality in streams by counting macroinvertebrates, identified wetland areas by taking soil samples and come to appreciate grassland biodiversity by carrying out a survey of plant species. They've dug up and cooked bamboo shoots in China, tapped rubber trees in the Amazon, and watched cluster bombs being cleared in Laos. Taking part in these practical experiences enhances learning and group bonding.

Human Library
It's said that everyone has a book inside them: the "Human Library" is the place to discover it. Here, "readers" can browse the titles of human "books", and check out the ones that catch their interest. The books tell their tale, and readers can ask questions, uncovering the huge range of stories and experiences from different contexts and cultures represented in the NGP platform.

World Café
Imagine a lively, cosmopolitan café where friends come and go and conversation buzzes at every table.... The World Café approach inspires lively group discussions. At each table, a "host" leads a discussion on a different question, while guests circulate between them. Ideas are exchanged, new arrivals build on previous guests' contributions, and pages of notes are scribbled in different coloured marker pen on the paper tablecloths – ready for the host to present a summary of the discussions to the whole group at the end of the session. With guests coming from different countries and speaking different languages, some participants also find themselves taking on the role of interpreter.

The social learning process aims to transform individuals' understanding, and to enable this transformation to permeate beyond the individual and influence wider approaches, practices and structures within their respective organizations, contexts and livelihoods. While social learning can lead to explicit, tangible impacts, less visible, "softer" outcomes are vital to catalyse these changes. An example can be seen in the language that companies use: many have embraced concepts explored in NGP, such as creating shared value and resilient landscapes, and have embedded NGP principles within their operations. Perhaps the biggest change seen in many companies over the last 10 years is not in their practices on the ground, but that they have become more open and approachable and better at listening to and working with other stakeholders. Of course, the NGP platform can't claim all the credit for this – but it has undoubtedly been a contributing factor.

For WWF and other NGOs, too, participating in NGP has been a learning process. Staff from different WWF offices and practices have returned from NGP events with a new understanding of plantations and how companies work.

This has helped them to engage more positively with business and to explore new ideas, in forestry and other sectors.

People are often dismissive of "talking shops", but NGP is proud to be one. Talking – and listening – is essential if we are to understand others' viewpoints, to challenge preconceptions and to come up with solutions.

This is more important than ever in today's political climate – where fixed positions increasingly take the place of healthy debate and compromise, and where people appear increasingly intolerant of opposing views.

As the stories in this book show, a lot can be achieved when companies, NGOs, governments and others put aside their differences and come together to pursue shared environmental, social and economic goals.

The NGP process has helped companies and NGOs to engage positively and openly with each other.

Visiting Parque das Neblinas, a restoration and conservation area managed near Sao Paulo managed by Suzano, at the 2016 Encounter.

NGP PARTICIPANTS AND THEIR FELLOW TRAVELLERS HAVE COME A LONG WAY TOGETHER OVER THE LAST 10 YEARS. WE'RE DETERMINED THAT, OVER THE COMING DECADE, WE CAN WORK TOGETHER TO TRAVEL EVEN FURTHER.

The NGP process has influenced and inspired other similar initiatives:

Boreal Forest Platform
Drawing closely on the NGP model, WWF-Russia launched the Boreal Forest Platform in 2015, along with NGP participants Mondi and Stora Enso, and other forestry companies, NGOs and government agencies. The platform seeks to influence government and the private sector to support a sustainable timber industry in Russia's boreal forest. In keeping with NGP principles, it promotes a balance of intensive sustainable forestry on already logged areas and protection of areas of high conservation value, along with effective stakeholder involvement.

Chile Forest Dialogue
The participation of Chile's largest forestry companies in NGP along with WWF paved the way for launching a national multi-stakeholder Forest Dialogue. In 2016, along with the international organization The Forests Dialogue (TFD), the Chile Forest Dialogue hosted a successful field event on Tree Plantations in the Landscape. It brought together 67 participants representing forestry companies, civil society organizations, local communities, indigenous peoples, workers' associations, NGOs, local government and research institutions.[36] This successful experience has created the conditions for future collaborations between NGP and TFD.

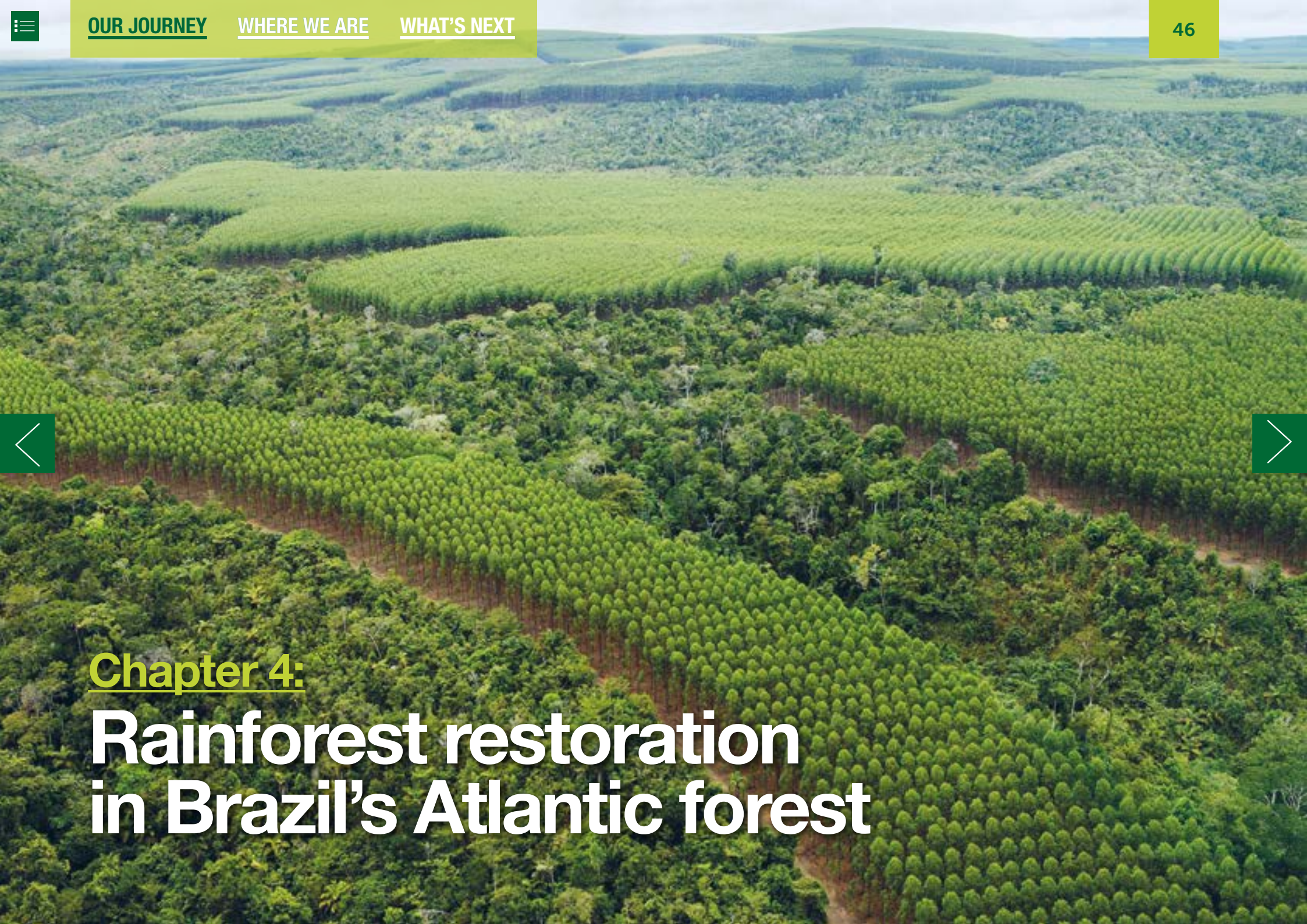
Learning by sharing with FSC
Right after the FSC's 2014 General Assembly in Seville, The Navigator Company hosted a field trip to its certified management units in the south of Portugal. The aim was to show how the NGP concept and FSC certification complement each other, and to learn by sharing ideas and solutions. It was an opportunity for NGP participants to interact with other FSC members to debate and share experiences on certification challenges and topics that underlie the NGP concept. Similar learning by sharing between NGP and FSC is now happening through the New Approaches Initiative on Smallholders.

Climate collaboration
Following the 2016 NGP study tour to Acre, Brazil, the China Green Carbon Foundation (CGCF) and the Acre state government began investigating the possibility of working together on a carbon-saving scheme. The CGCF has experience of using carbon market funding to support forestry projects, which could give a further boost to the Amazonian state's forest conservation and emissions reduction efforts. The scheme was officially announced at the NGP study tour to Gansu, China, in May 2017.

From top: the first Boreal Forest Platform study tour; the Chile Forest Dialogue; sharing between NGP and FSC in Portugal.

Part B:

Where we are: New Generation Plantations in practice



Chapter 4:

Rainforest restoration in Brazil's Atlantic forest

When the Portuguese landed in Brazil in 1500, they would have been met by a vast wall of forest. To the sailors tracing the length of coast and the first explorers setting out into the interior, it must have seemed endless.

The Atlantic forest – Mata Atlântica in Portuguese – once extended the entire length of Brazil's east coast, stretching inland into Argentina and Paraguay. It covered an area of over a million square kilometres – more than 10 times the size of the country the colonizers had come from. But over the centuries, the trees were cut down in their billions.

Above: Parque das Neblinas, an area of Atlantic forest restored by Suzano. Below: degraded pasture on previously deforested land acquired by Veracel. The land has now been restored as a mosaic of plantations and natural forest, similar to the previous page.

First came the rush to harvest brazilwood – a tropical hardwood that yields a bright red pigment perfect for dyeing cloth. The forests of the "land of brazilwood" were plundered to meet the insatiable demand for the red dye back in Europe. By the middle of the 16th century supplies were dwindling, but brazilwood exports had been overtaken by a different commodity: forests were cleared to make way for sugarcane plantations as Brazil became the world's largest sugar producer.

Coffee followed, then cocoa and cattle, while more trees were felled to supply a growing nation with timber and charcoal. Livestock ranches, fields of crops and sprawling cities like São Paulo and Rio de Janeiro sprang up where the rainforest once stood. During the second half of the 20th century, the pace and scale of deforestation grew rapidly.[37] Five hundred years after the first European settlers arrived, just 7% of Brazil's Atlantic forest remained.

Yet these small, scattered fragments still harbour some of the richest biodiversity on the planet. Here, some 450 tree species can be found in a single hectare, and more than half of them exist nowhere else on Earth. Of the 20,000 plant species so far recorded – around 8% of the global total – 8,000 are unique to the region. Other endemic species include 282 types of amphibian, 144 birds and 72 mammals, including 22 primates like lion tamarins and woolly spider monkeys.[38]

And it's not just wildlife that depends on what remains of the Atlantic forest. In a region of growing water stress, the forest supplies water for some 60% of Brazil's population – 120 million people. It's a buffer against soil erosion, and sequesters 2 billion tonnes of carbon dioxide – more than four times Brazil's annual emissions. Meanwhile, many of the region's indigenous inhabitants, like the Tupi and Guarani people, still depend on their ancestral forest and its resources for their livelihoods.

Despite increased legal protection in recent years, urban and agricultural expansion continues to chip away at the forest, with around 20,000 hectares lost each year.[39] Squeezed into smaller spaces and cut off from neighbouring populations, the region's extraordinary biodiversity is under intense pressure: almost 150 vertebrate species – 104 of them endemic – are listed as Critically Endangered, Endangered or Vulnerable on the IUCN Red List.[40] Most of these exist outside official protected areas.

Fibria has set up community nurseries to supply seedlings for its restoration efforts.

The arrival of pulp and paper businesses and their eucalyptus plantations into this landscape could have proved the final straw. But over the last two decades, these companies have been doing something different. They didn't follow the pattern of deforestation set over the previous five centuries. Instead, they began to restore the forest.

NGP participants Fibria, Stora Enso, Suzano and Veracel all have plantations within the Atlantic forest biome, managing more than 2 million hectares of land between them. Around half of this area is planted with eucalyptus, almost all of it on former grazing land that had become heavily degraded. The rest is set aside for conservation. And it's here that the Atlantic forest is making a comeback.

According to Brazil's Forest Code, landowners need to preserve natural vegetation on 20% of their land[41] ("legal reserves") as well as in "areas of permanent protection" designed to maintain ecosystem integrity – as buffers around water courses or to prevent erosion on steep slopes, for example. In many case, what the law says and what happens in practice are two different things. Violations of the Forest Code are commonplace – but not in the pulp and paper sector. The large majority of NGP participants' operations in Brazil are FSC certified, which provides assurance of legal compliance (as does PEFC/Cerflor certification) – and goes further by requiring companies to identify and manage areas of high conservation value.

In many cases, the set-aside areas are able to regenerate naturally – particularly when they adjoin existing fragments of native forest. Other parts, though, are too severely degraded for that to happen. Here, the companies are using their silvicultural expertise to actively replant the rainforest.

Veracel, for example, planted its first 207 native tree seedlings in 1994. Since then, it has planted more than 4 million seedlings, covering 6,099 hectares. Restoration areas are carefully chosen, the main objective being to create corridors linking fragments of existing forest. Fragmentation has a direct effect on local biodiversity and, for some species, may lead to local extinction. Re-establishing connectivity between these remaining fragments of forest enables wildlife to pass between them, which also has a positive impact on the genetic variability of the species. This will become particularly important if the region's biodiversity is to be able to adapt to the impacts of climate change.

So far on Veracel's land, restoration efforts have restored connections between more than 65,000 small, isolated patches of forest. Links have also been re-established between Estação Veracel – a 6,000 hectare nature reserve owned by the company which has become a centre for education and research – and two tribal reserves belonging to the indigenous Pataxó people. Pataxó leaders report seeing more armadillos and tapir, along with game species like catitu (a kind of wild pig) and paca (a large rodent).

4 MILLION

NATIVE SEEDLINGS PLANTED BY VERACEL SINCE 1994

Just seven kilometres from Estação Veracel is the Pau Brasil National Park that covers more than 19,000 hectares. Following a recent study, a 538-hectare ecological corridor has been proposed to link these two protected areas, in a partnership with The Nature Conservancy (TNC) and BioAtlantic Institute (Ibio). Setting up this corridor is a major challenge for the region. Research by the Federal University of Southern Bahia aims to help to motivate rural land-owners located in the corridor area to restore native forest, prioritizing key areas identified in the study.

Satellite monitoring demonstrates the changes that have occurred in the ten municipalities where Veracel operates since the company was first established in the 1990s. Images from 1990, 2007 and 2013 show a transformation from a pasture environment to a mosaic of plantations and forest in various stages of succession. The area of native vegetation increased by almost 12,000 hectares, of which 9,500 hectares was on land belonging to Veracel or to forestry producers involved with the company's development programme.[42] The results of this work are publicly available at www.igeo.org.br.

Fibria, meanwhile, has invested about R$80 million (US$25 million) over the last five years in restoring some 16,000 hectares, mainly in the Atlantic forest but also partly in the neighbouring Cerrado savannah. Its long-term goal is to restore 40,000 hectares by 2025. Restoration on this scale is no easy task, especially in a forest with so many tree species: to help meet the need for seedlings for planting, the company has helped set up 20 community-run tree nurseries. As well as supplying some 1.8 million seedlings each year, these provide an important income in rural areas where jobs are scarce.

But while forest restoration brings undoubted environmental and social benefits, why should a business devote significant resources to it? According to Fibria, improving the health of the surrounding ecosystem directly improves the productivity of its eucalyptus plantations. A key reason for this is the improved quality and availability of water resulting from the developing vegetation cover. Suzano, which is in the process of planting more than 3,400 hectares with native species in the state of São Paulo, also points to water availability as an important advantage of forest restoration. Additional benefits it cites include soil protection and pest control: while monocrop plantations are vulnerable to pest infestations, having native forests alongside encourages natural predators. That means better plantation health and less need for costly and potentially harmful pesticides.

These individual company efforts are part of a much larger vision – the Mata Atlântica Restoration Pact, of which Fibria, Suzano and Veracel are active members. Launched in 2009, the Pact's mission is to restore 15 million hectares of Atlantic forest by 2050, including a target of 1 million hectares by 2020. It brings together more than 260 members, including NGOs, businesses, government agencies and research institutions.

NGP participants have been closely involved in researching, developing and disseminating guidelines and best practices for Atlantic rainforest restoration, and providing technical and financial assistance to NGOs and community cooperatives involved in restoration activities. They have also developed an integrated system for monitoring biodiversity, which supports better landscape-scale planning to improve connectivity between species. This sort of collaboration will be crucial in enabling ecologically coherent and economically viable forest restoration to take place on such an ambitious scale – in the Mata Atlântica, and beyond.

Forest restoration: the global picture

The last few years have brought unprecedented global commitments to forest restoration. The Bonn Challenge, launched in 2012, is a global effort to begin the restoration of 150 million hectares of deforested and degraded lands by 2020, and 350 million hectares by 2030. In 2014, the New York Declaration on Forests – signed by 37 governments, 20 sub-national governments, 53 multinational companies, 16 indigenous peoples' organizations and 63 NGOs – included a pledge to restore hundreds of millions of hectares of degraded forest land. The following year, the Sustainable Development Goals agreed by the countries of the United Nations included a target to "... restore degraded forests and substantially increase afforestation and reforestation globally" by 2020.

Many countries made further forest restoration commitments at the Paris climate conference. Ten countries including Ethiopia, the Democratic Republic of the Congo, Niger and Uganda launched AFR100, a pan-African initiative to restore 100 million hectares by 2030, with the World Bank and other financial partners pledging more than US$1.5 billion in support. Initiative 20X20 aims to bring 20 million hectares of degraded land in Latin America and the Caribbean into restoration by 2020. India has pledged to restore 13 million hectares by 2020, and a further 8 million hectares by 2030. Private companies have got involved too: in Indonesia, APP has pledged to restore 1 million hectares under the Bonn Challenge to compensate for past deforestation.

In a deforested landscape in the state of Acre, only the protected Brazil nut trees remain. Under the Bonn challenge, Brazil has pledged to restore 12 million hectares of forest by 2030.

TO DATE, 39 NATIONAL GOVERNMENTS, SUB-NATIONAL GOVERNMENTS AND COMPANIES HAVE COMMITTED TO RESTORING JUST OVER 136 MILLION HECTARES – AN AREA AROUND 2.5 TIMES THE SIZE OF MADAGASCAR.

THIS HAS THE POTENTIAL TO SEQUESTER 13.92 GIGATONNES OF CARBON (EQUIVALENT TO ONE-AND-A-HALF YEARS OF GLOBAL CARBON EMISSIONS) AND GENERATE ECONOMIC ACTIVITY WORTH US$42.8 BILLION.[43]

Forest restoration in Chile

In previous decades, around 200,000 hectares of native forest in Chile, including the unique Valdivian temperate rainforest, were converted to pine plantations. By the 1990s, conversion of primary forest was rare with most plantations being established on already degraded land. However, some clearance of secondary forest and areas in the process of regeneration still took place.

When Chile's largest forestry companies – Arauco, CMPC/Forestal Mininco and Masisa – sought FSC certification, it brought the issue of conversion into the spotlight. Following intense dialogue with civil society, an agreement was eventually reached that the companies must restore any areas of native forest converted on their land since 1994: 25,044 hectares over 25 years for Arauco, 8,738 hectares over 15 years for CMPC and 1,588 hectares over 10 years for Masisa. In addition, the companies maintain and enhance areas of high conservation value on their land – which often involves active management to restore these areas to ecological health. Arauco's HCV areas total 58,818 hectares, while Forestal Mininco's cover more than 11,000 hectares.

Forest restoration on this scale is unprecedented in Chile. The companies are working closely with researchers from Austral University and elsewhere to design, test and monitor different approaches.

The NGP participants are prioritizing areas for restoration that will bring the biggest ecological and social gains, for example through creating wildlife corridors, securing water resources or restoring important cultural sites identified by Mapuche communities (see chapter 6). The active participation of stakeholders is a crucial part of the process – including neighbouring communities, civil society organizations, academia and local government. The restoration work has also provided jobs for local people, in seed collection and planting.

In the summer of 2016-17, Chile experienced some of the most devastating forest fires in its history. Many blamed large-scale plantations – more flammable than natural forests, which retain more moisture. The fires ravaged almost 600,000 hectares of land including some 320,000 hectares of tree plantations, as well as 102,000 hectares of natural forest.[44]

As companies and communities attempt to recover from the devastation, with support from government and other donors, there's a real opportunity to do more than simply replant trees. Restored native forest, biodiversity corridors and land for community growing could provide firebreaks between plantations, and increase climate-change resilience. Involving communities in the process could support local livelihoods and build trust.

"This is a chance to look at the future of the forest sector in Chile, one that evolves from a model of contiguous areas of thousands of hectares of even-aged pine and eucalyptus plantations to an NGP model with mosaics of multiple age, multi-species plantations, protected areas, and restored ecosystems as well as agricultural lands. From the ashes, we can create a new landscape that works for everybody."

Rodrigo Catalan, Conservation Director, WWF-Chile

NGP participants in Chile are restoring HCV areas like this araucaria forest (above) and recently converted native forest (below)

Chapter 5:

Water connections across a South African landscape

What connects the dairy farmer in the lush cultivated pastures of the KwaZulu-Natal Midlands with the hotels and office blocks of downtown Durban, and the informal settlements on its fringes? The insurance company and the bank manager with the mother in the tribal lands struggling to grow enough to feed her family and send her children to school? The cane grower and the sugar mill with the civil engineer and the shopper in Woolworths? Dragonfly nymphs with 4.5 million people and 15% of South Africa's GDP? And what connects all of the above with plantation forestry?

The answer is the uMngeni River. All of them depend on the water it provides. And all of them are affected by the way each other uses this water. Yet most of them have never had any direct contact with each other. And that's a problem.

If current water use patterns continue then by 2025 most water catchments in South Africa simply won't have enough water to meet rising demand. In the uMngeni, this disturbing prospect is already a reality – pipelines are used to divert water from a neighbouring river basin, but costly engineering fixes won't provide a sustainable long-term solution. Meanwhile poor land-use management and municipal water infrastructure result in poorer ecosystem health and poorer water quality, which means higher treatment costs and bills for households and businesses. With more users than ever competing for a limited resource, something has to give.

Plantation forestry is one of several major land uses in the upper and middle reaches of the uMngeni basin – and NGP participant Mondi has long been aware of the risks that water issues pose to its business. The physical risk of water shortages to its plantations and pulp mills is only part of the issue. As a "streamflow reduction activity", forestry needs to obtain a special licence and pay a tariff for its water use in South Africa, and could face further regulatory burdens if water scarcity continues to increase. Just as important is the risk to Mondi's reputation and its social licence to operate, which could be in jeopardy if the company is perceived as contributing to water shortages.

Mondi's own water stewardship journey began 20 years ago, when it began cooperating with WWF on wetland conservation. Wetlands and associated freshwater systems are crucial to water security in South Africa: they regulate water supply by acting as natural sponges, soaking up rainfall and releasing it slowly. This is particularly important in a country like South Africa which has big seasonal differences in rainfall – the rains fall in summer, and flow levels drop in the dry winter. But around half of South Africa's wetlands have been degraded or destroyed by agriculture and other unsustainable development, including poorly designed or located plantations.

WWF, Mondi and a team of experts worked together to agree a simple, scientific system to delineate the boundaries of wetland areas, based on the underlying soil characteristics. Mondi and other forestry companies began using this method voluntarily, pulling their plantations back from wetland soils and leaving a buffer zone of at least 20 metres. This subsequently became part of the national forestry regulations and the FSC standard in South Africa, and is also now being adopted by other sectors, such as sugarcane, through water regulations. Economically Mondi has incurred a cost, losing around 5% of its plantations: however, pulling out of wetlands has helped to improve water supply and maintain the business's licence to operate.

The collaboration led Mondi to become the main funder behind the WWF-Mondi Wetlands Programme (WWF-MWP) for the past 17 years. The WWF-MWP has played a major role in raising the profile of wetland conservation in South Africa, including helping to catalyse a massive government wetland restoration programme, Working for Wetlands. It also paved the way for Mondi to become one of the driving forces behind the formation of the NGP platform, hosting the first meeting between WWF and plantation companies in 2005.

Study tour participants survey aquatic invertebrates to monitor water quality in the uMngeni catchment.

Despite the progress made through both the WWF-MWP and NGP, lasting solutions to environmental and social challenges require larger-scale collaborations across sectors. That's certainly the case for a shared resource like water, where what happens in the upper reaches of a catchment has a direct impact on those downstream. But it also holds true for other issues – from food security and wildlife conservation to climate change resilience – that need to be tackled at a landscape level.

This is the thinking behind the latest phase of the WWF-MWP, which aims to catalyse water stewardship at a catchment scale by facilitating links between different land-use sectors and their respective value chains. In November 2014, NGP and the WWF-MWP organized a study tour to the uMngeni river basin that laid the foundations for these cross-sectoral collaborations. The five-day tour brought together 42 participants from South Africa and 16 other countries. As well as international and local foresters and conservationists, participants included South African representatives from the sugar and dairy industries, retailers and manufacturers, banks and insurance companies, government staff and water engineers – all of whom, ultimately, depend on water.

Field visits and presentations revealed that solutions are already out there. Take Mondi's work to rehabilitate wetlands and riparian areas on its own properties: reducing sedimentation and removing invasive alien species has had positive impacts on water quantity and quality – an increased abundance and diversity of dragonfly nymphs and other freshwater invertebrates is testimony to this. Take the Sustainable Sugarcane Farm Management System (SUSFARMS) developed by a group of sugarcane growers with support from the WWF-MWP – a suite of best management practices to address environmental, social and financial issues, including water risks. Or take James Keane's dairy farm: he's more than halved his use of irrigation water and cut his fertilizer use by two-thirds by using pasture management techniques that retain more water, nutrients and carbon in the soil.

But challenges were apparent too. The likes of Mondi may be able to afford to conserve and rehabilitate the wetlands on their land, but can a small sugarcane farmer – already existing on fine margins – be expected to do the same? Better pasture management that reduces water use can save money in the long run, but it requires an investment of time and resources that is beyond many small farmers, or it may simply never have occurred to others.

Dairy farmer James Keane has halved his use of irrigation water and cut fertilizer use by two-thirds thanks to better pasture management techniques.

The study tour provided a space for local and international stakeholders to share ideas, explore common challenges and start building alliances to address them. Mondi's work with WWF has shown how a constructive partnership between conservationists and the private sector can reduce an industry's environmental footprint without compromising its output and economic viability. The WWF-MWP has also developed tools that can help other sectors tackle issues like wetland delineation, and monitoring water quality and the health of freshwater ecosystems.

The finance and insurance sectors have a role to play too: a farmer using better water management practices is more resilient and represents less of a risk, so could the insurance industry incentivize better practices through reduced premiums? Could banks respond by offering better terms of credit to farmers who adopt systems like SUSFARMS? Retailers, manufacturers and other buyers of agricultural and forestry products need to ensure their long-term security of supply; so they should have a vested interest in supporting capacity-building projects to help suppliers reduce their water footprint. And how might government departments and water utilities redirect some of their investment in water treatment and storage into green infrastructure – like natural wetlands and grasslands – that can purify water and regulate supply more cost-effectively?

"The NGP study tour was a catalyst for bringing people together, to invite them to begin to explore the issues and to see things out of their usual box. It helped us cement trusted relationships, and our work on water stewardship has really taken off since."

David Lindley,
Manager of the WWF-MWP

Observing soils on a dairy farm (left) and testing the water at Mondi's Mount Gilboa nature reserve.

The upper uMngeni, where tree plantations are a major land use.

Since the NGP study tour, the WWF-MWP has worked with dairy farmers to carry out assessments of irrigation efficiency, wastewater handling and the health of wetlands and riparian zones. Associations like the Milk Producers' Organization have helped to communicate the results. Four dairy companies (Danone, Woodlands, Fairfield and Dairy Day) have since begun working with their suppliers on water stewardship initiatives, as have the retailer Woolworths and the financier Nedbank. Together, their commitments cover around 70 dairy farmers, making up a significant proportion of the milk supply in KwaZulu-Natal province. There's also been progress within the sugar sector. Priority areas for conservation have been mapped out and management actions agreed, while milling companies, SABMiller, Coca-Cola, the South African Sugar Association and 350 commercial sugarcane farmers covering around 100,000 hectares have agreed to collaborate on water stewardship in their catchment area.

Existing structures like irrigation boards and farmers' associations have begun to broaden their horizons. The Karkloof Irrigation Board, for example, worked with WWF to start a weekly water quality monitoring project, and now shares the results with dairy and forestry landowners in the catchment to support better management.

Similar work is now also under way in the uMhlathuze river basin, where Mondi's Richards Bay mill and some of its plantations are located. It's a severely water-stressed area: continued shortages through drought and poor catchment management could see the water supply to the mill severely impacted, giving Mondi a strong incentive to support water stewardship in the catchment.

"Crossing the sectors is still a struggle," admits David. "But what the study tour helped to do was to start to build trust and transparency and create an enabling environment where water stewardship can flourish."

And the impact isn't limited to this corner of South Africa. Seeing the work under way in the uMngeni has provided NGP participants with inspiration and practical ideas for getting involved in water stewardship and landscape approaches. As a result of their participation in the NGP study tour, WWF teams and NGP participant companies in Chile have launched a landscape-scale collaboration integrating forestry, freshwater and social issues. WWF-Spain is convening similar work to engage different land users on water stewardship around the Doñana National Park.

Water will become an increasingly important global issue over the coming decades, as demand continues to increase while climate change makes weather patterns more unpredictable. The World Economic Forum repeatedly identifies water crises as one of the top five global risks in the next 10 years.[45] According to the International Food Policy Research Institute, more than half the world's population and 45% of global GDP will be at risk from water stress by 2050 if current trends continue.[46] For any company that wants to ensure its long-term viability and resilience, getting involved in water stewardship is a business imperative. The work initiated by the WWF-MWP in the uMngeni points a way forward.

Can learning from South Africa inform water stewardship initiatives in other regions?

Water stewardship initiatives

In Guangxi, China, Stora Enso worked with chemical company Kemira and three communities on a water stewardship project. While Guangxi receives plenty of rainfall, local people face other water challenges, including ensuring a reliable supply of piped water and dealing with wastewater and sewage. The villages of Nahupo, Shengping and Baimei now have new water management systems in place, bringing better access to clean water to nearly 2,600 people. Septic tanks, sewage piping and artificial wetlands have brought visible changes in water quality. While the three-year project concluded in 2016, it's provided practical solutions that can be replicated in other areas.

In Chile, Arauco launched its "innovation challenge" water programme three years ago to improve access to water for local communities. At the core of the programme is the premise that local people best know their water needs, and can help develop collaborative solutions to water shortages. Arauco works in conjunction with municipalities, public services, businesses and residents of rural areas to design, finance and implement projects such as rainwater harvesting and the construction of small dams. Six projects are currently under way, benefiting more than 1,000 people. Another 13 are in development, bringing the number of beneficiaries to more than 3,500, and a further 10 are at the design stage.

Chapter 6:

Struggle and renewal: working with Mapuche communities in Chile

Mapuche cosmology tells of a great battle between two serpents: Kai Kai, the spirit of the water, and Treng Treng, the spirit of the land. When Kai Kai caused the rains to flood the earth, Treng Treng made the mountains rise up so the people could escape. The struggle is manifested in the landscape, in sacred sites that Mapuche call Treng Treng – places of prayer and spiritual renewal.

In later years, the Mapuche people have faced a new struggle. Southern Chile – known as Araucanía – is their ancestral territory, but their rights have not always been recognized by the Chilean state. When Araucanía was colonized during the second half of the 19th century, there was a huge expansion of agriculture, livestock farming and extractive forestry on Mapuche lands. A century later, during the 1970s and 1980s, forestry companies bought large swathes of this land to establish pine and eucalyptus plantations.[47]

Cut off from the land and the forest that used to sustain them, the Mapuche found themselves impoverished spiritually, culturally and economically. The loss of access to sacred sites and forest resources like medicinal plants dealt a heavy blow to the Mapuche way of life. With limited opportunities for earning a living, many Mapuche migrated from rural communities to cities, leading to a further loss of cultural identity.

Over the years, conflict has arisen between Mapuche groups and forestry companies. These disputes have been a focal point in a larger struggle for Mapuche autonomy over the last 25 years. Incidents have ranged from legal challenges against forestry firms, to civil disobedience such as sit-ins and occupations, and occasionally violent action, including arson and destroying company property and equipment.[48] This has led to economic losses for the companies, and damaged the industry's reputation and social licence.

But during the last decade, forestry companies have taken steps towards reconciliation. For Arauco, the trigger was the decision to pursue FSC certification in 2009. This development produced some significant changes. Firstly, over a laborious four-year process, the company completely transformed the way it engaged with civil society stakeholders, notably with its Mapuche neighbours. Secondly, as a condition of certification, it identified areas of high conservation value on the land under company control – including sites of cultural and sacred significance. And thirdly, the company agreed to restore more than 25,000 hectares of native forest to compensate for conversion that took place after the FSC's 1994 cut-off date.

"The FSC process brought a new interest toward learning and collaborating with the Mapuche communities. It enabled us to promote mutual understanding, maintain open engagement channels, identify and protect sites of cultural interest and be open to dialogue."

David Gutiérrez,
Arauco's Community Manager

The view from a sacred site in Elicura valley.

The company initiated various actions to learn about the world view of the Mapuche people. Open meetings with the communities were held, and a technical forum with *lonkos* (tribal leaders) was created to fully understand their vision. The Mapuche Communities Forum – one of several community forums that Arauco set up as part of the FSC process – held 19 meetings in two years, and proposed 18 projects to address key issues. Arauco made changes to its company structure and brought in experts to support its community engagement work, and established a Mapuche community relationship policy, which is followed by all members of the company.

The change can be seen in the case of the Antonio Leviqueo Mapuche community in Elicura valley in Contulmo commune – the oldest and most traditional settlement in the area, where most people make a living through farming and raising livestock. After sites in the area were harvested in 2012, Arauco's staff worked with the community to identify two HCV areas for restoration: Treng Treng Chico and Paliwe Lof de Elicura.

"We consider the Treng Treng as our place of prayer, it is spiritually and religiously very important," says community president Eliana Cruces Leviqueo. "This is where we receive our *newen* [strength] and where we turn to God to pray when we're in danger; when ruin, drought and hunger fall on us, we ask the *mapu* [land] to help us."

With the active participation of the community, Arauco put in place a number of measures to preserve these sites of cultural interest, and to restore 16.8 hectares of native forest around them. Community members took part in gathering seeds and planting more than 10,000 native trees – their knowledge was instrumental in choosing which species to plant. A nursery was set up at the local school to ensure the programme's long-term sustainability and to educate children on forests and native species. Other actions have included managing invasive species, ring-barking eucalyptus trees to remove them from water intakes, building paths to connect sites of interest, and providing and maintaining railings, benches and lookout spots.

The goal now is to build on this model of dialogue and participatory restoration in other areas. In 2015, the Los Huapes indigenous community visited the Antonio Leviqueo community to learn about the process and its results first hand.

"We want other communities to know what we're doing and for our Mapuche brothers to have a different vision of how to work with a company like Forestal Arauco," says Eliana. "We want to demonstrate that an agreement can be reached by working in peace, and there's a lot to be gained. It's good that they visit us and get to know our experience."

The Antonio Leviqueo community and Arauco staff at a Treng Treng site.

"Before, we didn't know the people of the company, the managers and assistant managers – we saw them at a distance. Today, instead, we've learned to get to know each other – they've come to know us as Mapuche, and we've come to know them as a company."

Eliana Cruces Leviqueo,
Community President

"The recovery of ceremonial areas and native vegetation in the Treng Treng will also allow the recovery and transfer of our cultural heritage. I'm proud of what we've achieved and of following my culture and tradition. "

Pedro Pablo Leviqueo,
Vice President

"Before 2009, Forestal Arauco thought of the Mapuche communities as just another neighbour. Today, the company recognizes that the Mapuche culture is alive, that it's part of the present and not the past; that it's dynamic and has its own unique world vision; and that the Mapuche communities have a cultural relationship with the land and the area they inhabit."

David Gutiérrez,
Arauco's Community Manager

Passing on cultural heritage to the next generation; a community water project initiated by Arauco.

Forestal Mininco, part of CMPC, has also taken steps to resolve conflicts and repair relations with Mapuche communities. Its work in Huapitrio, in Collipulli county, is a case in point. Poverty and unemployment rates in the area are much higher than the national average, as is the proportion of Mapuche residents.

In areas of social deprivation, communities can make heavy demands on companies like Forestal Mininco. While the company generally permits local people to use branches and thinnings from plantations for firewood, the situation in Huapitrio had escalated with local communities removing large quantities of wood to sell commercially. When Forestal Mininco attempted to clamp down on this, already strained relationships got worse, resulting in incidents of arson and disruption to company operations.

The company realized that a long-term solution could be found only through addressing the underlying socio-economic situation. Following local dialogues and surveys and input from government experts, in 2015 Forestal Mininco launched an ambitious project to support small-scale family agriculture. Working with two Mapuche associations – the "Seven United Communities of Huapitrio" and the "Huapitrio Agricultural Alliance", comprising 11 communities and more than 600 people – the company is supporting local families to grow commercial berry crops. Under the agreement, each family contributes an area of 2,500m^2 to grow strawberries, blueberries and raspberries – profitable but labour-intensive crops that are well suited to the local climate. The company provides the growing stock, irrigation infrastructure, training and technical support to help increase productivity. It's also supporting them with business management and selling their products, with the involvement of a fair-trade company.

To date, 94 families – nearly half of them headed by women – have set up 26 hectares of orchards. Already the results are promising. In their first summer, some families earned twice the minimum wage of US$430 a month. This contrasts with the low-paid temporary work that most used to depend on. During the harvest season, each orchard employed around five people: in fact, orchard workers made up 30% of the active labour force in the area, with significant benefits to the local economy.

"This is going to be a source of work that we did not have here, a source of work for indigenous people," says Jovina Llanca Cañuñan from the Seven United Communities of Huapitrio. "These crops are for a better life – not having to go far to work, to be close at home." Jovina and her sister are looking forward to being able to give their children an education and opportunities that they never had. "This was a very distant dream, but at the same time it was very close. Today it becomes a reality."

MORE THAN 600 PEOPLE FROM 11 MAPUCHE COMMUNITIES ARE GROWING BERRY CROPS WITH SUPPORT FROM FORESTAL MININCO

José Enrique Figueroa Tori and Maria Diaz on their berry farm set up in partnership with Forestal Mininco.

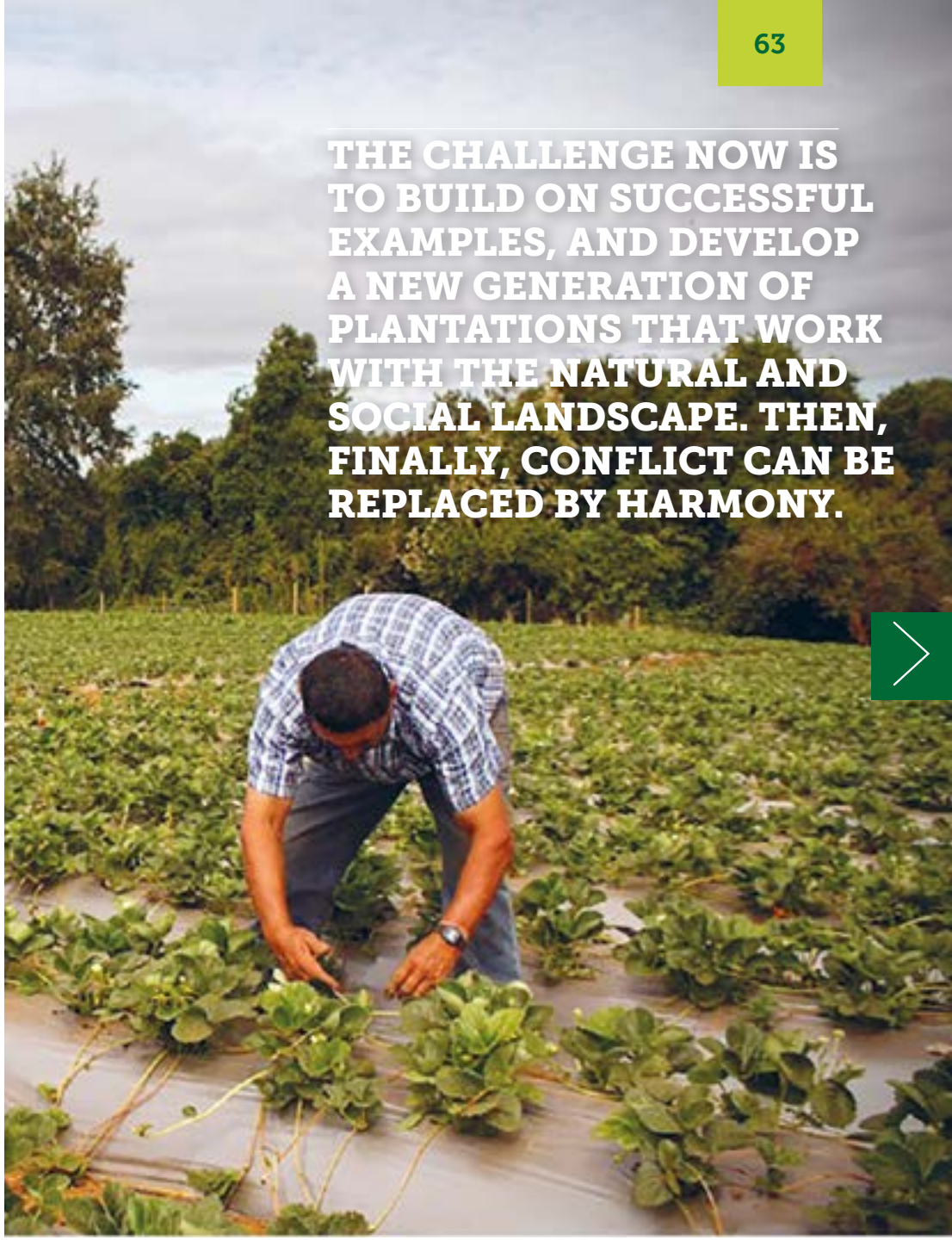
For Forestal Mininco, too, the benefits are clear. Community relationships have improved dramatically, and wood theft, fires and disruption have seen a significant reduction. The company will continue to support the project, while looking to replicate its success in other areas. Key goals include digging deep wells to improve water supply, reaching national and international markets for fair-trade products, and obtaining certification of Mapuche origin to increase the profitability of the berries.

"This project demonstrates that coexistence between Mapuche communities and forest companies is possible. With dialogue, development scenarios can be built that work for both parties, and that can be replicated to overcome poverty in other communities in the region."

José Zivkovic, Deputy Manager of Forestal Mininco's landholdings in Araucanía

Despite these successful experiences, problems have not entirely gone away. With Chile experiencing a decade-long drought, the impact of plantations on water resources remains a contentious issue – particularly in the light of the devastating forest fires that scorched the country in the summer of 2016-17. While research has highlighted a correlation between large-scale plantations and poverty in Chile[49], other studies suggest that poverty has significantly decreased in these areas over the years, and that the forestry and wood products value chain has a higher multiplier effect within the local economy compared to other sectors.[50]

The challenge now is to build on successful examples, and develop a new generation of plantations that work with the natural and social landscape. Then, finally, conflict can be replaced by harmony.



José Linqueo tends his strawberry field.

Betting on local workers

There aren't many Mapuche entrepreneurs working in the forest sector. Ghandhy Reyman, who's been working in forestry since he was 16, aims to change that.

Back in 2000, Ghandhy was a leader of the Coña Reiman community in the commune of Collipulli. When a forest company began operations nearby, Ghandhy objected to their bringing in hired labour from outside the area. He organized a protest, demanding that the company employ local people. The company responded by bringing in a contractor, who hired a mix of community members and external labour.

Ghandhy thought that still wasn't enough. Why shouldn't the company leave all the operations in the hands of the community? With his experience in the industry, he could manage and supervise local employees. It was the beginning of his career as a forestry contractor.

When Ghandhy heard that Masisa was moving into the Santa Ema area of Araucanía, he decided to offer his services. He had family living nearby, and he'd always wanted to work with the company. For one thing, Masisa works exclusively with pine trees, and he considered that a challenge. For another, he admired the company's quality standards and ethos. "This company has the best relationships," he says. "It has always been open to dialogue. It never intends to bully you, but builds trust."

Masisa hired Ghandhy as a contractor in January 2015. It was a gamble: they had no prior working relationship, and most of the community members Ghandhy recruited had no experience in the forest industry. Manual work replaced some mechanized tasks, and Masisa had to provide workers with safety, environmental and health training and support Ghandhy with technology gaps. All of this meant slower work and greater overheads compared to mechanized operations with contractors already trained in the company's working approach.

The expected pay-off for the company, though, was achieving a peaceful, open and mutually beneficial relationship with the people living nearby. Against a national backdrop of conflict between Mapuche communities and forest companies, this was a relationship built on respect and shared value. It created a direct link between the success of the plantation operation and the well-being and socio-economic development of the community.

Fifteen members of the Chanco Bajo, Chanco Alto and Ketrawe Anfilef communities were recruited, where only one had former forestry experience. This provided them and their families with a stable income and new skills.

"At the beginning, I talked to new workers and told them to think about the future when earning money," says Ghandhy. "I told them that they should be different people after working here. Some of them bought chainsaws to continue with this activity; others fixed their homes; while others purchased a vehicle. And that is betterment; they have to become someone different. They buy a refrigerator because they didn't have one, and now they have one because they can afford it. One man told me he helped his son get a Class B driving licence and that they were going to purchase a pickup truck. That's the thing! I've always told them not to drink with that money, but to invest it in their future."

Ghandhy says he has developed as a contractor as a result: "At the beginning I didn't have certified technologies, something that was mandatory to work with Masisa. Today, I have all of them, but further improvement is still required. I am pushed to provide better services; it means improving constantly. To date, 25 people have been trained in safety issues, environmental impacts and FSC." Having previously only worked with pulpwood, he's now experienced in harvesting pine for lumber, further improving his market profile.

More than anything, Ghandhy wants to improve the image of Mapuche workers and pave the road for other forest entrepreneurs. "This was my dream job because I wanted to prove – because we need to prove it – that we are up to it," he says. "There is a bad image of our people – that we complain or fight a lot, that we are not good workers. I want to change our image so that when I am no longer with Masisa another *peñi* [brother] can come and work with them."

"I told my new workers to think about the future when earning money. Some of them bought chainsaws; others fixed their homes, while others purchased a vehicle. That's the thing!"

Ghandhy Reyman, Mapuche leader and forestry contractor

From conflict to cooperation: examples from other regions

Transforming relationships and reputations

When the pulp industry took off in Brazil in the 1970s and 1980s, companies paid little attention to the needs and traditions of rural communities and indigenous peoples. Large blocks of eucalyptus plantations were formed to maximize production, restricting access and opportunities for local people whose livelihoods largely depended on the land and natural resources. As a result, companies such as Aracruz faced severe social unrest.

During the years of conflict, Aracruz's mill was shut down by indigenous protestors, the company's nurseries and offices were vandalized, the landless workers' movement (MST) occupied company land, and NGO campaigns targeted Aracruz and its investors and customers. Meanwhile, arson and wood theft were widespread, and criminal networks set up illegal charcoal furnaces within the company's plantations.

In 2009, Aracruz merged with another large pulp company, Votorantim, to form Fibria. The new company embarked on a major programme to transform its social relationships. It poured human and financial resources into this work: Fibria has invested well over US$10 million a year in its social programmes, which employ nearly 80 people in the Aracruz unit alone. Recognizing that effective engagement requires specialized expertise and different approaches, the company formed partnerships with various organizations from government, academia and civil society – including some who, previously, were opponents of the company and its business.

The situation has improved dramatically. In 2011, Fibria reached an agreement with the MST to transfer ownership of around 11,000 hectares of land: the company is supporting the 1,000 or so families that have settled in the area to produce a variety of agro-forestry crops. Fibria is also working with the indigenous Tupinikim and Guarani peoples – who have been granted legal reserves on former Aracruz land – on forest restoration, livelihood and cultural projects.

In addition, more than 2,000 hectares of the company's plantations have been converted to farmland for local communities. The company gives financial and technical assistance to smallholders to increase productivity and profitability, benefiting thousands of families. Fibria has invested heavily in social engagement processes that empower the whole community to take ownership of these projects. Fibria aims to achieve 80% approval ratings in neighbouring communities by 2025: by 2013, surveys suggested that 72.5% of local people had a favourable opinion of the company.

Although the cost of this work has been high, it has brought business benefits for Fibria. Wood theft for illegal charcoal production has been reduced by more than 90% – from 320,000m^3 in 2010 to 18,098m^3 in 2013. Arson has also been significantly reduced. The company has achieved FSC and CERFLOR/PEFC certification, which are important for access to high-value international markets. Staff engagement has improved, and the company enjoys a much better reputation.

More than 2,000 hectares of Fibria's plantations have been converted to farmland for local communities.

From land claims to partnership
During the 20th century, many indigenous communities in South Africa were forcibly dispossessed of their lands. In 1994, the post-Apartheid government passed the Restitution of Land Rights Act, which gives people the right to claim back this land. Mondi itself is the subject of a significant number of land claims, making up almost 55% of the company's total land holdings in South Africa.

Mondi has worked constructively with communities and government to settle these claims, with the aim of supporting communities to become successful forestry enterprises. By December 2016, Mondi South Africa had settled 21 land claims, representing 38,000 hectares or almost 13% of its landholdings.

A model was developed where the land is legal legally transferred to a community trust, then leased back to Mondi. The company pays the trust an annual rent, which helps to support various community development projects. It also pays a stumpage fee for the timber it harvests – this fee effectively means the community is getting a share of the profits, giving them a stake in the success of the business.

While Mondi still owns large plantation forests, it continues to train locally owned enterprises in forestry operations. The idea is that, when Mondi's lease expires, local people will have the skills and capacity to manage the plantations on their own, and possibly get into longer partnerships with Mondi to secure fibre supply. Since Mondi will still need wood for its paper and packaging business, the community will have a ready-made buyer – and Mondi will have a reliable supplier.

Mondi is training local people to take over the management of plantations on community-owned land.

Chapter 7:

Climate mitigation and adaptation in China

China will make or break international efforts to keep global warming below 2°C. As the world's most populous country and the engine room of the global economy, China is responsible for 28.5% of all CO_2 emissions[51]– considerably more than any other nation. But China is making serious efforts to address this. Its current climate pledges include a target to peak CO_2 emissions by 2030 at the latest and to lower the carbon intensity per unit of GDP by 60-65% below 2005 levels by the same date.[52]

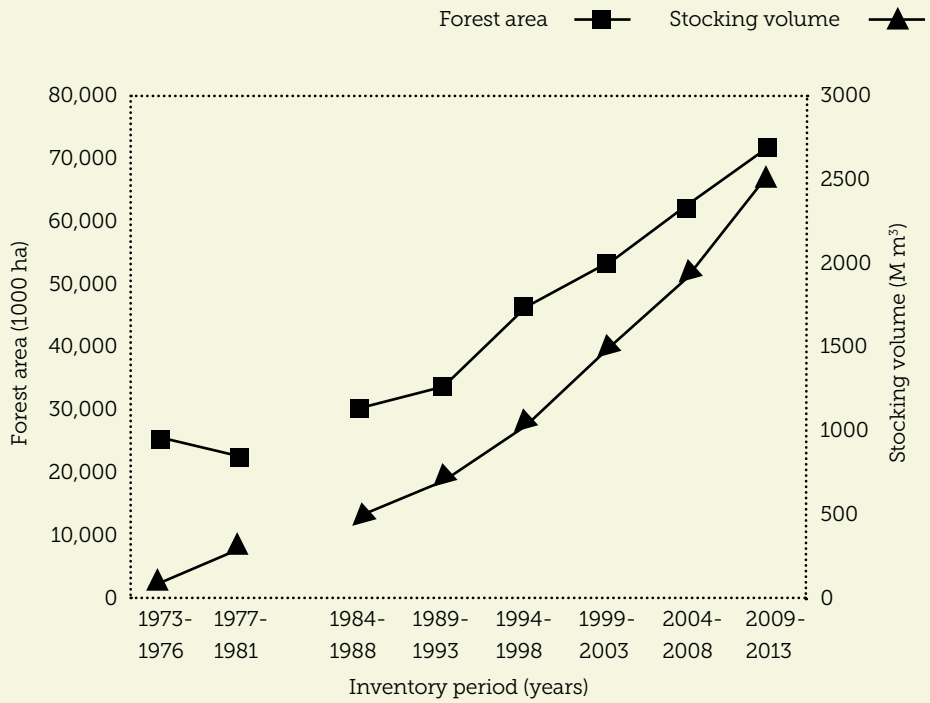
The transformation already under way in the energy sector suggests the country may meet these goals well ahead of target: in 2015, China increased its solar energy capacity by 74% and wind power by 34%, while coal use dropped by 3.7%.[53]

Less well known, but also of huge significance, is the contribution of forestry. As part of its climate change commitments, China has pledged to increase its forest stock by 4.5 billion cubic metres by 2030, compared to 2005 levels.[54] This comes on top of a massive increase in China's forested area over the last 40 years. In 1978, China's forest coverage amounted to 115 million hectares; by 2013, it was close to 208 million hectares, putting the country well on track to meet its target of increasing forest cover from 21.63% to 23% of its landmass by 2020. In the same period, the volume of wood in China's forest stock increased by more than 6 billion cubic metres. Afforestation and reforestation have played a dominant role in promoting this rapid expansion (see Figure 4).

According to the latest national forest inventory in 2009-2013, planted forests accounted for 69.33 million hectares, 36% of the total forest area, and 2.48 billion cubic metres, 17% of the total forest stock;[55] the volume is set to increase further as the plantations grow.

China increased its forest coverage from 115 million hectares in 1978 to 208 million hectares in 2013.

Figure 4: Area and volume of planted forests in China over the last 40 years[56]



A number of factors have driven this massive expansion in planted forests: increasing timber supply to meet growing urban and global markets, combating erosion and desertification, restoring degraded land and improving incomes for rural communities. In addition, demographic migration from rural to urban areas has left abandoned crop fields suitable for conversion into tree farms. Analyses suggest that these forces work jointly, though in regionally distinctive ways, to facilitate the expansion of planted forest.[57,58]

Recent years have brought renewed efforts to increase carbon sequestration in China's plantations. Since the mid-1970s, China's planted forests have sequestered around 300 million tonnes of carbon; the rapidly increasing carbon stock and carbon density in China's planted forests has been a major contributor to the increase in the global forest carbon sink over this period.[59,60,61] Since most of these planted forests are still very young and have not always benefited from the greatly increased public investment in forest technology and management in China, it is reasonable to assume that their full potential to accumulate additional biomass in living trees and in forest soils has not yet been achieved.[62]

The China Green Carbon Foundation (CGCF), founded in 2010, is playing an important role in this work. A nationwide non-profit organization affiliated to the State Forestry Administration of China (SFA), its mission is to "increase green vegetation, absorb carbon dioxide, address climate change, and protect our planet." It does this by raising funds from businesses, citizens and organizations who want to voluntarily offset their carbon emissions, and channelling them to afforestation and improved forest management projects that generate carbon credits.

By the end of 2016, CGCF had collected around US$100 million in donations from enterprises, organizations, events and individuals worldwide. So far, it's established around 8,000 hectares of plantations for carbon sequestration, and manages another 72,000 hectares of forest carbon projects established by its predecessor, the China Green Carbon Fund. These include projects supported by PetroChina which aim to produce biofuel from oil tree species such as yellowhorn (see below), as well as bamboo plantations and improved forest management. CGCF has also set up 66 afforestation bases in cities and counties across the country, where individuals can have trees planted to fulfil their civic duty: since the beginning of the 1980s, the Chinese government has called on individuals to voluntarily plant three to five trees a year. Now even urban dwellers can do so through an online donation.

CGCF is an active NGP participant, and its plantations are established along NGP principles. As a result, along with absorbing carbon emissions, they bring added benefits to people and nature.

US$100 MILLION

DONATIONS RAISED BY CGCF FROM BUSINESSES AND INDIVIDUALS TO OFFSET THEIR CARBON EMISSIONS THROUGH TREE PLANTING

FuturaGene's yellowhorn nursery in Gansu province.

An NGP study tour to Lin'an in Zhejiang province in 2015 showed how this can work in practice. In the village of Ni Luo, CGCF has funded 42 farm households to sequester carbon in bamboo plantations, totalling 257 hectares. The SFA provides support to help these farmers improve management practices – in particular they aim to reduce fertilizer use and encourage the development of an understory, which can increase carbon absorption and benefit biodiversity. Farmers can still sustainably harvest bamboo poles and their edible shoots, under an agreed management plan.

In its first five-year phase, the project sequestered 4,285 tonnes of CO_2e. The Zhejiang branch of the China Construction Bank bought these carbon credits to offset emissions from its day-to-day operations. Each household earned around US$50 for selling carbon credits from the first five years, and can expect to receive a further US$2,000 of carbon revenue over the next 15 years. While these may not sound like huge sums, they are a significant bonus for rural households and provide a strong incentive for farmers to adopt sustainable forest management practices. In a society which has seen rapid urbanization and industrialization, the project provides a vivid example of how industry can nurture agriculture, and urban dwellers support rural development.

This and other CGCF projects are based on voluntary schemes – they are additional to any government CO_2 reduction pledges, emissions taxes or UN Clean Development Mechanism (CDM) projects (which enable industrialized countries to meet their emissions reductions obligations by buying certified carbon credits from developing countries). But the CGCF is also using its technical and market know-how to enable forestry projects to be included in carbon markets, which could allow their social and ecological benefits to be scaled up significantly.

Following seven regional pilot schemes, China is in the process of rolling out a national cap-and-trade carbon market. Essentially, this involves putting a cap on carbon emissions from sectors such as manufacturing and power generation. Businesses that emit more than their entitlement must buy permits. The Chinese national market will be the largest carbon trading scheme in the world, and could lead to a significant rise in the cost of carbon globally. With the support of the CGCF, the first credits from a forest carbon sequestration project were traded on the Guangdong carbon market last year.

The Chinese national carbon market will be the largest in the world.

Millions of trees have been planted in and around Lanzhou New Zone, in Gansu province.

Internationally, the largest voluntary carbon offset programme is the Verified Carbon Standard (VCS). With technical support and investment from CGCF, four forest carbon projects are undergoing VCS verification, allowing the carbon credits they generate to be sold to international buyers. Two projects – one in Kunming, Yunnan province, and the other in Yong'an, Fujian province – have already been successfully registered, and two more – in Xishuangbanna, Yunnan, and Chao Er, in the Inner Mongolia autonomous region – are in the process of registration. Together, they cover an area of more than 3 million hectares and are expected to produce 6 million tonnes of CO_2e of carbon credits, directly benefiting 1,500 farmers.

In addition to the voluntary carbon market, a further five plantation projects to date have been registered with the CDM, including an afforestation project financed by the CGCF in Helinge'er county, Inner Mongolia. This project was begun in January 2013 thanks to a donation from the Lao Niu Foundation, a private family foundation. During the first five years, total investment will reach up to US$40 million.

The Helinge'er area was an arid, barren landscape, scarred by soil erosion and desertification, drought and sandstorms. Vegetation consisted of a few herbaceous plants and shrubs; there were no trees. Local people struggled to make a living growing a few crops and raising livestock, but food productivity was very low. Three-quarters of the population lived below the national poverty line; the mean per capita income in the project area was just US$470, though incomes in some villages were even lower.[63]

Since 2013, native tree and shrub species have been planted on 2,585 hectares around 13 villages, which are home to more than 10,000 people. Some 3,000 villagers are directly involved in planting, tending and managing the plantations: the project has generated 140,000 working days for local people, and around 60% of the investment has reached them directly in wages. After the completion of the project, each household will receive revenue of around US$600 per year from the project – making a significant difference to local livelihoods.

Today, the young forest is growing well. The trees sequester carbon in above-ground and below-ground biomass and increase soil carbon levels. In addition, they will also help to prevent further erosion and desertification, and benefit biodiversity: already, wildlife numbers and diversity are visibly increasing.

While these projects focus on mitigating the scale of climate change, they will also build resilience and capacity to adapt to its inevitable impacts. Changes in temperature and precipitation regimes have the potential to gradually affect forest structure, spatial distribution, growth and productivity. While some effects from rising temperatures and increasing precipitation, particularly in the colder north, may be positive for forest growth and productivity, others – such as increased fire occurrence and pest and disease outbreaks – are likely to be negative. In addition, a changing climate can affect hydrological processes and water yields in forested watersheds, as well as the downstream water availability for both people and wetland ecosystems. Northern parts of China are already experiencing higher temperatures and a decrease in precipitation, as well as a significant increase in the intensity and frequency of extreme climatic events, from droughts and heatwaves to snowstorms and rainstorms.[64] Without action to mitigate and adapt to these effects, this will accelerate the march of desertification. Since 1975, the desert area in China has expanded by 55,000km^2: dust-sand storms and desertification already affect some 400 million people, and direct economic losses have been estimated at US$7.7 billion per year.[65]

Growing trees can slow desertification, which is otherwise likely to increase as a result of climate change.

For many years the Chinese government has promoted tree-growing as a means to reverse desertification and improve soil quality. In 1979 China initiated the "Three-North Shelter Forest Programme", better known as "China's Great Green Wall": a 70-year-long attempt to slow down the encroaching Gobi Desert by planting a wall of forests 4,500km long. The programme is slated to finish in 2050 and aims to plant trees across 350,000km^2. The Great Green Wall has significantly increased vegetation and the carbon sink in the region, though some critics worry about the long-term ecological effects of growing trees in regions where they do not occur naturally.[66]

Above: picking yellowhorn flowers to make tea; top right: a newly established yellowhorn plantation on the edge of the Gobi.

In the north-western province of Gansu, FuturaGene, a subsidiary of NGP participant Suzano, has been carrying out field trials to test which species and management approaches work best in these arid conditions. As well as taking account of environmental factors, FuturaGene is aiming to find approaches that can be economically viable, enabling both the company and local farmers to profit.

Following several years of trials, they've identified a promising contender. Yellowhorn, or Chinese flowering chestnut (*Xanthoceras sorbifolium*), is a small tree native to the region. A nitrogen fixer, it grows naturally in these desert climates with carbon- and nutrient-poor sandy soils, and tolerates drought and extremes of heat and cold. It produces a profusion of small edible seeds, rich in oil, which could be used in applications ranging from food and cosmetics to jet fuel. All in all, there's huge potential for it to sequester carbon, enrich the soil and provide an income for local people.

FuturaGene has been breeding and selecting the most suitable clones, which it's now selling to local development projects. The SFA is also promoting the species for restoration projects, and the local government has big plans for using it to boost local economic development. The SFA Development Plan (2011-2020) proposes to support the planting of 1.6 billion yellowhorn trees across China's arid regions, covering 940,000 hectares.

While the enormity of the challenge can hardly be overstated, combating climate change in China also offers huge opportunities. China is now the global leader in renewable energy, which has become a key sector for driving economic growth, while phasing out coal power will have massive health benefits for the population. Similarly, growing the forest area is not only important for reducing carbon levels in the atmosphere, but it can also bring many social, environmental and economic benefits. A valuation study based on the eighth national forest inventory showed that the monetary value of the major forest ecosystem services (water conservation, soil conservation, carbon sequestration and oxygen release, nutrient accumulation, atmospheric environment purification, and biodiversity conservation) was up to CN¥10.01 trillion (around US$1.48 trillion) per year, equivalent to one-third of China's GDP.[67] As the world's largest economy grapples with climate challenges over the coming decades, plantations – from lush bamboo to hardy desert trees – promise to be a significant part of the solution.

Chapter 8:

The tissue issue: why we need sustainable intensification

When Kimberly-Clark introduced Kleenex facial tissue into the United States marketplace in 1924, the wood fibre it used came from the company's own pulp mills in North America. The wood, in turn, came from natural forests in the area.

As the company grew, so did its fibre demands. Customers wanted tissue products that were strong and absorbent, but also soft. That required a blend of softwood and hardwood: softwoods, primarily spruce and pine species, gave strength and absorbency. Counterintuitively, hardwoods – including oak, maple, poplar, alder and beech species – provided the softness. The wood came from Canada's boreal forest and temperate forests in the US.

In the 1970s, research found that eucalyptus, with its highly uniform fibres and low coarseness, was an ideal source of pulp for adding softness to tissues. Another positive was that eucalyptus could be grown to harvestable size in seven years, as opposed to the 50-100 years for hardwood species in North America. Major tissue producers, including Kimberly-Clark, recognized these attributes: by the 1980s, the tissue industry was one of the driving forces behind the expansion of eucalyptus plantations in the global south. Today, half of all the pulp produced by Fibria, the world's largest pulp producer, is used for tissue products.[68] Extensive softwood plantations, primarily radiata pine and loblolly pine, were also being established in the global south and the southeast United States.

Plantations have, of course, brought their own social and environmental issues, as discussed throughout this publication. What's undeniable, though, is that the tissue industry's use of plantation fibre has reduced the pressure on natural forests in North America.

"Our supplier Fibria estimates that they produce 10 tonnes of pulp per hectare per year," says Edward "Skip" Krasny, manager of Kimberly-Clark's Sustainable Forestry Program. "We use 1.1 million tonnes of eucalyptus, so that would require 110,000 hectares of land. Eucalyptus grows around 45 cubic metres per hectare per year, while aspen and birch from the boreal forest grow about 5 cubic metres. So you would need nine times the amount of boreal forest land to grow an equivalent amount of fibre, or an extra 900,000 hectares."

The tissue sector consumes around 10% of all pulp and paper produced globally, and the proportion is growing, so its forest footprint is significant. Today, Kimberly-Clark sources more than 70% of the virgin fibre it uses from plantations, and is looking to further reduce its dependence on natural forests, exploring alternative fibres like bamboo.

Alternative fibres like bamboo can reduce the tissue sector's forest footprint.

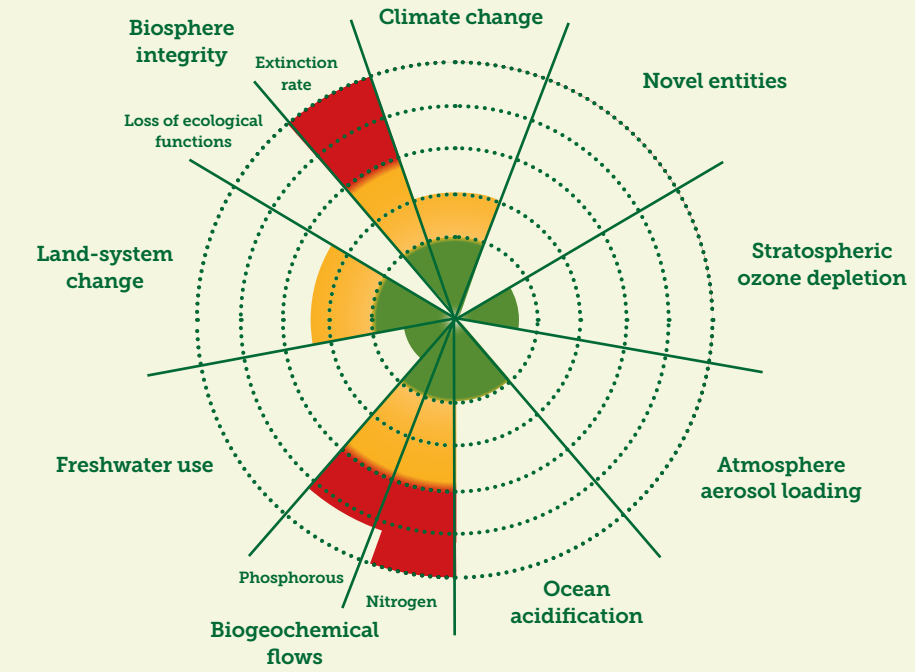
"YOU WOULD NEED NINE TIMES THE AMOUNT OF BOREAL FOREST TO GROW AN EQUIVALENT AMOUNT OF FIBRE TO WHAT WE GET FROM OUR EUCALYPTUS SUPPLIER."

The tissue fibre story illustrates a wider imperative. With rising wealth and populations, demand for consumer goods has increased – and so too has the need to produce them more efficiently. By the time a pine tree planted today is ready to harvest, the world's population will have passed 9 billion, and the global "consumer class" will have more than doubled.

But meeting the needs and expectations of all is not just a case of increasing production. Our planet simply can't sustain a continuation of the exponential growth of the last half-century. Scientists studying the critical Earth system processes that support life on our planet believe we have already crossed several "Planetary Boundaries" – on climate, biodiversity, land-use change and flows of chemicals such as phosphorous and nitrogen – taking us into unknown and dangerous territory.[69]

The challenge, then, is to find ways of doing more with less: to maximize production, while minimizing the need for land, water and chemical inputs and reducing impacts on the climate and the biosphere. In practice, this means increasing the output from existing productive or degraded land, without further conversion of natural habitats like forests, depletion of natural capital or other adverse environmental impacts. "Sustainable intensification" has become a widely adopted concept in discussions around development and food security – though some critics argue that it is an oxymoron, and simply a repackaging of existing intensive production models.[70]

Figure 5: Planetary Boundaries
We have already crossed several Planetary Boundaries, taking us into unknown and dangerous territory
Source: Steffen et al. 2015. Planetary boundaries: Guiding human development on a changing planet.



So can plantations make a significant contribution to sustainable intensification? The evidence suggests they can. Certainly the increased outputs have been dramatic. In Brazil, the area of land needed to produce a million tonnes of pulp has halved in the last 30 years, from around 160,000 hectares in the early 1980s to 80,000 hectares today. Put another way: without these advancements, NGP's Brazilian participants Fibria, Suzano and Veracel would need another 1.1 million hectares of plantations to supply the volume of pulp they produce today. Fibria's target is to reduce the area of land needed for pulp production by a further third by 2025, from a 2011 baseline.

While more efficient pulp mills play a part, much of this improvement has been achieved through tree breeding. Most eucalypts grown in plantations are clones that have been developed in companies' labs and nurseries. The best-performing clones are selected for their growth rates, their suitability for different soils and climates, and other characteristics. The increases in productivity seen today are the result of just four generations of scientific breeding. By comparison, selective breeding of corn has been going on for millennia, and has been scientifically documented for more than a century, or over a hundred generations.

Better plantation management and precision forestry techniques have also helped to increase productivity, while at the same reducing inputs and environmental impacts. Trees are replanted quickly after harvesting. This helps to minimize herbicide use, as the young trees grow before any weeds can become established, and reduces the risk of erosion by ensuring soils aren't left bare for any length of time. The nutrients in the branches and leaves of the harvested trees are taken up by the young trees, rather than leaching into the soil. It's not only Brazil that has achieved significant increases in productivity. In Chile, for example, Arauco has achieved a 40% increase in growth per hectare in its radiata pine plantations. This is partly down to the work of its Bioforest research centre, which includes clonal breeding, detailed knowledge of the planting site, selecting the right clones for that site, specific management measures and continuous monitoring.

GM trees: a necessary development?
Intensification to date has been achieved through conventional tree-breeding. This has resulted in high-performing clones that produce more fibre on the land available, and that are more resilient to pests and climatic stressors like drought. But there's a strong feeling within the industry that more could be achieved by using biotechnology tools, including genetic modification (GM).

Public and privately funded field trials are under way in a number of countries looking into how GM technology could enable trees to grow faster or increase their resistance to drought, frost and pests. Research is also being carried out into how GM technology could be used to modify trees' physical characteristics in order to improve production of pulp and bioenergy, or to provide renewable alternatives to fossil fuel-based materials such as plastics and pharmaceuticals.

It's in Brazil that GM tree plantations are closest to becoming a commercial reality. Suzano has been running trials since 2006 on a modified tree which has a 20% higher yield than conventional trees, with no other discernible differences.

But GM trees are contentious. The topic provokes strong reactions and raises a range of environmental, social and ethical questions. Dialogue is needed to avoid the risk of GM trees being established with unintended negative consequences – or, conversely, of failing to realize the advantages GM technology may offer to society and the environment.

Biotechnology has the potential to increase yields and resistance to drought and pests, but remains a contentious topic.

Above: Fibria's Rural Land Development Program has reached over 4,000 farming families; top right: a landscape mosaic with eucalyptus plantations alongside restored riparian forest

Despite the progress to date, sustainable intensification on the scale required to meet the needs of the future will involve more than just large companies increasing productivity at the site level. One major priority is to support smallholders and family farmers – who produce 80% of the world's food[71] – to adopt better management practices that can increase productivity and resilience. This is critical not just to increasing production, but also to achieving the socio-economic aspects of sustainability that are often overlooked – such as livelihoods, equity, social justice and economic viability.[72]

This is something NGP participants have begun to address. In Brazil, Suzano provides improved eucalyptus clones to outgrowers (smallholders who supply a significant proportion of the fibre used in their mills) and has also worked with them to improve conservation and management practices in order to achieve FSC certification. Fibria supports agricultural outreach work to help communities run productive farming and horticultural enterprises: its Rural Land Development Program, begun in 2012, has reached over 4,000 families, and the aim is to make these projects self-sustaining by 2025.

Equally important is ensuring intensification is sustainable and resilient at a landscape level. In the Atlantic forest biome, Kimberly-Clark worked with Fibria, Suzano and Veracel and environmental NGOs Conservation International, The Nature Conservancy and Instituto BioAtlântica to launch the Sustainable Forest Mosaics Initiative. The mosaic concept aims to fit together different land uses – such as plantations, agriculture and nature reserves – in a way that maximizes production while meeting local needs and maintaining ecosystem services and biodiversity. It's been a key part of efforts to restore the Atlantic forest, as described in Chapter 4.

While mosaic landscapes have proven to be a successful model for sustainable intensification at scale, other approaches can be equally valid. These include land-sharing models – for example combining plantations with grazing, as demonstrated by NGP participants in Uruguay, and agroforestry, as Stora Enso has been developing in Laos.

The state of Acre in the Brazilian Amazon provides another example. The state government – an NGP participant – sees sustainable intensification as a way to improve people's livelihoods while protecting the forest. Acre retains 87% forest cover, so the focus is on concentrating and intensifying production within the remaining 13%, much of which consists of low-productivity cattle pasture.

From 2000 to 2010, the number of cows in the state tripled from 1 million to 3 million – by improving soil and grazing management, rather than increasing the area of pasture. But Acre is looking to diversify away from beef production, by encouraging activities such as farming Amazonian fish species, fruit and vegetable growing, and raising pigs and poultry. Plantations also have an important role to play, growing trees including native acai palms, rubber, and eucalyptus for timber and bioenergy. These diversified land uses are more productive, more resilient and more profitable than cattle ranching alone, and provide more jobs: acai and aquaculture provide almost ten times as many jobs per hectare as raising cattle. The plantations can also enhance environmental services such as carbon sequestration and erosion control.

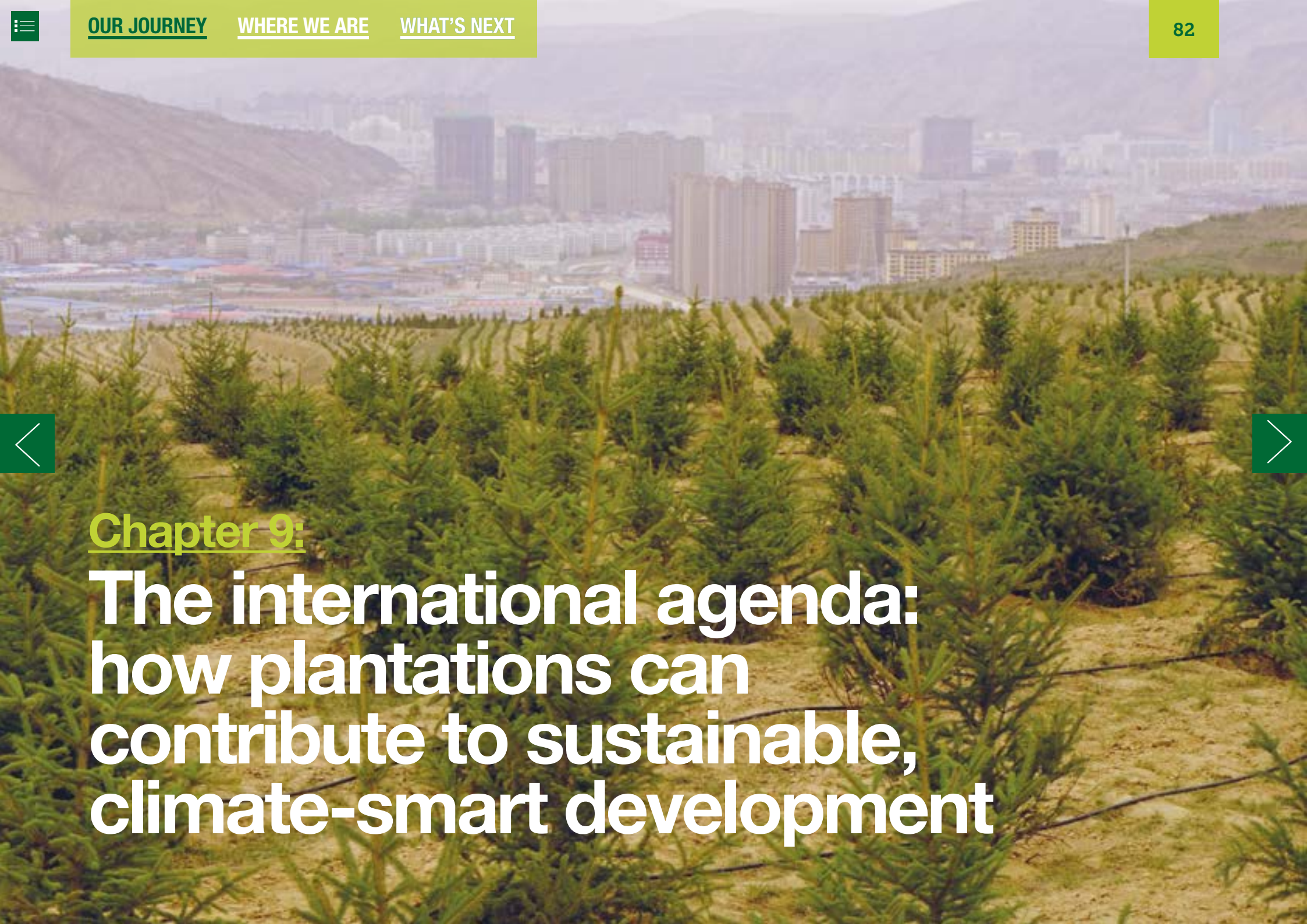
Whatever approach is taken, NGP principles – maintaining ecosystem integrity, protecting HCVs, working with stakeholders, creating shared value – are vital to ensuring that sustainable intensification is a paradigm, not a paradox.

10 TIMES AS MANY JOBS PER HECTARE ARE CREATED BY DIVERSIFICATION SUCH AS ACAI PLANTATIONS AND AQUACULTURE THAN CATTLE RANCHING.

Rubber trees (top left) and acai palms (above) in Acre, Brazil.

Part C:

What's next: growing the plantations of the future



Chapter 9:

The international agenda: how plantations can contribute to sustainable, climate-smart development

A tree nursery in Brazil: enhancing forest carbon stocks is encouraged in Article 5 of the Paris Agreement.

Recent years have brought unprecedented international commitment toward sustainable development.

The Paris Climate Agreement, which came into force in November 2016, has set the clock ticking for ambitious action on climate change. The Sustainable Development Goals set the agenda for inclusive, environmentally friendly progress between now and 2030. Initiatives like the Natural Capital Protocol mean development and land-use decisions are starting to take account of the value of nature.

New generation plantations can play a significant role in advancing these agendas. At the same time, they offer a means to significantly increase the positive contributions plantations can make to people and nature. There are real opportunities to channel development and climate finance, government spending and private sector investment through plantation forestry into community development, ecosystem restoration, climate resilience and other projects that create economic, social and environmental value.

The NGP platform provides a space to explore these opportunities, align our efforts and forge the partnerships needed to maximize the contribution plantations can make to people, planet and prosperity in the coming years.

Climate action

The historic Paris Agreement on climate change commits the nations of the world to take ambitious action to keep average global temperature rises to well below 2°C above pre-industrial levels, while pursuing efforts to limit the rise to 1.5°C. The Paris Agreement explicitly recognizes the importance of forests and sustainable land use in reducing emissions and increasing carbon sinks, while bringing other benefits:

Article 5

1. *Parties should take action to conserve and enhance, as appropriate, sinks and reservoirs of greenhouse gases... including forests.*
2. *Parties are encouraged to take action to implement and support... policy approaches and positive incentives for activities relating to reducing emissions from deforestation and forest degradation, and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries; and alternative policy approaches, such as joint mitigation and adaptation approaches for the integral and sustainable management of forests, while reaffirming the importance of incentivizing, as appropriate, non-carbon benefits associated with such approaches.*

Plantations can support REDD+ projects by providing an alternative source of fuelwood for local communities.

Forest conservation and restoration are significant components in many countries' climate change action plans, particularly in the developing world. A key mechanism to support this is the UN-backed REDD+ scheme. REDD+ aims to provide developing countries with incentives for reducing emissions from deforestation and forest degradation (REDD) and conservation, sustainable forest management, and enhancement of forest carbon stocks through forest restoration and afforestation (+).

Establishing plantations must not be seen as an alternative to urgent action to prevent deforestation, or to reduce emissions from fossil fuels and other sources. However, there is scope for plantations that have a net positive impact on the climate to play a complementary role in REDD+ landscapes and other forest restoration initiatives. As well as sequestering carbon themselves, they can act as a buffer against deforestation or forest degradation, and provide livelihood opportunities for local people. For instance, a REDD+ project may seek to prevent degradation by limiting fuelwood harvesting from natural forests; plantations could provide local communities with a sustainable alternative energy source. Approaches such as mosaics of restored forest and productive plantations can make reforestation projects more economically viable, while building resilience to aid climate adaptation: while forest restoration is expensive, NGP participants have demonstrated that private companies can carry out restoration activities alongside plantations while remaining commercially successful.

NGP participants possess considerable knowledge and experience that can aid forest carbon projects. The Acre state government runs perhaps the most advanced large-scale REDD+ programme in the world. In return for conserving forests, smallholders, indigenous communities and other landowners receive incentives such as equipment and training to support sustainable livelihoods. Outside of REDD+ and global climate commitments, the China Green Carbon Foundation has developed a successful model for enabling businesses and citizens to offset their carbon emissions by supporting afforestation. NGP participants can also offer expertise in areas such as silviculture, forest restoration and monitoring of carbon stocks.

Meanwhile, efforts to tackle climate change will drive a significant increase in demand for timber-based products. As discussed in chapter 1, bioenergy is projected to be the biggest driver in increased timber demand over the coming decades. A model developed for the WWF Living Forests Report suggests that keeping the global temperature rise below 2°C will require 75.3EJ of land-based bioenergy by 2050, compared to 18.8EJ in 2010.[73]

Expansion of bioenergy on this scale raises serious challenges. The use of agricultural land to grow biofuel crops could undermine food security and cause price rises, or drive further conversion of forests and other ecosystems by displacing food production. Furthermore, intensifying timber extraction for bioenergy in natural forests could lead to increased forest degradation if not well managed. Plantations that follow NGP principles have an important role to play: they can

take the pressure off natural forests as a source of biomass for energy, and can be grown on marginal and degraded lands that don't compete with food production.

The interior of Madrid airport contains 200,000m^3 of bamboo.

As well as substituting for fossil fuels in energy generation, timber products can provide a low-carbon alternative to materials like concrete and steel – with the added climate advantage that wood-based products also store carbon throughout their lifespan. In 2010, the FAO estimated that using wood in place of more energy-intensive building materials saved the equivalent of 483 million tonnes of CO_2 emissions – similar to the total annual emissions from international aviation – while the forest products industry sequestered 424 million tonnes of carbon.[74] These possibilities are expanding all the time as technology improves. Bamboo, for example, has huge potential as a construction material: the interior of Madrid airport used 200,000m^3 of bamboo, and wind turbine blades are being developed where bamboo replaces 60% of the fibreglass.[75]

One way or another, action on climate change looks set to lead to an unprecedented increase in afforestation and forest restoration globally, as well as increasing demand for timber-based products. NGP principles on maintaining ecosystem integrity, enhancing high conservation values, involving stakeholders and creating shared value can help ensure these efforts not only make a significant contribution to combating climate change, but also bring other benefits to people and nature.

Sustainable development

In 2015, the countries of the United Nations adopted the 2030 Agenda for Sustainable Development – an international "plan of action for people, planet and prosperity" that aims to eradicate poverty and heal and secure the future of the planet. Every country is committed to achieving a set of 17 Sustainable Development Goals (SDGs), which include 169 targets, to tackle major development challenges by 2030. They apply to developing and developed countries alike: no country has yet achieved all the goals. The SDGs are shaping the priorities for international development assistance and national government policy. They promote cooperation between governments, civil society and the private sector around shared aims and outcomes. Indeed, the contribution of the private sector is crucial: the UN General Assembly resolution "call[s] upon all businesses to apply their creativity and innovation to solving sustainable development challenges". Leading companies are beginning to integrate the SDGs into their business, with nearly a third of the members of the World Business Council for Sustainable Development (WBCSD) – 50 in total – communicating on the SDGs in their corporate non-financial reporting.[76]

NGP participants are already making a contribution to many of the SDGs. There are significant opportunities for plantation operators to partner with governments, development finance institutions, NGOs and other businesses to scale up and build on these initiatives. The following section summarizes some areas of particular relevance; it is not intended to be an exhaustive list. For example, companies that manage plantations may also play a role in reducing accidents and providing healthcare for workers (SDG3), providing educational opportunities (SDG4) and supporting gender equality (SDG9), among others.

SDG1: End poverty in all its forms everywhere

By creating shared value and providing employment and other livelihood opportunities, often in poor, rural areas, plantations can contribute to eradicating extreme poverty (Target 1.1) and reducing poverty in all its dimensions (1.2). New generation plantations that are established with the participation of local communities can help guarantee access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services (1.4). NGP approaches at a landscape scale can also build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters (1.5).

SDG2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture

Providing financial support and access to land, technical support and markets for community farming and food projects alongside plantations can help to ensure access to safe, nutritious and sufficient food (2.1.). Companies have provided support that contributes to increasing agricultural productivity and incomes of small-scale food producers (2.3). By contributing to landscape-scale initiatives and maintaining and restoring ecosystems, plantation companies can help ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality (2.4).

SDG6: Ensure availability and sustainable management of water and sanitation for all

In cooperation with other water-users in their catchment areas, plantation operators can help to ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity (6.4) and implement integrated water resources management at all levels (6.5). They also have an important role to play in target 6.6: By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes.

SDG7: Ensure access to affordable, reliable, sustainable and modern energy for all

Sustainable, renewable bioenergy from plantations can provide an alternative both to traditional wood fuel from natural forests and fossil fuels. This can help ensure universal access to affordable, reliable and modern energy services (7.1) and increase substantially the share of renewable energy in the global energy mix (7.2).

SDG8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

Plantations can contribute to economic growth (8.1) and achieving higher levels of economic productivity through diversification, technological upgrading and innovation (8.2) – although promoting high-value added and labour-intensive opportunities (8.2) is a challenge in the plantation sector. Well-managed plantations are also important to improving resource efficiency and decoupling economic growth from environmental degradation (8.4). Responsible plantation operations support productive employment and decent work (8.5) and should protect labour rights and promote safe and secure working environments (8.8). There are also opportunities for plantation operators to promote sustainable tourism that creates jobs and promotes local culture and products (8.9).

SDG10: Reduce inequality within and among countries

By investing in rural areas where there are few economic opportunities, plantations can support income growth of the bottom 40% of the population (10.1).

SDG12: Ensure sustainable consumption and production patterns

Plantations can make a significant contribution to the sustainable management and efficient use of natural resources (12.2). NGP participants can lead by example in encouraging companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle (12.6). By increasing the supply of FSC timber and paper products they can enable sustainable public procurement (12.7). They can also contribute to ensuring that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature (12.8).

SDG13: Take urgent action to combat climate change and its impacts

The relevance of plantations to the international climate agenda is discussed above. In relation to specific SDG targets, plantations can contribute to strengthening resilience and adaptive capacity to climate-related hazards and natural disasters (13.1) and improving education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning (13.3).

SDG15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

Following NGP principles on ecosystem integrity and HCVs, particularly when implemented at a landscape scale, can make a direct contribution to several goals under SDG15:

15.1: By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements

15.2: By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally

15.3: By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world

15.5: Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species

15.8: By 2020, introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems and control or eradicate the priority species.

SDG17: Strengthen the means of implementation and revitalize the global partnership for sustainable development

The NGP platform helps to facilitate the global partnerships necessary to achieve the SDGs. Among other things, it can help to promote the development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries (17.7) and enhance international support for implementing effective and targeted capacity-building in developing countries (17.9). It's an example of the sort of multi-stakeholder partnerships that mobilize and share knowledge, expertise, technology and financial resources, to support the achievement of the sustainable development goals in all countries (17.16) and encourages effective public, public-private and civil society partnerships (17.17).

Natural capital

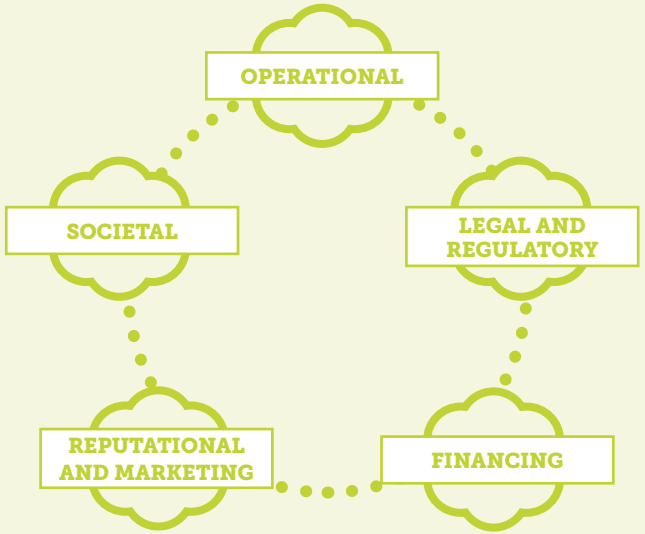
Globally, recognition is growing of the need to account for the value of nature and the services it provides. Governments, businesses, economists and finance institutions regularly refer to the concept of natural capital. This refers to the stock of natural assets that people benefit from – forests, grasslands, rivers, lakes, oceans, soil, biodiversity and so on. In turn, natural capital yields a flow of goods and services – known as ecosystem services – from clean air and water to pollination and recreation. Globally, the value of the benefits that natural capital provides has been estimated at US$125-145 trillion per year – significantly larger than the world's total economic output.

As natural capital is lost, so are the benefits it provides to society. The long-term economic costs of this are immense. The annual losses that result from the conversion of natural landscapes such as forests, grasslands and wetlands have been estimated at US$4.3-20.2 trillion. Conversely, restoring and enhancing natural capital can increase the value it provides to society – suggesting that conservation and restoration should be seen as an investment rather than a cost.

An increasing number of countries are beginning to report their "environmental accounts", enabling them to monitor changes in the natural assets that are crucial to their long-term prosperity. The internationally agreed System of Environmental-Economic Accounting (SEAA) provides a standardized method for doing so.

The private sector, too, is showing growing awareness of the importance of natural capital to businesses – which both depend upon and have impacts upon natural capital. In 2016, the Natural Capital Coalition, which brings together businesses, accountancy firms, academia, government and NGOs, launched the Natural Capital Protocol. This provides a framework and tools to help businesses identify, measure and value their impacts and dependencies on natural capital. Doing so can help them avoid business risks, create greater value, be more efficient and make better decisions.

Figure 6. The Natural Capital Protocol
Source: naturalcapitalcoalition.org/protocol



OPERATIONAL
- Reduce raw material costs and risk of interruption to supply from extreme weather, flooding etc
- Realize efficiency gains

LEGAL AND REGULATORY
- Identify future legislation
- Reduce compliance costs and risk of fines and penalties

FINANCING
- Reduce financing costs and increase margins
- Improve access to finance – attracting investors

REPUTATIONAL AND MARKETING
- Identify new revenue streams and differentiate your products
- Improve ability to attract and retain employees

SOCIETAL
- Identify benefits and negative impacts to local communities through improved natural capital (e.g. water quality)
- Support a social licence to operate

Plantations that follow NGP principles are likely to have a net positive impact on natural capital, by maintaining ecosystem integrity and protecting and enhancing HCVs. Plantations themselves are likely to provide a greater flow of ecosystem services than the degraded or agricultural lands they replace, and their value increases significantly if they are accompanied by restoration of natural ecosystems. Baral et al (2016) have outlined the main ecosystem services from planted forests, and propose a framework for measuring them (Figure 7).

The Natural Capital Protocol and national natural capital accounts complement and reinforce many of the ideas and initiatives being explored by NGP participants. They provide useful tools for companies to measure and communicate their impacts (positive and negative) and to engage with other businesses, finance institutions and governments. They can also, potentially, provide a source of funding – including through payments for ecosystem services – to scale up conservation, restoration, water stewardship and shared value creation efforts.

Figure 7: Ecosystem services from planted forests

Source: Baral, H., Guariguata, M. and Keenan, R. 2016. A proposed framework for assessing ecosystem goods and services from planted forests.

Ecosystem service	Description	Scale	Unit of measurement
Food	Provision of wild foods such as mushrooms, berries, fruits	O	Number of foods or kg/ha
Raw materials	Provision of raw materials for construction, pulp and wood, biofuels and essential oils	O	m3 or tonnes/ha
Freshwater	Filtering, retention and storage of freshwater available for human consumption or industrial use	O – R	ML/ha/yr
Medicinal resources	Availability of plants for traditional medicines as well as raw material for pharmaceutical industry	O – R	Number of species or kg/ha
Local climate and air quality	Enhancement of rainfall and water availability at local scale, and regulating air quality by removing pollutants from atmosphere	L – R	
Carbon sequestration and storage	Regulation of global climate by sequestering and storing greenhouse gases	O – G	Tonnes/ha
Moderation of extreme events	Buffering against extreme weather events or natural hazards, such as floods, storms and landslides, and hence reducing damaging impacts	L – R	Number of events protected against
Erosion prevention and maintenance of soil fertility	Capacity to provide vital regulating services by preventing soil erosion	O	ha/yr
Pollination	Capacity to support habitat for insects and birds that provide pollination and other services essential for the development of products, e.g. fruit, vegetables and seeds	O – R	Number of or impact of pollinating species
Water regulation	Provision of land cover and hence regulation of erosion and hydrology	O – R	m3/ha
Biological control	Habitat for natural fauna and flora that act as natural controls of predators and parasites	O – R	Number of beneficial species
Habitat for species	Habitat for a variety of native plants and animals	O – R	Number of species present
Maintenance of genetic diversity	Capacity to support high biodiversity	O – G	Number of species which makes them more genetically diverse than others
Recreation and mental and physical health	Provision of scenic and natural landscapes that provide recreation areas important in maintaining mental and physical health	O – L	Number of visitors/yr
Tourism	Natural ecosystems as sites for ecotourism, outdoor sport, local tourism opportunities	O – R	$/yr

Chapter 10:

How will new technology transform plantation forestry?

By Adam Costanza and Susan McCord, Institute of Forest Biosciences

Remote technologies and satellite data can support forest managers and landscape-level decision-making.

Numerous technologies are becoming available for use in sustainable plantation forestry. Wider application of these technologies is helping to increase efficiencies, improve tree health, and connect people with information in new ways. Some examples of how this is occurring are presented here and fall into four areas: precision, speed, scale and connectivity.

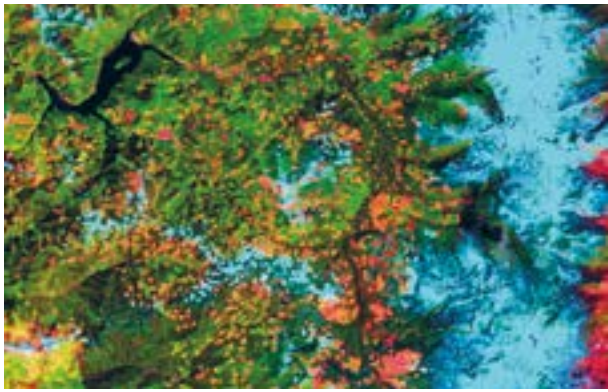
Precision

Increased precision leads to better forest practices – whether it is identifying the minimum effective amount of fertilizer to apply, optimizing rotation times, or demarcating HCVs and wetland areas. Technology is at the heart of these improvements. New precision-at-a-distance technologies are allowing tree-growers to optimize their operations on a scale:efficiency ratio unimaginable just a few years ago.

The rapid transition of military drone technology to consumer small Unmanned Aircraft Systems[80] (sUAS) has opened up a wealth of opportunities. Aerial imagery such as Light Detection and Ranging (LiDAR) and hyperspectral 3D imaging was once only available to large companies and government agencies. Today, these technologies are in reach for smaller operators.[81] For example, a single operator can now generate georeferenced 3D maps to estimate tree health, height and standing volume using a relatively inexpensive drone and cloud computing power. This gives tree-growers actionable insights[82] about rotation planning, weed and pest incursion, and allows monitoring of best management practices over a large area of forest land, within a matter of hours.[83]

Even without owning dedicated remote sensing machinery, a tree-grower can assess aspects of their plantations by using very remote technologies: satellites. It is becoming easier for even small-scale users to access satellite imagery, such as MODIS (moderate-resolution imaging spectroradiometer)[84] data, to estimate the overall health of their forests.[85] The technology also has significant potential for improving landscape-level decision-making.

Technological advances in this area are far from peaking. For example, drones can be used to deliver seed capsules to replant in remote locations or challenging terrains.[86] As the technology continues to develop, it will open up new possibilities, and become increasingly accessible to even the smallest landowners.



AS TECHNOLOGY CONTINUES TO DEVELOP, IT WILL OPEN UP NEW POSSIBILITIES, AND BECOME INCREASINGLY ACCESSIBLE TO EVEN THE SMALLEST LANDOWNERS.

New breakthrough technologies provide rapid and precise ways to "edit" a plant's genome in order to produce desired traits.

Speed

Breeding programmes can improve tree growth rates, increasing productivity and profitability. But breeding is also important for responding to threats such as pest infestations and climate change. Pests are a concern in all forestry, with a cost to society running into tens of billions of dollars, but particularly in high-density plantations with limited species diversity. Global trade and transportation provides an easy means of distributing pests around the world in a 24-hour cycle, and climate extremes can exacerbate pest problems, giving rise to multiple life cycles of destruction.[87] Meanwhile climate change is creating new challenges, including increased drought and higher temperatures; as growing zones shift, determining which trees should be planted where will become more and more important. Rapid responses are needed to combat these challenges.

Because trees mature much more slowly than agricultural crops, conventional breeding programmes are slow. However, the rapidly accelerating pace of biotechnology offers opportunities for swifter progress.

One such technology is using genomic selection techniques to predict a plant's phenotypic traits (how it looks) from genotype data (its DNA) before it's ever put in the ground.[88] This enables plantation operators to select better-performing trees, speeding up conventional breeding by a decade or more.

New breakthrough technologies in genetic modification (GM) are also creating new opportunities. With conventional breeding, thousands of genes are transferred to the next generation along with the trait sought. This "genetic baggage" can bring in undesirable traits. In contrast, GM techniques are precise and insert or modify only those genes needed to produce the desired phenotype. The genes of interest can come from the same species or from another plant species. However, the use of GM technology in forestry remains the subject of intense debate. Strict regulations add significant time and expense for developers, while social acceptability of GM trees poses an even greater challenge.

CRISPR-Cas9 (CRISPR) is a technological breakthrough that enables rapid and precise genome editing – essentially, it involves removing pieces of DNA then reconnecting the ends.[89] Since it doesn't involve adding genes from outside the plant, it isn't currently subject to many of the regulations governing other forms of GM, and is likely to be more acceptable to other stakeholders. CRISPR techniques have proven effective in trees,[90] for example in modifying lignin and tannin production.[91]

Researchers are exploring ways to use this technology, which can stably confer genetic changes within a single generation. Efforts are under way to use these techniques in trees to increase their resistance to pests, increase nutrient use efficiency so less fertilization is required, and increase their growth rate so that less land and fewer inputs are required to grow a given amount of wood fibre. CRISPR is also making GM technology much more accessible, rapidly moving it from the realm of PhDs and expensive lab equipment to high-school science fair projects and simple, inexpensive kits.[92]

Scale

As discussed already in this publication, meeting the food, fibre and fuel demands of a growing world population will lead to a significant expansion in the scale of forest plantations. Technological innovations could further add to the demand for wood, reinforcing the need for well-managed plantations.

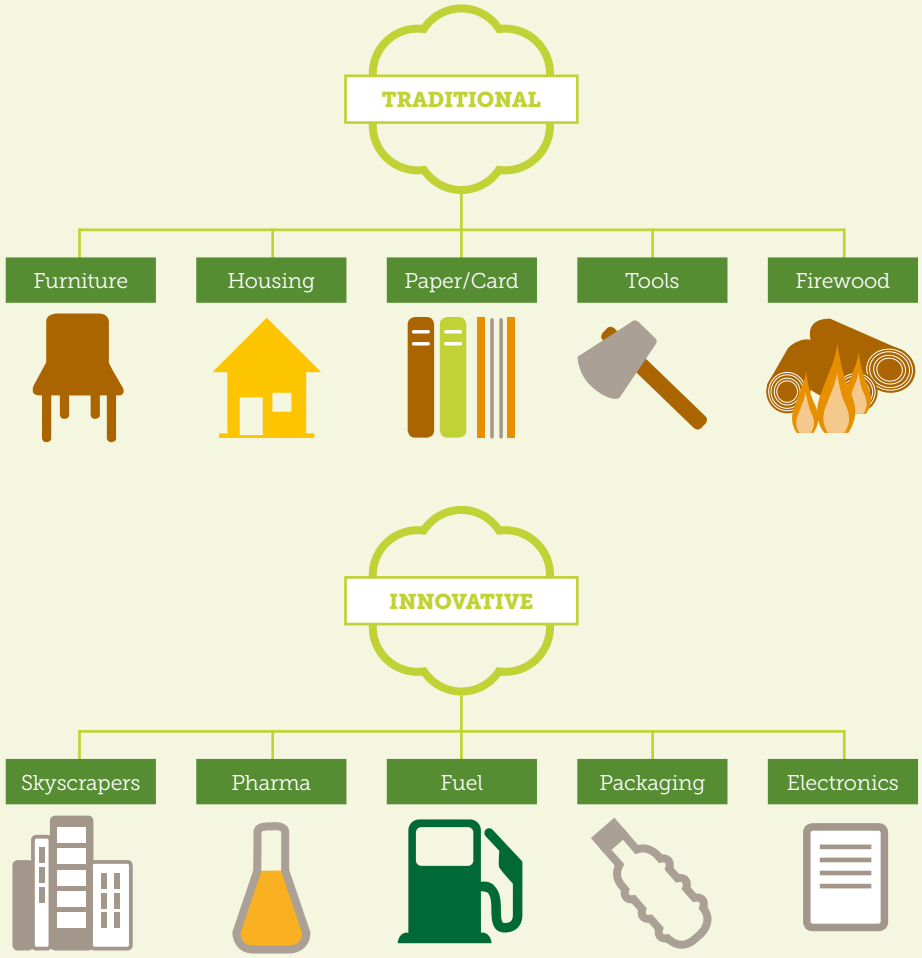
For example, could a significant proportion of the 2.5 billion new urban dwellers expected between now and 2050 be housed in wooden skyscrapers? Several projects are demonstrating the feasibility of using cross-laminated timber panels in tall buildings. These panels can be up to 20m long, 2m wide and 40cm thick. As well as reducing emissions from steel and concrete production, wood's ability to store carbon makes it an environmentally responsible alternative as a structural building material.[93]

Innovative technologies also mean wood can be used not only to produce heat and electricity but as a transport fuel. In 2015, UPM began producing BioVerno renewable diesel in Lappeenranta, Finland, using crude tall oil, a residue from its own pulp-making process. The refinery will produce 120 million litres of biofuels a year.

Bioplastics are another important growth area: the variety of plastic materials that can now be made from bio-based sources is growing all the time, with significant environmental benefits. The pharmaceutical industry uses wood pulp derivatives as a binding agent in many pills. Attention is also focusing on potential uses of lignin, a by-product of the pulp-making process, including to produce carbon fibres – extremely strong but lightweight materials, used in everything from car parts and clothing to bicycle frames and phone cases.

To date, most of these uses are by-products of the pulp and paper industry's core business. In the future, though, pulp mills could become biorefineries producing a whole range of products, adding value to plantations.

Figure 8. Traditional and innovative uses of wood



An "open forestry" movement could increase NGP's reach and effectiveness.

Connectivity

Information-sharing and the "open" movement are providing innovative ways to work on complex problems from human health to climate change. Problems are easier to overcome with more minds and hands developing creative approaches to solve them. Moving from traditional centralized command-and-control operations of information to complete decentralization, such as peer-to-peer networking, led to rapid innovation, but little organization of knowledge. Open movements have evolved to harness the power of decentralized innovation while establishing connections that generate actionable information. These models are becoming the norm in many sectors of society. An "open forestry" model is ideal to meet the demands asked of forests by a burgeoning global population.

A global open forestry movement could connect people and resources through human and digital networks in innovative ways, enabling knowledge-sharing across socio-economic, geographic and expertise boundaries. This would create opportunities for more people to generate knowledge and resources, improve upon them, and use them in new ways and in new places to benefit more people. It would point people to resources, technologies and experts to foster collaboration, expand knowledge-sharing and build a global network to solve problems in forestry.

Often information is generated and used by large companies or research organizations and fails to make its way downstream to on-the-ground users in general, and forest smallholders in particular. This limits the ability of smallholders to access useful information and keeps them from realizing a sustainable forestry-based livelihood. It also limits technology providers' access to grassroots innovation, partnerships and data. NGP has been working to bridge the gap between researchers, companies, and smallholders for a decade. The open forestry movement could increase NGP's reach and effectiveness by providing a multitude of human and digital networks.

Open forestry has the potential to drive precision, speed, scale and connectivity within the forestry sector. Central to this movement is a dynamic give-and-take where participants provide information or resources, as well as gaining knowledge, contacts or tools.

Today, most people carry more data processing power in their pocket than was used to send a spaceship to the moon, and can connect instantaneously with people anywhere in the world. Anyone with a smartphone can gather and share useful data for a wide range of forest-related needs. For example TreeTaggr (treetaggr.org) uses a smartphone's GPS, camera and data transfer capabilities to enable citizen scientists to gather information on trees and forest health. This provides robust and actionable data that researchers and managers can use, far beyond anything experts could accomplish on their own.

Technology is revolutionizing accessibility of forestry information, allowing anyone to improve the vitality of forests for the betterment of society and the environment.

Chapter 11:

The new New Generation Plantations

By Luis Neves Silva, NGP platform lead

The NGP Ecosystem of Collaboration

So where does the NGP platform go from here? Just as the use and uses of wood are rapidly expanding, so are the opportunities for plantations to contribute to important environmental and development challenges. Equally, the increased pressure on the world's land, water and natural resources, climate change, biodiversity loss and socio-economic inequality make finding solutions to these challenges all the more urgent.

It is in bringing people together to co-create these solutions that NGP's greatest value lies. In the early days, the platform consisted of a small number of people focused on the technical aspects of responsible plantation management. Over the years, NGP has opened up, and brought people together through its study tours and events to share their knowledge, experience and views, to listen to and learn from those of others.

This has expanded the range of stakeholders in the NGP "landscape". Today, our vision for the future of NGP is to evolve as an "Ecosystem of Collaboration", linking different organizations locally and globally, inspiring ideas and mobilizing collective action. This is how we intend to scale up our impact, without growing in size, and remaining agile enough to continuously adapt the way we work to meet changing challenges.

In an increasingly complex world of limited resources and volatility, fundamental changes are required in production models, business paradigms and governance. Isolated efforts simply won't be enough. Organizations must develop a strong ecosystem of partners stretching across their stakeholder landscape, and develop creative strategies to harness and leverage the skills and talents of interested outsiders. Developing relationships, cross-cultural empathy and building networks, in the real world and through social media, are all important ingredients of this.

NGP will continue setting up dedicated teams in all these areas, to build and provide expertise, to make the links between NGP participants and others in the ecosystem, and to form collaborations with other open, flexible partners. Most of all, we will continue to provide a safe space, where people and organizations from different backgrounds, with different interests, trust each other to develop common understandings and co-create solutions.

I envisage a New Generation Plantations Ecosystem of Collaboration that is diverse, fluid, networked and far-reaching, fostering collaborations that are:[94]

Aligned – with one another and with broader agendas for change, so we can find our place in relation to larger goals and frameworks. This will allow us to make the most significant contributions we can, while avoiding unnecessary competition or replication.

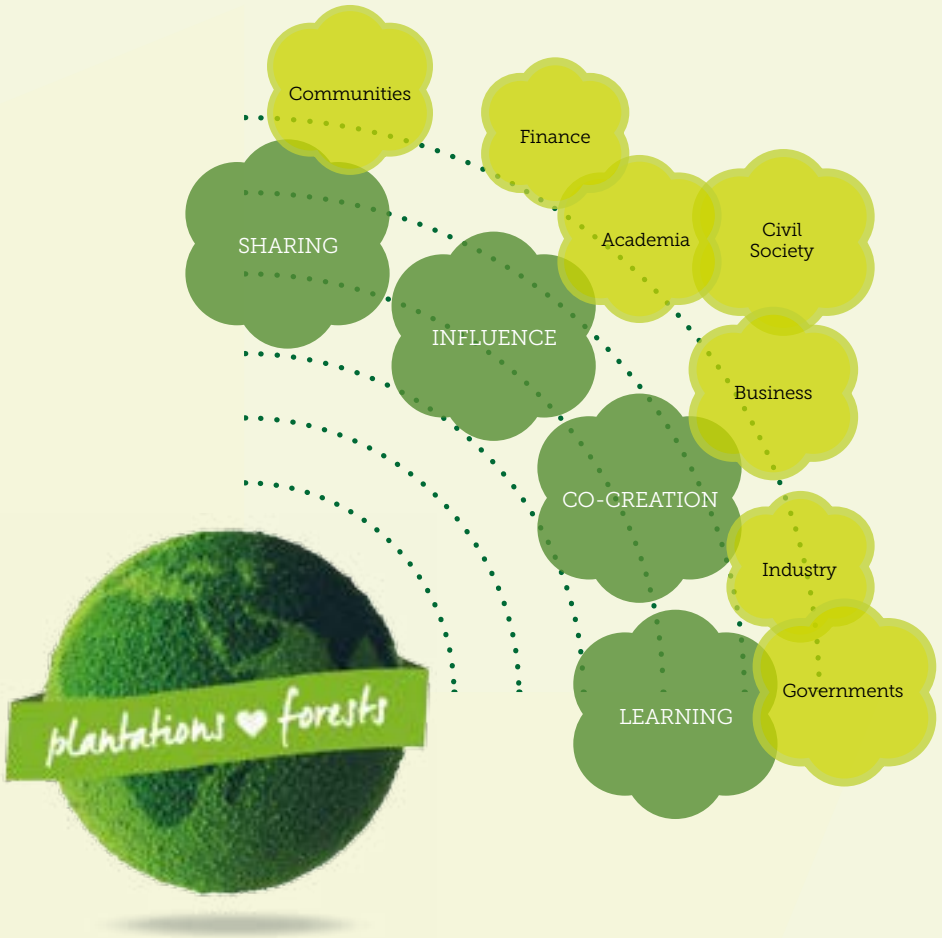
Flexible – able to move quickly, actively experiment and adapt to continually changing circumstances. This means focusing on the skills and techniques that enable effective collaboration and innovation – like relationship-building, continuous communication, brainstorming and the freedom to fail.

Practical – we will encourage collaborations that make a difference on the ground, and don't get bogged down in bureaucracy. Collaborations need to be able to form and dissolve easily, so partners don't lose sight of what they really intend to accomplish. Openness, improvisation and surprising discoveries are all welcome.

Visionary – collaborations should demonstrate collective leadership, see the larger system, foster deep reflection, and help shift focus toward positive visions of the future and the means to get there.

By developing and applying these skills, NGP can help to catalyse ambitious systemic changes and make a positive contribution to people, planet and prosperity at a greater scale than ever.

Figure 9. NGP Ecosystem of Collaboration



Our legacy for future generations

The need for the NGP approach has never been greater. A year after NGP's inception in 2007, we witnessed the collapse of Lehman Brothers – a global turning point that accelerated a global cycle of changes and uncertainty. Populism, protectionism, nationalism and intolerance are on the rise.

Lamentably, this is no great novelty in the world of forestry. The forest sector provides fertile ground for fancifully simplistic solutions. Wood is widely promoted as an environmentally friendly, renewable raw material, yet many people simultaneously decry intensive forest management and silviculture. Plantations are the perfect scapegoat: "green deserts" are an easy concept to communicate, harder to counteract with the more nuanced reality. Equally, though, forestry companies have, at times, resembled out-of-touch elites with little understanding of the struggles of the poor and the dispossessed. As long as different sides remain in their own echo chambers, little progress can happen.

If we are shy, we are dead: NGP has the obligation to be courageous to stand for its values and be bold about it. We've embraced the uncertainty and complexity of our times, developing an approach based on science and facts, and creating a safe space where different viewpoints can be heard, and mutual understanding and co-creation happen.

In 2017 and beyond, let us be champions of our core values of tolerance, diversity and equality, let us deepen our networking and devote ourselves to multilateral cooperation with renewed vigour. This is essential if we're to face up to the 21st century's most urgent planetary challenges on poverty, biodiversity, water, soil and climate.

In a world of finite resources and growing demands, new generation plantations can provide the ecological infrastructure to build a green future. A future where well placed and managed plantations provide opportunities and value for people living alongside them, opportunities to restore degraded ecosystems and build resilience, opportunities to increase the supply of renewable raw material while sparing natural forests. Success will depend on how intelligently and sensitively we integrate a mosaic world of different cultures and values, where areas for agriculture, industry, forestry, infrastructure and cities coexist with nature.

Only together can we plant hope for future generations.

Children in Laos: a third of the country's population is under 15.

ONLY TOGETHER CAN WE PLANT HOPE FOR FUTURE GENERATIONS.

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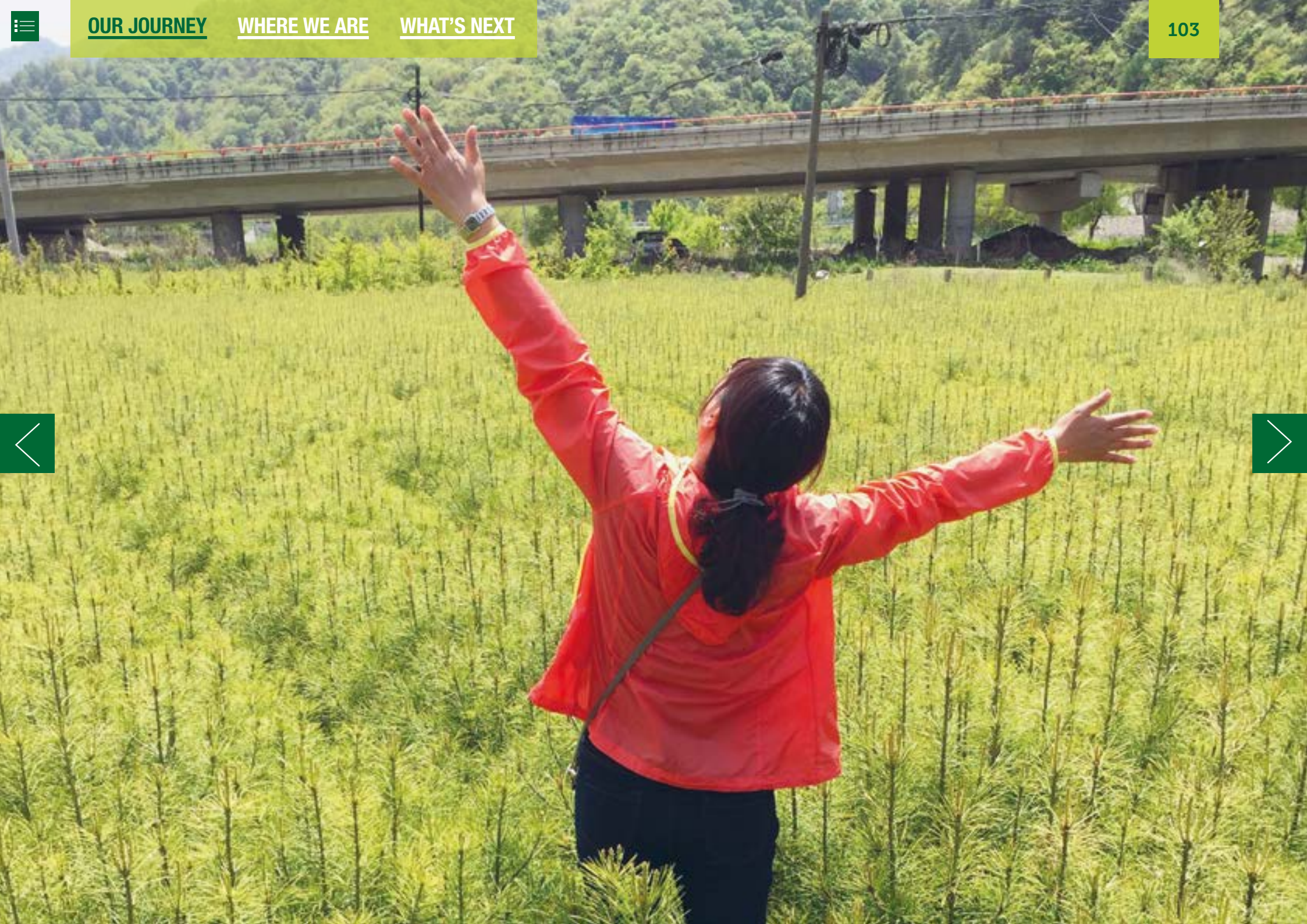

New Generation Plantations are forest plantations that:

- maintain ecosystem integrity
- protect and enhance high conservation values
- are developed through effective stakeholder involvement processes
- contribute to economic growth and employment.

www.newgenerationplantations.org