CHAPTER 3

Forest Plantations in Central Africa

Coordinators: Paul Bertaux,[1] Carla Baltzer[1]

Authors: Paul Bertaux,[1] Carla Baltzer,[1] Jessenia Angulo,[2] Charlie Bosworth,[3] Pierre Clinquart,[4] Daniel Diangana,[5] Emilien Dubiez,[6] Timothy Fleming,[7] Vincent Freycon,[6] Maurice Goma,[8] Jean-Michel Harmand,[6] Michael Henson,[9] Mike Howard,[10] Shauna D. Matkovich,[11] Régis Moukini,[1] Olivier Mushiete,[12] Cléto Ndikumagenge,[13] Salvator Ndabirorere,[14] Tapani Pahkasalo,[15] Régis Peltier,[6] Robert Van Der Plas,[16] Andries Smith,[17] Colin Smith,[18] Luis Neves Silva,[19] Julius C. Tieguhong,[20] Richard Eba'a Atyi[21]

[1]FRM Group, [2]FMO, [3]Miro Forestry & Timber Products, [4]Hanns Seidel Foundation, [5]ex-ECO s.a., [6]Agricultural Research Centre for International Development (CIRAD), [7]International Woodland Company, [8]Consultant, [9]PNG Biomass, [10]Fractal Forestry, [11]The Forest Link, with International Woodland Company at the time of writing, [12]Project Ibi and Domain and Reserve of the Bombo Lumene, [13]FAO DRC, [14]FAO BURUNDI, [15]Forest Investment Professional, [16]Marge, [17]CDC, Investment Director and Head of Forestry & Wood Products, [18]Paperbark Forestry Consulting, [19]WWF - New Generation Platform, [20]African Development Bank, [21]CIFOR -ICRAF

Photo by Paul Bertaux

Introduction

> **Demand for wood is growing worldwide and this trend is set to accelerate through the remainder of the 21st century. This is the case not just for traditional markets, but for other sectors like construction (responsible for 36 percent of greenhouse gas emissions), bioenergy and green chemistry seeking to de-carbonize and go biobased in an effort to move into the emerging sustainable, green economy in which companies are located closer to their raw materials and local markets.**

This landscape offers more opportunities than threats for the forestry sector and sustainably managed wood products, which are carbon neutral by nature. But to harness these opportunities, the sector must be prepared to adapt, to rise to the challenges it faces and to fundamentally change the way it operates.

Globally, the gap will widen between the production capacity of natural forests – whose size and productivity are inherently limited – and different types of forest plantations.

Countries will therefore only be able to maintain their status as forestry economies (i.e. the sector accounts for a significant share of GDP) if they take decisive steps to develop their plantation activities. Much more generally, it would be a grave strategic error to assume that any sector could continue with business as usual in the coming years.

This chapter of the latest edition of the State of the Forests of Central Africa focuses on forest plantations and agroforestry plantations intended for production. It does not discuss assisted natural regeneration, enrichment plantations or agro-industrial plantations (e.g. palm or rubber).

Forest plantations are human-made forests grown from seeds or saplings for the purpose of producing wood or non-timber forest products (production plantations) or for boosting various types of ecosystem services (protection plantations).

The term 'plantation' covers a broad continuum of techniques and situations, tailored to the specifics of the local context.

There are usually seven stages to the production of timber or biomass from a plantation: seeds/nurseries, planting/establishment, tending/management, harvesting and one or more stages of processing, transportation and marketing.

Jobs and wealth are created at each node of the supply chain and costs are incurred. Various actors work at the different nodes, whether in a specific node or across the different nodes depending on a range of factors relating to: the legal/policy environment and institutional arrangements, support services, extension agents, service providers, inputs and financial institutions.

3.1 Situation analysis of plantations in Central Africa

3.1.1 Policy measures and the role of the state

Given the diversity of national contexts, legislative provisions on plantation forestry vary significantly across Central Africa, both in terms of their content and how they are implemented. It therefore remains difficult for governments to agree common or harmonized rules on forest management.

3.1.2 Forest plantation size in Central Africa

Forest plantations in the subregion tend to be very small, both in terms of area and production volumes. Updated figures on the size of forest plantations in Central Africa are presented in Table 3.1.

Table 3.1: Forest plantation size in Central African Forest Commission (COMIFAC) countries

Country	Area planted (ha)	Source
Cameroon	30,000	Atyi and Mbonayem (2018)
Gabon	46,800	Bayol et al. 2010, no notable change
Equatorial Guinea	13	Bayol et al. 2010, no notable change
Central African Republic	3,900	Fonds de Développement Forestier [Forestry Development Fund] 2020 + Communication from South-West Regional Development Project (PDRSO) 2020 + Communication from CentraForest 2020 (unpublished data from the FRM engineering database, updated 2022)
Democratic Republic of Congo (Kinshasa supply basin)	30,000	Unpublished data from the FRM engineering database, updated 2022
Republic of the Congo	74,500	Briefing Note on EU-ROC FLEGT VPA, 2010 + Communication SPF2B 2020
Rwanda	301,500	Nduwamungu 2011
Burundi	146,000	Nduwamungu 2011
Chad	-	No data
Sao Tome and Principe	-	No data

3.1.3 Case study on forest plantations in the Republic of the Congo

Development of clonal eucalyptus plantations in the Republic of the Congo: 1950–1996

A number of scientific innovations were made in the Eucalyptus subsector in the 1950s to respond to the need for fuelwood in Pointe-Noire, which was in the midst of a boom. For instance, the National Office for Forests established plantations using *Eucalyptus terticornis*, the product of joint forestry research between France and the Republic of the Congo (yield = 7 m^3/ha/year).

From 1963 to 1986, the Congolese Industrial Afforestation Unit (UAIC) planted 25,000 ha with these two natural hybrids (yield = 12–20 m³/ha/year). From 1989 on, Congolaise de Développement Forestier (CDF), a subsidiary of Shell, funded UAIC to establish 17,000 ha of clonal plantations in Pointe-Noire. The plantations grew to cover 42,000 ha.

The growth of a subsector with ECO s.a.: 1997–2001

In 1997, CDF merged with UAIC to create the company ECO s.a. (Eucalyptus du Congo s.a.). The company was active until 2001, with Shell as the majority shareholder and the Congolese Government as the minority shareholder.

By 2001, ECO s.a. was a major economic player in the Republic of the Congo, employing 3,500 workers and generating a turnover of around XAF 15 billion.

When the price of wood fell, ECO s.a. ran into financial difficulties. Its performance was unsatisfactory and bioenergy – Shell's real strategic target – was a long way from making its breakthrough, costing USD 20 per barrel.

Shareholders over time and the uncertainty of the subsector: 2001–2018

In June 2001, Shell exited ECO s.a. The Congolese Government took over Shell's shares for a symbolic amount and continued to honour the sales contracts agreed and complete replanting programmes while seeking another private sector partner.

The plantations in Pointe-Noire, some of which are in peri-urban areas, were threatened by problems linked to urbanization, leading to persistent illegal logging affecting almost 10,000 hectares. A presidential decree designating areas for reforestation in the department of Kouilou somewhat alleviated the situation, which had been exacerbated by the fast growth of the city of Pointe-Noire. In 2005, the South African group Chartwell Carbon Ltd, replaced soon after by Canadian group MagIndustries, signed a long-term lease with the Republic of the Congo for a concession covering the 40,000 ha previously held by ECO s.a., 7,000 ha from the National Reforestation Service (SNR) and 20,000 ha from the extension zone.

Eucalyptus Fibres Congo (EFC) was created to manage these 70,000 ha and positioned itself on the woodchip market given that there was little profit in prepared logs. Poles were still harvested from pines in Loudima (200 km from Pointe-Noire), but transporting them to the port in Pointe-Noire by rail was difficult and the road impassable. An XAF 16 billion woodchip factory was built in 2008 in the port, with an annual capacity of 500,000 tons. The Republic of the Congo is the first sub-Saharan African country to have a factory of this type.

Weakened by the 2008 global economic crisis, which disrupted the international wood and wood products market, EFC was not able to get back on its feet.

At the end of 2011, the Chinese Evergreen Holdings Group became the majority shareholder of MagIndustries, and EFC subsequently ceased almost all its operations until the groups' departure.

At the end of 2016, the government signed a new long-term lease with the Moroccan group SOS NDD, which withdrew due to a lack of financing in 2017. Finally, Romanian group ZEBRA TESAF CONGO took over the 25,000 ha southern section of the forest in 2018, but little is known about the company's strategic intentions.

New developments with COFOR in Madingo-Kayes

In 2019, a long-term lease was signed between the Republic of the Congo and the company COFOR, a Congolese subsidiary of the French FRM group, covering almost 38,000 ha. This area forms the Madingo-Kayes Reforestation Area (PRMK) and comprises 8,000 ha of eucalyptus plantations, 6,000 ha of extension zone, natural forests and protected areas.

Due to the degraded state and advanced age (10 to 30 years) of the eucalyptus plantations, it is necessary to implement several replanting and forest restoration strategies aligned with different strategic objectives.

The PRMK forest management project led by COFOR has a number of objectives:

- Regenerate the underdeveloped area around the plantation – where unemployment and rural depopulation take a heavy toll – by creating jobs on the plantations and increasing agricultural production within those areas assigned to agroforestry;
- Reduce the deforestation and degradation of natural forests with a high biological value, which is mainly caused by shifting agriculture, wildfires and forest fires, and the production of charcoal from illegal wood;
- Offer an alternative source of charcoal and timber, from sustainably managed plantations;
- Support climate change mitigation efforts by dynamically managing plantations to sequester CO_2 and by reducing the risk of forest fires.

The strategy for managing the forest is geared towards a multifunctional mosaic plantation made up of geographically coherent blocks organized into several new forests, nature reserves and agroforestry areas.

New forests will be grown or regrown by implementing afforestation, reforestation and agroforestry techniques using different species (*Acacia auriculiformis* and *mangium, Eucalyptus* UxG and PF1).

The commercial products produced by these forests are destined mainly for the local market (including fuelwood in the form of charcoal, timber in the form of veneer, plywood, engineered timber and electricity poles, and food crops).

In 2020, COFOR launched a preliminary pilot to establish a tree nursery and an initial acacia agroforestry plantation. Implementation was delayed by the outbreak of Covid-19 and did not take place until 2021.

The PRONAR and SNR plantations

In addition to the forests described above, tens of thousands of hectares have been planted across the Republic of the Congo by the National Reforestation Service (SNR) and the National Afforestation and Reforestation Programme (PRONAR), which now manage them. PRONAR is a robust policy initiative by the Government of the Republic of the Congo to launch, support and develop different types of plantations.

It aims to promote forestry and agroforestry plantations, to encourage and support stakeholders to undertake afforestation and reforestation to supply national and international markets with timber and non-timber forest products (such as essential oils, resins, biofuels, honey, fruits, vegetables and medicinal plants).

It seeks to relieve human pressure on natural forests by reducing deforestation, to develop land not suited to crop or animal farming, and to improve the country's supply of wood for manufacturing, construction, energy and industry. Feasibility studies for the programme were conducted with the support of international partners (World Bank and FAO). It aims to plant over 1 million ha of forest by implementing a range of components intended to mobilize public and private sector actors and rural communities (Lignafrica 2014).

Lessons learned

In contrast to the industrial success observed in South America and South Africa, which use similar technologies, the plantation forestry subsector has not grown as expected in the Republic of the Congo. This is the case despite the succession of managers, the large areas planted, high yields, the Congo's world-renowned experience in the sector (plant material, research and development, local know-how) and the proximity of the forests to the port of Pointe-Noire.

Table 3.2: Distribution of forests across the three PRONAR components

PRONAR objective	1,000,000	ha (plantations + infrastructure)
% infrastructure (tracks, firebreaks, etc.)	15%	
Area actually planted/productive	850,000	ha planted/productive
Areas not suitable for planting (protection, human occupation, etc.)	30%	
Area required to be allocated to PRONAR (with land title)	1,300,000	ha with a land title
Component 1: Industrial forest plantations	50%	
	425,000	ha planted/productive
Short-rotation plantations (for industry/fuelwood)	80%	
	340,000	ha planted/productive
Medium-rotation plantations (timber)	20%	
	85,000	ha planted/productive
Component 2: Agro-industrial plantations	40%	
	340,000	ha planted/productive
Component 3: Rural agroforestry plantations	10%	
	85,000	ha planted/productive

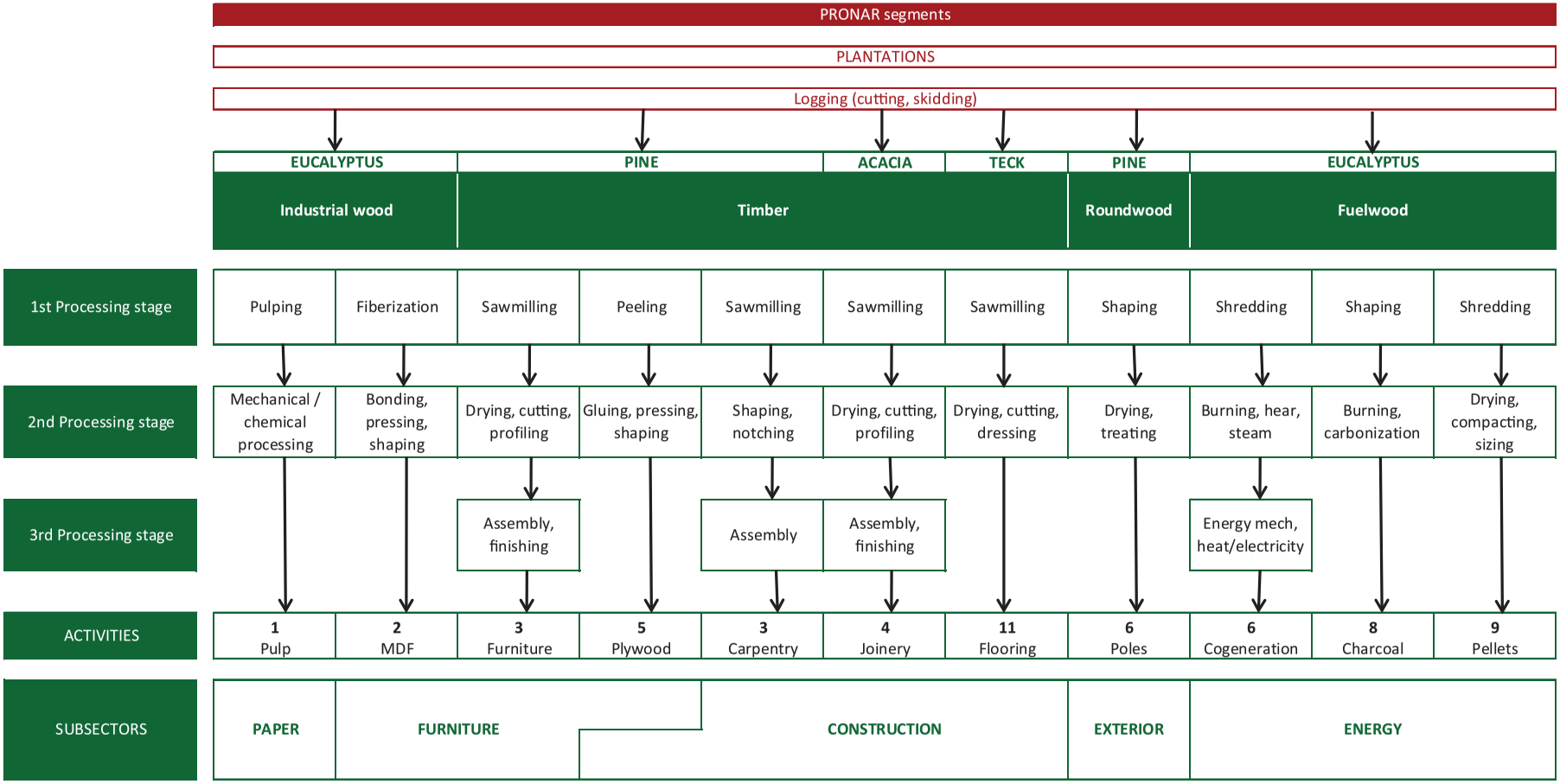
Source: Lignafrica 2014

The markets and subsectors are shown in the figure below.

This situation can be explained by:

- Proximity to a city that has doubled in population size over 15 years (600,000 to 1.2 million inhabitants);
- Insecure land titles, an issue partially resolved by a presidential decree following long disruptions;
- The lack of genuine product diversification and high dependence on the paper manufacturing sector, which has become very concentrated and highly competitive;
- The lack or absence of industrial strategies on the part of various investors over the years. The withdrawal of Shell, which had many similar companies in its portfolio, was not directly tied to the context in the Republic of the Congo, but was rather a consequence of the strategic decision to exit the biomass energy segment, which was deemed too new in 2000.

Table 3.3: Possible processing subsectors for different types of plantation using the example of PRONAR, Republic of the Congo



Source: Lignafrica 2014

Box 3.1: A 40,000-hectare plantation project led by Total and FRM has recently launched in the Republic of the Congo within the framework of PRONAR

In March 2021, within the framework of PRONAR, the Republic of the Congo signed a partnership agreement with Forest Neutral Congo (FNC), a subsidiary of the FRM group, and Total Nature Based Solutions (TNBS), a subsidiary of the Total group, for the implementation of a large-scale afforestation project on the Batéké plateau, to the north of the Léfini River, 250 km from Brazzaville.

The 40,000-hectare forest will form a carbon sink that will sequester more than 10 million tons of CO_2 over 20 years and will be certified to international standards. The initiative, financed by Total, includes agroforestry farms (charcoal production and crop farming) and a carbon sink, with timber production, offering social, economic and environmental benefits.

Planned to run until 2040, it will employ the selection cutting system to promote the natural regrowth of local species and supply Brazzaville and Kinshasa with sawnwood and plywood.

The 50,000-hectare property will comprise:

- 15,000 ha of infrastructure and protected areas, allowing sites with high biological value and patches of natural forests (gallery forests, slope forests) to recover and even expand in buffer zones.
- 2,000 ha devoted to the agroforestry component with crops (cassava, etc.) grown between rows of acacia trees by local farmers.
- 38,000 ha planted over 10 years under the carbon component, which combines carbon sinks and timber production. Over 20 years, 10 million tons of CO_2 will be sequestered and the growth will then be harvested annually and processed into timber. This forest will supply 160,000 m3 of wood per year for processing into three products: sawnwood, veneer and plywood. A biomass cogeneration plant will also be supplied with wood waste for electricity generation (and heat for drying) for nearby industrial facilities and villages.

For more information see: https://www.makanisi.org/congo-une-foret-de-40-000-ha-dacaciasa-vocation-ecologique-et-agro-forestiere/?fbclid=IwAR0IySsogN63T0sGoK2_0UeGpJ6hWB5C 6fGWTzc5dnAmQcEvijBwexnCTdE

With nearly 50 years of experience, a unique industrial heritage and large areas of savannah land available (few farms and few inhabitants), the Republic of the Congo has immense potential for the development of plantations.

The monospecific, single product/market-oriented planting model, which prevents the land being used for other purposes, has also shown its limitations. Highly inclusive models that involve local people (beyond basic silvicultural operations) and target a range of markets, including local markets, are a much more promising, resilient and effective option, given that they are capable of generating multiple revenue streams from locally processed products simultaneously.

The end of the globalized, highly concentrated and specialized fossil fuel model is set to disrupt economic activity and many industrial sectors. It offers many opportunities for local models that are integrated with modestly sized industrial hubs, located precisely at the source of decarbonized resources and serving mainly local markets.

3.1.4 The acacia-cassava agroforestry system developed in DRC

Agroforestry

Agroforestry combines the time and/or space dedicated to trees with crops and/or livestock (agro-sylvo-pastoralism) by optimizing the agronomic, ecological and economic synergies between the various components of the system. It has several benefits:

- It enriches the soil with organic matter and nutrients;
- It regulates and ensures the availability of water;
- It protects against erosion;
- It acts as a windbreak and shades crops;
- It increases biodiversity;
- It diversifies revenue streams.

Among the many agroforestry models currently available, the 'sequential' agroforestry system (also called 'cyclical', 'productive tree fallow' or 'Taungya'), as opposed to the 'permanent' agroforestry system, has become the dominant model in Central Africa.

Box 3.2: Problems related to slash-and-burn agriculture and the demand for charcoal on the Batéké plateau

Shifting agriculture on cleared and burned land is the predominant model in Central Africa, whether in forested or savannah areas. It is relatively productive for a few years, but soil depletion drives farmers to move on to new land. This practice, together with the concomitant production of charcoal, is the main driver of deforestation.

On sandy savannahs, it delivers only modest yields for 1 to 3 years, following which a fallow period of 5 to 10 years is needed to allow the soil to slowly recover.

The Batéké plateau is made up of sandy savannahs fragmented by valleys, many of which are lined by gallery forests. They cover 12 million hectares from south-eastern Gabon to north-eastern Angola, on both sides of the Congo River north of Brazzaville and Kinshasa.

This ecosystem is characterized by a complex mosaic of savannah and forest. The consequences of slash-and-burn agriculture and charcoal production to supply the two capitals are dramatic, both for the equilibrium of the forest and for the food security of rural populations. Indeed, Kinshasa requires 2.14 million tons of charcoal each year (Dubiez et al. 2022) and Brazzaville more than 100,000 tons.

The acacia-cassava agroforestry system developed in Mampu

To meet the high demand for charcoal from Kinshasa, an innovative agroforestry system was designed and deployed on the Batéké plateau in the DRC in the 1980s, as part of the Mampu project. This system combined Australian acacias (*mangium* and *auriculiformis*), which have a natural capacity to enrich the soil and high-quality wood, with cassava, the main food crop.

Under the supervision of the Hanns Seidel Foundation, this agricultural system, which performs well on poor savannah soils, was deployed over 8,000 hectares between 1987 and 1993 with the voluntary settlement of indigenous farming families from the wider region. The plantations were then divided into 25-hectare farms and allocated to independent farmers between 1995 and 2001.

Sequential agroforestry

In sequential agroforestry systems, the crops (cassava, maize, peanuts, market garden produce, etc.) are planted at the same time as the acacia trees. They benefit from the way the land is prepared for planting (clearing and ploughing) and are farmed for the first two years in the spaces between the rows of trees.

Acacia can be mixed with other trees, local species (*Maesopsis, Pentaclethra, Milletia, Afrormosia, Terminalia*) and even fruit trees. Beekeeping can also be introduced into this agroforestry system.

From the third year, the plantation enters the 'productive tree fallow' phase for 5 to 6 years until the trees are harvested.

A new agroforestry cycle then begins on the loosened soil, which is naturally weed free and enriched with nitrogen and organic matter, without the use of chemical products. The acacias are regrown by replanting or using controlled burning to activate dormant seeds present in the litter. Food crops are replanted between the rows of trees.

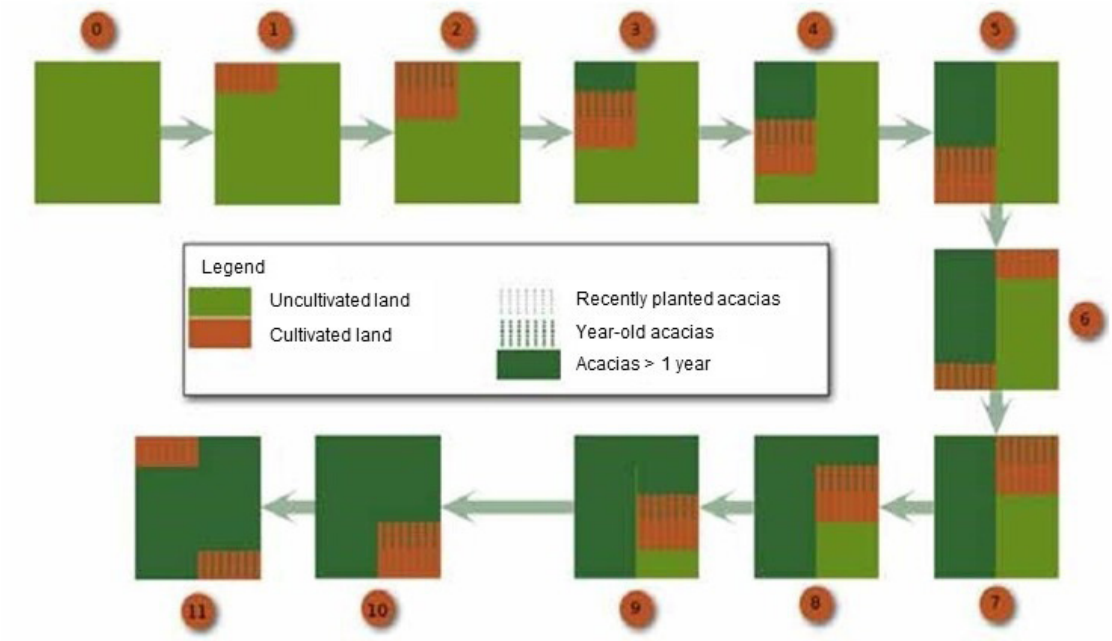


Figure 3.1: Diagram of the sequential agroforestry cycle (Boldrini et al. 2017)

Figure 3.2: Comparison between productive tree fallow (agroforestry) and traditional bare fallow

Source: Paul Bertaux, FRM

Subdividing agroforestry estates into the same number of plots as years of the harvest cycle (for example 8 plots) has the benefit of ensuring that both food (1 to 2 out of 8 plots) and forest products (1 out of 8 plots) are both produced every year.

The tree fallow system offers an effective alternative to the traditional bare fallow system in savannah areas. The period of natural soil restoration (but with regular burning) required by the latter is replaced by a productive period of tree growth that accelerates the enrichment of the soil with organic matter and nitrogen.

Lessons learned from Mampu

The Mampu agroforestry system has proven effective. Three hundred farming families have been living on 25 hectares of acacia trees each for 20 years now, in a plantation zone that is home to several thousand people centred around a residential and commercial hub.

One reason for the project's success is the incorporation of traditional slash-and-burn practices into the agroforestry system, allowing for the natural regeneration of the acacia trees. This technique, which farmers know well, has facilitated the adoption and therefore the sustainability of this agroforestry system.

The Mampu project also has a major environmental dimension in that it replaces charcoal obtained via illegal logging – a major driver of deforestation around Kinshasa – with charcoal from sustainable plantations. Twenty years after the establishment of the plantation, Bisiaux et al. (2009) estimated that the area produces around 10,000 tons of charcoal annually, 10,000 tons of cassava, 1,200 tons of maize and various non-timber forest products, including 2 tons of honey.

With an annual turnover of 10 percent of its initial investment, the project has also demonstrated its economic viability and its positive impact on social development. Mampu is now an autonomous peasant farming system. It does not rely on funding or support from international donors and stands as a valuable example in the field of agroforestry.

The success of this agroforestry system has encouraged international donors and technical cooperation bodies to promote it across the Congo Basin.

The Ntsio agroforestry project

The Ntsio project ('savannah' in the Teke language), implemented by the Hanns Seidel Foundation 200 km from Kinshasa, has incorporated the recommendations from the institutional, technical and sociological reports on the Mampu project:

- Resolve the issue of customary claims over the land by obtaining a ministerial subdivision order that sets out the conditions for acquiring the land;
- Consider whether there is a water source in the area suitable for the implementation of an agroforestry project;
- Reduce the size of the areas assigned to farmers.

The Ntsio project covers 5,500 hectares comprising 260 17-hectare agroforestry farms and the infrastructure required by the participating associations (covered meeting area with an office, warehouse and water tower), materials for which come from timber plantations (mainly *Eucalyptus sp.*).

The project area is served by a water supply network. In addition to increasing farmers' ownership of irrigation activities and maintenance, this infrastructure has allowed for the establishment of a central nursery (1 million plants/growing season, up to two seasons per year, diversification of plantations with *Pinus sp., Eucalyptus sp., Maesopsis,* palm trees, etc.).

Farmers are grouped into four associations, which hold land titles over the project area, monitor compliance with operating standards for the farms and coordinate the community's management of the infrastructure and the sale of the goods produced.

Economic performance, challenges and opportunities

In Ntsio and Gungu, average incomes are around USD 2,600/ha at the start of acacia harvesting, equivalent to USD 200/month. It is estimated that Mampu and Ntsio each produce about 1 percent of the charcoal required by Kinshasa.

Cassava yields have also increased due to wider adoption of improved varieties. The introduction of cereals and legumes to the agroforestry system is currently under way.

Table 3.4: Estimated average incomes per hectare from the first round of acacia farming

Product	Yield (t/ha)	Local selling price (USD/kg)	Income (USD)
Charcoal	10	0.1	1,150
Maize	0.6	0.2	150
Cassava (cossettes)	3.2	0.2	800
Cowpea	0.3	0.3	100
Honey*	0.1	4	400
TOTAL			**2,600**

* From five hives at a rate of 20 kg of honey per hive

Source: Hans Seidel Foundation database, 2021 (data provided by author Pierre Clinquart)

Encouraging producers to plant acacias in cultivated areas is an effective way to gradually convert farms to this system. The creation of sustainable resources through agroforestry encourages the rural population to organize and manage their local environment. This opens up opportunities for rural people, discouraging rural depopulation and reversing the trend of the city feeding the countryside.

The Ibi Batéké agroforestry carbon sink (PCIAB)

Based on the same agroforestry model, the Ibi Batéké agroforestry carbon sink (PCIAB) was established in 2008. In 2015, it produced nearly 500 tons of cassava tubers, 100 tons of maize and almost 900 tons of makala (charcoal) annually on 80 hectares of land.

These activities employ 900 workers on a daily basis and provide 1,200 indirect jobs throughout the value chain.

Table 3.5. Overview of the Ibi Batéké agroforestry carbon sink

Plantation area	1,500 ha	
Plantations recognized as a 'carbon sink'	800 ha	
Carbon stock officially reported to the UNFCCC in 2020 (Tariff = 4 USD/tCO2)	46,700 tCO_2	
Area of forest logged each year for the production of sustainable green makala	900 t	
Average annual production	Cassava (fresh	500 t
	tubers)	500 t
	Maize	100 t
Number of jobs (daily)	Makala	900 t
	Direct jobs	(±900)
	Indirect jobs	> 1,200

Source: PCIAB internal database

Scaling up the Batéké Plateau Ecological Corridor (CEBAT)

The Mampu, Ntsio, Gungu and Ibi Batéké agroforestry carbon sink programmes cover a total of almost 18,000 ha of plantations across a very large area.

At the end of 2020, the Congolese Institute for Nature Conservation (ICCN), DRC, resumed its the activities in the Bombo Lumene Game Reserve in the province of Kinshasa. This initiative opens up new opportunities through the implementation of a large-scale sustainable community-based agroforestry project. The project builds on previous models and aligns with the fundamental principles for the management and conservation of protected areas set out under Congolese law.

In this context, a public-private partnership bringing together ICCN, scientific partners and the sponsors backing the Ibi Batéké agroforestry carbon sink is in the process of launching the Batéké Plateau Ecological Corridor (CEBAT).

This initiative aims to establish a protected area covering 3.5 million hectares, stretching from the Angolan border at an altitude of 1,000 m to the northern edge of the Kwamouth Territory (Mai-Ndombe province) at an altitude of less than 400 m. It will directly impact nearly 18 million people.

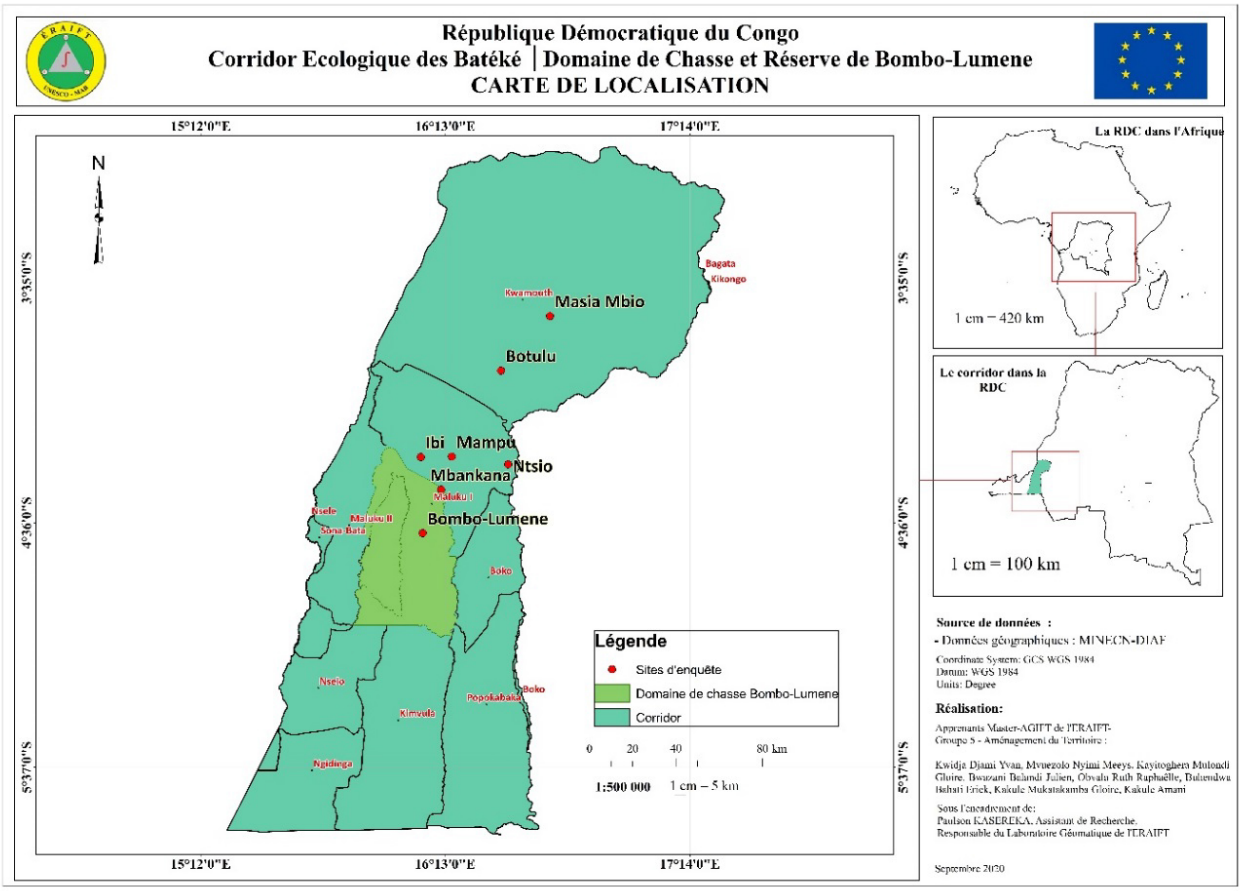


Figure 3.3: Location of the Batéké Plateau Ecological Corridor (CEBAT)

Source: Regional Post-Graduate Training School on Integrated Management of Tropical Forests and Lands (ERAIFT)

The Bombo Lumene Game Reserve is located in the centre of the Batéké Plateau Ecological Corridor and will link nearly 300 villages within the 'Mboka Mayele' network. The project aims to create tens of thousands of jobs. Investments will focus on agroforestry programmes, processing agricultural and forestry products and strengthening basic social and economic infrastructure.

The Batéké Plateau Ecological Corridor is designed to create a green bulwark against the human pressure exerted by Kinshasa and, in 2021, ICCN and its partners began the process of registering the Batéké Plateau Ecological Corridor as a UNESCO World Heritage Site.

Carbon impact

Acacia agroforestry plantations create carbon sinks based on two components:

- The permanent stock of the plantations, on harvest cycles of 8 years to more than 20 years depending on the cycle and markets chosen (charcoal, bioenergy, timber);
- The annual replacement of wood, which would otherwise come from unsustainable illegal logging, deforestation or trees from natural forests, with sustainable plantation wood.

This dual benefit can be used to generate carbon credits once a project has been certified to carbon standards that guarantee a project's concrete environmental benefits. Certification then makes it possible to capitalize on the environmental services delivered by a project in the form of payments for the amount of CO_2 sequestered.

Box 3.3: Factors affecting the agricultural sustainability of the acacia-cassava model

Emilien Dubiez, Vincent Freycon, Régis Peltier, Jean-Michel Harmand (CIRAD)

Fallow land planted with acacia has proved to have high productive capacity over relatively long periods. Remarkable results have been achieved on plateaus characterized by sandy, acidic and very nutrient poor soils with a very low water retention capacity (Kasongo et al. 2009).

Nevertheless, although this method represents real progress and avoids vast areas of forest being destroyed by slash-and-burn agriculture, Dubiez et al. (2018) found contrasting changes in the chemical composition of the soil after 22 years of farming using the Mampu acacia agroforestry system.

Soils under this system had higher levels of carbon and nitrogen as a result of nitrogen fixation by the acacia trees, but were more acidic and had lower levels of exchangeable bases (calcium, magnesium, potassium and sodium) than the original savannah soils.

The depletion of the mineral content of the soil over the 22-year period, for all acacia management models (unlogged plantations, one or two harvest cycles of acacia and food crops), can be explained by the transfer of cations from the soil to the plants and their removal when the products are harvested.

To rectify soil acidification, the depletion of exchangeable bases and the general decline in the productivity of the system, it is necessary to propose new practices and study their impacts on the chemical composition of the soil.

The undesirable effects observed could be reduced by removing the bark from trunks before carbonizing the wood, returning small branches to the ground and adding natural phosphate rocks or liming.

These preliminary findings suggest that further studies are needed to improve the techniques used to manage *A. auriculiformis* stands and increase the sustainability of the system by managing soil fertility more effectively.

Forest carbon is primarily traded on voluntary carbon markets. The Verified Carbon Standard (VCS) is one of the most widely used standards on voluntary markets, with nearly 1,800 projects certified in 2022. This corresponds to sequestration or emissions reductions equivalent to 468 million tons of carbon.[1] Once a project has been certified and verified according to the rules and requirements of a standard, it can receive carbon credits (Verified Carbon Units or VCUs).

In DRC, the Ibi Batéké agroforestry carbon sink is the only project registered under the UNFCCC Clean Development Mechanism. The 2020 Ibi Batéké carbon sink verification report (experts commissioned by the World Bank) approved a final stock of 46,700 tCO_2 over an area of 800 ha (58.45 tCO_2/ha). The 2009 greenhouse gas emission reductions agreement between the World Bank and the sponsors of the Ibi Batéké carbon sink project provides for a fixed payment of USD 4/tCO_2

1 https://registry.verra.org/app/search/VCS

on the basis of temporary credits, valid for 5 years. Carbon payments also go to local family-run agroforestry farms, which have recently organized into cooperatives, such as the Cooperative and Economic Interest Grouping of the Teke Territory, which was established in 2015 with the direct involvement of customary chiefs.

The Ntsio project, for its part, did not initially plan to go as far as trading the carbon it sequestered. Internal studies have shown that producer communities do not have the know-how for carbon trading, both in terms of their technical and administrative capacity. It may however be possible through a specialized third-party organization, depending on the standard chosen, the target market and changes in the market value of carbon. While there are plans to register the project with DRC's REDD unit to lay solid foundations for Ntsio to pursue carbon trading, this has not yet been done.

3.1.5 Case study on forest plantations in Burundi and Rwanda: Complexity and complementarity of stakeholders and management methods

The history of plantations in Burundi

As early as 1907, Burundi was described as a degraded landscape without many plantations. In 1933, the authorities decided to implement legal measures to protect the last remaining fragments of forest.

Fifteen years later, the Burundian forestry sector had grown significantly: the forested area had reached around 90,000 ha, with 40,000 ha of tropical montane forest, 25,000 ha of savannah woodland and gallery forests, 20,000 ha of artificially afforested land and 5,000 ha of trees outside forests (FAO 1999).

In 1978, following increasing pressure on natural forests and timber shortages, Burundi, supported by donors, launched a vast reforestation programme to ensure the supply of timber and reforest denuded ridges. Between 1978 and 1992, the country's forest cover increased from 3 percent to 7 percent (from 25,428 ha to 146,000 ha). More than 30,000 ha were decimated during the crisis of October 1993.

In 2010, plantations occupied 146,055 ha, where 66 species were grown, 52 percent of which were for sawnwood and 48 percent for fuelwood. The species used were mainly fast-growing, multipurpose and low-cost exotic species in protection plantations, such as: *Eucalyptus sp.* (36 percent), *Grevillea* (3 percent), *Pinus sp.* (15 percent), *Callitris calcarata* (30 percent), other softwood (10 percent) (Nduwamungu 2011).

Main challenges

Plantation forestry is tied to a number of socioeconomic and environmental challenges:

- In a country like Burundi with a population density of more than 400 inhabitants per km², **the availability of forest resources for multiple uses** remains a major issue. The biggest challenge is finding species that meet different needs, such as for fuelwood, livestock feed and watershed protection.

- **Strengthening the role of forest plantations in soil protection** to prevent sediment runoff and improve carbon storage.
- **Dependence on fuelwood**, which is mainly used in rural areas (76 percent of national consumption). The diversity and complexity of the stakeholders involved is a major challenge. Owners of afforested areas (the state, municipalities, private sector), coal miners, transporters, wholesalers and major consumers (bakeries, restaurants, etc.) do not coordinate and operate without a framework for consultation.
- **The impact of internal and external migration on plantations**. Successive wars and sociopolitical unrest in Burundi have caused massive flows of refugees and internally displaced persons. This takes a heavy toll on plantations, given that these people tend to take refuge in state or communal forests and protected areas, near Lake Tanganyika for its rich fish resources, in the Rumonge and Nyanza region for its fertile land (oil palm) and on the Bururi, Kigwena and Rumonge reserves.
- **Issues related to land tenure and the promotion of private forests and agroforestry systems** linked to securing land rights.
- **Dependence on external funding allocated through the government budget and national actors** in partnership with the government. The government has committed to fund reforestation efforts in full, through the national reforestation programme 'Ewe Burundi Urambaye' ('a well-dressed Burundi' in English), thereby reducing dependence on external funding.

Gaps and opportunities

The current annual rate of deforestation is estimated at 2 percent, whereas reforestation rates remain below 1 percent (Ministry of the Environment, Agriculture and Livestock 2019).

To address these problems, Burundi should launch new research and development efforts, pilot projects on industrial value creation and assess plantations' impacts on water and soil (pines, eucalyptus).

In terms of initial and ongoing training, modules on monitoring natural and artificial forests using satellite data could be strengthened to enable degradation and deforestation to be closely monitored.

The role of the forestry sector in the implementation of the Paris Climate Agreement should be strengthened. In its Nationally Determined Contribution, Burundi committed to reduce its greenhouse gas emissions from 2016 to 2030 by increasing the country's forest cover by at least 60,000 ha at a rate of 4,000 ha/year over 15 years from 2016, and up to 120,000 ha at a rate of 8,000 ha/year (subject to conditions). By 2030, the government also aims to replace all traditional charcoal kilns and all traditional cooking stoves.

Since 2019, Burundi has financed efforts to delay land degradation through national programmes fully funded by national budgets.

This trend should be encouraged and existing efforts should be strengthened with the support of other technical and financial partners, as well as the financing mechanisms advocated by the Paris Agreement.

Box 3.4: Fuelwood in Africa today: A case study on Rwanda

Robert J. van der Plas (www.marge.eu)

In most African countries, wood still makes up a significant proportion of the energy mix, which has evolved without government oversight.

Although the consumption of electricity, gas and petroleum products is increasing, the consumption of fuelwood is not declining at an equivalent rate; indeed, firewood and charcoal remain widely used energy sources (Owen et al. 2013). Nevertheless, the increasing volume of fuelwood and charcoal purchased even in rural areas opens up opportunities for farmers and landowners to sell trees as a cash crop.

Rwanda offers a case in point. Here the strong demand for fuelwood continues unabated, even though wood from natural forests had virtually disappeared decades ago. It is relatively difficult to obtain wood from public plantations and there is very little land available for additional large-scale plantations (whether private or public) due to the high population density. Farmers saw a business opportunity in this situation and planted large numbers of trees on their land to sell to the fuelwood market.

In doing so, they compensated for the loss of natural forest and the majority of fuelwood now comes from trees planted for this purpose. However, this situation is generally poorly recognized, given that the government has recently taken steps to shut down the production of charcoal, which predominantly uses wood from purpose-planted trees. Much of the population will continue to use fuelwood as its main source of energy for some time to come, because it is still cheaper than electricity, gas or petroleum products for an equivalent energy yield. Wood from farmers' fields has a lower production cost than that from large plantations and can be obtained without having to navigate administrative barriers.

Although the government asserts that it can plant more trees on marginal land, it is unclear whether this wood will be easy to sell. Indeed, the cost per m3 is substantially higher than for wood from farmers' land. There are no reliable data on the actual production and use of fuelwood that could be used to reliably determine whether this will be a problem in the future. The supply of fuelwood has met demand for energy without major government intervention and it appears that this will not change in the near future.

Despite alarmist rhetoric about an imminent wood shortage in Africa, fuelwood is still widely used in many African countries. Progress has been slow on improving access to electricity for most people and population growth often outpaces the number of new connections. If the use of electricity and liquefied petroleum gas is not incentivized by generous subsidies, fuelwood will remain the cheapest source of energy for cooking and likely the main source of energy in many countries.

3.2 Challenges and opportunities for the development of plantation forestry in Central Africa

3.2.1 Funding

Despite strong potential and attractive opportunities, investment in commercial forestry plantations in Africa has stalled due to 20 years of sluggish economic growth.

According to the literature, financing is generally available for commercial operations that will generate a positive cashflow in three to five years and that have an acceptable level of risk.

For this reason, banks may be less interested in financing the production side of plantation forestry projects, but more interested in downstream segments like processing or adding value. Indeed, the fastest time to positive cashflow reported by plantation forestry investments is 5-8 years (Harwood and Nambiar 2014).

In Central Africa (with differences between countries), investments are complicated further by unclear land tenure and land-use arrangements, weak industrial infrastructure, poor technology and low productivity, as well as serious funding gaps.

Some authors note that different stakeholders are hindered by different barriers to investing in plantation forestry in Africa: local investors and financiers are opportunistic, strategic investors face barriers to entry, financial investors have demanding investment criteria (mainly risk related) and development financing projects seek enabling conditions (Indufor 2016).

However, investment in the forestry sector may take the form of greenfield investments in plantation establishment, processing or forestry, within the framework of official development assistance. This category of investments can be broken down into five main groups, shown below with a few examples that could be scaled up:

- Development finance institutions, such as the African Development Bank and the World Bank, with the possibility for them to compensate for the long lead times and social risks associated with plantation forestry;
- Donors with incentive schemes for local tree growers and farmers (Global Environment Facility (GEF), Climate Investment Funds (CIF), Adaptation Fund and other trust funds);
- Governments with innovative policies on leasing land to responsible investors;
- Governments and donors jointly providing support, sharing risk, developing infrastructure to facilitate forest investments or providing complementary financial guarantees (forest investment programmes);
- Strategic and financial investors who partner with local actors and take advantage of opportunities in Africa.

3.2.2 Investments

A sector with specific challenges in need of enabling conditions for investment

Compared to other land-use options, the majority of investments in commercial plantation forestry are, at best, marginally profitable. It is therefore imperative to be fully aware of the key challenges affecting African forestry, which, if addressed, can become enabling conditions for successful investment. Poor understanding of these challenges has led to the current suboptimal state of the majority of greenfield plantation investments.

The African forestry sector can be regarded as high risk from an environmental, social and governance, business integrity and financial returns perspective. The main risks relate to land use and loss of livelihoods, occupational health and safety skills, social acceptability, negative impacts on biodiversity, the potential for bribery and corruption, an uncertain investment environment, inadequate infrastructure and illegal logging of natural forests.

Though there is significant opportunity for investment growth in the African forestry sector, progress is hindered by a risk-averse investment climate, the limited availability of financing and the lack of successful forestry business models (outside South Africa).

Investing in Africa's forests is a bold undertaking, but one the continent urgently needs, for the sustainability of its wood supply, climate change mitigation and adaptation, and rural development.

Agroforestry and carbon markets could therefore offer a solution to these challenges, if not be a game changer.

Investment structures

Debt vs equity

African forestry is generally not developed or liquid enough to carry commercial debt.

The basic long-term internal rate of return of forestry projects is usually somewhere between 6 percent and 9 percent. In very specific imperfect market conditions, more can be achieved, but not usually in the long term. Engaging in downstream processing can improve returns, but is not without its challenges.

Financing solutions are becoming more complex in the face of these return metrics and equity from committed investors would be the most appropriate option. Commercial investors often demand more than a 15 percent return on investment to offset the risk profile.

If an investment project succeeds in raising some form of concessional debt, this is very valuable. However, it is difficult to find and often comes with near impossible strings attached.

Many development banks take a commercial approach to the African forestry sector and often demand a return on investment that exceeds the potential internal rate of return. Project leaders are then encouraged to be optimistic when estimating profitability in order to raise the necessary funds.

Project leaders who have obtained debt financing then find themselves urgently trying to reach profitability before debts become too large to service.

Equity financing, on the other hand, comes with its own challenges. For example, assessing the value of a project is difficult for investors who enter a long-term investment at different stages.

Avoiding the need for mid-cycle capital

The lack of a positive track record is a significant challenge for the African forest investment space. If a project ends up needing to raise capital before it is generating significant return on investment, it will most likely find itself in a tenuous position. The project will need to prove to capital providers that it is one of the few success stories and that it is close to turning a profit.

This will require a strong business plan, convincing management, a track record of meeting budgets and a bit of luck.

If the project is indeed successful in raising funds, the original investors will usually find their stake either heavily diluted, subsidizing a high interest rate or both. The only way to avoid this mid-cycle risk is to have sufficient funding to reach positive cashflow from the outset.

3.2.3 Partnership models to support plantations

The various financial and investment options available for the development of plantation forestry can be grouped into three partnership models: public-private partnerships, private sector-community partnerships and partnerships between financial institutions and countries.

Public-private partnerships for establishing forest plantations

Public-private partnerships have proven to be a model for economic prosperity in many sectors and there are a number of examples in Central Africa relating to the establishment of forest plantations.

Case study on Gabon

In Gabon, since the end of 2011, the company Plantations Forestières de la Mvoum (PFM) has been working to develop a 40,000-hectare area about 100 km from Libreville awarded by the Gabonese Government.

Approximately 17,000 hectares of existing 30-55-year-old okoumé plantations are expected to produce 100,000 m^3 of logs per year. These plantations are scheduled to be harvested over 20 years and replaced with clonal teak.

To finance part of its investment programme, PFM carried out a capital increase in 2013 reserved for Gabon's Caisse des Dépôts et Consignations, allowing it to acquire 15 percent of the capital.

Since 2014, work has focused on establishing the first teak plantations and harvesting the existing okoumé plantations. By the end of 2016, the nursery had about 100,000 teak plants and 100 hectares of clonal teak had been planted.

At the same time, PFM continued its applied research programme on tropical forest plantations, focusing on the genetic improvement of plant material.

In 2016, PFM signed a partnership agreement with Gabon Special Economic Zone, which will purchase almost all of the okoumé produced from its plantations.

New avenues for creating value will be explored, working with partners where relevant. PFM's ambition is to meet the growing need for timber and fuelwood in Africa, against a backdrop of strong demand for renewable products and rising fossil fuel prices.

Case study on the Republic of the Congo

The ten-year partnership between the Government of the Republic of the Congo and Société Plantations Forestières Batéké Brazzaville (SPF2B) aimed to plant 10,000 hectares of forest to supply the Brazzaville market with charcoal from sustainable plantations and partially replace the charcoal currently obtained by cutting natural forests.

According to the agreement, SPF2B is responsible for financing the project, while the government, with PRONAR, facilitates access to improved plant material and technical exchanges on plantation management.

Planting started in October 2018 with an annual planting target of 500 to 1,000 ha. The project is expected to create 500 direct jobs in neighbouring communities and to catalyse the development of village plantations, thereby contributing to the national objective of planting trees over 1 million hectares (ATIBT 2019).

Private sector-community partnerships

Lessons can be learned from Uganda's Supporting Timber Plantations through the Sawlog Production Grant Scheme (SPGS).

Before the launch of this project in Uganda, a long history of underfunding forest operations and poor management had contributed to the degradation of forestry plantations that were originally publicly managed.

Productive plantations on degraded forestland were seen as a way to meet the growing demand for timber while relieving the pressure on the remaining natural forests.

The objective of the EU-supported SPGS programme is to promote private sector investment in timber production by supporting plantation development on degraded forestland with much-needed financial and technical support.

Financial assistance is provided as a direct grant paid within two years of planting. The total grant is USD 330 per hectare, but will only be paid if the growers meet the conditions set out in the contracts that must be agreed in advance. No money is paid up-front.

The main conditions are: sound species choice, using only improved seed, with at least 80 percent survival after planting, and ensuring the plantation is weeded and protected for two years. The principle is to 'grow trees' rather than simply 'plant trees'.

SPGS offers farmers sound technical support and two forestry companies also provide training to Ugandan foresters. Through field meetings, practical training courses and publications, the SPGS team has begun to convince people that commercial forestry is a serious business opportunity for those with suitable land in Uganda.

SPGS has funded 10,000 ha of plantations to date, from small community-based tree planting associations to large-scale commercial operations. The programme has also supported communities to plant seedlings, led to the establishment of the Uganda Timber Growers Association and created 5,000 jobs.

So far, growers have used degraded land in forest reserves leased by the National Forest Authority, but interest in using private land is now growing. Support to plant an additional 25,000 ha has been requested.[2]

Partnerships between financial institutions and countries

The issue of independent businesses launching development projects and social inclusion in the forestry sector must not be overlooked if we want to improve the livelihoods of small-scale tree farmers by encouraging them to plant trees on small plots, despite challenges linked to land tenure.

Agroforestry appears to be a relevant approach to relieving the pressure on natural forests. The World Bank is working with partners in Mai-Ndombe province, DRC, on an integrated REDD+ initiative built around investments and performance-based payments (World Bank 2018). Since 2014, the Forest Investment Programme (FIP) has been supporting farmers to implement agroforestry activities, such as planting several million acacia trees under the agroforestry model described in this chapter.

This programme is reported to have improved the living conditions of thousands of farmers, sequestered carbon in planted forests and reduced carbon emissions. Participants also receive payments from the Carbon Fund of the Forest Carbon Partnership Facility (FCPF) under an Emissions Reduction Payment Agreement (ERPA) signed by the World Bank and the Government of DRC. The average cost of establishing one hectare of this type of agroforestry plantation is estimated at USD 1,000.[3]

The African Development Bank (AfDB) recognizes the economic and development potential of a thriving large-scale forestry sector on the continent. Furthermore, the Climate Investment Funds have already invested substantial resources to attract investment to the sector, which is growing in importance as its role in climate change mitigation and adaptation has recently been highlighted. The Climate Investment Funds are currently working to encourage the private sector to invest in transforming the African forestry sector (AfDB et al. 2019).

The Green Zones Development Support Project in Kenya (the Mau Forest Reforestation Project) was financed by the AfDB (2007–2016) to the tune of USD 38.8 million, which led to the reforestation of 14,300 ha. The project led to the creation of 3,000 permanent and sustainable jobs in communities bordering forests and increased the income of 17,100 households (40 percent headed by women) (AfDB 2018). Over the ten years of the project, the average cost of establishing one hectare of forest was estimated at USD 2,713.

2 https://spgs.mwe.go.ug/

3 Dr Clement Vangu Lutete, Coordinator of the Forest Investment Programme in DRC, personal communication.

3.2.4 Enabling conditions for plantation investments

Management, staff, labour and expatriate presence

When it comes to management and staffing, setting up a plantation project in Africa from scratch is not an easy task. There are a number of possible approaches, but all face the challenge of balancing overhead costs and maintaining an adequate skill base.

In the early years, many projects require the presence of expatriate staff to get them off the ground. Planning how to minimize the use of expatriate staff should be a priority early in the project life cycle. Effective high-quality staff training is one of the single most important hallmarks of a successful project. Gradually shifting responsibility from expatriate managers to local staff is more cost effective and ensures sustainability.

Plantation development and management is a science, developed and practised successfully in many countries around the world. Some argue that it is important to incorporate traditional farming practices into plantation management. However, care should be taken not to 'reinvent the wheel' where very simple and successful established practices exist.

Health and safety does not often come naturally to developing markets. Having a healthy and safe workforce requires considerable investment in the early days, but is indispensable for success in the long term. Third-party forest management certification can also be a helpful framework to support the integration of health and safety measures. A skilled, healthy and safe workforce will be motivated to come to work, keen to improve their skills and share the company's values.

Silviculture and forest management

Genetics

It is best practice to use improved genetic material regardless of the type of plantation forestry. There is however some debate around whether to use clonal or non-clonal species and there are many valid arguments on both sides. Clonal forestry using a sufficiently wide genetic base offers the best return on investment for many traditional plantation species. Unfortunately, many plantation projects in Africa have not used high-quality genetic material from the outset. The composition and growth rate of early plantations often has a significant impact on their commercial viability. Many large professional companies have however begun to pay greater attention to genetics more recently. When implementing a project, time and logistical constraints are often cited as reasons for the use of poor-quality genetic material. It is however risky to rush this essential step when establishing a plantation.

Site and species compatibility

The success of a forestry project relies on the compatibility of the site and the species used. While this may seem obvious, many still get it wrong.

To match a site with the rights species, the soil must first be analysed and long-term meteorological data collected (including consideration of climate change-related risks). As those of us who have been caught out know, with rainfall, it is not just long-term averages that matter, but the magnitude of annual variation.

Fire risk

In most African countries outside South Africa, forest owners are on their own in the event of a fire. Fire is a serious risk in most plantation regions in Africa. There are four main ways to manage this risk:

1. Manage the forest to reduce the fuel load during fire seasons (weeding plantations) and by creating firebreaks;
2. Set up rapid response fire detection and suppression capacity;
3. Work with neighbours to prevent fires across the wider landscape and develop community safety plans;
4. Consider buying insurance.

Biodiversity

A major criticism of plantation forestry is the risk of biodiversity loss when planting large areas with a small number of non-native species.

However, in the case of Uganda, for example, the International Woodland Company (IWC) invested in pine and eucalyptus plantations in an area where the landscape had become highly degraded due to slash-and-burn agriculture and unmanaged grazing. Here, the plantations restored productivity to the landscape and protected vast natural forests and riparian areas from encroachment and further degradation.

As part of the Forest Stewardship Council (FSC) certification process, IWC hired an external partner to carry out biodiversity studies twice a year. These studies continuously reported that plantation activities were not harming conservation or biodiversity and that more species of birds and mammals had been observed at all sites surveyed. These plantations are more biodiverse than neighbouring farmland (without responsibly managed plantations scenario).

Processing and markets

In Africa, many markets for forest products are informal and underdeveloped. Understanding the market is crucial in the planning stage. Some organizations have the skills to move downstream into processing, while others may simply wish to remain plantation owners.

To be able to plan for the future, it is crucial that project leaders understand both current trade restrictions and the political will behind them.

Tenure

Land tenure is one of the most contentious issues affecting plantation forestry investments in Africa. Intractable challenges can arise when a land-intensive resource like a forest is combined with poorly defined and enforced land tenure legislation and a local population of marginalized subsistence farmers who are highly dependent on the land.

In Uganda, IWC was able to navigate these challenges through strong leadership, by drafting a company code of conduct, hiring a dedicated community engagement team, consulting regularly with communities, developing and managing a grievance redress mechanism and delivering

community co-benefit activities. Despite the perception that tenure poses one of the biggest risks for plantation forestry investments in Africa, IWC's approach has substantially minimized this risk.

Valuable lessons have been learned about land tenure over the investment period. It is necessary to:

- Only invest in a project once the land tenure is clear. Doing so saves precious time and allows investment capital to get to work immediately.
- Have a thorough understanding of the plantable land before investing, not only in terms of biological capacity, but also with respect to conflicting land rights. Not having such an understanding from the outset could negatively impact the expected return on investment.
- Navigating land tenure enforcement with the relevant authorities is challenging, especially while upholding the company code of conduct. Nevertheless, maintaining positive relationships, frequent engagement and collaboration with relevant civil society organizations can be effective.

Frameworks for environmental and social risk management

There are a wide range of stakeholders involved in African timberland investments: investors, sector stakeholders, governments (local, national and foreign), non-governmental organizations (NGOs), research organizations, media representatives and local communities.

Fast-growing forest plantation projects — like any large-scale land purchase — must comply with the minimum requirements imposed by the host country to limit environmental and social harms.

Virtually all countries require projects to conduct an environmental and social impact assessment (ESIA) and adopt an impact management plan, obtain free, prior and informed consent and provide evidence of widespread community support; however, the conditions and guidelines for the establishment, monitoring and application of the measures adopted vary from one country to another.

Given private sector companies' growing interest in commercial plantations and their arrival in complex and vulnerable environments, it is important to recognize weaknesses in the host country's formal risk management frameworks.

In jurisdictions where enforcement is weak, voluntary forest management certification has proven to be a valuable tool for ensuring that forestry investments meet the high environmental, social and governance standards advocated by investors.

Plantation managers are not simply required to ensure a return on investment; they must also secure community and government benefits, manage investments in or support for regional resilience frameworks, and participate in initiatives to build the capacity of local institutions and regional economic communities. The private sector must moreover comply with existing national and international laws and good practices, if its presence is to have a positive impact over time.

Successful investments in plantation forestry in Africa:

- Are actively involved in relevant local and wider networks. This includes tree growers' associations, various local NGOs, the European Commission (or other multinational bodies), the FAO, FSC and various platforms bringing together other plantation operators in the region.
- Develop a process for obtaining the free, prior and informed consent of community stakeholders.

- Establish a flexible community engagement, grievance redress and outreach strategy based on regular and responsive engagement with neighbouring communities.
- Engage in positive media communication and share success stories.
- Establish a company policy on how to address media, research and other indirect stakeholder enquiries, and ensure key staff are informed on how to respond to such enquiries. Enquiring parties with a pre-existing negative agenda pose significant reputational risk.

Managing community expectations can be very challenging. From the outset and through frequent engagement, make it clear what the programme will look like, what both sides expect and how they will benefit. Do not overpromise. Have a support plan for programme co-implementers.

External funding (outside of investment funds) plays an important role in initiating community outreach programmes, which work to reduce risk, secure value and create lasting impact. Nevertheless, investment overheads must still include funding for maintaining community buy-in through continuous engagement activities that outlive external project financing.

Development finance institutions have a range of tools to support private sector actors to make sustainable investments in plantation forestry and agriculture. One of these tools is the implementation of the voluntary sustainability standards or performance standards introduced in the private financial sector. Major financial institutions have committed to apply the International Finance Corporation (IFC) performance standards, which provide a clear framework for managing social, environmental and biodiversity-related risks.

Forestry and carbon credits

Continuing with the example of IWC in Uganda, the initial company that received the investment was founded in the late 1990s with the goal of pursuing sustainable forestry through the sale of carbon credits. The voluntary carbon market and associated revenues did not materialize as expected and IWC's investors undertook to purchase the project and develop a commercially viable plantation.

The company has maintained its Gold Standard certification throughout the investment holding period and the project is expected to generate more than 1.5 million tons of certified carbon credits over its 50-year lifetime.

Although the certification is relatively low maintenance, since the Gold Standard accepts the FSC certification/audit procedure as a proxy (except for the carbon inventory component), carbon forestry is not without its challenges.

Carbon forestry has been the subject of extensive criticism and significant managerial resources have been required to maintain the project's credibility. There was also a potential liability on exit, given that the land is required to be held in continuous cycle forestry for the 50-year duration of the certification (this did not however prove to be a problem). Ultimately, there has been little appetite for carbon credits and prices have not achieved the level expected.

Various lessons can be learned from this experience:

- Until the factors affecting carbon prices shift significantly, it is perhaps best to consider carbon credits sales as an upside to investments in plantation forestry, rather than as a foundational component.

- The question of carbon 'tenure' has become a hot topic following the signature of the Paris Agreement and the adoption of its nationally determined contributions. It is therefore advisable to ensure project leaders have a good understanding of the national government's position on forest carbon ownership and transferability.
- Long-term carbon supply agreements with large buyers should be considered.
- Engaging with critics of carbon forestry is recommended, both to understand the risks and concerns related to engaging in this sector and to take steps to mitigate them, while building positive working relationships.

3.3 Lessons learned from plantation experiences in Africa and other parts of the world

The development of plantation forestry in Africa, particularly in Ghana, Malawi, Mozambique, Rwanda, Sierra Leone, Tanzania, South Africa, Eswatini and Uganda, has been undertaken by the private sector since the 1980s when government initiatives were constrained by limited resources and budgets.

This is in direct contrast to earlier patterns of plantation development (1930s to 1970s) when governments were the dominant developers of commercial plantation forestry.

Box 3.5: Enabling conditions for successful investments

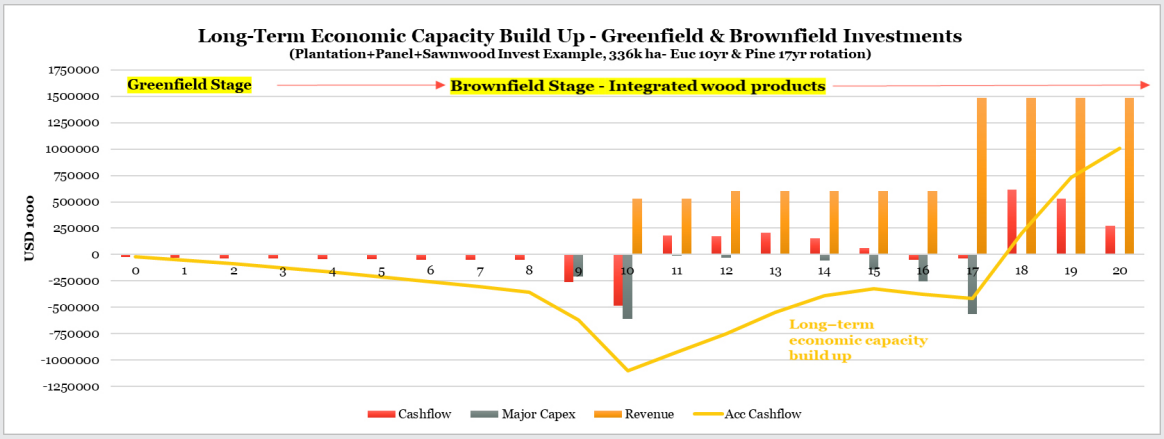
Andries Smith – Forestry Investment Consultant

1. Appropriate allocation of financial capital

- Readily available patient (not time bound) risk tolerant equity capital
  - » Suited to the gradual increase in forestry's economic capacity over the long term
  - » Recourse to debt is advised only once in the "brownfield" stage and operating cashflow is positive
- Appropriate allocation of capital and phasing
  - » Based on a robust strategic business plan that integrates wood products and is supported by forest management measures
  - » Initially focused on adding value through organic growth
  - » Appropriate mergers and acquisitions considered only when there are clear cost and/or revenue synergies
- Leverage non-returnable technical assistance capital to deepen the development impact and address barriers to market development
- Consider alternative revenue streams - such as carbon credits - for additional (but not deal-breaker) income, particularly in the form of forward purchase agreements to cover some of the initial costs of establishment

continued on next page

Box 3.5 : Continued



IFC, World Bank Group 2016, Ethiopia Commercial Plantation Forestry Industry Investment Plan

2. Environment and social inclusion

- An ESG management plan and budget should form an integral component of the strategic business plan
- Forestry projects should be developed on the basis of an inclusive landscape approach, perhaps as part of a mosaic encompassing commercial plantations, communities, agriculture/small woods and high conservation areas
- Incorporate FSC principles from the outset, covering both the internal and third-party supply chain
- Inclusive and influential stakeholder roundtable, whose representatives should at a minimum include the company CEO, community groups (including young people, women and men, and minority groups), ESG and farming-related NGOs, and local government
- Encourage and support 'out grower' schemes to help neighbouring smallholders by providing seedlings and/or assistance with tree growing, to enable them to potentially become reputable independent wood suppliers
- Encourage and support the development of non-timber product projects where appropriate
- As regards land tenure, seek transparent win-win agreements without areas of conflict
- A strategic business plan should also include a reputational risk management plan

3. Forest management capacity

- Senior management: Experienced managers, implementing an exceptional programme of skills development and safety measures
- Market and product alignment: Planting regime aligned with wood product strategy (pulpwood/logs/poles/veneer)
- Enhanced profitability: Target lowest cost of wood delivered per m^3 (not lowest cost per hectare) [+cost per ha / + mean annual increment per ha = low wood cost/m^3]

continued on next page

Box 3.5 : Continued

- » Climatic and edaphic matching of site species to optimize mean annual increment per m^3/ha/year
- » Advanced nursery practices and tree genetic improvement, using those clones or seedlings best suited to the site – considering hardiness and pest and disease resistance
- » High-quality and effective methods for establishing and maintaining the site
- » Effective management of fire, pest and diseases (good community relations are important)
- » Safe, efficient, low impact harvesting and transport system suited to local conditions and tailored to the wood product

4. A defined strategy for wood products

- Senior management: Experienced managers, implementing an exceptional programme of skills development and safety measures
- Market and product development: Wood products tailored mainly to domestic and regional markets
  - » Target the highest possible value add, with a plan to shift from primary to secondary products
  - » Collaborate with industry actors and governments to optimize the sector's value chain
  - » Wherever possible, consider the potential for industry clusters and/or strategic alliances, without forgetting micro, small and medium enterprises
  - » Supply chain logistics: leverage existing knowledge in the forestry sector and take advantage of strategic partnerships
  - » Market intelligence on competitors: imports and unregulated local low-cost products
- Enhanced profitability: Target the highest capacity to pay for wood
  - » Minimize transport distance from the forest and maximize dollar value recovery at processing plants
  - » Develop an optimized wood processing flow from the outset based on the target future processing capacity
  - » Affordable and reliable energy supply: If the energy supply network is unreliable, consider combined heat and power generation during the initial cost-benefit analysis

Interventions supporting the development of plantation forestry in Africa have acted directly and indirectly to varying degrees:

- Direct interventions via the provision of financial assistance: grants or reduced taxation and/or the provision of seedlings and equipment directly to growers;
- Indirect interventions: advice, training, promotional campaigns and support to set up bodies representing the sector and growers' associations.

3.3.1 Lesson 1: Programme objectives, target participants and incentives must be transparent and aligned

Among programmes aimed at rapidly developing the sector to reach significant industrial scale, those focused on large companies have been most successful, as evidenced by the Chilean and Uruguayan schemes where plantations have reach millions of hectares in size.

The example of Chile is interesting: the sale of large tracts of government-owned land at attractive prices, tax breaks and the provision of cheap and long-term credit were very attractive to corporations, as were the clear and simple procedures for accessing these measures. In contrast, where incentives have been aimed at supporting the development of small or medium-size plantations, the size of the areas planted was far smaller than under the South American programmes, but there was far wider participation by rural people.

The Sawlog Production Grant Scheme (SPGS) in Uganda provides insight into the balance that can be achieved between the various scales of growers, if the needs at each scale are recognized and appropriate incentives proposed. For example, large-scale growers were less interested in the indirect services offered by SPGS and far more focused on monetary grants (for improving in-house skills and sending staff on training courses), while small (<10 ha) and medium-size (10-100 ha) growers were dependant on SPGS for these indirect support services.

The example of SPGS in Uganda has also demonstrated the need for ongoing and detailed technical support in the area of forestry for small and medium growers to enable them to meet technical performance standards. Grower field days, plantation visits by skilled extension officers, environmental education and safe working practices are essential prerequisites for the successful establishment and management of these new plantations.

3.3.2 Lesson 2: Ensure the availability of suitable land for forest plantations

Access to land with secure tenure for a period of at least two to three harvest cycles of timber (25 to 50 years) is an irreplaceable prerequisite to attract growers to establish commercial timber plantations.

In Chile, government-owned land was sold to growers at very attractive prices on the condition that the growers would hold the land for a set time and establish plantations on it. As a consequence of the development of the forestry sector, the value of this land has increased considerably, thereby increasing growers' assets. This has allowed them to obtain additional financing for processing facilities, for example, based on the strength of their balance sheets.

In Uruguay, land was specially zoned for forestry and the purchase of this land for plantations was incentivized by grants to subsidize the cost of establishing a plantation. Like in Uganda, the grants were only paid out after a site inspection by the authorities had confirmed that the trees had been successfully established.

In Uganda, growers have been licensed by the National Forest Authority (NFA) to use land on government-owned Central Forest Reserves (CFRs). Subject to a performance review after two years, the licences are issued for a period of 25 years. Initially medium and large-scale growers were

given preference when applying for licences, as it was thought that small-scale growers would not be able to meet the performance criteria. These small-scale growers objected to the 50-hectare minimum area requirement and the NFA acknowledged the importance of including them. Small-scale growers were subsequently granted licences to establish plantations in CFRs.

It is now widely accepted that forest plantation interventions that include farmers at all scales are more stable, subject to less conflict and far more socially acceptable. There has been strong opposition to plantation development in Chile, Uruguay and Brazil where plantation ownership is dominated by large corporations, many of them foreign owned. In contrast, where participation has been more broad based, such as in Tanzania and Uganda, there has been far less opposition to timber plantations and in many instances the general public views their creation as very positive.

Competitive tender processes for assigning land for commercial forestry plantations, such as those used in Chile and Uganda, are seen as fair, provided that small growers are protected by a system guaranteeing that a fair proportion of the land is allocated to them.

3.3.3 Lesson 3: Ensure the availability of appropriate funding accompanied by clear and achievable procedures

Access to appropriate financing mechanisms is as important as access to land. The types of funding available and how this funding is accessed and disbursed needs to be aligned with the participants of the plantation development programme, its objectives and the funders involved:

- Grants, which recipients are not required to repay, are most important for small and medium-size growers. Without them, these growers would not have the resources to plant the trees. Where grant disbursements have been subject to performance criteria, access to other sources of funding have been used, typically loans from family members or village saving schemes.
- Equity funding, which comes in various forms, allows funders to take a stake in the shareholding of the company or venture. There are a number of examples in Uganda where family members have provided equity funding to enable the applicant to access the minimum plantation size required by the licence agreement. Larger companies, on the other hand, have all leveraged equity funding from various sources, including high net-worth individuals, family offices and development finance institutions (e.g. Green Resources, New Forests Company and Global-Woods, which are all active in East Africa). The shareholder agreements signed by these large companies are far more sophisticated and formal than those used by the family businesses that have established plantations in Uganda. Greenfield forestry development requires 'patient capital' due to the long lead time between establishment and the generation of revenues from the sale of the forest products.
- Loans have to be repaid at some point and typically attract interest. Loan funding is really only accessible to larger, formal companies. All actors that have established plantations in the East Africa region have indicated that loan funding must have the following characteristics:
    - » Have a term aligned with the harvest cycle length of the plantations.
    - » Allow for an interest deferral period, typically the first few years of the loan when the business does not have the cashflow to service the loan.

» Carry an interest rate that is aligned with the typical returns offered by commercial forestry plantations. Interest rates in excess of 10 percent have been extremely challenging for forestry companies. A nominal interest rate of 1 percent or 2 percent above inflation seems to be the maximum that greenfield plantation projects can realistically afford.

Financial support can also take other forms, such as tax breaks or the sale of land by the government at very affordable prices, as in Chile, but these measures are more attractive to large companies.

3.3.4 Lesson 4: Ensure access to high-quality plants

The value of high-quality planting stock has been proven in many cases where forestry plantations have been developed or extended.

One of the most effective ways to secure high-quality plants is by buying seed from tree improvement programmes that have been in operation for a number of years. Growers in Chile drew on the New Zealand *Pinus radiata* breeding programme that had been running for many years.

The SPGS programme in Uganda not only helped to source improved seed from South Africa, Australia and other counties, but also introduced a nursery certification system to accredit nurseries as suppliers of high-quality plants grown from improved seed. Buying seedlings from an accredited nursery was made a prerequisite for the disbursement of grant funding to growers, ensuring that they would plant only the best plants available. Given that neither seeds nor young plants have any particular visual characteristics that indicate the quality of the trees that will be produced, it is essential that seed is obtained from known and reputable sources.

To accelerate the development and deployment of improved planting material, another option is to join or form a tree improvement cooperative to screen and develop new seeds and plants. Plantation companies in Lichinga province in Northern Mozambique joined the CAMCORE cooperative, which operates out of North Carolina State University, to access a wide range of genetic material to select that most suited to the area.

Increased temperatures due to global warming are already affecting the use of *Pinus patula* and *Eucalyptus grandis*, two of the most common plantation species grown in Africa. These species are becoming increasingly susceptible to pests and diseases. The development and use of hybrids (*P. patula* x *tecunumanii*, *P. elliotii* x *caribaea* and various hybrids of *E.grandis* x *urophylla*, *E. grandis* x *pelita*) offers a potential solution, as these hybrids are far superior to the pure species in that they have faster growth rates, better wood properties and greater resistance to pests and disease.

3.3.5 Lesson 5: Ensure programmes are designed to be long term

For support programmes to be most effective, it is essential that they are designed to run over extended timeframes given the typical harvest cycle length of forestry plantations. It takes time to get programmes up and running to the point where they are both effective and efficient. A long-term programme must have a long-term vision and a funding stream to match. Consistency and continuity are important aspects of successful programmes, because uptake by growers is dependent on growers understanding how the support arrangements work and having confidence in their ability to benefit from the incentives on offer.

3.3.6 Lesson 6: Launch a national forest inventory to track the progress and development of the sector

The old adage 'you can only manage what you measure' is particularly relevant to the development of the plantation forestry sector. The absence of a National Forest Inventory in Uganda is hampering the further development of the sector as there are no publicly available statistics on the extent of the commercial forestry estate. This information gap concerning the raw materials makes it difficult for investors to support downstream processing initiatives. It is common knowledge that there are vast areas of plantations, but details about them — such as their geographic location, region, species or age-class distribution — are not known. It is strongly recommended that a national forestry inventory be launched in tandem with or as an integral component of any plantation development programme.

Conclusions

Fast-growing tree plantations could make a significant contribution to the conservation and sustainable management of forest ecosystems and people's livelihoods in Central Africa. Nevertheless, they come with significant controversy related to the alteration and homogenization of ecosystems and the loss of access to land and resources for indigenous communities and local rural populations (who depend on forest services and products).

Given the private sector's growing appetite for commercial plantations and commercial players' entry into complex and fragile contexts, it is essential to ensure all stakeholders' needs are considered and environmental and social risks carefully weighed. Finance institutions have a range of tools to support private sector actors to invest sustainably in plantation forestry and agriculture.

Interconnected regional and national policy approaches remain imperative to regulate regional and local priorities and to adopt laws and regulations that promote responsible investment.

In Central Africa, such investments are complicated by unclear land tenure and land-use arrangements, weak industrial infrastructure, poor technology, low productivity and serious funding gaps.

Compared to other land-use options, the majority of investments in commercial plantation forestry are, at best, marginally profitable. It is therefore imperative to be fully aware of the key challenges affecting African forestry, which, if addressed, can become enabling conditions for successful investment. Poor understanding of these challenges has led to the current suboptimal state of the majority of greenfield plantation investments.

The various financial and investment options available for the development of plantation forestry can be grouped into three partnership models: public-private partnerships, private sector-community partnerships and partnerships between financial institutions and countries.

The sustainability of plantation forestry in Central Africa depends on the decisions taken at each stage of the project: selecting managers and staff, establishing the plantation, determining the forestry or forest management techniques to be used, and managing land tenure and marketing, stakeholder engagement, carbon impact assessment and certification standards.