CHAPTER 8

Forest plantations in Central Africa: new forms of forestry to meet new business needs

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1. Introduction

The Congo Basin forests constitute the second largest tropical forest after the Amazon. These ecosystems are extremely important. Sustainable management policies are beginning to produce visible results in the field and a regional process, the Convergence Plan is currently being implemented (COMIFAC/CBFP).

Even if deforestation in the wet zones is still not widespread, deterioration and damage may still be seen on the outskirts of the big cities, in dry zones and on the edges of the dense forest.

Planting a tree has strong ancient symbolic and universally recognized significance. In recent decades, diverse forest plantations have become vital components of sustainable tropical forest management. They increasingly contribute to the perennial production of both commercial and non-commercial goods and services, and they are at the heart of global climatic and environmental challenges.

The term "forest plantations" is perceived in various ways. In Central Africa, despite past successful efforts, the planting of trees in forests has long been considered by a large number of actors in the forestry sector useless at best and predatory at worst, while paradoxically, very large natural forest areas have been converted into industrial farming plantations (oil palm, rubber tree, for example).

Photo 8.1: Funtumia Plantation, a rubber and medicinal tree, destined for industry, Cameroon

2. An ancient practice that makes the most of past lessons

First attempts at domesticating and planting tropical tree species date back to the beginning of the 20th century. In the middle of the 20th century, several arboretums, which have provided valuable lessons, were introduced in Bilala (Congo), Mbalmayo (Cameroon), Sibang (Gabon) and Yangambi (DRC). This allowed for testing the suitability of many native species for domestication and adaptation for production. Adjusting the tropical forest silvicultural techniques to those used in temperate plantations was, however, not without failures or a good deal of trial and error. But with knowledge and understanding gained from experience, management techniques in tropical plantation forestry were developed. This achievement has taken many forms, which contributed to timber and non-timber products, both which are vital to national forest economies.

Scientific knowledge has accumulated in a variety of technical fields. In Pointe Noire (Congo), for example, intensive clonal silviculture of eucalyptus was perfected in the beginning of the 1970s. Techniques developed in Congo led to the creation of several millions of hectares of high-yield plantations in the inter-tropical zone which created new jobs and wealth. These clonal plantations were established in Latin America, Asia and South Africa, but not in Central Africa, unfortunately – with the exception of the eucalyptus clonal area of 42 000 hectares planted around Pointe Noire (Congo).

3. Planting trees, an important institutional indicator

Photo 8.2 : Restocking Mukulungu Plantation (Autranella congolensis), 7yr old tree, CAR

In Central Africa, nearly all forestry departments in charge of the forests are state-owned or partly state-owned organizations dedicated to forest plantations, such as : ANAFOR (National Agency for the Support of the Development of the Forest) in Cameroon ; SNR (National Reforestation Service) in Congo ; or DHR (Horticulture and Reforestation Authority) in the Democratic Republic of Congo.

These organizations spearheaded major plantation projects from 1960 to 2000 and have often been fundamental to innovation. They have, for the most part, been financed by a tax collected by the forestry fund and redistributed to projects accordingly, the annual "Day of the Tree" being one of these. The majority of these organizations are now confronted with operating constraints : the gradual reduction of financing ; non-replacement of agents over several years ; a global drop in technical standards ; and a reduction in operational capacity. This despite the fact that stronger global emphasis on plantations programs is considered important to combat climate change, and to satisfying national needs for timber products and the creation of wealth in rural areas.

In parallel, several private forest plantation projects, formal and informal, are emerging in Central Africa, gradually replacing projects which were predominantly managed by state-run forestry institutions.

It would be wise to rethink the goals and means of these state-run organizations as soon as possible in order to modernize them, strengthen their expertise and develop their traditional role as executing agencies without neglecting private initiatives, which must be favored.

4. A rapidly-evolving regional situation : increasing demands

The current situation exists in an international context increasingly constrained by rapid changes in rules and regulations and the ever-increasing multiple demands and changes of civil society.

The prevalent extensive cultivation system of managing natural forests, even with certified forestry which is considered sustainable, produce a low return on investment. Profitability is usually insufficient and especially uncompetitive in relation to other land uses. Global, regional and local demand for timber products (timber, industry and energy) and for their associated services (health, employment, etc.), raises the question of whether a raw material sufficient in quality or quantity can be produced at competitive prices. The ever-increasing pressures on the land result in significant increases in environmental mitigation requirements and their related costs (certification, legality, etc.). Thus, increasing costs of managing natural forests and ever-increasing pressure on the land often lead to a specialization of production forests and the types of products. Moreover, climate change will have important long-term repercussions (positive or negative) on the forests while some speculative operations (farming, etc.) will undoubtedly cause very short-term repercussions.

New opportunities, linked to debates on climate change and REDD+ mechanisms in particular, are based on the remuneration of carbon stocks and flows. If these mechanisms fully develop, forest plantations could play a major role in REDD+.

Finally, continuous population growth in both rural and urban areas, and the persistence of unsustainable farming methods are major elements of the inevitable degradation of natural forests. Slash-and-burn farming in woodfuel production is by far the most important cause of degradation and deforestation. How can these threats be addressed ?

5. A road to the future : cultivate the national forest

In this unstable and ever-changing environment, new forms of forestry must be invented so the forest ecosystems of Central Africa maintain their important role in national economies. Unless comprehensive preservation via complete protection of the forests ("sanctuarization") is adopted, which will inevitably be partial and random, new types of forestry should be proposed for natural forests which will make it possible to protect them while at the same time making them productive. These new types of forestry are necessary. In many cases, they still remain to be invented because the premise of reconstitution of natural forests in identical form or of a sufficiently rapid natural renewal between two periods of logging is unlikely to be feasible. Consequently, current forestry techniques must be improved to allow economically viable and sustainable production of timber products (especially timber, but also others).

Forest plantations, through their diversity, make it possible to develop new types of forestry techniques that apply to natural forests (cfr following paragraphs). These new techniques, if carried out correctly, will not only avoid jeopardizing the sustainability of the forests, but will help to ensure their sustainability through the creation of greater income. The improved use of natural forests will form the basis on which to guarantee greater sustainability of these ecosystems.

The management of forests, including plantations, is again becoming a priority on national and regional agendas. It is enabling the emergence of new development strategies which are of interest to both international financiers and actors in the private sector.

Photo 8.3 : Pépinière villageoise dans la province du Bas-Congo – Projet Makala – RDC

6. Planting a tree : everything except insignificant

Planting a tree, let alone a forest, is first and foremost a voluntary act, a sign of hope and a long-term investment. It requires thought, a strategy, effort and cost. Behind each planted tree there is willpower and a human action, where the final success depends on coherence. In several regions, planting a tree is considered to be an act of "land claim", whereas cutting down a tree in a natural forest is a right of use. Formal law addresses forest use more frequently than forest regeneration or the introduction of new plantations.

The planted forests are not natural forests. The artificial ecosystems of planted forests are often more productive, but also more fragile than natural, spontaneous forests. Although, for their care and management, these two "groups" of ecosystems come with a number of principles and they are the result of different complex technical processes. These techniques, which must be adapted to each situation, also depend on the desired end-products (timber, wood for energy, NTFP, enhancement of the environment, etc.).

Sustainable management of planted or natural forests needs a clear and stable institutional environment. Moreover, a good command of technical tools and assessment of expected financial, social and environmental costs and benefits constitute the principal elements to be considered before any silvicultural operation is undertaken.

7. New demands and values for forest plantations

The recent and imminent evolution of tropical societies in an increasingly globalized context has given rise to new demands vis-à-vis forest plantations. Indeed, the exploitation of natural tropical forests is facing increasing constraints such as environmental, social and demographic pressures, and increasing demands for goods and services.

New demands from society are also expanding the role of forest plantations. Challenges linked to global changes (climate, energy, water and agriculture), the evolution of processing technologies, the character of evolving international markets, and the privatization of the forestry sector are increasingly affecting forest plantations. Reforestation species and their uses must be diversified so as to adapt to the varying scales of production and intervention (individual, village, territorial, industrial…).

With this in mind, a new silvicultural adapted to the tropical forest plantations can bring with it solutions for :

- Producing homogenous timber raw material for industry or energy or a raw material for subsequent processing such as green chemistry, etc.
- Intensifying management and increasing productivity of managed forests, improving their economic performance, concession profitability and enhancing sustainability.
- Restoring degraded natural forests (due to itinerant slash-and-burn farming, for example) or marginal natural forests (lightly-covered forests and/or interrupted renewal process).
- Re-creating diversified forest spaces in areas where these have disappeared, and with it a number of goods and services previously supplied by the natural forests in local communities and, more widely, in nearby territories.
- Protecting areas of symbolic importance (forests with high conservation value, protected areas, fragile zones) by creating buffer peripheral zones where local populations will be able to find needed products.
- Providing recreational areas and "green lung" areas via urban and peripheral afforestation.
- Marking the territory and thereby providing to local stakeholders "appropriation tools" for spaces with uncertain legal status.

- Intensifying farming by the introduction of trees in the farming and forest-farming systems.

Traditionally introduced specifically for wood production and related wood resources (energy, paper pulp, saw, etc.), diverse plantations are now integral to forest management and to territorial plans to which they can contribute further economic value. They also contribute to the creation of social and environmental value, as well as to the foundations and organization of both urban and semi-urban areas of the territory. They protect sensitive areas (affected by erosion and protected areas, for example). Finally, they often support local natural biodiversity if correctly and professionally managed.

Photo 8.4: Three years of assisted natural regeneration on sandy soils – Makala Project, DRC

8. The forest plantations – integration and social and community development factors

Interaction between people and forest ecosystems, regardless of whether they are natural or artificially planted is a common element. Contrary to industrial plantations, which rely on financial investment, social forestry depends essentially on informal labor. Thus, 1 000 hectares planted for industry could produce as much or more than what 1 000 village plantations of 1 hectare each would produce. On the other hand, the outcome in terms of social integration, local distribution/redistribution of income and poverty reduction is very different.

Small farmers' plantations are increasingly included in a farming, industrial forestry or conservation farming system. "Social logging" integrates a spatial mosaic dimension through planning and zoning norms, and guarantees overall sustainability of the system. However, technical knowledge regarding forest plantations is generally lacking amongst local communities. Strengthening their knowledge requires substantial and long-term investment to transfer knowledge and techniques which would allow them to better plant and manage this investment.

A tree in a city, just like any tree outside its natural habitat, acts as an essential element of well-being (improvement of the environment, aesthetics, shady areas…) and the provision of diverse goods and services to rural and urban populations.

Land security and/or benefits gained from plantations limit large-scale development of plantations by local actors. Popularizing individual or village plantations requires a very shrewd approach, so as not to collide with traditional powers and also in order to integrate local rights into national laws and policies, which are often few and far between and rarely spelled out in detail.

The ownership of plantations by local populations is a key factor in contributing toward their sustainability. This entails important but gradual efforts to adapt and adjust to local norms as well as specific, targeted public policies.

9. Diversified technical tools and itineraries for varied goods and services

There is no conflict between natural forests and plantations (in the broad sense), more specifically there is a continuum of complementary situations and techniques. Clonal plantations, improved village agroforestry or agro-industrial plantations, assisted natural regeneration, natural forest restoration of disturbed ecosystems, semi-urban forests, etc. are merely aspects of the same concept.

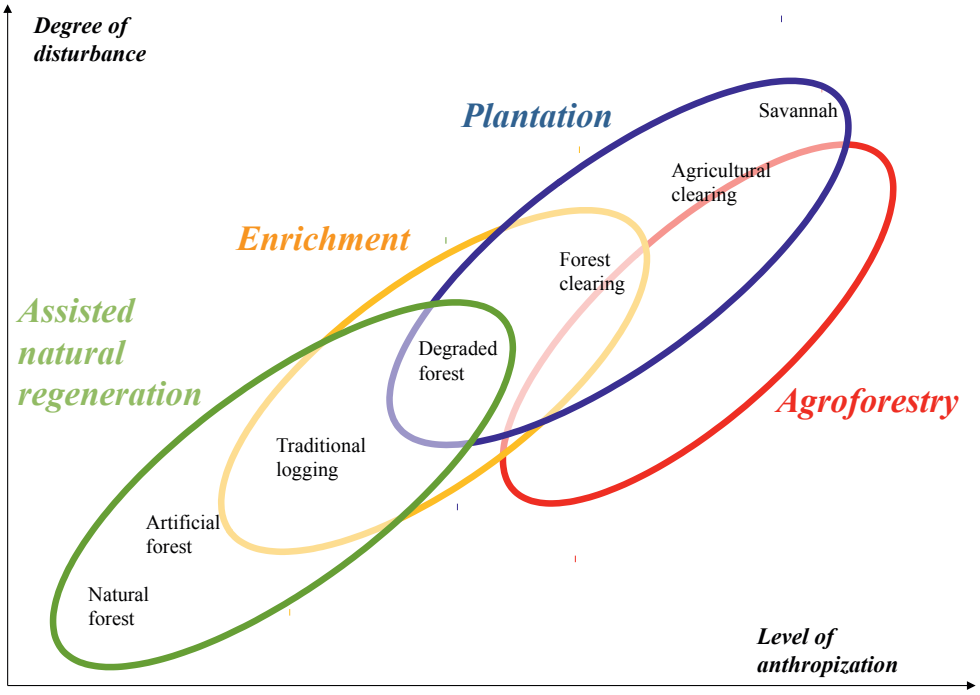


Figure 8.1 : Relative place of the various "plantation" tools according to levels of degradation of natural forests and anthropic pressure

Many technical processes for forest plantations are adapted to different local situations. These techniques tend to strengthen – not replace – the role of the natural forests. In this context, local and exotic species must be taken into consideration and adapted to context and goals pursued.

Central Africa has many examples of forest plantations and attempts to manage natural forests. All of these examples provide us with much knowledge and important lessons.

9.1 Forest plantations

Farming wood (fiber, energy, etc.) in the same way we farm corn or poplars is the challenge faced by mass plantation developments. This requires knowledge and implementation of approaches, techniques and economic foresight derived from intensive agricultural practices. Of course, everyone has in mind millions of hectares of intensive eucalyptus or pine plantations in Brazil or South Africa. Central Africa has, however, been a forerunner in this area, but for the last

30 years, global conditions (investment security, for example) have not favored the maintenance and expansion of intensive forest plantations. This environment could be improved with new actors, new investors and new markets, and with a more secure and stable institutional context.

The following concrete examples are not exhaustive, but they provide a good picture of the immense potential existing in Central Africa and in neighboring countries, even though the total areas reforested are not equal to the potential areas available. It should be made clear at this point that oil palms are not regarded as forest plantations but rather as agro-industrial plantations.

9.1.1 High-yield industrial plantations of exotic species in savannas or deforested zones

Clonal eucalyptus – Pointe Noire – Congo – 40 000 ha – EFC Company

As the result of research and development conducted without interruption for over 40 years, these high-productivity industrial clonal plantations (15 m^3/ha/year on average) are intended for the supply of industrial wood for paper pulp. This large area has served as an example. Most intensive clonal tropical eucalyptus plantations are based on this model and on the clonal multiplication techniques developed here. These plantations are currently being subjected to strong social pressures due to the expansion of the city of Pointe Noire.

Hevea – Kisangani – DRC – 10 000 ha – State

These plantations are distributed all along the River Congo and its tributaries. Political instability has stopped latex production, but the plantations are still in place and it would not be difficult to revive *Hevea* forestry oriented towards timber production (sawn wood or energy) pending the revival of latex production.

Teak – Bassama – Cameroon – 200 ha – State

These teak plantations were initiated by the State in several stages some 20 years ago. Even though ecological conditions for this species are not optimal, this plantation, without genetic improvement of any kind, produces between 4 and 5 m^3/ha/year of small sawn wood. It is in the process of gradually being converted to coppices.

Photo 8.5: Industrial eucalyptus plantation – Pointe Noire, Congo

9.1.2 Plantations of local species of timber of value on savannas or degraded forests

Okoumé – Mvoum – Gabon – 14 000 ha – Sogacel

Aged between 30 and 55 years and inserted in a planted area of 39 000 ha, this *okoumé* plantation is becoming mature and subject of a logging and replanting project. Its average productivity of 10 m^3/ha/year demonstrates the ability of local forestry species to provide industrial production of prime economic importance.

Ayous – Batouri – Cameroon – 200 ha – Alpicam/STBK

This recent, partly clonal plantation constitutes the first phase of an ambitious *ayous* development project. The technological characteristics of this species are particularly appreciated by the timber industry. The species is easily domesticated. It has a strong colonization capacity through natural regeneration on logged areas or farmland. Its young growth is rapid, which gives it many advantages.

Limba – Bilala – Congo – 100 ha – SNR

Aged between 30 and 60 years, the limba (*Terminalia superba*) plantations in Mayombe were initiated after completion of many research projects. Their growth is very strong (over 10 m^3/ha/year). A selection of superior clones has been developed successfully here. Timber quality is good and a part of the plantation has already been harvested. This plantation clearly shows that

it is possible to reduce the rotation period and to lower the optimum age of harvest compared with a well-managed dense forest.

9.1.3 Creation of buffer zones around protected areas

Acacia – Goma – DRC – 5 000 ha – Ecomakala project

Peasant acacia plantations have been under development since 2005 around the Virunga Park with the aim of developing an alternative activity to wood-cutting and poaching within the park. Over 5 000 ha have been planted by 5 000 peasant farmers, which has enabled substantial timber production for energy purposes. The use of earnings from this production needs, however, to be reviewed in order to make it a genuine source of income and incentive for planters.

9.1.4 Wood production for local use (energy, etc.)

Eucalyptus – Antananarivo – Madagascar – 100 000 ha – Private planters

The eucalyptus plantations have been developed for over 50 years by small private planters (0.5-1 ha on average) on degraded land. Without any external encouragement, these planters have created a productive area (3-5 m^3/ha/year) which supplies the capital and the major cities with wood for energy. This area, often a coppice grown on aged trunks with amateurish management is an excellent example of the success of informal private initiative in response to urban demand.

9.2 Agroforestry (see chapter 7)

Agroforestry comprises a multitude of agricultural systems in which the tree is one of the components of the area concerned. The association of trees with another crop, fruit-growing or stockbreeding exhibits many forms according to the local context and the objectives of the farmer, for example the cocoa and coffee agroforestry systems in southern Cameroon, whose rationale is more agricultural than forestry-related.

Photo 8.6: Truck loaded with eucalyptus logs near Pointe Noire, Congo

9.3 Trees outside the forests

Trees outside forests are characterized by low density – a few dozen trees per hectare – in various areas. This is an unavoidable fact in certain rural landscapes and also in urban and suburban landscapes in Central Africa. Low tree density is closely associated with increased human population density and the development of small areas (generally, urban plots or hut gardens).

9.4 Urban and peri-urban plantations

Trees in towns are a result of urban development works, such as hedge rows and parks. In this case wood production is not the primary objective.

Brazzaville – Patte d'oie – Congo – 150 ha – MDDEFE

Apart from its role as an urban forest, the *Patte d'oie* forest in Brazzaville is an urban wooded area with great symbolic value. Despite numerous attempts at dismemberment because of land interests and pressures, a large portion has been conserved. Further conservation efforts are being made and reforestation is continuing with both local species and eucalyptus. The plantation's role in marking territorial boundaries is particularly important.

Eucalyptus – Kinshasa – DRC – 100 ha – Makala project

Some 11 000 eucalyptus saplings have been planted by a project in a district of Kinshasa. At the rate of two saplings per plot, over 5 000 urban plots have been planted with a total area of over 100 ha. The visual effect, which is immediate, is raising great expectations among the local population, who are also happy to see their environment upgraded.

Green belts – Ndjamena – Chad – 657 ha – MERH

In 2009, Chad initiated an ambitious and voluntary program for the greening of a belt around the capital as part of its national "green belt" program. Over 200 ha have already been planted with the cooperation of all ministries. The effects in terms of greening and the regeneration of local species, both herbaceous and timber, are very positive and already noticeable.

Photo 8.7: Industrial nursery – Pointe Noire, Congo

9.5 Silviculture of natural settlements

The future of the natural timber forests of Central Africa depends to a large extent on the ability of managers to intensify the practices developed in regional territorial plans, and even to develop the very concept of such plans. What is involved is nothing less than moving from on the practice of extensive felling to more intensive management without jeopardizing the functions, goods and services furnished by these ecosystems.

The gradual advent of new non-forestry actors such as organizations for the conservation of nature enables the forests to be seen in a new light, a view sometimes far removed from that solely based on the harvesting of the timber resource. In addition, growing international and regional demand for non-conventional products (reconstituted wood, etc.) or for new uses (bioenergy, green chemistry, etc.) should help to greatly modify the perception of timber uses. It would no longer be a case of adapting uses to the natural resource available but the opposite, namely gradually adapting the resource to the needs of society.

In this context, the principle of the multifunctionality of forests and the scale of application should evolve. In fact, all the functions of ecosystems must not necessarily be fulfilled at the scale of the individual plot but, on the contrary, multi-functionality can be achieved over a broader scale by juxtaposing plots under different management. These two levels, local and global, are complementary and must therefore be taken into account. Various silvicultural techniques for natural forests have already been put into practice. They have generally been based on the forestry techniques that were used in temperate stands (e.g. in Europe). However, these systems are complex and costly, and they have largely been discarded, especially in the increasingly stringent environment facing private forestry companies. Minimal-cost strategies are now being developed by several actors in the forestry sector because of the constraining political, institutional, fiscal, economic and competitive medium and long-term conditions prevailing in many central African countries.

Industrial demand for homogeneous wood products and the gradual disappearance of very large diameter trees is leading to a decrease in average felling diameter. Efforts to find an acceptable level of profitability will inevitably lead to an intensification of extraction. One can thus imagine a scenario in which increasingly destructive forest "mining" will lead to accelerated degradation and deforestation and herald the end

Photo 8.8: Protected young tree in a manioc field – Bateke plateaux, DRC

of the forest. However, one can also envisage a situation where increased extraction will be offset by adapted forestry methods that will enable an increase in the density of higher-value species. The future silvicultural of natural Central African forests would thus inexorably approximate to the methods developed in other latitudes, where the manager constantly monitors the renewal of stands, the growth of trees and the harvesting of products. A conference organized by CIRAD in Montpellier in November 2011 reviewed this important issue (IUFRO, 2011).

One of the major constraints on the cost, and hence the development of silvicultural techniques in natural forests is the time factor. The costs may be substantial. If technological procedures are not properly mastered and integrated into the harvest plans, the calendar and the operational budget in logging operations, substantial costs could prove fatal to the profitability of the whole enterprise. These costs should also be calculated against profits anticipated in the long-term since the ultimate objective is a real increase in the volume of wood harvested and a corresponding decrease in unit management and harvesting costs.

9.5.1 Assisted Natural Regeneration (ANR)

Forestry operations are rarely followed by appropriate concomitant measures because management is based on the forests' capacity for natural regeneration, evaluated on the basis of inventories. Many examples point to the capacity of ANR to promote such regeneration.

Enrichment, the planting of seedlings or seeds in tracks, once widely used after logging has been practically abandoned because of the high cost related to thinning the regrowth over several years, as very rapid regrowth casts a deep shadow over the seedlings and creates competition for daylight. Regeneration in logging gaps creates the same problem and requires care and very precise and coordinated work with the logging team. In order to be successful, these techniques must be carefully thought out and integrated into management before logging begins. Felling for seeding (opening of cover and clearing of undergrowth)

Photo 8.9: Individual nursery for Makala project - Kisangani, DRC

could be practiced in order to promote natural regeneration under or near seed-producing trees which have been identified and preserved. This technique requires good knowledge of the phenology and methods of reproduction of dense-forest species and of their social and ecological behavior, but this knowledge is still largely underdocumented. In much degraded forests, such as the forest fallows on the Bateke plateaux in the DRC, ANR is employed by farmers who clear forest growth in order to grow temporary crops before leaving the land fallow. The technique consists of keeping seed-producing trees on the margin of their plots and in the selection and conservation of seedlings when crops are weeded. The protection of these stems and seedlings enables the rapid return of the forest after the plots are left fallow. Thus these plots retain their forestry role, which makes it possible to maintain farming and forestry productivity in extensive areas.

In the *marantacea* areas of northern Congo, the natural seeding cycle of trees is interrupted by this undergrowth vegetation. The sowing of skidder tracks with seeds or seedlings of sun-loving species can yield excellent results by retaining productivity in areas which have lost their timber potential. Nevertheless, the reintroduction of trees must be followed up in order to avoid damage due to excessive pressure by fauna (uprooting and trampling).

9.5.2 Thinning and clearing

Provided they are clearly identified, regeneration spots may comprise thinning and clearing in order to limit competition from competing species or species at risk (lianas, etc.) and to promote the development of selected future stems.

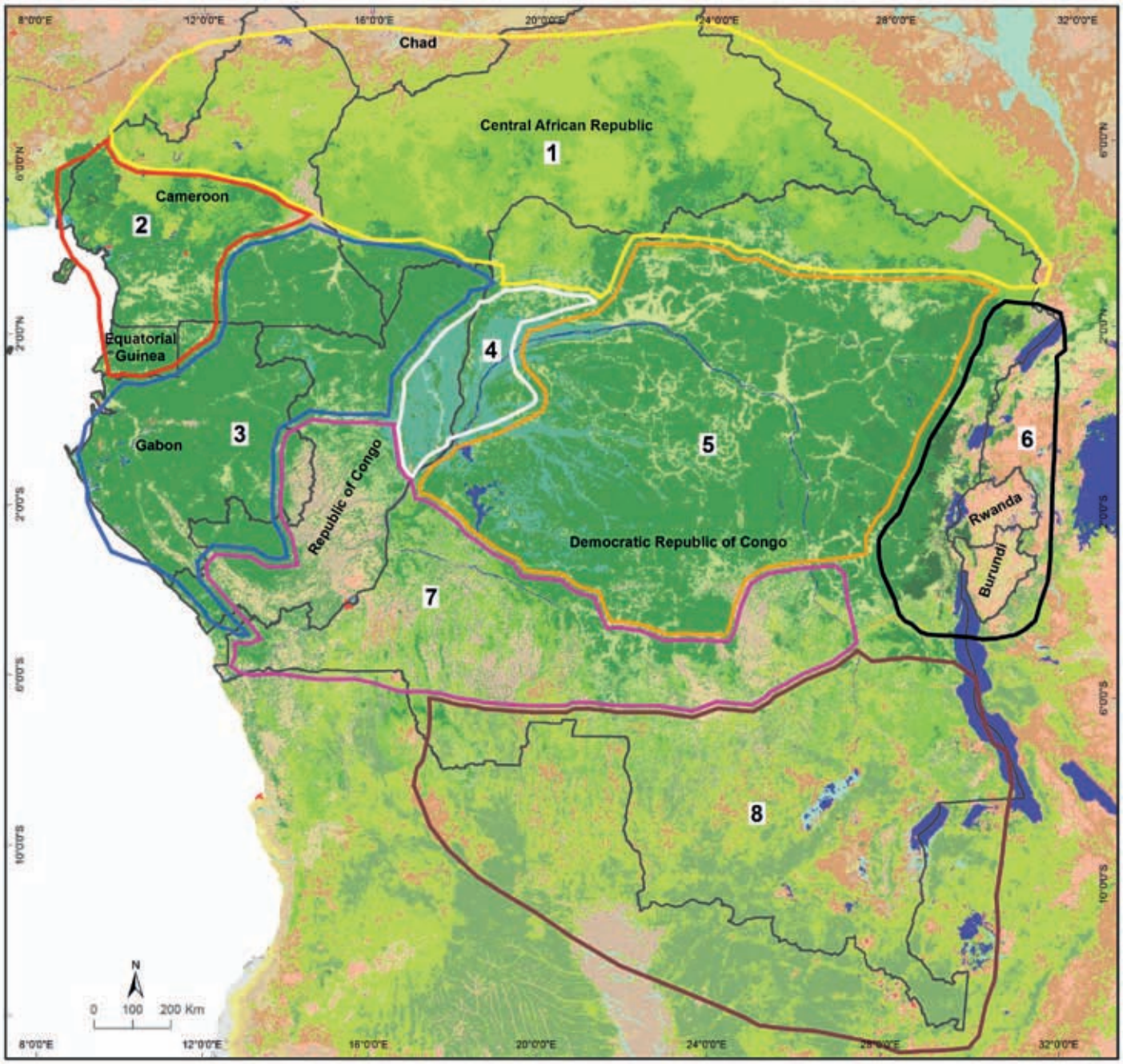
9.5.3 Selective thinning

A move to selective thinning has already been made in certain forest concessions. Part of the non-essential forest cover and certain low-value species are cut down in order to promote the growth and development of stems of higher-value species. These thinnings must maintain a balance of flora sufficient to conserve the various functions of these complex ecosystems.

10. Tools and priority steps according to socio-ecosystems

A socio-ecosystem (SES) is an integrated and complex system of ecosystems and human societies interacting with one another. This system is relevant in order to take into account the multiple interactions between its various components and thereby answer the questions arising concerning development paths. Central Africa is a complex of forest socio-ecosystems. Eight SES have been identified (figure 8.2) in which forest plantations and new forestry techniques do not have the same potential, the same feasibility or the same interest.

The map below shows the spatial distribution of these SES. For each of them, the level of disturbance of natural ecosystems and their degree of "anthropization" play a key role in the choice of objectives pursued, and consequently the plantation and silvicultural techniques to be prioritized. Table 8.1 proposes targeting regional priorities on the SES where the impacts of forest plantations may be strongest and investments the most interesting.



Socio-ecosystems

- SES 1 - Growing savannization whose cause is instability
- SES 2 - Anthropogenic pressure compatible with overall development
- SES 3 - Political will for diversified economic development
- SES 4 - A future joint management of water resources
- SES 5 - In the heart of dense forests, the challenges of access and control of resources
- SES 6 - Forest ecosystems as adjustment variable
- SES 7 - Savannahs in search of agricultural valorization
- SES 8 - Anticipating decline in mining

Figure 8.2: Map of forest socio-ecosystems in Central Africa and interest for different forest management modes.

Table 8.1: *Intérêts des plantations sur les SES*

	Socio-ecosystem							
	1	2	3	4	5	6	7	8
Plantation								
Assisted natural regeneration								
Agroforestry								
Peri-urban plantations								
Forestry natural stands								

Interest	
High	
Middle	
Low	

11. Understanding the effects

Much has been said about the essentially negative impact (eucalyptus, certain types of pine, etc.) of forest plantations on ecosystems. The international debate on forest plantations reached a peak in the 1980s and 1990s. The massive introduction of more or less adapted exotic species, poorly assimilated or unassimilated technical procedures, recurrent conflicts with local population groups, a fragmentary approach and virulent policies on the part of ecological organizations and certain sections of civil society in both north and south gave rise to much controversy and opposition, which was unfortunately sometimes justified. This debate on forest plantations is currently coming to an end, mainly due to the combination of several convergent phenomena. Because of the increase in international needs for timber, an ever-increasing share of the needs for timber and timber by-products is now based on the development of forest plantations. The identified effects of climate change are weakening natural ecosystems and are likely to impede natural adaptation processes.

Table 8.2 lists a number (not complete) of possible direct or indirect positive effects related to the development of forest plantations in Central Africa.

Table 8.2: *Several effects of the development of forest plantations in Central Africa*

Ecological effects	Soil Water Transformation of natural ecosystems, catalyst effect Naturalization of exotic species Invasive species
Social effects	Individuals Villages and rural communities Urban and semi-urban populations Local appropriation Fair sharing of profits
Economic effects	Intrinsic profitability Profitability in relation to other farming methods Types of investments and management methods A response to needs at all levels
Institutional effects	Policies Regulations Tax Incentives Privatization Land-law Customary law Research Access to knowledge
Effects of development	Land use Land development Management strategies Processing procedures Supply-chain

12. Invest in forest plantations?

Without doubt, the best manner in which to address the issue is to develop a pragmatic approach, guided by objective choices and supported by the reality of the field.

The planted forests are not intact natural forests

Behind every plantation there is a human decision. Because of their simplification in relation to natural ecosystems, the planted ecosystems are higher yielding (for a given yield) but are also more fragile. Behind their apparent ease (what's simpler than planting a tree…), precise techniques are applied for which the complexity is often underestimated. Moreover, the plantations must allow transferability of use of the land after the final cutting. Each plantation project represents an investment (financial, human, etc.) to which a benefit (financial or other) is expected.

Outstanding successes/success stories, not without resounding failures

In the 1960s-1970s, several plantation programs appeared in all Central African countries, mostly managed by the states and often thanks to international financing. Green barriers, semi-urban plantations, afforestations, "Day of the Tree", afforestation for protection, enriching plantations, etc. are amongst several examples. Unfortunately, apart from some spectacular and sustainable successes still present as examples, the results are mixed. The notable neglect of public authorities in the field, geopolitical uncertainties, a climate not conducive to long-term investment, and the use of inappropriate techniques all contributed to an end to plantations. Several African projects were suspended while during the same period, planted forests became a fundamental component of forestry management in Latin America and Asia. In the last twenty years, attempts at silvicultural in dense forests have been left to the state because of a perceived lack in profitability. It should also be noted that for an entire decade, a sense of dogmatism led to explicitly excluding artificially planted trees from sustainable forestry management certification programs. Fortunately, this attitude has evolved.

A renewed interest in planted forests and silvicultural has been observed over the last few years. Socio-economic advancement, changes in the labor market and new challenges linked to climate change are causing increasing deterioration and imbalance between man and the ecosystems.

Causes of failures or multiple under-achievements

Most of the noted failures are strictly man-made and merely reflect implementation errors and overall lack of necessary skills and knowledge. There are several types of failure:

- Insufficient or erroneous preliminary **strategic analyses** (lack of long-term objectives and/or follow-up);
- Approximate or non-adapted **technical practices** (choice of species, of sites, of technical processes);
- Poor judgment/assessment of **social challenges** (non-ownership by local communities, conflict, etc.);
- Non-resolution of **land tenure prerequisites** (pressure for other use, real estate or agricultural speculation);
- Erroneous **economic calculations** (less productivity than forecast, no income or non-reinvested income);
- Underestimated **political or institutional** constraints (tax, regulations, etc.);

Photo 8.10: Acacia auriculiformis plantation – Bas-Congo, DRC

- Insufficiently recorded **environmental impacts** (plantations in dense forest, erosion, etc.);
- Reforestation projects often burdened with debt due to **discontinued financing**. These require financing right up to the first harvest (taillis) or the first cutting (mature timber forest) to be financially profitable while projects generally only finance the planting phase which is then abandoned due to lack of funds.

A lack of scientific data, particularly for plantations of local species

Acquiring scientific data is absolutely essential to develop plantations, particularly for local species. Most studies have in fact been devoted to exotic species (genetics, silvicultural, technology, etc.). On the other hand, the behavior and potential for reforestation with local species are still largely unknown. The few and only reference works concerning mature trees come from the various arboretums scattered around the subregion. New research projects are nevertheless tending to fill part of this gap in knowledge.

Many potentially usable species have not, or have hardly been tested in plantations because they did not figure among the major timber species. With the exception of certain species such as ayous, limba, okoumé and a few other "pioneer" species, their growth and productivity are practically unknown. Among these are species whose regeneration is linked to forestry fallows or in highly degraded forests and whose young growth may be very rapid. Only through better knowledge of ecological requirements, of methods of reproduction (the lack of seeds seriously curbs the development of such plantations) and of behavior will it be possible to diversify the range of local species which are potentially usable in plantations.

Towards the sustainable management of planted forests

Several "reference systems" for the sustainable management of forestry plantations (notably principles, criteria, indicators and verifiers) exist in the region, both for natural forests and for plantations (OIBT, FSC, etc.). These reference systems propose guidelines for the sustainable management of forestry plantings, but complying with the guidelines does not necessarily guarantee success. They must be disconnected from certification, which is a marketing tool. The fact remains that the only valid indicator is, in the final analysis, comparison between forecasts and reality on the ground at the time of harvesting.

The "artificialization" of the environment makes it necessary to acquire knowledge and innovative know-how. Research and development must necessarily precede strategy and be applied to plantations over the long term. The mutual exchange of knowledge and know-how and the sharing of information at the regional level would certainly be very beneficial to the whole community engaged in reafforestation.

Investments are not limited to the planting of trees but must include the cost of long-term work (management, maintenance, silvicultural) up to harvesting or the first marketable thinning. Many failures are in fact attributable to the abandonment of plantations which nevertheless started off successfully.

Public intervention needs to be rethought: the design of effective, credible and sustainable incentives. The private sector alone cannot take all the risks, even for the benefit of future generations. It needs, in return, security for its investments.

Photo 8.11: Old eucalyptus in the planted Mampu Forest, DRC

13. Conclusion

The development of new silvicultural practices for natural forests and the development of forest plantations in degraded forest zones or savannas pose major challenges for Central Africa. "Traditional" methods of management used today (even if only recently) must be re-examined in light of all kinds of new issues, challenges and demands confronting Central African countries and societies. To not develop forestry management capacity and technologies endangers the entire forest ecosystem with the risk of disastrous degradation or even disappearance of the forest. This would then lead to economic and human non-competitiveness compared with other more remunerative short-term use of the land. Accelerating the establishment of new forestry management practices will nonetheless only occur with strong and loyal support from central African political institutions and administrations.