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LA RÉFÉRENCE EN MATIÈRE DE BOIS TROPICAL

SPECIES MANAGEMENT IN THE PRODUCTION FORESTS OF CENTRAL AFRICA

Forest & Industry Commission

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1. Rules and principles established by CITES

1.1 Non-detriment findings

The CITES Convention requires Non-Detriment findings to be made by scientific authorities designated by producer countries, for trade in specimens of taxa listed in Appendix II, to verify "whether a proposed export would be detrimental to the survival of that species".

The model non-detriment findings vary according to the taxonomic group concerned by the trade, but paragraph 1 a) of Resolution Conf. 16.7 (Rev. CoP17), Non-detriment findings (NDFIs), recommends that scientific authorities take into account several non-binding guiding principles in determining whether trade would be detrimental to the survival of a species and, inter alia, whether a species "**can be conserved throughout its range at a level commensurate with its role in the ecosystem**".

The EU is a "Party" to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). As such, it applies the Convention and defines its regulations on the protection of species of wild fauna and flora by controlling their trade, in line with CITES, with specific requirements. The scientific authorities of the EU Member States and the European Union's Scientific Study Group issue scientific opinions on each import and on the Non-Detriment findings drawn up, to validate or reject the import of the products concerned. For tree species, this assessment essentially involves the rigorous verification of information on each forest management unit in the country of export to ensure that the measures taken are sustainable in the long term.

1.2 European Union proposal to the Plants Committee

The EU submitted document PC26 Doc 18 to the Plants Committee in June 2023, concerning sustainability criteria for timber non-detriment findings. As used in this document, the regeneration (or re-establishment) capacity of a harvested population is the capacity of the remaining trees to reconstitute the population or to repopulate areas where individuals or sub-populations have been eliminated. In this document, the EU refers to the "reconstitution indices" set up nearly 30 years ago by forest managers for the management of forest concessions in Central Africa.

Concerning regeneration capacity, "the EU considers that, ultimately, a species listed in the CITES Appendices and subject to forest management can only be considered fully sustainable if the forest demonstrates full regeneration and recovery capacity, i.e. a regeneration index of 100%".

At present, and without having informed Central African timber producers/importers, the EU is refusing imports of specimens of timber classified in Annex 2 if the reconstitution index is less than 50%, thus exceeding the requirements set by the Central African countries (which do not systematically impose this minimum threshold per species). It is even considering raising this requirement to 75% or even 100% and has offered to put this forward to the working group on Non-Detriment findings for high-value timber.

This document, drawn up by the ATIBT with the contribution of members of the Forest & Industry Commission, aims to provide methodological and scientific information on the sustainability criteria used for the management of production forests in Central Africa and to propose an approach guaranteeing the survival of the species concerned following the CITES Convention.

2. Principles of sustainable forest management in Central Africa

2.1 Background

Originally, in Central Africa, the first management of production forests was concerned only with maintaining regular timber production (the notion of sustained yield). It was not until the early 1990s that the concept of integrated management emerged, taking into account socio-economic and environmental considerations: the Dimako integrated management project in Cameroon, financed by French cooperation, laid the foundations for what forest management should be in Central Africa. In 1998, the ECOFAC institutional project, funded by the European Union, drew up the 1st management plan that was implemented (in the CAR).

In the 2000s, the production of management plans became a legal requirement for all forest concessions. Institutional projects (PARPAF in CAR, PAPPFG in Gabon, PAGEF in Congo, AGEDUFOR in DRC) financed by the French Agency of Development and institutional support programmes for the forestry sector (such as the Canadian International Development Agency in Cameroon) have translated management standards into national regulations. They have also helped build the capacity of institutions and supported concessionaires in drawing up their management plans.

The management rules currently in force for forest concessions in Central Africa are a direct result of the thinking behind projects carried out by the European Union and France.

The 1990s also saw the emergence of the first FSC and PEFC sustainable management certification standards, which incorporated the requirements set out in these management standards.

For the past 20 years, research projects, notably the sub-regional DynAfFor and P3FAC projects of the collective DYNAFAC[1], have been studying the dynamics of logged stands. Their results have helped to refine the assumptions used in stand modelling and to propose several changes to the model.

2.2 Management principles for production forests in Central Africa

In the dense rainforests of Central Africa, the forest stand is made up of a wide variety of species of different ages and sizes, which has led managers to opt for irregular high forest management.

The principles of this type of management are based on maintaining the forest cover, with trees over a minimum diameter set by each country being cut down on a 25-30-year rotation while maintaining future trees and seed trees and preserving the ecosystem functions of the forest.

The rules thus defined at the national level guarantee that the harvesting carried out is "sustainable and not detrimental to the survival of the species" concerned, including by taking into account the "volume of legal and illegal trade (known, induced, anticipated, estimated)", as recommended by Resolution 16.7 (see part 4).

[1] https://www.dynafac.org/en

It is important to bear in mind that it would be illusory, after a 1st logging operation, to want to reconstitute in a few decades all the volume that has accumulated standing for centuries: subsequent felling will only be able to harvest the production accumulated during the management period (Durrieu and Forni, 1997, Morin-Rivat et al., 2017): the objective of forest management in Central Africa is therefore not to maintain identical populations of a given species locally on the scale of a concession. This principle of forest management is applied throughout the world and is not specific to Central Africa.

Preserving species and ecosystems in Central Africa is one of the main priorities of COMIFAC member countries. Each country has established its regulations defining the terms and conditions for managing forest concessions, which are broadly similar from one country to another:

- Signature of a contract between the forest administration and the forest concession holder, committing them to a management approach,
- Carrying out studies to characterise the forest to be managed, through :
  - an inventory of timber and non-timber resources (non-timber forest products, wildlife),
  - mapping of habitats and ecosystems,
  - a socio-economic analysis,
- Drawing up the management plan, including:
  - allocation of the concession area into management "series",
  - management rules for the series dedicated to production, aimed at renewing the populations exploited (Cf. § 3),
  - management rules for the other allocations.

Although the institutional contexts in the 3 tropical forest basins are fairly similar, with the adoption in the 2000s of laws, forestry codes and standards making forest management mandatory, the technical itineraries differ significantly. In the Amazon and Southeast Asia, the principle of forest management does not involve a prior assessment of the resource, nor does it measure the level and conditions of resource renewal within the concession.

In this sense, the rules in Central Africa are far more complex and demanding, to ensure the survival of species. It would therefore not be legitimate to impose sustainability criteria, as proposed by the EU, that would only apply to Central African forests.

3. Management rules at the concession level

3.1 Principles for regenerating exploited populations

The sustainability criteria proposed by the EU are based on the regeneration capacity of a logged population, but neither in Central Africa nor in other tropical forest basins can the management rules set out in management plans meet these expectations. Furthermore, the survival of a species cannot be assessed on the scale of a forest concession but over its entire range (Cf. 3.2.3.2).

In the case of the forests of Central Africa, the manager of a forest concession seeks to ensure that the removal of the only large trees in each logging cycle (rotation) is compensated before the next removal by the growth of stems in diameter classes initially below the Minimum Cutting Diameter (MCD), and which reach this MCD during the rotation, as illustrated in Figure 1. The aim here is not to assess the renewal of an entire population or a mature population, but rather the renewal of only those trees that can be harvested above a minimum

diameter set by the authorities.

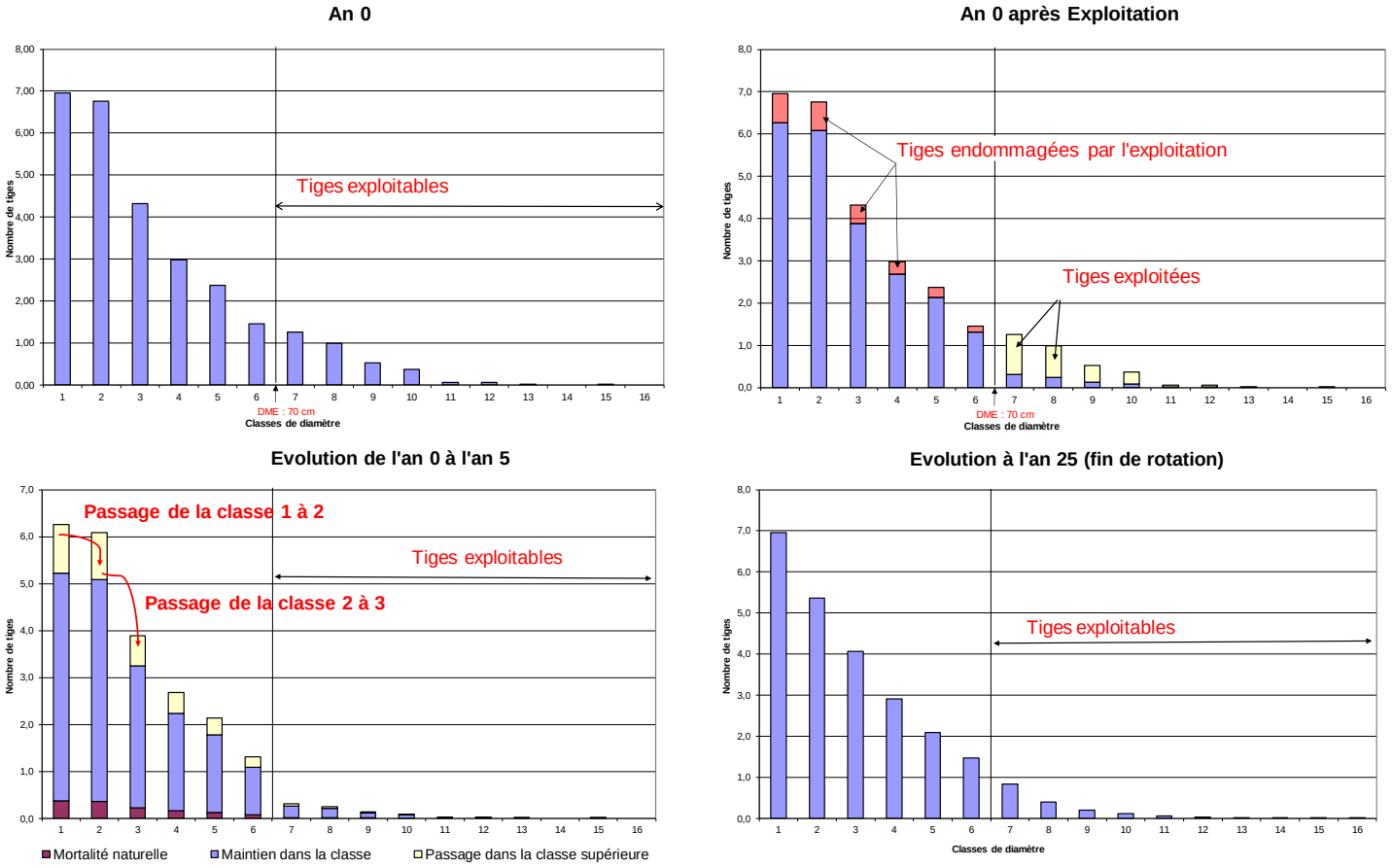


Figure 1: Principle of irregular high forest management in Central African production forests

Once this silvicultural principle has been established, the next step is to ensure that future populations are capable of ensuring a minimum level of reconstitution of the resource from one rotation to the next. Reconstitution rates or indices are indicators used by forest managers in the Congo Basin to assess the economic sustainability of forest management and measure the sustainability of timber harvests (Cf. § 3.2).

The objective of the approach adopted in Central Africa is to maintain a sufficient timber harvest from one rotation to the next to ensure the sustainability of the economic benefits of forest management. The level of harvesting and its reconstitution can be adjusted, to achieve the sustainability objective set by the regulations, by varying the length of the rotation, the Minimum Cutting Diameters of the species (the MCD under management defined by the Management Plan can be different and generally higher than the official MCD defined a priori and on a national scale by the Administrations) and in certain countries the level of harvesting of trees with a diameter greater than the MCD.

Forest managers must guarantee the sustainability of the forest and its economic, social and environmental functions. This requires the implementation of various measures, as well as careful planning of harvesting to ensure that residual stands are not endangered.

3.2 The rate of reconstitution

3.2.1 A tool for forest operators

The rate of reconstitution: one of the tools used to help set development parameters, as part of a set of measures and decisions taken by the development plan.

Le taux de reconstitution constitue un outil d'aide à l'aménagiste forestier, créé dans les années 1990 (DURRIEU DE MADRON L.*et al.*, 1998), et qui n'est jusqu'à ce jour employé que dans le Bassin du Congo, où son calcul est exigé par les normes des différents pays qui fixent des taux minimums à atteindre (Gabon, Congo, Cameroun, RCA, RDC – Cf. Encadré 1). Cet outil s'est avéré très utile depuis plus de 20 ans pour préparer les plans d'aménagement sur plus de 40 millions d'hectares (OFAC, 2022). The reconstitution rate is a tool to assist forest managers, created in the 1990s (DURRIEU DE MADRON L. et al., 1998), and which has so far only been used in the Congo Basin, where its calculation is required by the standards of the various countries which set minimum rates to be achieved (Gabon, Congo, Cameroon, CAR, DRC - see inset 1). This tool has proved very useful for over 20 years in preparing management plans for more than 40 million hectares (OFAC, 2022).

For instance, the most commonly used method for calculating the rate of reconstitution is to use the following formula, known as the "Dimako formula" (adapted from DURRIEU DE MADRON et al. 1998):

$$\%\,\mathrm{Re} = \frac{[No(1-\Delta)](1-\alpha)^{R}}{NP} \times 100$$

With :

% Re = percentage of reconstitution of the number of stems above the MCD

Values from the management inventory

N_O = number of one, two, three or four diameter classes immediately below the MCD (depending on growth and length of rotation)

NP = Number of stems above the MCD at time 0

Values derived from research into settlement dynamics

α = annual mortality rate

Δ = rate of damage due to operations

R = rotation duration for which the reconstitution rate is measured

We must not go too far in basing management planning solely on this mathematical formula, as dense rainforests are extremely complex ecosystems and knowledge of forest dynamics is still incomplete. This formula should be considered as one of several decision-making tools.

It is important to remember that regeneration rates and the resulting management parameters (species managed, rotation length and MCD) are only part of the vast edifice that is sustainable forest management. Other measures and decisions taken by management plans as part of the "forest production" component are also essential: respect for the management parcel, areas put under conservation, Reduced Impact Logging rules, etc.[2]

[2] Etude sur le plan pratique d'aménagement des forêts naturelles de production tropicales africaines. Volume 1 : Production forestière », pages 50, 51 et 62 (ATIBT, 2007)

Inset 1: Varying reconstitution requirements under national legislation in Central African countries

In Cameroon, the manager must individually reconstitute 50% of a set of "managed" species, chosen by the manager from a list of main species defined by the Administration (also known as the "TOP 50"). These managed species must represent at least 75% of the total marketable volume of the main species. There is no requirement for the other main species, so there are no reconstitution requirements for any individual species. However, it is regrettable that this list of TOP 50 species contains very abundant species that are difficult to exploit in the long term.

In CAR, a minimum recovery rate of 50% must be achieved on a list of objective species that can be exploited in the short term.

In Gabon, the flagship species, Okoumé, must be reconstituted at 75%, but as this is impossible in certain forests, a lower rate can be accepted as long as the Minimum Cutting Diameter under management is raised above the official MCD of 70 cm. Also in Gabon, a minimum rate of 70% is imposed on the group of other objective species, with each of the species making up this group having to be reconstituted to 40%.

Finally, in the DRC, each species managed must be reconstituted at a rate of 30% and the entire group of the best-valued species must be replenished at a rate of 50%. The calculation methods are slightly different and the normative management framework allows the planner to intervene on another factor (in addition to the rotation period and the MCD), the removal rate, i.e. the percentage of trees that can be harvested from the populations of trees that have reached the MCD.

National regulations have set minimum thresholds (around 50%) to guarantee the renewal of harvestable trees, without requiring forest managers to reconstitute the forest stand identically from one rotation to the next.

3.2.2 Precautionary principles for interpreting the reconstitution rate

Assumptions about the percentage of trees with diameters greater than the MCD removed need to be clarified to correctly interpret the reconstitution rate.

The calculation of the reconstitution rate is generally based on the assumption that all trees that have reached the Minimum Cutting Diameter are removed. In reality, for various reasons (selection of certain qualities, bank protection measures, voluntary preservation of seed trees or trees useful to the population, etc.), some trees with a diameter greater than the MCD are not harvested, thereby increasing the actual reconstitution of populations. In the **DRC**, the standards take into account this need for a better approximation of actual reconstitution, and the calculation is based on the assumption that some of the trees with a diameter greater than the MCD are not harvested.

The formula for calculating the rate of recovery is therefore as follows:

$$\%\,Re = \frac{[(No * (1 - \Delta) + Np * (1 - h)](1 - \alpha)^R}{Np * h} \times 100$$

With:

% Re = percentage of reconstitution of the number of stems above the MCD
Values from the management inventory
N_O = number of one, two, three or four diameter classes immediately below the MCD (depending on growth and length of rotation)
NP = Number of stems above the MCD at time 0
Values derived from research into settlement dynamics
α = annual mortality rate
Δ = rate of damage due to operations
h = operating damage
R = rotation duration for which the reconstitution rate is measured

In addition, it is impossible to reconstitute in one rotation the stand built up over centuries, and it will not be possible to find very large-diameter trees during the second and subsequent logging periods. Taking this constraint into account, the calculation methods defined by the standards in **Cameroon** differ somewhat from those in other countries: only the 4 classes above the MCD must be reconstituted, with trees in diameter classes above MCD + 40 cm being considered as a 'bonus' for the first harvest.

The specific composition of the forest will inevitably change over time, and while it is vital to preserve the overall structure of the forest stand and all the functions it performs, it is impossible to reconstitute the populations of each species individually.

3.2.3 Limits on the use of the reconstitution rate

There is no scientific basis justifying the use of the reconstitution index at the scale of a concession to assess whether the exploitation of a species according to the management rules established by a management plan is detrimental to its survival. It is also important to be aware of the limitations of using reconstitution rates.

3.2.3.1 The uncertainties affecting the values of the parameters used to calculate the recovery rate

The parameters used for the calculation are not always known with sufficient precision. For some species and some concessions, no data on annual growth exists, or the data used was acquired on other sites and is used in the absence of available local data. The calculations are based on a simplifying assumption regarding natural mortality (generally a default value of 1% applied to all species and diameter classes), and the structures established based on the management inventory data for an individual species are often marred by significant statistical errors regarding the number of trees. These inaccuracies are reduced when reconstitution rates calculated for a group of species are considered, as the calculation is then based on a larger number of trees. As far as possible, and always to improve accuracy, it is preferable to use a periodic growth, specific to the

diameter classes that will exceed the MCD during the rotation, rather than an average annual growth. In the future, it will be important to specify the natural mortality rates, as the assumption currently used of 1% mortality per year for all species and diameter classes is too simplistic, and it is likely that mortality will be lower for stems with a diameter immediately below the MCD, which are used in the calculation of the reconstitution rate.

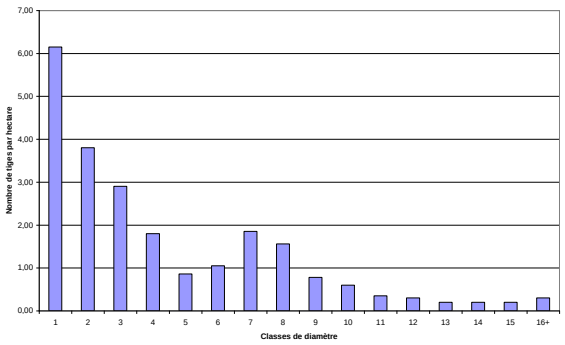
A statistical analysis of the assessment of the rate of recovery of Sapelli (*Entandrophragma cylindricum*) in CAR gives an accuracy of 45% of the reconstitution assessment, at the 95% probability threshold (PICARD et al. 2008). Generally, for the different species studied, accuracies are in the order of 30 to 50% (PICARD & GOURLET-FLEURY, 2008).

Furthermore, as indicated in the RCA management standards (PARPAF. 2008) *"If the structure of a managed species is erratic, calculating a rate of reconstitution becomes pointless. On the other hand, the numbers of this species will be taken into account when calculating the overall rate of recovery for the group of managed species".*

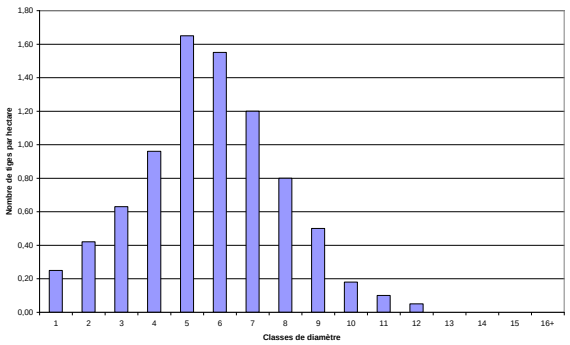
3.2.3.2 An indicator that does not measure changes in the overall structure of the population.

Analysis of population structures is the key to assessing the sustainability of harvesting.

The rates obtained only measure reconstitution in the first rotation, and the analysis is therefore based on only part of the structure. It is important to analyse the population structure as a whole. In Figure 2, for example, it is easy to see that the long-term reconstitution of the population of species 2 is more problematic than that of species 1, due to a shortage of small-diameter stems, whereas the recovery rate of species 2 is much better than that of species 1, due to the abundant number of stems with diameters immediately below the MCD.



Species n°1: *"Exponential" structure, with an abundance of small-diameter stems (Ozigo, Dacryodes buettneri in a concession in Gabon) - 29% reconstitution over 25 years (DME of 70 cm), abundance of small-diameter stems.*



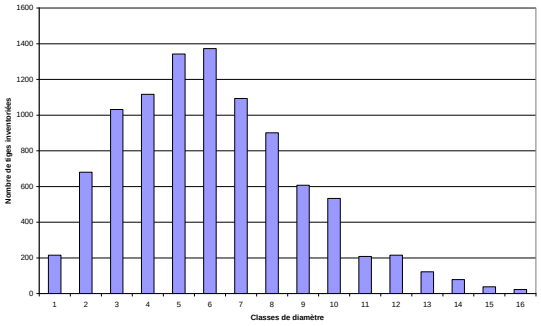
Species n°2*: Bell-shaped" structure, with a deficit of small-diameter, stems (Limba, Terminalia superba, in a mature forest in the Congo - 76% reconstitution over 25 years (DME of 70 cm), despite a large deficit of small-diameter stems*

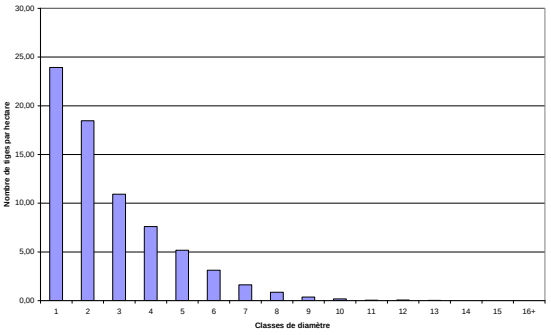
Figure 2: Two examples of the structure and reconstitution of tree species populations: on the x-axis, the diameter classes at breast height, with a 10 cm amplitude, and on the y-axis, the number of stems found in each diameter class.

Moreover, the structure of a given species can vary greatly from one forest to another. The structure of a given population is linked, on the one hand, to the ecology of the species in question and, on the other, to the history of the forest (DOUCET, 2003).

From an ecological point of view, the sustainability of a species must be considered on a regional scale. Sapelli

is gradually disappearing from certain forest massifs (BAYOL, VAN LOON. 2007), as shown by the "bell-shaped" structure observed, but its populations remain very dynamic at the edges of the forest massif, in CAR for example, with an "exponential" structure (PARPAF. 2007) or in recently rejuvenated formations, near Kisangani for example (BAYOL., CHABBERT. 2008). The same applies to Okoumé, as shown in Figure 3, which is abundantly recolonizing the savannahs of the coastal zone or Haut-Ogooué in Gabon, but whose range is shrinking in Ogooué-Ivindo (BAYOL, BORIE, 2004, Guidosse et al., 2022). In both cases, should we try at all costs to maintain the populations of these two species in environments that no longer correspond to their ecological optimum, which would imply having a major impact on ecosystems, or should we give priority to ensuring the species' survival by managing the most dynamic populations?





Population d'Okoumé dans une forêt mature de l'Ogooué-Ivindo

Population d'Okoumé dans une jeune forêt sur recolonisation récente de savane dans le Haut-Ogooué

Figure 3: Example of Okoumé (Aucoumea klaineana) structures

3.3 Taking into account the fruiting capacity of individuals

As we can see, reconstitution rates are an important element available to the forest manager when drawing up a management plan, but they cannot be the only parameters for the sustainability of forest management.

Other factors must be taken into account when determining the Minimum Cutting Diamater under Management, and in particular the fruiting capacity of individuals with their diameter. In addition to the reconstitution of stands

in the first management rotations, the long-term preservation of species requires sufficient natural regeneration. To achieve this, it is vital to maintain standing trees capable of producing seeds. Knowledge of forest dynamics (growth, mortality rate, fruiting diameter, etc.) has been developing for more than thirty years and is continuing with the installation and monitoring of research facilities by the DYNAFAC Collective (Dynafac, 2022). DYNAFAC also aims to improve how research findings are taken on board by the national authorities responsible for forests, by improving regulatory texts. The Collective is currently working with countries from the region to ensure that the main recommendations[3] are properly integrated into national forestry legislation.

4. Analysis of the vulnerability of tree species exploited in Central Africa

As presented in PC26 Doc18[4] on sustainability criteria for Timber Non-Detriment findings (NDFs), with regard to logged tree species, the principle of sustainability requires several biological prerequisites for populations, including sufficient population density and a healthy age structure which, combined with other parameters such as biological reproduction, dispersal and annual increment, allow local tree populations to regenerate after logging.

The vulnerability of Central Africa's tropical tree species has always given rise to considerable debate, as the volume produced comes from natural forests with multiple functions. In addition, certain exploited species, known as competitive species (sought after for NTFPs as well as timber), are the focus of criticism from civil society and international observers. Industrial logging in Central Africa is also known to be highly selective, with around 90% of timber production based on just a dozen species. Their populations are therefore potentially under considerable pressure, despite low removals (1-2 trees/ha for all species combined). In fact, their exploitation is generating negative reactions from several organizations calling for a boycott of tropical woods. For greater objectivity, these organisations very often base their criticisms on the levels of vulnerability announced by international institutions, principally the Red List of the International Union for Conservation of Nature (IUCN). However, the IUCN itself highlights the limitations of its Red List: (i) "a globally applicable category may not correspond to a national or regional category for the same taxon"; (ii) "taxa [are] not reassessed at appropriate intervals"; (iii) "the data used to assess taxa are often estimated with considerable uncertainty...".

The actual degree of threat to the main commercial species in the Congo Basin is currently poorly documented, given (i) the age of the data used (over 20 years), the latest assessments of Central African species predate the publication of the first version of the *Guidelines for the Use of IUCN Red List Categories and Criteria*[5], and (ii) the lack of knowledge for modelling long-term changes in tree populations. Many commercial tree species are included on the IUCN Red List under criterion A1, which considers the population reduction observed, estimated, inferred or assumed in the past (reduction measured over three generations, i.e. around 300 years

[3] https://www.dynafac.org/files/upload/mediatheque/Documents_de_synthese/Note_Aux_Decideurs_DYNAFAC-V7.%5B1%5D.pdf
[4] https://cites.org/sites/default/files/documents/PC/26/agenda/E-PC26-18.pdf
[5] https://www.iucnredlist.org/fr/resources/redlistguidelines

for tropical trees). However, this criterion is not very applicable to tree populations, as it is difficult to obtain reliable data over so many years. In addition, for many species such as afrormosia (*Pericopsis elata*), okoumé (*Aucoumea klaineana*) and sapelli (*Entandrophragma cylindricum*), the most recent IUCN source is a book that predates the arrival of management plans (Oldfield et al. 1998) listing trees that are threatened worldwide.

An update of the IUCN conservation status of nearly twenty logged[6] species in Central Africa was carried out to identify, based on recent scientific data, (i) species that are not threatened and for which logging can continue according to current standards, and (ii) species that are genuinely threatened, following the principles of the *Guidelines for the Use of IUCN Red List Categories and Criteria*.

Criterion A3 of the IUCN Red List, which relates to expected or assumed population reductions over the next 10 years or three generations (whichever is longer, but no more than 100 years), was used to analyse the vulnerability of each species over its entire range, taking into account the impact of logging and habitat loss. This modelling was based on the analysis of data from 98 forest management units representing around 22 million ha of forest. Additional information (the species' population density, diameter structure, the intensity of threats to the main dispersers, and the match between the regular fruiting diameter and the minimum cutting diameter) was also considered in the analysis of the conservation status of each species.

Only three species, *Entandrophragma candollei* (Kosipo), *Erythrophleum ivorense* (coastal forest Tali) and *Triplochiton scleroxylon* (Ayous), were classified as Vulnerable (VU), suggesting that logging has little impact on the species throughout their range (Loubota Panzou et al., 2023).

Assessing the level of vulnerability of exploited species is of crucial importance for Central African countries. To carry out a complete analysis, it is necessary to include all the data available at national and regional level and across the species' distribution area. This update must be attentive to the long-term evolution of tree populations and requires the use of robust methodologies, particularly with regard to criterion A3 of the IUCN red list.
An essential step for Central Africa is to rapidly set up a system for regularly monitoring the vulnerability of key commercial species. This initiative must be based on up-to-date data and sound methodologies, guaranteeing a reliable and relevant information base. Such a monitoring system will strengthen the capacity of decision-makers at international level by providing them with up-to-date, region-specific data to ensure informed decision-making on species conservation.

5. Discussion: how can species be managed sustainably in Central Africa?

Over the last 30 years, with the support of international cooperation, particularly European and French, the countries of Central Africa have defined rules for the management of forests used for timber production within the Permanent Forest Domain. These production forests exist alongside protected areas and areas set aside

[6] *Aucoumea klaineana* (Okoumé), *Afzelia bipindensis* (Doussié), *Bobgunnia fistuloides* (Pao rosa), *Cylicodiscus gabunensis* (Okan), *Dacryodes igaganga* (Igaganga), *Entandrophragma candollei* (Kosipo), *Entandrophragma cylindricum* (Sapelli), *Entandrophragma utile* (Sipo), *Erythrophleum suaveolens* (Tali), *Erythrophleum ivorense* (Tali), *Lophira alata* (Azobé), *Milicia excelsa* (Iroko), *Millettia laurentii* (Wenge), *Prioria balsamifera* (Agba), *Pterocarpus soyauxii* (Padouk), *Terminalia superba* (Fraké), *Testulea gabonensis* (Izombé), *Tieghemella africana* (Douka) et *Triplochiton scleroxylon* (Ayous).

for conservation in order to preserve the functions of forest ecosystems.

The management principles put in place include the collection of data on all forest stands at the scale of the managed concession, in particular the number and structure of tree populations. This collection of data by means of a precise management inventory over the entire surface area of the concession, with a fairly high sampling rate in order to obtain reliable data for forest management, is unique and does not exist in other tropical forest basins. The proposed management principles aim to maintain the productive potential and ecosystem services at the scale of each concession.

Forest managers should not seek to achieve a complete reconstitution of the exploitable populations of each species (Fargeot et al., 2004). The African forest is still evolving; it is the product of a turbulent history, linked to climate change and marked by the gradual reconstitution and ageing over the last two thousand years of a largely destroyed massif (Morin-Rivat et al., 2017, MALEY J., 2004).

Around 2500 BP, the western forest massif of the CAR and northern Congo were occupied by open vegetation, savannahs and open forests. As a result of strong ecosystem dynamics that continue to this day, sometimes coupled with the effect of anthropogenic disturbances such as agricultural clearings, the species composition is changing in the heart of today's forest massif (Biwolé et al., 2019; Morin-Rivat et al., 2017; Ndonda Makemba et al., 2022). Heliophilous and semi-heliophilous species tend to disappear from ageing forests, as shown by some of the bell-shaped structures observed, with a high deficit of small-diameter stems (Guidosse et al., 2022; Ndonda Makemba et al., 2019). It must be emphasised that this is a natural development, unrelated to forest management. Faced with this situation, the forest manager should not necessarily seek to reconstitute the forest stand identically from one rotation to the next. A choice has to be made: should we follow the natural evolution and take advantage of it, or undertake heavy silvicultural actions which would imply a major disturbance and a strong opening of the forest, equivalent to agricultural clearing, to regenerate certain species, by recreating the ecological conditions favourable to their growth? There is no single solution, and a compromise between the two must be found; it depends on each person's objectives and the stands to be managed. It is often necessary to accept that the specific composition of production will change significantly over time, and to anticipate this change by seeking outlets for the species that will have to ensure tomorrow's production. From this perspective, the aim of using recovery rates and the resulting measures is to guarantee a smooth transition to this new production, and to do this, aim to maintain an acceptable level of production of traditional and more easily exploitable species in the second rotation, to preserve the long-term economic profitability of forestry activity, without threatening the specific diversity of managed forests.

The main aim of recovery rates is to assess the economic sustainability of timber production. The aim is to ensure that the volume that can be harvested in subsequent rotations will ensure the profitability of the forestry activity, subject, as already mentioned, to the acceptance of a certain evolution of this production towards new species. From this point of view, it is not the level of recovery of each individual species that is important, but that of all marketable species. Reconstitution must therefore first and foremost be analysed on the basis of a set of species that are currently marketed. What's more, the minimum recovery rates to be achieved must be the result of a compromise between economic and ecological requirements. If the break-even point for companies is not reached, the logging activity will no longer have any raison d'être and, as a result, the States will no longer receive the income from it. It is important to point out here that governments must of course be involved, and in fact are, in the choice of minimum values for the rate of recovery, because the socio-economic benefits generated depend on the choices made. Forest management decisions are the result of compromises reached between the State and the private sector. They cannot be called into question without the State being

involved and without all the social and economic consequences being taken into account.

. The objective of forest management policy in Central Africa is not to aim for a high level of recovery for each individual species in each concession, as this is an economic indicator, but to ensure that logging does not cause the disappearance of species, either locally or regionally, and that forest production generates income for forestry companies and governments over the long term. Thus, a low recovery index for a given species in a given concession does not imply a threat to the survival of the species in these concessions or throughout its range.

The stakeholders in the sector - forest managers, researchers and forestry authorities - have all worked to put in place demanding forest management methods, using reconstitution indices among other tools. These methods have been recognised by the producer countries in the region and incorporated into their regulations. They are also considered by the FSC and PAFC sustainable forest management standards as guarantees of good forest management. There is no justification for seeking to impose stricter standards, such as those proposed by the EU, on producer countries that are not based on well-established scientific evidence.

Furthermore, imposing recovery indices of 100 or even 75 or 50% for each species and in each concession, as the EU would like to do, will not help to ensure the survival of the species concerned, but will only threaten forest economies, the jobs they generate and all the social spin-offs, with potentially disastrous consequences for forest ecosystems.

Management methods are constantly being consolidated as the first management plans are implemented. In particular, forest managers committed to the sustainable management of their forests have agreed to follow the following guidelines:

- Comply with national regulations, particularly in terms of forest management, and implement the validated management plans, in particular by not harvesting any trees with a diameter smaller than the Minimum Cutting Diameter, not complying with the harvesting plans (date of harvesting of the Annual Cutting Areas) and the harvesting rules ;
- When making decisions, give priority to calculating the rate of recovery for a group of species made up of species regularly exploited at the time the management plan is drawn up, and aim for a minimum recovery of 50% of the exploitable numbers for this group of species. This figure is a compromise, obtained on the basis of management plans covering millions of hectares, between economic and ecological requirements; It also takes into account the fact that by the next rotation, efforts to diversify production will make it possible to compensate for the drop in production in the range of species initially exploited. The minimum recovery rate targeted in the second management rotation should be higher than in the first rotation;
- Present in the Management Plans the rates of reconstitution and the population structures of each of the species managed, insofar as the statistical accuracy of the management inventory results allows, i.e. only for species that are sufficiently represented in the stands;
- Take into account the Effective Fruiting Diameter when it is known and ensure that a sufficient population of fertile trees is maintained;
- Support the revision and standardisation, on the basis of analyses and the inclusion of fruiting diameters, of the official Minimum Logging Diameters for commercial species at regional level (recommended by the DYNAFAC Collective);
- Raise, compared with the official MCD, the MCD under management for species that recover very

poorly and have an unfavourable structure (deficit of small-diameter stems) and ensure that a sufficient number of seed trees are maintained;

- Consider realistic management solutions adapted to each species and each forest: voluntary modification of the specific composition of the stands, increase in the MCD under management, natural or artificial assistance with regeneration...

Under these conditions, reconstitution rates will remain an essential tool in the management of dense humid production forests.

The survival of species in forest concessions is a constant concern for those involved in the sector. To assess the impact of the exploitation of a tree species, an approach defined by the IUCN would be much more appropriate than that proposed by the EU, with a set of criteria designed to assess the vulnerability of species (Cf. § 4). This approach measures the threats to the entire population of a given species (and not just the part made up of the largest trees) over its entire range (and not on the scale of a forest concession).

6. ATIBT recommandations

"ATIBT promotes the development of a sustainable, ethical and legal forestry industry and management of tropical woods as a natural and renewable resource, essential to the socio-economic development of producer countries." (https://www.atibt.org/en).
To achieve this, the Forestry and Industry Commission makes the following recommendations to the Parties to CITES:

- **Prohibit all imports of illegally harvested timber, and set up control mechanisms**, through CITES bodies, to verify the legality of timber entering their territory;
- Ensure that timber harvested from the permanent forest estate for which we trade comes from forests with **validated management plans that comply with regulations**;
- Continue to promote the **sustainable management of production forests**;
- **Base CITES assessments on the approaches developed by the IUCN for its red list classifications**, by generalizing vulnerability analyses to all exploited species and over their entire range, and by regularly updating these assessments.

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