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Emergence, approaches and challenges of sustainable forest management in Central Africa

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ABSTRACT: The study revealed that sustainable forest management (SFM) is nothing new. It has always been a concern, both in Central Africa and worldwide. Several approaches have been put in place to make it a reality: certification, participation, the community approach, the integrated approach and the ecosystem approach. However, the implementation of these approaches, especially in the Central African sub-region, faces a number of challenges. Despite the efforts made, sustainable forest management is far from being a reality, and forest resources are deteriorating in many areas, or even disappearing altogether in others. This is why it is imperative that we continue to reflect on these issues and find solutions to ensure that these approaches are effectively applied, taking into account the reality of each environment, and that sustainable forest management becomes a reality.

KEYWORDS: emergence, approaches, challenges, Sustainability.

1 INTRODUCTION

Sustainable forest management has always been a major concern. In fact, sustainable forest management is important because it brings both socio-economic and ecological benefits to the people who depend on the forest for their survival. Forests provide goods and services that are consumed throughout the world and maintain the ecological balance. It is undoubtedly at the heart of a number of issues. In Central Africa, a region with a large forest area, its importance is recognised and approved by all, especially as a large part of the population depends on it. This research has therefore focused on the understanding and history of SFM in general. This will be followed by a review of the approaches used to implement sustainable forest management in Central Africa. It will also highlight some of the challenges associated with applying these approaches to the Congo Basin forest. This will help to formulate some useful recommendations for achieving sustainable management.

2 UNDERSTANDING SUSTAINABILITY

In ecology, 'sustainability' explains how biological systems remain productive at all times. This means that sustainability refers to the balance of a species with the resources of its environment. 'Sustainability' also refers to the maintenance over time of all soil or ecosystem functions through appropriate management. According to the Brundtland Report (1987), 'Sustainability' means meeting the needs of the present generation without sacrificing the ability of future generations to meet their own needs. It means promoting economic and social progress while respecting natural ecosystems and the quality of the environment. Thus, linked to human action in relation to its environment, sustainability refers to the balance between a species in relation to its environment and the factors or resources available to allow all its parts to function, without damaging health or sacrificing the capacities of another environment. Sustainable forest management, on the other hand, is synonymous with good forestry. However, forestry and forest management are sometimes perceived negatively by many forest ecologists, environmentalists and society in general. This perception is largely due to poor forestry practices such as the extraction of excessive quantities of timber and fuelwood, and illegal logging. These practices were very common in the past and are still fairly common in tropical forests [1], [2], [3], [4]. One of the most widely accepted definitions of SFM is that of the ITTO, which states that it is 'a forest management process aimed at achieving one or more clearly specified management objectives with

respect to the production of a continuous flow of desired forest products and services without such production resulting in an undue reduction in the intrinsic values and future productivity of the forest being exploited and without excessive undesirable effects on the physical and social environment' (OAB - ITTO, 2005). This definition appears to be both very forestry-oriented and utilitarian. It is based on a traditional logic of sustained yield and sustainability of forestry exploitation [5]. It follows from the above that the objective of SFM is not only to ensure the flow of goods and services, but also to maintain forest processes intact, including the maintenance of the diversity of functional species that provide the goods and services. From the outset, SFM considers forests in time and space [6]. At the Interministerial Conference on the Protection of Forests in Europe, held in Helsinki in 1993, Resolution H1 defined SFM as 'the management and use of forests and wooded land in a way and at a rate that maintains their biological diversity, productivity, regeneration capacity, vitality and their potential to fulfil, now and in the future, relevant ecological, economic and social functions at local, national and global levels; and that they do not cause damage to other ecosystems' [7]. According to the 2008 United Nations General Assembly, SFM 'aims to maintain and enhance the economic and social value of all types of forests for the benefit of present and future generations. It is characterised by seven elements: the extension of forest resources, forest biological diversity, forest health and vitality, the productive functions of forest resources, the protective functions of forest resources, the socio-economic functions of forests and the legal, policy and institutional framework' (UN, 2008/Resolution 62/98). In your opinion, it is quite simply a question of maintaining all the functions of the forest in order to satisfy the essential needs of those who depend on it or who will depend on it in the future. All these definitions show that the concept of SFM combines the principles of respect for the environment, social well-being and economic balance. SFM aims to maintain management that restores biodiversity at multiple scales, to ensure the viability or improved ecological resilience of forest ecosystems as a whole, while meeting socio-economic needs for the use of forest resources, timber, fauna, flora and forest landscape amenities. SFM also aims to introduce adaptive management [8], [9], [10].

The concept of SFM has also been adopted within wildlife, fisheries and environmental sciences, since 'wildlife and its habitats are (...) an essential component of our natural heritage characterised by significant biodiversity. The richness of this wildlife is highly dependent on the general management conditions of its habitats, the management of existing populations and the protection of the most sensitive species' [11], [12].

According to Beaurain [13], sustainability has now entered the arena of political discourse where it is losing its original meaning linked to sustainability in time and space. To this end, sustainability is seen as a normative concept that refers to what is 'good', 'desirable', or 'morally right', particularly when used in compound terms such as 'social sustainability', 'environmental sustainability' [14], [15].

Within this formal framework, SFM is defined as the use of forest land in a way and at a rate that maintains its productivity, regeneration capacity, vitality and potential to fulfil, now and in the future, the relevant ecological, economic and social functions, at local, national and global levels, and that does not cause damage to other ecosystems. For this reason, most countries have begun to adjust their policies more or less voluntarily, incorporating the principles of SFM into their speeches and certain acts relating to the management of natural resources.

From this perspective, sustainable management is used as a source of inspiration for the process of developing standards for environmental resources and economic development [16].

But how did the idea of sustainable forest management come about ? The following paragraph attempts to answer this question.

3 HISTORY OF SUSTAINABILITY

Sustainable management has its origins in the protection of forests, the first laws of which were enacted in Ur in 2700 BC. But sustainability as a scientific concept goes back two millennia. The first forest conservation measures are recorded in Assyria in 700 BC, when hunting reserves were closed by the Royal Hunting Decree [17], [18], [19].

In fact, in 300 BC, the Chinese philosopher Mercius expressed his concern about deforestation as a result of timber harvesting, overgrazing by mountain bulls and the impact of this deforestation on river flows. At the same time, Platon described deforestation in the hills around Athens as a result of wood consumption and agricultural clearing. Indeed, Plato explains that 'there used to be forests on the mountains, but they have since been cut down, which has led to erosion' [20], [21].

Over the following centuries, a variety of forest management practices were adopted. Their aims were to prevent flooding, ensure the supply of wood and maintain forest areas. Federau [21] refers to the reforestation of deforested hills in Japan in the 9th century to prevent flooding of lower catchments or the new forest created in England in the 11th century.

In 14th century France, the forests almost disappeared before being saved by political measures. Specifically, in 1346, the Brunoy ordinance stated that 'the masters of the waters and forests will survey and visit all the forests and woods and will sell them in order to prevent the said forests from being perpetually maintained in good condition'. It was at this time that the notion of the forest's 'potential' emerged, i.e. its ability to produce goods sustainably. This is the concept of sustainable management. It was thanks to this concept that Colbert launched a major reform of forests, reaffirming this principle in the name of future generations [22], [23].

In the 17th century, the term sustainability was explicitly used in forest management. For foresters, 'sustainable management consists of exploiting forest resources, wood or other forest products, while maintaining the capital standing so as to pass it on intact to future generations. Only the interest on the capital, or part of it, is harvested. In other words, the harvest only concerns the annual biological growth which, if it were not harvested by man, would be naturally consumed by the various recyclers such as bacteria, fungi and animals. Man thus partially replaces the natural recyclers' [24].

In the 18th century, Hans Carl von Carlowitz published 'Silvicultura oeconomica' in 1713, in which he called for wood to be conserved, increased and used in a continuous, stable and sustainable manner [25]. This was the first documented use of the German term 'Nachhaltigkeit' for sustainability.

In 1795, Hartig formulated the principle of sustainability from an intergenerational perspective, writing: 'It is not possible to conceive of sustainable forestry, nor to expect it to be achieved, if the allocation of timber from forests is not calculated with sustainability in mind... Therefore, any wise forest management must impose taxes (by setting a value base) as high as possible on forests, aiming, however, to use the forests in such a way that future generations can derive at least as much benefit from them as present ones' [26].

In the same century, Thomas Robert Malthus [27], in his 'Essay on the Principle of Population', highlighted the inadequacy of resources to feed a growing population in the 18th century. For Jégou [28], his questioning of the finiteness of the earth's resources is one of the sources of inspiration for sustainability.

In the 19th century, a number of economists addressed the principle of sustainability, expressing concern about resources: should they be exploited or preserved ? They included Tassy Louis (1816 - 1895), Henry David Thoreau (1817 - 1862), Ralph Waldo Emerson (1803 - 1882) and George Perkins Marsh (1801-1882). And the main purpose of forestry is the production of wood; all other goods and services from the forest are considered to be products [28].

Tassy [29] sees forest management as the regulation of the harvesting of a forest in order to obtain a sustainable annual yield that is 'sustained' and as advantageous as possible. Henry David Thoreau, for his part, was driven throughout his life by a passion for the wilderness. Nature was to be his main subject of writing, so much so that a literary genre has been attributed to him: 'nature writing', where poetic sensibility, scientific knowledge and militancy in favour of environmental protection are combined [30], [31].

For Ralph Waldo Emerson, nature is sometimes a mirror, accessible and transformable, sometimes an erotic and all-consuming excess. In his writings, he mentions that 'the greatest pleasure to be derived from fields and woods is the secret relationship they suggest between man and plants...' [32].

George Perkins Marsh (1864), in his book Man and Nature, is recognised as the first conservationist. In it, he gives a vivid description of the process of environmental degradation in Europe. And it was thanks to this work that his readers were convinced of the need for reasoned management of natural environments [33].

In 1889, Lucien Boppe modernised the science of forestry and published a treatise on silviculture that became a worldwide standard-setter. At the end of the 19th century, Biolley [34] pointed out that silviculture and forest management were tools for safeguarding forests. According to him, sustained yield is the result of a balance between the increase and growth of stocks.

In the 20th century, in 1910 to be precise, Gifford Pinchot wrote a veritable firebrand: 'The Fight for conservation'. In it, he wrote 'Our unsurpassed health and well-being are the direct result of our country's superb natural resources and the way our people have used them, now and in the past. We are prosperous because our grandparents bequeathed us a land of marvellous resources that are still inexhaustible. Should we preserve these resources and, in turn, pass them on to our descendants ? If we don't, those who come after us will have to pay the price in poverty, decadence, failure to progress and prosperity as we know it.

When natural resources will be exhausted, disaster and disintegration in all areas of life will follow. The preservation of natural resources is therefore the basis, and the only basis, for our nation's success. There are other conditions, but this is the foundation' [35].

In 1920, Cotta noted that climate and soil influence the shape of trees and, consequently, the standing volume of forests [33]. And, since then, the concept of SFM has taken off following the United Nations Conference on Environment and Development (known as the Earth Summit), held in Rio de Janeiro, Brazil in June 1992.

SFM therefore involves maintaining and enhancing the economic, social and ecological values of forests for the benefit of present and future generations. This concept is closely linked to that of sustainable development, which refers to natural resources. It also shows that sustainable forest management is an economically viable, socially acceptable and environmentally friendly activity [36].

4 SUSTAINABLE FOREST MANAGEMENT IN CENTRAL AFRICA

4.1 A BRIEF PRESENTATION OF THE FORESTS OF CENTRAL AFRICA

The forests of the Congo Basin contain the second largest area of dense tropical rainforest after the Amazon. These forests cover 530 million hectares of total forest area; 268 million hectares of forest area; 6% of the world's forest area; 70% of Africa's forest cover and 91% of Africa's dense rainforests. They are shared between six countries: Cameroon, the Central African Republic, the Republic of Congo, the Democratic Republic of Congo, Gabon and Equatorial Guinea [37]. However, an analysis of their evolution reveals a considerable increase in the annual rate of disturbance between 2015 and 2020, which rose to 1.79 million ha per year from 1.36 million ha in 2005 and 2015. The main causes of this situation include the increase in cultivated areas, population growth and infrastructure development [38]. The distribution of these forests can be seen in Figure 1 below.

Fig. 1. The forests of Central Africa (Cifor, 2021)

In terms of their roles, these forests make a diverse contribution to the economies of the countries of Central Africa. A significant part of the contribution of forests to the socio-economic development of Central African countries is made through the value chains of non-timber forest products, fuelwood and the exploitation of wildlife for food purposes, value chains which are, however, still dominated by the informal sector.

To manage these forests, the governments of the countries in this region, under pressure from international organisations and donors, have been forced to overhaul their legal and institutional frameworks, to adopt a coherent framework for action (national environmental management programmes, national forestry action plans, etc.) and to adopt modern planning, management and monitoring tools. In fact, the pressure being exerted on these countries was inviting them to manage their forests sustainably.

To make it operational, SFM is on the agenda of the Central African states. This is why the six forested countries of the Congo Basin have designed and adopted forestry policies with the aim of reducing poverty, particularly in rural areas, helping to improve their national economies and promoting responsible management of biological diversity [39], [40], [41].

In practice, implementation of SFM results mainly in the management of forest concessions by export-oriented industrial companies [42]. The sustainable forest resource management approaches that have been put in place are described in the next section.

4.2 APPROACHES TO SUSTAINABLE FOREST MANAGEMENT IN CENTRAL AFRICA

Several approaches are currently used to manage forests in Central Africa sustainably. These include various forms of certification (FSC, FLEGT, private certificates), the integrated approach, the ecosystem approach, and the participatory or community approach [3], [39], [43].

Certification, initiated in 1989 by the Rainforest Alliance, has been promoted as a quality standard aimed at assuring consumers of timber and timber products that they come from forests whose production and management systems respect the principles and criteria of sustainability. It is a procedure whereby a third party provides a written commercial assurance/label that a product, process or service conforms to specific standards on the basis of an audit conducted according to agreed procedures [44], [45], [46]. As a result, it is a mechanism for certifying, after independent and neutral verification, that a product or service meets a given norm or quality standard. The result is the award of a label [47].

The integrated approach, although not highly developed in the field of forest management, emerged in some Western countries in the 1990s. Its role is to compensate for the shortcomings of sectoral management in ensuring equitable planning between the socio-economic uses deriving from the exploitation of natural resources and the underlying social players. Through a holistic approach, it aims to take account of the entire territory that is the subject of planning, without forgetting the different uses and stakeholders involved [48]. This approach responds to the public's demand for access to forest management, which is seen as a shared natural, social and economic heritage. Any decision taken in terms of management must therefore be taken in consultation with methods adapted to the 'multi-objective' and 'multi-actor' context, allowing consultation and the development of a reasoned and well-documented decision-making process.

The ecosystem approach was first developed by Watt [49] in its application to forestry. This approach is the 'main framework for action' of the Convention on Biological Diversity. It is based on taking into account the resilience of ecosystems, their capacity to regenerate and the interactions between their components [50], [51]. The aim is to ensure that biodiversity is adequately protected, in response to the shortcomings of traditional management, which did not take account of the characteristics of natural systems. As a result, the environment will have to be perceived as a number of interacting sub-systems. The ecosystem approach can also be better understood by the description of the principles for its application as agreed at the Malawi meeting in 1998 'Malawi Principles' and described by the Convention on Biological Diversity: 'a strategy for the integrated management of land, water and living resources that promotes the conservation and sustainable use, in an equitable way, of the benefits arising from the utilization of genetic resources' [52].

The participatory or community approach, for its part, originated in the Bali Declaration (2007), through the role of local communities in the sustainable management of protected areas. It lays the foundations for integrating these sites into their social environment, while at the same time reducing conflictual relations between conservationists and local populations due to their divergent interests. This approach is presented as one that can lead to the emergence of new regulations based on the dynamics of consultation, co-management and co-decision. As an illustration of sustainable forest management, participatory management is another common feature of the legal frameworks applied in the countries of the Congo Basin [53], [54].

Generally speaking, two types of operation promote the involvement of local people in forest management. The first promotes the management of forest exploitation concessions according to rules defined in a management plan, where local practices must be accepted and promoted. The second relates to community forests, which are considered to be the most complete example of decentralisation of forest management to the local population [55], [56], [57].

According to Nyange [58] and Mbuangi [59], the strengths of this approach lie in the fact that it focuses on socio-cultural and political factors and emphasises the power of collective action and the ability of local communities to influence the social and political systems in which they live. It is therefore a forest management strategy that implements actions likely to guarantee the sustainability of forest landscapes and ecosystems. To achieve this, the fight against poverty by promoting entrepreneurship and the use of techniques with low impact on the forest should be promoted.

5 CHALLENGES TO SFM IN CENTRAL AFRICA

The SFM approaches, briefly analysed in the previous section, refer to appropriate planning between the socio-economic uses deriving from the exploitation of natural resources and the underlying social actors, as well as taking into account the resilience of ecosystems, their capacity for regeneration and the interactions between their constituents. It also considers the

environment as a set of interacting sub-systems. It is based on the dynamics of consultation, co-management and co-decision. It promotes the fight against poverty by encouraging entrepreneurship and the use of techniques that have a low impact on the forest. Finally, it encourages producers to improve their practices to ensure that a product or service meets a given norm or quality standard.

In fact, several studies show that there are considerable difficulties in implementing these approaches in forest management. Not all the solutions proposed by these approaches are implemented.

The ecosystem approach, as applied throughout the world, including in Central Africa, faces enormous challenges. According to the FAO (2006), these include - the mismatch between the expectations of stakeholders, including the general public, and available forest resources; - difficulties in reconciling the competing objectives of the many stakeholders who use the resources of the same ecosystems; - insufficient knowledge of ecosystem interactions and the response of different ecosystem components to specific management measures. - inadequate capacity of management agencies and stakeholder groups to cope with the additional demands of the ecosystem approach to forest product use.

With regard to certification, for example, the work of Cerruti and Nasi [60] revealed that mechanisms offering to certify timber from concessions that have a forest management plan and comply with certain specifications remain marginal, and only 9% of forest concessions were certified in 2018.

In Central Africa, this approach faces many obstacles. As highlighted by Teketay & al., [61], the challenges associated with this process include: - the unsustainability of forest certification initiatives due to a lack of appropriate capacity; - lack of accreditation and certification at local level; - insufficient capacity for verification and certification of ecosystem services; - demotivation of forest operators due to the complexity of forest certification standards and procedures; - the fact that forest certification processes are voluntary and lack market-oriented legal requirements; - the lack of awareness of forest certification in some countries. To these difficulties must also be added the insufficient involvement of the government in forest certification, despite the fact that in several countries forests are state property. It should not be forgotten either that forest certification is a good tool for medium-sized and small companies, but that it represents a major challenge for small producers, who lack economies of scale.

The challenges facing the integrated approach are also enormous. These include the complexity of immersing oneself in a negotiated cognitive process where, as Lapointe [62] has argued, taking ecosystems into account transposes a set of structural rules onto the management framework. It will also be necessary to recognise the scale of the system of human activities generated by integrated forest management and the complexity of ecosystems. This suggests that the challenge of such management lies in the effort involved in designing the information system and maintaining its use. For the countries of Central Africa, this approach therefore faces the challenge of taking into account all the uses and players involved, not forgetting knowledge of the multi-resource use of forests. Another challenge in implementing this approach is to ensure the sustainable management of forest resources while taking into account the demands of economic development, as well as the social and environmental needs of growing populations, in a context of climate change that is impacting forest ecosystems.

There are many difficulties and constraints associated with participatory management. These include, for example, the ideological rivalry between, on the one hand, conservationists who criticise the potential impact of populations on nature and advocate forest conservation excluding all human activity [63] and, on the other hand, those who campaign for the use of forests by the local populations who depend on them to be taken into account. It should also be pointed out that implementing such an approach, which requires the effective involvement of local people, is a real challenge. Mbuangi [59] has acknowledged that the significant dependence of local communities in the Luki Biosphere Reserve in the DRC on the forest, their low level of education and lack of training constitute a major obstacle to their participation in the sustainable management of forest ecosystems, not to mention the demographic pressure and short-term economic interests they aim to obtain from the forest. For his part, Nkeoua [64] highlighted several challenges linked to participation in forest management in Central Africa. He alluded to the fact that forest ecosystem conservation programmes developed in Central Africa, as well as attempts to involve local communities, are carried out through the participation of NGOs in meetings and various committees monitoring the management of protected areas or the development of management plans. However, these NGOs are not established within the community. They do not have enough field experience and have few links with local populations. These NGOs are run by intellectuals who, for the most part, do not have a good understanding of the real problems experienced by local people. What's more, local people do not really benefit from the exploitation of forests or the conservation of wildlife.

6 CONCLUSION

This study has successively defined SFM, analysed its evolution and presented the approaches recommended for sustainable forest management. Ultimately, SFM involves using production to meet current needs without compromising those

of the future. It is, in fact, an act of solidarity between present and future generations, because we need to think about meeting their needs.

This is why a number of approaches have been put in place to ensure that sustainable forest management becomes a reality in this region of Central Africa, so that its population, most of whom depend on it, can actually enjoy the benefits of the forest and the economic advantages it provides now and in the future.

However, several studies carried out in Central Africa have highlighted the main obstacles to sustainable forest management. These are enormous and constitute an obstacle to improving the living conditions of the people who depend on the forest for their survival.

For this reason, this study considers that certain measures need to be taken as a matter of urgency, and that certain behaviours need to be adopted by the population, those involved in forest exploitation and the governments of Central African countries. These include continuing to think in a participatory way to ensure that the desired approach, in line with the requirements of each environment, is actually applied; stepping up law enforcement against those who infringe SFM, because SFM is incompatible with the notion of « let it happen »; and setting up organisations within forest-dependent communities to encourage their effective participation in forest management. In short, the aim is to remove all obstacles to the effective implementation of SFM.

REFERENCES

[1] Lanly, J.P., 1999: Forest management and sustainable development. French Forestry Journal, 51 (sp), 45-49. DOI: 10.4267/2042/5503.

[2] Lanly, J.P., 1994: Changes in the state of forests in the 20th century. Ecodecision, 13, 28 - 32.

[3] Gareau, P., 2004: Sustainable forest management worldwide: socio-political perspectives and alternative approaches. Environmental synthesis (Doctoral thesis). Quebec University, Montréal, 61 p.

[4] Sist, P.E, Rutishauser, E, Pena-ClaroS, M, Shenkin, A, Herault, B, Blanc, L, Baraloto, C, Baya, F, Benedet, F. & Da SIlva, K. E., 2014b: The Tropical managed Forests Observatory: A research network addressing the future of tropical logged forests. Applied Vegetation Science 18: 171–74.

[5] Smouts, M.C., 2001: Tropical forests, international jungle. Rennes: Presses de sciences PO. 349 p. https://doi.org/10.3917/scpo/smout/2001.01.

[6] Thompson, C.R., Shanna, H.S, Moore C.J. & Frederic, V. S., 2009: Our plastic age. Philosophical Transaction of The Royal Society, 364, 1973 – 1976.

[7] Barthod, C. & Touzet, G., 1994: From Strasbourg to Helsinki. The first two ministerial conferences for the protection of forests in Europe. Revue Forestière Française, 4 (319 - 334).

[8] Lindenmayer, D.B & Franklin, J.F, 2002: Conserving Forest Biodiversity: A comprehensive multiscaled approach. Washington DC: Island Press, 368 p.

[9] Hulme, P. E., 2005: Adapting to climate change: is there scope for ecological management in the face of global threat? Journal of Applied Ecology, 42 (5), 784 - 794.

[10] Koskela, J., Buck, A. & Teissier Du Cros, E., 2007: Climate change and forest genetic diversity: implications for sustainable forest management in Europe. Roma: Biodiversity international, 111 p.

[11] Burley, J., 2002: Forest biological diversity: an overview. Unasylva 209 (53): 3 - 9.

[12] Fortier, A. & Alphandery, P. (2012). Les enjeux d'une gestion durable de la faune sauvage. La mise en œuvre des ORGFH en France. Economie Rurale 327 - 328: 52 - 64.

[13] Beaurain, C., 2003: Local environmental governance and economic behaviour. A new perspective on the relationship between time and space. Sustainable development and territories, Dossier 2, 19 p.

[14] Verchère, A., 2011: Sustainable development in question: economic analyses around an improbable compromise between optimistic and pessimistic acceptances of the relationship between Man and Nature. L'Actualité Economique, 87 (3), 337 – 403.

[15] Boisvert, V., Carnoye, L. and Petitimbert, R., 2019: Strong sustainability: epistemological and political issues, from ecological economics to other social sciences. Sustainable development and territories [Online], 10 (1). https://doi.org/10.4000/ Developpement durable.13837.

[16] Boyle, A. & Freestone, D., 1999: International law and Sustainable Development: Past Achievement and Future change. Oxford: Oxford University Press, 364 p.

[17] Dixon, J.A. & Sherman, P.B., 1990: Economics of protected areas: a new look at benefits and costs. London: Island Press, 251 p. DOI: https://doi.org/10.4000/ethnoecologie.160

[18] Grove, R.H. & Hémery, D., 1999: Green Imperialism, Colonial Expansion, Tropical Island Edens and the Origins of Environmentalism, 1600-1860. Dans Marie-Noëlle Bourguet et Christophe Bonneuil. From inventorying the world to developing the globe. Botany and colonisation (late 17th century - early 20th century). French Review of Overseas History, 86 (322-323), 337-341.
[19] De Wever P., Cornee, A., Egorof, G., Duranthon, F., Lalanne, A., De Kermadec, & Lucet, S., 2019: Geological heritage: concept, state of the art, Valorisation. Naturae 2019 (1), 1-58.
[20] Waley, A., 2005: Three ways of thought in amount China. Rootledge Stratford, C.A.: Stratford University Press, 280 p.
[21] Federau, A., 2017: Pour une philosophie de l'anthropogène. Paris: PUF, 435 p.
[22] Clément, V., 2004: Le développement durable: un concept géographique? Lion: ENS, 125 p.
[23] Sylvie B. & Hervé R., 2019: The Forest in the Middle Ages, Les Belles Lettres, Paris, 419 p.
[24] Hartig G. L., 1805: Instructions on woodland cultivation for foresters () translated from the German by J.-J. Baudrillart. Paris: Levrault, 173 p.
[25] Schmithüsen, F., 2013: Three hundred years of applying sustainability to the forest sector. Unasylva, 240 (64), 9 p.
[26] Malthus, T. R., 1798: Essay on the population principle (translated from English by Pierre, P. & Prévost, G.). Paris: Guillaumin et C°, 236 p.
[27] Jégou, A., 2007: French geographers and sustainable development. Geographic Information, 3 (71): 6 - 18. DOI: 10.39117/lig.713.0006.
[28] Glück, P., 1984: Die Einstellung österreichischer Stadtbewohner zum Wald. Forstwesen, 101 (3), 142-159.
[29] Tassy, L., 1858: Studies on forest management. Paris: Hachette, 432 p.
[30] Latour, D., 2010: Henry David Thoreau or the ecological reveries of a solitary walker. Les chantiers de la création, 3. DOI: https://doi.org/10.4000/lcc.244
[31] Grandjeat Y.C., Englebert J.P., Campos L. & Chapoutier G., 2011: The place of the animal in American environmental literature. In Engélibert, G. Campos, L., Coquuio, C. & Chapoutier, G. (dir). The Animal Question. Between science, literature and philosophy. Rennes: Presse Universitaire de Rennes, 107 - 119.
[32] Zaninetti, J.M., 2012: The environment, a contentious issue. The spaces of North America, 169 – 182.
[33] Guillaume, B., Demeulanaere, E. & Feuerhahn, W., 2017: Environmental humanities. Investigations and counter-investigations. Paris: Sorbonne, 350 p.
[34] Biolley, H.E., 1920: Forest management according to the experimental method and especially the control method. Paris: Neuchâtel, 90 p.
[35] Le Tacon, F., 2012: Développement durable ou gestion durable?. Revue forestière française, 2012, 64 (1), pp.83-96.
[36] Wolfslehner, B., Vacik, H. & Lexer, M.J., 2005: Application of the Analytic Network Process in multi-criteria analysis of sustainable forest management. Forest Ecology and Management (207), 157-170.
[37] Laurence C., 2021: Central African forest: what remains to be saved, in lemonde.fr, Le Monde, 05 October 2021.
[38] Gillet, P., Vermeulen, C., Feintrenie, L., Dessard, H. & Garcia, C. 2016: What are the causes of deforestation in the Congo Basin ? Synthèse bibliographique et études de cas, BASE, Volume 20, 2016, Issue 2. DOI: 10.25518/1780-4507.13022.
[39] Lescuyer, G., 2004: Criteria and indicators for sustainable forest management: some lessons from current experiences in Central Africa. Proceedings of the international symposium 'Sustainable development: lessons and prospects. Ouagadougou: International Organisation of the Francophonie, 63-69.
[40] Kuma, J.K., 2020: Poverty and unemployment in the Democratic Republic of Congo: state of play, analysis and prospects. University of Kinshasa: CREQ, 24 p.
[41] Mbuangi, L.M., 2022: Socio-economic and ecological issues of the charcoal industry on the outskirts of the town of Boma in the DRC (PhD thesis). University of Kisangani (DRC), 175 p.
[42] Karsenty, A., Lescuyer, G. & Nash, R., 2004: Is it possible to determine criteria and indicators for the sustainable management of tropical forests ? French Forest Review 506 (5), 457-471.
[43] Mankoto, S. & Maldague, 2003: Systemic strategy applied to biodiversity management, the case of the Luki Biosphere Reserve (DRC). Paper submitted to the 12th World Forestry Congress, Quebec City: Canada, 35 p.
[44] Bass, S., 2001: Forest certification. Report prepared by the Advisory Group on ForestCertification (GCCF). European Forest Institute, 36 p.
[45] Briec, L. & Mandard, M., 2016: The failure of forest certification. The case of FSC certification examined through the sociology of translation. Mondes en développement, 1 (173), 63 - 78.
[46] Van Dijk, S., Stas, S., Van Benthem, M., 2020: Overview of forest certification schemes for sustainable forest management in Gabon. Wagenningen: CTA, 37 p.
[47] Cuny, P., 2011: Current status of community and communal forestry in Cameroon. Wageningen: Tropenbos International Congo Basin Programme, 110 p.
[48] Margerum, R. D., 1999: Integrated Environmental Management: the Foundations for Successful Practice. Environmental Management, 24 (2), 151 – 166.

[49] Watt, A. S., 1947: Pattern and Process in the Plant Community. Journal of Ecology, 35 (1 et 2), 1 – 12. DOI: 10.2307/225649749.
[50] Gareau, P., 2005: Approaches to sustainable and democratic forest management worldwide. Vertigo 6 (2). https://doi.org/10.4000/vertigo.2717.
[51] Brou, A. N., 2005: Approches stratégiques de gestion durable des ressources forestières: La place de la transdisciplinarité. Abidjan: Université Félix Houphouët-Boigny, 11 p.
[52] CDB., 2004: Ecosystem Approach (CBD Guidelines), Montreal: Secretariat of the Convention on Biological Diversity, 51 p.
[53] Nguinguiri, J.C., 1999: Participatory approaches to forest ecosystem management in Central Africa: a review of existing initiatives. Michigan: CIFOR, 24 p.
[54] Karsenty, A., 2008: Problematic local communities. In Concerted management of natural resources. The test of time. Gret: Karthala, 277- 288.
[55] Oyono, P.R., Ribot, J.C., Mvondo, A.S. & Logo, P.B., 2007: Corrective measures for decentralised forest management in Cameroon: options and opportunities from ten years of experience Governance Brief, 33 (f). Bogor: CIFOR, 12 p.
[56] Joiris, D.V. & Bigombe, P.L., 2010: Participatory management of Central African forests. Versailles: Quae, GIE, 236 p.
[57] Lescuyer, G. & Cerutti, P., 2013: Sustainable forest management policy in Central Africa. Taking the informal sector into account. Perspective (21), 1 - 4.
[58] Nyange N. M., 2014: Local community participation and sustainable forest management: the case of the Luki Biosphere Reserve in the Democratic Republic of Congo (PhD thesis). Laval University, Quebec, 205 p.
[59] Mbuangi, L.M., 2016: Participation in the sustainable management of natural resources: current constraints of local communities in the RBL in the DRC. Saarbrücken, EUE, 100 p.
[60] Cerruti, P. O. & Nasi, R., 2021: Sustainable forest management (SFM) of tropical moist forests: the Congo Basin', in Blaser, J., Hardcastle, P. (Eds.) Achieving sustainable management of tropical forests, Burleigh Dodds Science Publishing, Cambridge.
[61] Teketay D., Mbolo A. M. M., Kalonga S. K. & Ahimin O., 2016: Forest certification in Africa: achievements, challenges and opportunities. African Forest Forum, Nairobi, Kenya. 172 p.
[62] Lapointe M., 1999: La gestion intégrée des forêts et le développement des systèmes d'information. IRECUS, Essai présenté au programme de maîtrise en gestion et développement des coopératives, Université de Sherbrooke, 84 p.
[63] Devall, B. & Sessions G., 1985: Deep Ecology: Living as if Nature Mattered, UT: Gibbs Smith, Salt Lake City, 267 p.
[64] Nkeoua, G., 2003: Challenges of sustainable management in the Congo Basin. World Forestry Congress XII.