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Sustainable Management of Tropical Dry Forests: An Overview from Cameroonian Context and the Special Case of Mozogo-Gokoro National Park

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Abstract

Climate change, desertification, and biodiversity are critical factors in the ongoing multilateral mobilization for sustainable management of natural resources. In order to investigate the administration of a national park, this chapter focuses firstly on the directions taken by the international normative arsenal in the Cameroonian context of forest governance and specifically the reminder of some regulatory texts concerning national parks. After addressing the issue of management of protected areas in the dry Far North of Cameroon, the second part examined the special case of the Mozogo-Gokoro National Park, located in this region, with reference to the results of a survey and administrative report consultations. The analysis reveals a gap between international and national legal instruments and their actual implementations. The park's status as a plant conservation model in Sudano-Sahelian zone is mostly attributable to empirical local practices adapted to the resilience of vegetation.

Keywords: Cameroon, efficiency, *in situ* conservation, international agreements, regulation

1. Introduction

In the dry Sahelian and Sudanian zones in Africa, the constantly growing population is permanently exerting pressures on nature, making unstable ecological systems [1–3]. Climate variability and the fragility of soils are added to constitute worrying risks for the stability of natural ecosystems [4–6]. In addition in these regions, climatic fluctuations at different time scales (seasonal, interannual, and decennial) strongly affect the dynamics of vegetation [7, 8]. Land degradation is also more pronounced there, with a negative impact on biodiversity and soil properties [4]. Human activities have a major effect on these changes [9]. Protected areas representing the main refuges of biological diversity must particularly face

these various constraints, hence the recommendation of sustainable management standards starting from the international level.

The international community recommends, in dry areas as elsewhere on the planet, the sustainable management of natural ecosystems as a solution adapted to various threatening factors for the preservation of the environment [10–13]. It is a complex process, involving appropriate planning and integrating the multiplicity of constraints and actors [10, 11, 14, 15].

The definition commonly used at the international level is formulated as follows: “Sustainable forest management means the management and use of forests and woodlands in a way and at such intensity that they maintain their biological diversity, their productivity, their regenerative capacity, their vitality and their capacity to satisfy, now and for the future, the relevant ecological, economic and social functions at local, national and global levels, and that they do not cause damage to other ecosystems” [16, 17]. Sustainable management of dry tropical forests has also been defined as the planning and execution of actions to ensure the conservation and use of a forest according to defined objectives and the physical and socioeconomic context, for the satisfaction of needs of the present and future generations [11, 18]. It helps to conserve and enhance the value of the land, water, plant, and animal heritage, using technical means that are economically and socially appropriate and respectful of the environment. It also implies clearly defined and realistic objectives which can be modified according to biological, ecological, socioeconomic, and political constraints [10]. It contributes to achieving a compromise between what is desirable and what is possible to do as well as to the proper use of all the resources available through continuous and permanent actions. It is presented as an option for adaptation and mitigation of sensitive changes affecting ecosystems [10, 15, 19]. The theoretical realization of a management plan in dry area ecosystems is structured in three [18] or four stages [11, 20]: the knowing and description of the existing; defining objectives, tools, and means; negotiating and drafting a management plan; and the implementation of this plan, its monitoring, and control, which led to the definition of assessment and certification systems for sustainable management.

In other words, it is about developing a multidisciplinary and participative approach, which would allow multiple interventions in the optics of sustainable development. Cameroon, not being on the sidelines of this international advocacy, has set to work on the implementation of these texts through several programs focused on the conservation of natural resources and the fight against desertification. There is a need to ensure over time that this policy is effectively applied, as well as the texts and strategic actions put in place to increase efficiency in forest management. Some authors point out some obstacles in these processes, mainly in relation to governance [21, 22].

In the first part of this chapter on a presentation of the context of sustainable management of dry forests in Cameroon, the description of the normative and institutional frameworks, aspects of the regulations concerning national parks, and the situation of forest governance in the semiarid region of the Far North of Cameroon is discussed alternatively. The second part of the chapter focused mainly on the evaluation of the management efficiency of the Mozogo-Gokoro National Park (MGNP), located in this dry area of the country. Interactive initiatives involving especially scientific actors are recommended in this process [23]. It was thus a question of completing the preliminary work of Sandjong Sani et al. [24], by introducing new data highlighting the constraints, threats, and gaps in the management, and analysis of park evolution, confronting the opinions of various stakeholders and formulating explanatory hypotheses.

2. Context of sustainable forest management in Cameroon dry lands

2.1 Evolution of the normative and institutional frameworks

Profound changes have marked forest management in Cameroon since the colonial era, as specified in the National Forest Action Plan document [25]. Originally, the exploitation of degrading resources of natural ecosystems was almost systematic. It was done without rigorous management planning and division of the territory based on the use and allocation of land according to their different vocations. The forest classification took into account requirements such as the practice of hunting tourism, reforestation, and the protection of endangered areas or the enrichment of impoverished ones. In addition, irregularities had been noted, in particular the weakness of taking into account the socioeconomic and demographic evolution of the zones classified in the delimitation of protected areas, the exclusion of populations in forest management, and a forest administration deficient in skills and technical and financial means for monitoring and effective control of the forest heritage [25]. The consequences were the disappearance of materialized limits, the degradation of the spaces set aside, conflicts from either side of the national territory, and a mining or degrading exploitation of forest resources [26].

Having noted all these shortcomings and in the spirit of an incentive-based multilateral mobilization, the Cameroonian government has adopted, since 1994, new legislative and regulatory texts and programs including the consequent modifications [26]. The zoning of the national territory is systematized (but applied only in the southern part of the country), a diversity of actors are involved in management planning, and the participatory aim is clarified through the concepts of community forest and communal forest and the exercise of right of use in carrying out sustainable development plans. Despite these resolutely sustainability-oriented measures, other noted anomalies led to the establishment of a new important political vision for planning, closely linked to the entire forest and environment sector: the Forest and Environment Sector Program, abbreviated as FESP [26]. Other management initiatives specifically related to the Far North region have come in support, among others, the National Reforestation Program (NRP) and the National Action Plan to Combat Desertification (NAP-CD).

The FESP was set up by the Cameroonian government with the help of the international community, to contribute to the implementation of a new policy of sustainable and participatory management of the country's forest and wildlife resources. The primary objective of this program is to enable the establishment of a coherent framework for all interventions. It is a national sectorial development program established by the government but remains open to funding from all donors as well as contributions from civil society and nongovernmental organizations or NGOs [26]. The FESP set itself the following overall objective: the conservation, management, and exploitation of forest and wildlife resources respond to the local, national, regional, and global needs of present and future generations. Conjectured since its final design for a period of 10 years, it was finally in 2006 that the FESP was able to start with the lifting of the last constraint linked to the availability of external funding for the program. Assessment standards have also been developed.

The National Reforestation Program and the National Action Plan to Combat Desertification were launched in 2006. They were initiated following the observation by the FAO in 2005 of the state of degradation of savannas and the random nature of natural regeneration, especially in areas exploited for long periods and for the application of ratified international conventions [27]. Previously, the Poverty

Reduction Strategy Paper (PRSP) [28] had been adopted in 2003, based on the Millennium Development Goals (MDGs), and focusing one of its objectives on natural resource management and environmental protection.

Beyond this great strategic vitality of planning concerning the forestry sector, some problems are pointed out in the application of texts, especially relating to bad governance [29]. Pitfalls are noted in the traceability of resource extraction and sharing activities, regarding the rights of access of local people to resources and concerning the securing of rights acquired by law.

At the initiative of Ministry of Economy, Planning and Regional Development (MINEPAT), the Strategy Document for Growth and Employment (SDGE) 2010–2020 [30] was established with the planning for emergence of the country by 2035 [31]. Unfortunately, shortcomings were noted in its implementation, and a much better perspective was envisaged with the National Development Plan calibrated over 10 years (2020–2030). In this political vision of programming, the forest sector is well placed. Two main ministries are responsible for implementing the strategic axes concerning the forestry sector.

The Ministry of Forests and Wildlife (MINFOF) should integrate in the different annual or priority action plans the sustainable management, enhancement, promotion, and improvement of the tourist landscape of protected areas. In addition, the Ministry of the Environment, Nature Protection and Sustainable Development (MINEPDED) is also involved in forest management. It intervenes in the implementation and monitoring of the REDD⁺ mechanism [32, 33]. A National Observatory on Climate Change (ONACC), created in 2009 and placed under its supervision, is responsible, among other things, for proposing to the government mitigation and/or adaptation measures to the harmful effects and risks linked to climate change and to facilitate the achievement of compensation for the climate services provided by forests through sustainable management, conservation, and restoration of ecosystems. The National Adaptation Plan on Climate Change (NAPCC) drawn up in 2015 and the National Biodiversity Strategy and Action Plan revised in 2012 (NBSAP II) are also part of the missions of this ministry [34]. The Ministry of Tourism and Leisure (MINTOUR) intervenes indirectly in the promotion and development of certain nature conservation sites, for ecotourism purposes.

Furthermore, in forest governance in Cameroon, the use of multilateral and bilateral cooperation is a reality. The government relies on an instrument for consultation and management of the forestry sector at the sub-regional level, such as the Central African Forest Commission (COMIFAC) and on other related structures like Network of Protected Areas of Central Africa (RAPAC), Observatory of Forests in Central Africa (OFAC), or the Partnership for Forests of the Congo Basin (PFBC). MINFOF benefits in its daily missions from the support of a considerable number of international and regional cooperation organizations and from the support of donors, such as the European Union (EU), International Union for the Conservation of Nature-Central and West Africa Program (IUCN-PACO), the World Bank, the World Wide Fund for Nature (WWF), German technical cooperation (GIZ), the Center for Development and Environment (CED), the Wildlife Conservation Society (WCS), the Global Environment Facility (GEF), the German Development Bank (KfW), etc. [22]. Thus, despite the threats of terrorism (in the Far North of the country) and the insecurity imposed by certain armed groups (in the northwest and southwest regions), Cameroon enjoys relative political stability, benefits from the responsiveness of its forest, and environmental administrations and the dynamism of its civil society. The country has long served as a laboratory for sustainable forest management initiatives in the Congo Basin [35].

2.2 Specific regulations for the sustainable management of national parks

A protected area is a geographically clear and defined space, recognized, dedicated, and managed by any effective means, legal or other, in order to promote the long-term conservation of nature, ecosystem services, and the cultural values that it abounds [12]. This rational management cannot be effective without the knowledge of ecological, cultural, socioeconomic, and even economic values of the protected area. The 13 successive stages distinguished by IUCN in developing effective management planning for a protected area are as follows [13, 36]:

- Pre-planning, that is to say, preparing the management plan by appointing a team dedicated to the task for a good organization.
- Data collection, identification of obstacles, and various consultations.
- Evaluation and analysis of the data collected in order to obtain information on resources.
- Identification of constraints, opportunities, and threats.
- The development of a management vision and objectives.
- The development of options to achieve this vision and these objectives, including zoning.
- The preparation of a draft management plan.
- Public consultation on the project.
- Evaluation of tenders, revision of the draft plan, production of a final version, analysis of tenders, and report on the results of the consultation process.
- Actions to have the management plan approved.
- The effective implementation of the plan.
- Monitoring and evaluation.
- The decision to revise and update the management plan and reflections on responsibilities.

In summary, a management plan is required in the conservative planning approach of protected areas. This is a necessity in drylands where serious threats to biodiversity exist.

Protected areas are classified into six categories by IUCN, according to their management objectives [12]. We cannot therefore in theory categorize a protected area without information on its management objectives. Category II represents national parks that are managed primarily for ecosystem conservation and recreation. Two others are added to the IUCN categories, created by UNESCO, which very often overlap: biosphere reserves and world heritage sites [37].

In the regulatory texts of Cameroon, in particular the 1994 forestry law [38] and subsequent implementing decrees [39, 40], national parks and other protected areas (wildlife reserves, areas of hunting interest, state-owned game-ranches,

wildlife sanctuaries, buffer zones) are part of the state's permanent forest estate. In Cameroonian law, a national park is defined as a perimeter in one piece, whose conservation of fauna, flora, soil, subsoil, atmosphere, water, and, in general, the natural environment presents a special interest which is important to preserve against any effort of natural degradation and to withdraw from any intervention likely to alter its appearance, composition, and evolution [39]. The following activities are prohibited: hunting and fishing, except in the management process; agricultural, pastoral, and forestry activities; the wandering of domestic animals; overflight by an aircraft at an altitude below 200 m; the introduction of native or imported zoological or botanical species, except for scientific purposes or within the framework of management operations authorized by the ministry responsible for wildlife [39].

These Cameroonian texts define sustainable management as the implementation, on the basis of objectives and a plan agreed in advance, of a certain number of activities and investments, with a view to sustained production of forest products and services, without affecting the intrinsic value or compromising the future productivity of the forest and without causing undesirable effects on the physical and social environment. Any activity in protected areas is therefore subject to the development of a management plan.

The management plan is a document adopted by the minister in charge of forests, based on the results of a so-called management inventory. It includes the objectives assigned to the protected area, the infrastructure to be built, the operating methods and conservation conditions, the regeneration programs, the related forecast costs, as well as the plan revision periodicity. The governance of protected areas is state-based. However, it is possible to associate a public body playing an intermediary role like decentralized local authorities and to subcontract certain activities to private or community structures (local communities, associations, and NGOs) in the realization of management plans.

2.3 Status of national park management in the Far North Region

The Cameroonian government has so far established the Waza, Kalamaloué, and Mozogo-Gokoro National Parks in the semiarid Far North region as well as 17 forest reserves. Waza National Park is presented alone as the only *in situ* conservation site to have an ecological monitoring system relating to the management plan [22]. However, the protected areas of this region, mainly in savannah ecosystems, are of great importance for the conservation of the large mammalian fauna of Africa, with more than 40 different species of large and medium mammals, and more than 300 species of birds, some of which are endemic or endangered [41].

Regarding the management of forest cover in this region, the absence of zoning of the forests, like those of the southern part of the country, frequently leads to numerous conflicts of use between the activities of farmers and ranchers (clearing, pastures) and those of conservation and tourism stakeholders [22]. A study carried out in this environment by Gautier and Ntoupka [42] indicates a change in the perception of the community of users of tree resources, favorable to their protection. Peasants in this densely populated region have become aware, for the most part, of the exhaustion of plant resources. They are committed to preserving the tree capital they have or to reforest. This change in perceptions is not necessarily linked to a change in practices favorable to the reconquest of the trees. Aging, residual wooded parks, without recovery or good management, are still observed [42]. However, changes in perception and attitude are also observed among the actors of the administration and development agents [42]. The first set themselves

up as technical advisers to the population instead of resource conservators; the second operate a new reflection on trees and land with the need to rehabilitate the traditional forest heritage [43, 44].

Despite these positive aspects, practices prohibited under the law are still observed in protected areas [27]. The implications of the changing legal arsenal of forest sector for protected areas in the region are sometimes ineffective and limited [27, 44]. To remedy this illegal appropriation, several management strategies with direct or indirect effects in these conservation areas are applied. They are carried out through the state (programs and projects under the supervision of MINEPDED, MINFOF, and MINEPAT), multinational structures (e.g., PRESIBALT or Program for the Rehabilitation and Reinforcement of Socio-ecological Resilience Systems in the Lake Chad Basin), donors and cooperation organizations (World Bank, EU, IUCN, GIZ, etc.), and NGOs such as ACODED (Concerted Action for Sustainable Development) and Actions for Biodiversity and Land Management (ABIOGeT). The State also invests in the enrichment of forests and the restoration of degraded ecosystems. The National Forestry Support Development Agency (ANAFOR) and the Regional Committee for Drought Control are government technical partners in these various projects. Several NGOs are also supporting the sustainable management of natural resources in the region through initiatives aimed at the development and the fight against poverty of local populations, often affected by displacement due to the conflict against “Boko Haram.” In this case, we can cite the Support Service for Local Development Initiatives (SAILD) and the “RESILIENT” consortium (Inclusive Economic and Social Recovery and the Fight against Food and Nutritional Insecurity in the North and Far North Territories of Cameroon), bringing together several NGOs counting, among their intervention sites, the two main municipalities of influence of the MGNP (Koza and Mozogo).

It is deplorable to note that due to the context of insecurity, all the national parks of the Far North region are experiencing a drop in tourist numbers. There is evidence of significant economic losses felt at the state level but also by the local population. To deal with this unfortunate situation affecting the management of protected areas, obtaining a sufficient database of physical and human environments at all times is an essential step.

3. Special case of the management of Mozogo-Gokoro National Park

3.1 General information about the site

Mozogo Gokoro National Park is situated between 10°56' and 10°57' North latitude and between 13°54' and 13°58' East longitude. This IUCN Category II protected area is located in Mayo-Moskota sub-division of Mayo-Tsanaga Division in the Far North region of Cameroon. Covering an area of 1400 ha, this site was created as a forest and wildlife reserve by decree No. 165 of June 12, 1932, of the High Commissioner of the French Republic in Cameroon and erected as a National Park by decree No. 120 of December 5, 1968, of the Secretariat for the Development of the State of Cameroon [45]. It is headed by a conservator under the direct supervision of the divisional delegate.

It should be noted that this protected area was delimited without cadastral references, almost at the edge of the vegetation. These limits can therefore be moved by the population according to their interests. Moreover, the park does not have a buffer zone, as provided for by regulations. With a fairly dense population of the riverside area (more than 300 inhabitants/km²), cultivated areas, pastures, and

human constructions are observed up to the edge of the park. Together with Waza National Park, the site constitutes the 600,000 ha of the Ramsar site of the Waza-Logone floodplains, making 10% of the wetlands in the West African Sahel [22].

Under a Sudano-Sahelian climate, the vegetation is fairly dense and consists mainly of mosaics of dense to clear dry forests and gallery forests [45]. It shelters a moderately diversified fauna with species of artiodactyles, primates, carnivores, rodents, insectivores, and especially many reptiles [24]. However, the animal presence is insufficiently known, even if it is considered to be very rewarding and generally arouses particular interest among managers of protected areas.

3.2 Methodological approach

The population living near the MGNP was the main target of an ethnoecological survey. For the sake of confrontation, several other groups of influencing actors of management, direct or indirect, from the local, divisional, and regional levels were considered, notably the local forest administration, the decentralized administrations attached to the forest sector, the cooperation organizations, development projects, and NGOs. This investigation was carried out in two phases due to the insecurity and the unavailability of certain people to be interviewed.

Firstly, from December 2011 to January 2012, 45 representatives of the local population, mainly among the elderly with a seniority of at least 30 years in outlying areas of the park, were surveyed in households. For this group of actors, five people were interviewed in each of the seven peripheral localities (Mawa, Karazawa, Gabas, Gokoro, Nguetchewe, Yamgazawa, and Mozogo) and 10 more in Mozogo, the chief town of Mayo Moskota sub-division. According to data from the last general population census, Mozogo is home to around 4/5 of the population living around the park [46]. A number of 30 people sampled are generally considered to be a suitable minimum, when analyses are not directed towards the strict distinction of specific groups in a population [46]. Furthermore, three representatives of the local forestry administration (two former conservators and the one in office in 2012) were also interviewed during this phase.

In the second phase from February to March 2018, the survey concerned 35 people with seniority in the region (dated at least from the first phase of the study), and administrative reports from 2011 were also consulted. Thus, the continuation of the interviews made it possible to complete the group of local forest administration at six, with two eco-guards and the conservator in post in 2018. In addition, 7 representatives of the divisional and regional forest administration, 18 representatives of decentralized administrations and forest-related organizations in divisional and regional levels (environment, tourism, land use planning, and development), and finally 7 actors from NGOs, cooperation organizations, and development projects intervening at the regional level in the management of natural resources (GIZ, IUCN, SAILD, ACODED, PRESIBALT, and Support Project to Improve Livestock Productivity known by the French acronym PAPE) were interviewed during this period.

In short, besides the diversity of influencing actors and the representativeness of the localities and the seniority of residence, other criteria such as age and sex were taken into account in this sampling. In total, the overall sample consisted of 83 respondents, including 45 from the local population and 38 representatives of local, divisional, and regional administrations or organizations. Respondents were questioned on the basis of closed, semi-closed, or open questions, essentially relating to the perception of the space-time evolution of the park, its importance, and its management. The names of the species cited as vernacular names were determined during the survey and were subsequently carried out in the field or at the national herbarium (for plant names), even using the determination keys [47–50],

with updating according to the nomenclature of Roskov et al. [51]. Photographs of plant and animal specimens were sometimes used for this identification. The help of resource persons, who have a good command of localities and local vernaculars, was often essential.

3.3 Constraints, threats, importance, and management gaps

The activities of the people surveyed among the local population, likely users of the park’s resources, are diverse and varied (**Figure 1**). However, agriculture is the main activity of the populations living near the park (53.33% of surveyed). It is often associated with trade (11.11%); sedentary cattle breeding, especially goats and sheep (15.56%); or traditional medicine (6.67%). This evaluation of the various activities of the populations living near the park indicates the strong current pressure on the resources of the park, with population growth, through the search for agricultural land, pastures, and wood cuts. Authors such as Dupuy et al. [14] argue that this predisposition poses a serious threat to vegetation, in addition to drought, socio-political factors and scientific and technical difficulties.

Precisely, the results of the survey indicate, within the local population, strong anthropogenic pressure capable to affect negatively the vegetation of the park (**Figure 2(a)**). The main indicators of anthropogenic pressure cited by the farmers are wood cutting (51.11%), poaching (48.88%), bush fires (44.44%), and pastures

Figure 1.
Activities of respondents in the local population.

Figure 2.
Indicators of anthropogenic pressures in the park: (a) different forms of anthropogenic pressures, (b) wood resources harvesting methods.

(31.11%). Bush fires have been reported much more in the past and around the protected area. All villages are affected by illegal resource withdrawals. These samples are taken mainly in the dry season, due to the ease of access, linked to the existence of multiple tracks, in addition to the 20 km provided by the administration. For the more coveted wood resource, the harvesting mechanisms are not always compatible with regeneration and growth (**Figure 2(b)**). These are pollarding and tadpole cutting (15.55%), debarking (13.33%), and uprooting (11.11%). Other threats to the stability of the park and inadequacies in management are witnessed by several farmers, as **Figure 3** confirms.

A production role undoubtedly stems from the removal or expression of needs for diversified resources (firewood or service wood, non-timber forest products) by 78.12% of residents [24]. Regarding the appreciation of the management of the park, the regressive dynamics of woody trees is mainly a corollary of the excessive cutting of wood. The inventory of methods of harvesting wood resources is all the more important since Bellefontaine [52] encouraged those involved in the forest environment to seek management techniques favorable to the natural regeneration of woody species. The magnitude of human pressures in natural ecosystems has led Sist et al. [53] to conjecture forest management which will mainly take place in so-called “anthropogenic” forests.

When confronted with the opinions of other actors of influence (**Table 1**), the results showed a maximum agreement (from 73.33 to 100%), concerning the anthropic pressures which can negatively affect the vegetation. The illegal exploitation of the park’s resources, particularly wood, is also observed by the vast majority of actors (71.42–100%). It emerged specifically from interviews with conservators and eco-guards that all the riparian regions are affected by illegal harvesting and that they are mainly carried out during the dry season, from October to June, at dawn, at twilight, or overnight. To be more precise, with regard to poaching, they add that gunshots are heard late at night; traces of heating fires and hiding spots are observed around the artificial ponds created. They also specify that bush fires are relatively absent, sometimes observed at the edge, and very quickly controlled.

Moreover, apart from the local population, the other actors of influence, especially non-forestry ones (57.15–77.67%), seem to attach less importance to the MGNP in the region, than, for example, to the Waza National Park inscribed on the world heritage of UNESCO. Most of those interviewed recognize the richness of

Figure 3.
Selected farmers’ views on park management.

Elements of confrontation	A	B	C	D	E
Major area of competence or activity	Agriculture (53.33)	Forestry (100)	Forestry (100)	Variable (no area > 50%)	Variable (no area > 50%)
Main source of information on the site	Direct contact with the site (88.88)	Direct contact with the site (100)	Administrative documents, personal knowledge and experience (85.71)	Personal knowledge (66.66)	Personal knowledge (71.42)
Limit information **	70.18	100	28.57	16.66	17.33
Visit to the heart of the park **	73.33	100	33.33	16.66	28.57
Information on the evolution of biodiversity **	70.18	83.33	14.28	05.55	14.28
Agreement on the existence of anthropogenic pressures	73.33	100	100	83.88	100
Main pressure expressed **	Wood harvesting (77.77)	Wood harvesting (100)	Wood harvesting (100)	Wood harvesting (83.33)	Wood harvesting (71.42)
Assessment of degree of importance of the park **	Very high (88.88)	Very high (100)	High (57.14)	Low (33.33)	Low (42.85)
Essential value identified	Forest products (88.88)	Rich biodiversity (100)	Rich biodiversity (100)	Rich biodiversity (61.11)	Rich biodiversity (85.71)

Elements of confrontation	A*	B*	C*	D*	E*
Main problems raised relating to park management	<ul style="list-style-type: none">• Conservator approval requirements (88.88)• Wildlife presence devastating crops (48.58)	<ul style="list-style-type: none">• Absence of a management plan (100)• Difficulties in water supply for wildlife (100)• High anthropogenic pressures (100)• Important land pressure for agriculture and animal husbandry (100)• Poor execution of certain projects (construction of ponds, watchtower, etc.) (100)	<ul style="list-style-type: none">• Insufficient human, material, and financial resources (85.71)• Galloping demography (42.85)• Poor governance and corruption (28.57)• Absence of a national structure in charge of protected areas (14.28)• Poaching of the defense forces (14.28)	<ul style="list-style-type: none">• No priority given to the MGNP considered as a protected area of lesser importance (88.88)• Absence of a consultation framework (33.33)• Degradation of public morals (11.11)• Insufficient skills in the implementation of decentralization projects (11.11)	<ul style="list-style-type: none">• Fear of insecurity (85.71)• Large influx of refugees and displaced persons (57.14)• Insufficient roads passable in all seasons (14.28)• Climate change (14.28)• Lack of patriotism (14.28)• Little participatory management (14.28)• Non-respect of grazing areas (14.28)
<p>A, local population; B, local forestry administration; C, divisional and regional forestry administration; D, deconcentrated attached administrations; E, cooperation organizations and NGOs. *The numbers indicate the % of individuals favorable to opinion. **Parameters used for the calculation of χ^2.</p>					

Table 1.
Confrontation of the opinions of various influential actors in MGNP.

the park's biological resources but point out several problems that could hamper sustainable management, especially relating to the absence of a management plan. The analysis in **Table 1** makes it possible to confirm that knowledge of the park varies significantly depending on the type of influencing actor ($\chi^2 = 227.94$; $P < 0.0001$). This result tends to confirm the diverging interests of the diversity of actors, noted in the governance of protected areas by UICN [13] or by Saleh [54]. This difference in perception indicates that there are gaps in information about the park, which can be explained by the remoteness of the site on a daily basis, or by belonging to a professional body not related to the forestry sector. This is evidence of a lack of harmonization of sectorial policies and multi-scale governance impacting protected area management that Sist et al. [53] considered as factors hindering their conservation. In a similar study [55], a perception of the plant cover varying according to the distance from the W national park of Burkina Faso was also highlighted.

Furthermore, consultations of administrative reports reveal deficits in the implementation of reference standards in the management of national parks and non-participative governance predominantly state-owned. In agreement with the opinion obtained from the interviews of local forest administrators, several other difficulties emerge from these documents transmitted to the hierarchy with suggestions for solutions. We can cite, among others, staff often in insignificant numbers with limited skills, insufficient equipment and materials necessary for ecological monitoring and follow-up, poor collaboration with the police forces involved in the procedures of sanction, the absence of a buffer zone profitable to the population, the difficult water supply (almost permanent drying of one of the two artificial ponds since 2009 and the drinker with solar energy pumping is not functional), and the easy access to the park through several trails in addition to the 20 km of tracks arranged by the administration inside the park.

3.4 Analysis of evolution of the park

In the local population, the average age of those surveyed is 49.7 ± 8.4 years. It is sufficient for the perception of evolution of the park, given the seniority (at least 30 years old) of most respondents (64.33%). Many local residents (70.18%) claimed to know the boundaries of the park and are therefore able to assess changes in the area and structure of the vegetation. This assessment is one of the main criteria to becoming aware of the existence of a protected area and thus preventing its encroachment.

Figure 4 gives a view of the peasant's perception of the evolution of the area and the structure of the vegetation. Contingency tables were constructed from the values obtained for the application of the independence test. It confirms that the area of the park has changed over time ($\chi^2 = 13.28$, $P < 0.05$). The structural dynamics (density and size of trees) are globally perceived with confusion, that is to say, not statistically significant ($P > 0.05$) with regard to both its increase ($\chi^2 = 0.038$), its decrease ($\chi^2 = 0.010$), and its stability ($\chi^2 = 0.02$). By somewhat including the bordering area, Wafo [27] noted using remote sensing, a spatio-temporal variation of the elements of land use between 1986 and 2001, in particular an increase of burns, clear forest, altitude forest, and bare soil with little vegetation cover and a decrease of crop areas, herbaceous and fallow, and savannah with trees and shrubs. Using a different nomenclature, Sandjong Sani et al. [56] showed between 1982 and 2015, in the same site, the extension, although slow, of more open vegetation to the detriment of dense dry forests and gallery forests, in particular especially relating to anthropogenic disturbances. This spatiotemporal study has, through the analysis of interannual vegetation indices, demonstrated a regressive and extensive fluctuating evolution of the vegetation.

Figure 4.
Peasant assessment of the park surface and vegetation structure compared to the periods of the 1980s and 1990s.

The local population has an idea of the animal or plant species that are decreasing, increasing, or disappearing in the park and its surroundings. **Figure 5** gives an idea of this perception. An analysis of this table shows the regressive trend in animal (74.78%) and plant (74.65%) biodiversity in the park (dominance of the species cited as decreasing or disappearing). The animals mentioned fall into the following groups: mammals and reptiles, the majority of which have already been reported in the literature, with the exception of those considered missing in the park (lions, elephants, buffaloes, giraffes, hyenas, leopards, and red monkeys). The absence of certain disseminating animal species in the park may explain the disappearance or reduction of certain plants. Seventy percent of the plants listed belong to the woody group. This is an indicator which attests the sufficient knowledge and the importance of this resource for farmers. Some of these woody species were not inventoried in the parallel floristic study [45] or were cited as having disappeared from the park (**Table 2**).

With the analysis of the decline in animal and plant biodiversity, it is noted that the percentages of species cited in the responses, and only in the surrounding, are low due to the degradation of vegetation at these sites due to various anthropogenic practices. By comparing these opinions with the groups of different stakeholders interviewed, it appears that the local forest administration mainly (83.33–100%) has a clearer idea of the evolution of plant and wildlife populations, in line with the local population (70.18–88.88%).

Figure 5.
Peasant perception of the evolution of animal and plant species.

No.	Vernacular names (Mafa)	Scientific names	Families
1	Gonokoud	<i>Annona senegalensis</i> *	Annonaceae
2	Gangar	<i>Borassus aethiopum</i>	Arecaceae
3	Lakalak	<i>Daniellia oliveri</i> *	Fabaceae
4	Pekelde	<i>Ficus abutilifolia</i> *	Moraceae
5	Mindek	<i>Ficus dicranostyla</i> *	Moraceae
6	Kouzlar	<i>Ficus sycomorus</i> subsp. <i>sycomorus</i>	Moraceae
7	Tondaz	<i>Haematostaphis barteri</i> *	Anacardiaceae
8	Mbalmbal	<i>Maytenus senegalensis</i>	Celastraceae
9	Waf roua	<i>Parkia biglobosa</i>	Fabaceae
10	Foreu	<i>Senna siamea</i>	Fabaceae
11	Wandar	<i>Ziziphus mauritiana</i> *	Rhamnaceae

*Species listed as disappeared from the park.

Table 2.
Species cited by the riparian population not listed in the floristic inventory.

Wildlife extinction can be explained by migration, habitat degradation, or poaching [14]. Wafo [27] explains that the reduction in wildlife is due to the small size of the park and proximity to the local population. This loss of animal biodiversity can be justified by the fragmentation of vegetation around the park and its isolation. Climate constraints, competitive dynamism of species, and human pressures are also justifiable reasons. The impact of human activities, which may cause changes in plant succession and environmental degradation, is an explanatory hypothesis approved by several authors [55, 57].

Other analyses of plant evolution, Aubreville [58] and Letouzey [59] have previously stated that the vegetation has reconstituted itself and should not be considered as a primary forest relic. In the same way, Boutrais et al. [60] believed that with crop exclusion and lack of fire, shrubs from a likely degraded initial forest firstly proliferated in thicket formation, and woody strata removed the savannah and reconstituted a closed forest cover. These views are slightly different from Dewaulle [61], who described the park’s vegetation as primitive, having been protected by beliefs or prohibitions. Yengué [62] states that MGNP is the only protected area in the Far North region that is in a good state of conservation. Moreover, it cannot be denied that the dynamics of this vegetation are linked to the presence of a more or less varied fauna.

Following recent parallel work [45, 56, 63], the park’s great preservation and resilience to various pressure factors can be questioned. Natural accessibility constraints with the domination of the thorny species *Senegalia ataxacantha* in the flora, complacency in the application of rules of access restriction in local governance, and peasant practices and uses favorable to plant conservation are explanatory assumptions of such status. Despite many challenges in the management of MGNP, it appears that one of the main ways of conserving natural ecosystems in drylands remains protected areas, particularly national parks. It is therefore necessary to question the effectiveness of the normative systems of national park management in the Sudano-Sahelian zone, which are too rigorous and controlled mainly by state actors.

4. Conclusion

In summary, after recalling the regulatory framework for the sustainable management of natural ecosystems in the context of Cameroon, this chapter reveals

the deficit of their effective implementation through investigations conducted in MGNP, following a participatory approach. Local stakeholders involved in the management process better understand the dynamics of vegetation, as well as the importance of the park, indicating the multiple resources available or the rich biodiversity. They also show an analysis of regressive floristic and wildlife changes in the park's evolution, mainly due to anthropogenic pressures (wood cuts, grazing, poaching, and bushfires). The lack of a sustainable management plan in accordance with the existing legislation was noted as a major shortcoming. In accordance with inclusive and multi-sectorial governance, the weakness noted can be corrected in the conception and implementation of a sustainable management plan for this park.

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