# Chapter

# Contribution of Geospatial Data in the Mapping and Restoration of Sacred Forest in the Grassfield Communities in Cameroon

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# Abstract

Throughout the centuries, the grassfields of Cameroon have been the site of the development of numerous social and cultural values associated with sacred forests. These values are deeply intertwined with the socio-cultural roles that local people have attributed to the forests, which serve as places of worship and ritual. Managed under chieftaincy, these sacred forests have historically safeguarded the villages from threats and adversities. Unfortunately, the biodiversity of these forests is now under threat due to agricultural activities, rapid population growth, and other land use issues. To address these challenges, a participatory demarcation and remote sensing approach can aid in understanding the issues affecting these sacred forests. Furthermore, implementing a restoration plan in collaboration with local communities, including the identification and preservation of local species, is crucial for the sustainable protection of these forests, ensuring the continuation of the cultural practices that are integral to these communities.

**Keywords:** sacred forest, participatory mapping, restoration, cultural values, land tenure

## 1. Introduction

The tree cover of the sacred forests of the western highlands is prey to human activities (agriculture, strong population growth, and climate change) and other land issues that contribute to their crumbling and denaturalization.

Over the centuries, many social and cultural values have been developed around sacred forests by local people. These values were linked to the socio-cultural roles assigned to them by the local people and helped to reinforce the mechanisms set up locally to protect these forests. These measures included the prohibitions that ensured respect for this circumscribed area and the regular worship services held in the villages during periods of crisis. Under the coordination of the chiefdom, divine beliefs contributed enormously to the protection of the village against its enemies and various calamities.

These sacred forests, which were an important reservoir of biodiversity in the villages/kingdoms, were not to be neglected as they enabled sustainable conservation by leaving natural forest formations.

The participation of local people [1, 2] in development initiatives affecting them has been interpreted in different ways in practice. 'It is a constantly reactivated, functional, and pragmatic dynamic, in which development agents and local people combine their knowledge, know-how and will in concerted partnership actions to improve, in a sustainable way, the assumption and management of the actions undertaken'. This concept allows the technician involved in the participation process to maintain the predominant place and role of the local people in achieving their aspirations. It is then up to the people to take responsibility for designing and carrying out their undertakings [3].

The participation of communities in their own development is not new. Tchawa and Moupou [4, 5] quoted by Ndjounguep [6, 7] speaking of the genesis of the participatory approach in Africa and Cameroon, show how socio-economic conditions and the needs for sustainable development require the participation of all stakeholders. Participation varies in intensity, from forms with a low level of participation to forms characterized by a real transfer of power to individuals and populations. In this work, participation is a community diagnosis tool that requires an appropriate method and consistent results to ensure that local or collective data is taken into account in the decision-making process [6].

According to Amelot et al. [8], quoted by Ndjounguep [6, 7] participatory mapping is about consultation and information. It is propaganda mapping insofar as the basic geographical data have often been manipulated, hence the need for stakeholders to criticize and use them.

Participatory mapping for sacred forests in highland villages in the West Cameroon region aims to (i) restore the link between communities and these cultural spaces that are prey to accelerated degradation and (ii) restore cultural and economic values to strengthen biodiversity conservation and land tenure security [9].

# 2. Materials and method

#### 2.1 Presentation of the study area

The kingdoms of Bameka and Bamougoum are situated in the departments of Haut-plateaux and Mifi, respectively. They are positioned between latitude 5°25′50" North and longitude 10°20′16″. These kingdoms fall under the first-degree chieftaincies of the West region, holding vast territories overseen by the king, 3rd-degree chiefs, and notables, with a population of over 21,392 inhabitants (as per Bucrep [10]) [11]. The Mifi River is the primary watercourse running through these areas. Please refer to **Figure 1** for the precise location of the study area.

#### 2.2 Methodology

The sustainable restoration of sacred forests in the highlands of the West region was facilitated through participatory mapping using the unified methodology for participatory mapping in Cameroon [12, 13] (2016). This collaborative process



**Figure 1.** *Location of the study area.* 

engaged stakeholders in identifying and locating sacred forests and sites, outlining their boundaries, highlighting existing challenges, creating and validating maps of the area, and exploring options for restoration. Through participatory demarcation, stakeholders were able to gain insights into their roles and the challenges impacting the sacred forests, thus enabling them to pinpoint necessary actions for conservation improvement. An illustrative stakeholder information meeting is depicted in **Figure 2**.

# 2.3 Sensitization

Raising awareness is a crucial step in the participatory mapping process, as it helps identify stakeholders and invite them to participate in various activities. When it comes to sacred forests, only those who are affected by their sacred nature take part, such as the King, village chiefs, notables, and traditional practitioners. We organized focus groups to better involve the stakeholders in the process and emphasize the participatory aspect of the activities. This phase helped clarify the planned activities, obtain Free Prior Informed Consent (FPIC) for effective participation, gather relevant information on sacred forest management, and identify the species to be planted to enhance sacred forest conservation (**Figure 2**).

# 2.4 Carry out participatory mapping

The initial implementation of participatory map is awareness-raising meeting. It was efficiently created with stakeholders appointed by the Paramount Chiefs



Figure 2. Information meeting with chiefdoms. Photo Ndjounguep, 08, 2022.

(including Notables, Prime Ministers, Chief's representatives, sacred forest managers, and women's spokespersons). This pivotal stage offered an initial understanding of the spatial distribution of the sacred forests and degraded areas, as well as the individuals contributing to degradation. Creating the mental map involved:

- Defining thematic layers such as uses of the sacred forest (medicinal plants, NTFPs, fishing, hunting, gathering: raffias, and stems)
- Establishing the legend and symbology
- Drawing the mental map on the ground
- Representing primary boundaries and physical geographic features
- Depicting communication routes (roads, tracks)
- Mapping watercourses
- Depicting socio-collective facilities (chiefdoms, households, etc.)
- Representing thematic classes
- Defining routes for data collection
- Identifying areas of sacred forest degradation
- Determining restoration needs including species and areas.

All this data was gathered in the field using a GPS gaming system, with the participants, who were authorized for sacred forest and site management, leading the facilitation. The collected data was utilized to create a digital map (**Figure 3**).

# 2.5 Digital mapping elaboration process

Digital mapping is the phase of the process that encompasses data collection and the subsequent sharing of information with the community. Due to the participatory



Figure 3.

Training of notables on the use of GPS for data collection on sacred side, Bamengoum village. Photo Ndjounguep, 08, 2022.

nature of the project and the need for confidentiality surrounding the sacred forests, the data was obtained by knowledgeable and willing community members who were carefully chosen and trained in the use of GPS technology for spatial data collection. The collected data was then analyzed by the GIS manager, leading to the creation of various thematic maps (**Figure 4**).

# 2.6 Result restitution and map validation

The completion of the process involved two phases: a data verification phase to generate the maps, and a final validation and feedback phase.



Figure 4. Field data collection phase. Photo Ndjounguep, 08, 2022.



Figure 5. Map validation with notables. Photo Ndjounguep, 08, 2022.

The map-checking phase aimed to rectify any errors in toponymy and form, with the participation of the community's notables who had been involved in the awareness-raising, training, and data-collection meetings. This phase ensured that any mistakes in the spelling of the names of sacred sites were corrected.

Following the verification phase, the cartographic data was returned to the community for review. At this stage, the individuals involved in data collection presented the final maps to the population for validation, and each notable and various kings received a copy of the map (**Figure 5**).

# 3. Results

#### 3.1 Types of sacred forest in the Cameroon western highland

In the highlands of West Cameroon, there are three distinct types of sacred sites: sacred forests, neighborhood sacred forests, and sacred sites. These sites are considered to house the gods that protect the village during times of crisis and are highly revered by the local people. However, the perception of these sacred forests has been negatively impacted by the forces of globalization, leading to a reduction in their cultural value and a lack of respect for their sacredness. As a result, these sites are facing increasing human pressure for agricultural land, firewood, and housing. To address this issue, it is imperative to identify and implement effective practices for the cultural and economic management of sacred forests. Doing so could not only help conserve biodiversity but also preserve the cultural values of the populations in the highlands of West Cameroon (**Figure 6**).

#### 3.2 The importance of sacred forests in the highlands of Western Cameroon

The significance of sacred forests is deeply intertwined with the cultural and social roles assigned to them by local communities. For generations, these forests have been safeguarded by local customs, serving as venues for traditional courts, spiritual practices, and as sources of botanical materials for artisans and traditional healers.

Local beliefs attribute divine qualities to these forests, as they are believed to be inhabited by the spirits and deities of the village's ancestors. These divine entities are thought to shield the community from adversaries and misfortunes. The forest gods are revered in times of crisis and also in the everyday lives of the villagers, playing a crucial role in various aspects of their spiritual and practical existence.



#### Figure 6. Idendified sacret side (Bamougoum market (a) water source (b) and the sacred huts (c)). Photo Ndjounguep, 08, 2022.

A profound spiritual connection exists between the people and the resources found within the sacred forests, shaping a unique alliance. Customary regulations dictate the utilization of these forests, encompassing strict guidelines and prohibitions. Only those who have been initiated are permitted to access specific areas, and a range of activities such as hunting, tree felling, and farming are strictly prohibited.

The sacred forests within the region consist of both eucalyptus trees and natural vegetation. The eucalyptus trees dominate vast areas of the sacred forests, lending a distinct character to these revered landscapes.

### 3.3 Sacred forest management methods

The most important are those around the chiefdom.

The others, made up of small patches of forest, are located in strategic areas of the group.



Sacred forests are managed in a special way. Harvesting is allowed to a certain extent. Firewood, dead wood, medicinal plants and bark, fruit and condiments, honey and small game may be harvested, but the harvested items cannot be sold. These forests are protected by a set of rules—no crops can be grown in them, only the edges are allowed to be used for cultivation. To harvest from the forest, offerings such as salt and palm oil must be made first. Penalties for breaking these rules are imposed by the tutelary deities.

Unfortunately, these sacred forests are shrinking due to the increasing pressure on the land they occupy. Every year, agricultural activities encroach more and more on the woodland. Another threat is religious conversion, as people who convert to other religions no longer honor the prohibitions. Surprisingly, the sacred forests are better preserved compared to the forest reserves created by the State [14].

### 3.4 History of the villages and link with the sacred forests

The oral history of the Bameka people, also known as 'Muka' in the local language 'Ngembà', indicates that the first chief of the Bameka kingdom came from a family of hunters. Around 1700, four hunting brothers from Fongo Tongo in what is now the Menoua department discovered unoccupied land and decided to settle there. Their names were SAA, NKA, NgOUM, and NDJOU. SAA chose to stay where he was, while NKA settled on the other side. It was from his name that the name Bameka originated. Since its establishment in 1700, the Bameka kingdom has seen 20 kings succeed each other as the leaders of this chiefdom.

The Bamougoum kingdom, known as Ngwong Mungoum in the Ngemba language, was founded in 1403 by Ndjwongveu, who also became its first king.

The sacred forests have existed since the village's creation and have been maintained over the generations. The king acts as the guardian of tradition and is solely responsible for all the sacred forests. Historically, the sacred forests have facilitated the formation of spiritual and traditional relationships between past and present generations. The king is supported by the prime minister of the group and other notable individuals.

#### 3.5 Physical environment characteristics

The area receives high rainfall, ranging from 1500 to 2500 mm per year, with an 8-month rainy season and a 4-month dry season [15]. The population density ranges from 90 to 300 inhabitants per square kilometer [16, 17]. There is significant demographic pressure, and the population tends to be older [15]. The North-West region accounts for 25.2% of the country's farms [16, 17], and the area is heavily farmed.

It is situated in a densely forested ecosystem, but deforestation caused by human activity has led to the degradation of farmland and timber resources [16, 17]. The forest presence has decreased, and wooded savannah has developed due to deforestation [18]. Since the 1990s, 90% of the forest reserves have been occupied, and the relict forests of the highlands have disappeared. The vegetation on the plateau has been significantly affected by human activity.

The sacred forests still contain a variety of forest species, and the hedgerows and concessions have been enriched with fruit trees [16, 17]. These areas have both ritual and political significance.

Our field observations have shown that the vegetation predominantly consists of grassy savannah with tall grasses such as sunflowers and sissongos. Additionally, there are fruit trees, eucalyptus, raphia, and Chinese bamboo in marshy areas (**Figure 7**).

# 3.6 Participatory maps elaboration of sacred forest

The participative mapping operations helped locate and mark 14 sacred forests in two villages: 5 in Bameka and 9 in Bamougoum. 70% of these areas are part of the chiefdom's sacred forests, while the remaining 30% are sacred sites and other small sacred forests in the crossroads or neighborhoods. In total, 237.31 hectares were identified as belonging to the sacred forest domain for the two groups, with 61% for Bamougoum and 49% for Bameka. **Figure 8** displays the spatial distribution of the identified sacred forests.



Figure 7. Vegetation around sacred forests. Photo Ndjounguep, 08, 2022.



Figure 8. Participatory map of sacred forests in Bameka and Bamougoum.

# 3.7 Land cover dynamic in the sacred forest

An analysis of satellite imagery from the Sentinel 2 sensor for the years 2012 and 2022, along with field data, reveals that the land use around the sacred forests has changed, affecting their integrity. Some areas have been reforested with Eucalyptus trees, helping to maintain forest cover, but not at its natural level. Overall, agricultural activities pose a threat to the sacred forests, contributing to their gradual decline. The sacred forest around the chiefdom is managed by the royal family, with each woman holding a portion that she cultivates to support her family. Please refer to **Table 1** for the changes in land use around the sacred forests between 2012 and 2022.

The sacred forests have been impacted by construction, the creation of fields, and the planting of eucalyptus trees. These activities have altered the original landscape, leading

#### Safeguarding the World Culture Heritage – Advances and New Perspectives

Occupation du sol	2012	2022	2012%	2022%	Differences
Constructions	1.05	3.15	0.44	1.33	0.88
Champ	84.56	145.8	35.63	61.44	25.81
Savane	5.1	12.25	2.15	5.16	3.01
Forêt galerie	136	39.99	57.31	16.85	-40.46
Plantation eucalyptus	10.6	36.12	4.47	15.22	10.75
Total	237.31	237.31			
Source: Sentinel 2 Image, 2012 and 2022.					

#### Table 1.

Occupation du sol dans les zones des forêts sacrées entre 2012 et 2022.

to the growth of savannah and gallery forests. Between 2012 and 2022, the percentage of land used for construction increased from 0.44% to 1.33%, fields expanded from 35.63% to 61.44%, savannah grew from 2.15% to 5.16%, gallery forests decreased from 57.31% to 16.85%, and eucalyptus plantations increased from 4.47% to 15.22%. **Figure 1** illustrates the changes in land use within sacred forests from 2012 to 2022 (see **Figure 9**).

There has been a 40.46% loss in gallery forests due to a significant increase in agricultural activities (25.81%), savannahs (3.01%), eucalyptus plantations (10.75%) and buildings (0.88%). The following figure depict rural activities in sacred forests (**Figure 10**).

Please remember the following information:

- a. Eucalyptus is being harvested on the edge of a sacred forest in Bamougoum.
- b. There is a field on the edge of a sacred site at the Bamougoum and Bameka market.

After establishing their fields, the farmers around the sacred sites and forests gradually encroach upon the forbidden zone by breaking up the forest. This encroachment often involves bush fires, cutting down nearby trees, and planting tubers or other plantain trees. These activities make the land look cultivated in the next growing season and lead to an expansion of the fields.



#### Figure 9.

Land use losses and gains source: Sentinel 2 Image, 2012 and 2022.



Figure 10. Farming activities in the sacred forests. Photo Ndjounguep, 08, 2022.

This practice is becoming increasingly important due to the scarcity of land caused by the growing urban and rural population. In Bameka and Bamougou, the chiefs are compelled by this demographic boom to allocate areas around the sacred forest for cultivation to accommodate the people displaced from NOSO (nationals from the conflict zone in North-West and South-West Cameroon). In 2019, Chief Bamougoum offered them areas for the resettlement of those affected by the Ngouache disaster (a landslide in part of Bafoussam 3 in 2019) (**Figure 11**).

# 3.8 Local measures are taken to protect sacred forests from degradation

Chiefdoms put up fences made of shrubs and bamboo around the sacred forests to demarcate and protect them from degradation. These fences are important for conserving sacred forests against human degradation but are still vulnerable. In



Figure 11. Land use in the sacred forests in the localities of Bamougoum and Bameka.



Figure 12.

Protection of sacret site using bambou for fence building in Bamoungoum village. Photo Ndjounguep, 08, 2022.

response to the degradation of sacred forest areas, the chiefdoms and those in charge of the sacred forests also take endogenous protection measures. These measures include hedges around certain areas and planting eucalyptus trees at the boundaries. Bamboo fences are used to demarcate and protect against intrusion and degradation. These measures are of great importance for conserving sacred forests against human degradation (**Figure 12**).

# 3.9 Restoration needs of sacred forests

Restoration of degraded areas and promotion of the involvement of women and young people in reforestation activities will take place in the 25 hectares of sacred forests in the villages of Bameka and Bamougoum. This will involve:

- Reconstituting the boundaries of the sacred forests by using living hedges with specific plant species identified by the management team, such as neloum, eucalyptus, and bamboo.
- Restoring the buffer zones of watercourses and drinking water points using fodder plants and raffia palm.
- Rehabilitating degraded areas of the sacred forest by planting sacred and medicinal trees like Quinquina.
- Restoring fields and grazing areas around the sacred forests by planting fodder plants, fruit trees, and eucalyptus.

A table displaying the species chosen for the restoration of degraded areas within the sacred forests is provided below.

# 3.10 Identification of degraded patches for restoration in the sacred forest

The areas that need restoration were identified with the help of community leaders and confirmed on the day the participatory mapping data was collected, with input from the village chiefs. It was agreed with the village chiefs to restore the following areas:

- Sacred forests around the chiefdom
- Sacred forests in small neighborhoods
- Marshland/lowlands
- Fields around the chiefdom and around the sacred forests.

In total, the degraded areas of sacred forest make up about 14 hectares of the 30.15 hectares that were mapped. The specific species chosen for each area are listed in **Table 2**.

The species chosen for planting on degraded sites were based on the cultural specificities of the plants and their socio-economic contribution. The following **Figure 13** displays some of the degraded areas surrounding the sacred forests.

Type of plants	Area for restoration	Characteristics
Eucalyptus	Sacred forest at the bottom of the chiefdom	Lowlands, marshy areas and creek banks
Raphia	Along the river band	marshy areas and along streams and streams
Medeinal trees Quinquina	Au centre des forêts sacrées	Toutes les forêts sacrées des deux villages
Fruits trees	Farmland at the chief palace	The farmland located within the chiefdom's territory, near the forests and sacred sites.
Closing trees (neloum, eucaliptus, bambou)	Around sacred forest	All sacred sites
Identify plants suitable for animal nutrition through foraging.	Around Palace sacred forest	In the savannah areas, measures are in place to prevent the spread of cattle from the chiefdom domain into the forest zone.

#### Table 2.

Classification of species for reforestation in sacred forests.



**Figure 13.** *Agricultural activities around the sacred forests.* 

# 4. Discussion

In conclusion, it is crucial to preserve the sacred forests in the highlands of Western Cameroon [19]. Despite their size, these forests play a vital role in maintaining social harmony, cultural heritage, and biodiversity conservation. These areas, affected by human activities and climate change, have experienced a 40.46% loss of gallery forests due to a significant increase in agricultural activities (25.81%), savannahs (3.01%), eucalyptus plantations (10.75%), and construction (0.88%) for the Bameka and Bamougoum communities.

The losses highlight his urgency to preserve the sacred forests. Through a participatory mapping exercise in Bameka and Bamougoum, the condition and governance of 14 forests and sacred sites were assessed. Covering an area of 237.31 hectares, the significance of these sites lies in the ecosystem and socio-cultural/religious benefits they provide to communities. The sacred forests surrounding the chiefdom's land estate account for more than 70% of the land. These areas have varied forest stands with multiple uses [20]. The chosen restoration approach aims to preserve the existing stands without causing any disruption. Due to the limited availability of timber, it has become necessary to plant eucalyptus trees on the outskirts of the sacred forests to fulfill the wood needs of the local communities [21].

The participatory selection of restoration plan types in the highlands of Western Cameroon involves community participation in the sustainable management of sacred forests, although its use is conditional.

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# References

[1] FAO. cité part. Jean Bonnal, Participation et risques d'exclusion: réflexion à partir de quelques exemples sahéliens. 1995

[2] EU REDD Facilities. Project; Reduicing deforestation through landuse planning. 2014-2018. Available from: http://www.euredd.efi.int/publications/ building-a-mapping-alliance-forinclusive-and-transparent-land-useplanning

[3] Gallard J, Koné P. La méthodologie de l'approche participative. 1994

[4] FIDA. Cartographie participative et bonnes pratiques. Fonds International de Développement Agricole (FIDA); 2009. 59 p

[5] Tchawa P, Moupou M. Contexte de l'apparition et génèse des approches participatives en Afrique et au Cameroun. In: Participation et développement rural au Cameroun. Préface Eboussi Boulaga F., édition clé; 2018. pp. 33-34

[6] Ndjounguep J. La cartographie participative, un outil de dialogue et de résolution des conflits dans les communautés de Nguti, region du Sud-Ouest Cameroun, thèse. Université de Yaoundé. 2000;**1**:18-33

[7] Ndjounguep. La cartographie participative: un outil de dialogue et de prévention des conflits dans les communautés de nguti, region du sudouest cameroun [thesis PhD]. University of Yaounde I, Department of Geography; 2020. pp. 18-33

[8] Amelot et al. Conservation and Environmental Management in Madagascar, edited by Ivan R. Scales REP, (2005). 2011 [9] Abbott J, Chambers R. Participatory GIS: Opportunity or oxymoron. Participatory Learning and Action Notes. 1998;**3**:27-34

[10] Bucrep. Recensement général de la population du Cameroun. 2005

[11] FPP (Forest People Programm).
Cameroon community mapping.
2010. Available from: https:// www.forestpeoples.org/sites/ default/files/publication/2010/07/ camerooncommunitymappingjuly07eng.
pdf

[12] Rainbaw Environmental Consult. Méthodologie Unifié pour la cartographie participative au Cameroun. 2016. 20 p

[13] Rainforest Foundation Uk.Participatory mapping methodology for communities led forest governance. 2014.19 p

[14] Matthieu S. Espaces politiques, espaces rituels: les bois sacrés de l'Ouest-Cameroun. Presses de Sciences.
2010;55(19):38. ISSN 1278-3986

[15] Jean-Marie F. Érosion des terres cultivées et propositions de gestion conservatoire des sols en pays bamiléké (Ouest-Cameroun). Cahiers ORSTOM. 1993;28(2):351-366

[16] Serge M. Colonisation agraire,
espaces pastoraux et dégradation
des milieux dans les hautes terres de
l'Ouest Cameroun. Cahiers d'outre-mer.
1994;185:79-104

[17] Yanick T. Situation actuelle des agricultures familiales des régions des Hautes terres du Cameroun: Risques et enjeux. 2015. Available from: https:// hal.archivesouvertes.fr/hal-01241133 [Accessed: 9 November 2018] [18] Denis G. Poupées russes et montagnes Bamiléké. De la concession à la chefferie: emboîtement des structures et dynamiques spatiales en pays Bamiléké. L'Espace géographique. 1996;**25**(2):173-187

[19] MINFOF. Inventaire, cartographie et étude diagnostic des forêts sacrées du Cameroun: contribution à l'élaboration d'une stratégie nationale de gestion durable. Millennium Ecologic Museum. 2010;**2015**:74

[20] RRI (Right Ressources Initiatives). Cameroonian mapping. 2017. Available from: https://rightsandresources. org/wp-content/exported-pdf/ cameroonmappingcommunitiesarticle. pdf

[21] Tenure Facilities. Community mapping for effective land-use planning: Cameroon. 2015. Available from: https://thetenurefacility.org/projects/ community-mapping-for-effective-landuse-planning-cameroon/