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Anthropogenic drivers of biodiversity loss in forested wetlands of Fundong Subdivision, Northwest region, Cameroon

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Abstract: **Forested wetlands in Fundong Subdivision, Northwest Region of Cameroon, are under increasing threat from anthropogenic activities. This study investigated the main human-induced drivers of biodiversity loss in the forested wetlands. It was conducted in two areas with varying levels of anthropogenic disturbance: Fujua, a highly disturbed area, and Ijim, a less disturbed area of forested wetlands in Fundong. Data were collected through key informant interviews and field observations in March 2024. Results revealed that farming, logging, and cattle grazing are economic activities driving biodiversity loss in forested wetlands of Fundong. Farming is favoured a high human population that is attracted by fertile soils and favourable climatic conditions. Logging has led to destruction of habitats and loss of plant and animal species. Loss of biodiversity through cattle grazing is related to compaction of soil and burning of vegetation for pasture regeneration. Other contributing factors include proximity human settlements to wetlands, weak enforcement of conservation laws, and population growth. The study concludes that unchecked human activities are accelerating biodiversity loss in Fundong's forested wetlands. Effective conservation will require strengthened institutional frameworks, enhanced law enforcement, and community-based management systems. Policy interventions should prioritize environmental education, alternative livelihoods, and the promotion of sustainable land-use practices. Protecting the ecological integrity of forested wetlands in Fundong is crucial not only for biodiversity conservation but also for sustaining the livelihoods of riparian communities. Collaborative action between local authorities, traditional institutions, and stakeholders is essential to reversing current biodiversity trends.**

Keywords: **anthropogenic drivers, biodiversity loss, environmental degradation, forested wetlands, Fundong Subdivision.**

I. INTRODUCTION

Biodiversity forms the backbone of ecological sustainability, human well-being, and economic development across the globe. In Africa, a continent rich in biodiversity, wetlands play a vital role in providing ecosystem services such as water purification, climate regulation, and support for agriculture and livelihoods (Ola and Benjamin, 2019; Mandishona and Knight, 2022). However, in recent decades, biodiversity across the continent has been rapidly declining due to a growing list of anthropogenic activities – ranging from agriculture and logging to infrastructural development and unsustainable exploitation of natural resources (Perrings and Halkos, 2015; Saliu et al., 2023). According to the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, Africa is projected to suffer significant biodiversity losses by 2050 if current land-use trends continue unchecked (IPBES, 2018). These pressures are most evident in ecologically sensitive zones such as forested wetlands, where human dependence on natural resources is highest, but regulatory oversight is often weak. Wetlands in Africa, despite their recognized importance, remain among the most threatened ecosystems due to inadequate legal protection and widespread encroachment (Kingsford et al., 2016). As human populations grow and demand for arable land and natural resources intensifies, wetlands are increasingly converted into farmland or used for settlements and grazing. This conversion has significant ecological consequences, especially in montane and highland

regions where biodiversity is often both unique and fragile. The IUCN Red List of Ecosystems lists several wetland ecosystems in sub-Saharan Africa as vulnerable or endangered, further underlining the urgency of addressing anthropogenic impacts in these environments (Monyeki, 2021).

In Cameroon, which lies at the heart of the Congo Basin, biodiversity is both abundant and diverse. The country is considered one of Africa's "mega-diverse" nations, with ecosystems ranging from coastal mangroves and dense equatorial forests to montane and wetland habitats (Sodhi et al., 2013). These ecosystems are not only ecologically rich but also socio-economically significant, particularly for rural communities who depend heavily on their immediate environments for food, medicine, timber, and cultural practices. Cameroon is home to approximately 310 known mammal species, 900 bird species, and thousands of plant species, many of which are endemic (Egbe et al., 2019; Awazi et al., 2024). However, rapid urbanization, expansion of agriculture, illegal logging, and infrastructure development have dramatically increased anthropogenic pressures on these ecosystems, leading to habitat fragmentation, species extinction, and soil degradation (Mbozo and Ekollo, 2024). Wetlands in Cameroon, especially forested ones, are among the least studied and most vulnerable ecosystems. Despite being vital for maintaining hydrological cycles and biodiversity, they are often undervalued in national development planning. The Ramsar Convention recognizes seven Ramsar sites in Cameroon, yet the majority of forested wetlands remain unprotected and poorly managed (Ramsar, 2006). Cameroon's decentralization policy, intended to enhance local governance, has had mixed results in environmental management, as local councils often lack the technical capacity and resources to effectively conserve biodiversity. Furthermore, customary land tenure systems in many parts of the country complicate the implementation of statutory conservation laws, resulting in widespread non-compliance and resource overexploitation (Ruysschaert et al., 2023).

In the Northwest Region of Cameroon lies the Boyo Highlands, a mountainous ecological zone that forms part of the western highlands agro-ecological zone of the country. This region is characterized by its high altitude, fertile volcanic soils, dense vegetation, and relatively high rainfall – all factors that support rich biodiversity and thriving agricultural systems. The Boyo Highlands include subdivisions such as Fundong, Njinikom, and Belo, where livelihoods are largely agrarian, and forest resources are central to the daily survival of local communities (Ngong, 2020). The forested wetlands within this region are particularly important because they act as water sources, carbon sinks, and refuges for endemic flora and fauna. Fundong Subdivision, the focus of this study, is the capital of Boyo Division and home to approximately 20,000 people, predominantly from the Kom ethnic group. The landscape of Fundong is marked by steep hills, deep valleys, and fertile lowland swamps, which are increasingly being transformed due to anthropogenic activities. The region experiences a bimodal climate with an annual rainfall of about 2400 mm, supporting both agriculture and diverse vegetation types. However, the same environmental conditions that make Fundong ecologically rich also make it highly vulnerable to biodiversity loss (Tsi et al., 2006). Population pressure, subsistence and commercial farming, logging for timber and fuelwood, and cattle grazing have intensified over the years, threatening the ecological integrity of the forested wetlands.

The forested wetlands of Fujua and Ijim - two key sites in Fundong Subdivision, illustrate contrasting levels of human disturbance. Fujua, heavily disturbed due to intensive agriculture, logging, and grazing, is undergoing significant biodiversity decline, while Ijim, relatively undisturbed, retains more of its ecological balance. Prunus africana, a critically endangered medicinal tree species, is among those severely threatened in these areas due to overharvesting. Furthermore, the proximity of Laikom Palace and various communities to these wetlands has exacerbated human pressure, as residents frequently access the forest for fuelwood, medicinal plants, and non-timber forest products (NTFPs). Despite the existence of both customary and statutory frameworks for natural resource governance, enforcement remains weak in Fundong. Traditional institutions such as the *Kwifon* continue to play a role in regulating access to forest resources, but their influence has diminished over time due to modernization, population growth, and administrative limitations. With the increasing commercialization of agriculture and expanding land use, there is an urgent need to identify, understand, and mitigate the anthropogenic drivers of biodiversity loss in Fundong's forested wetlands. This study therefore aims to investigate human activities that contribute to biodiversity decline in the forested wetlands of Fundong and propose intervention measures to policy makers.

II. MATERIALS AND METHODS

Fundong Subdivision is the capital of Boyo Division in the North West region of Cameroon (Figure 1), with a population of approximately 20,000 people. It is located in the grassland savannah zone of the mountainous western highlands of Cameroon. The subdivision is bordered by Wum to the west, Noni to the east, Fungom to the north, and Njinikom to the south. Fundong lies about 80 km from Bamenda and spans an area of approximately 519 square kilometers, encompassing 34 villages and several quarters. The population is predominantly rural, with farming being the main occupation. The area is primarily inhabited by the Kom people.

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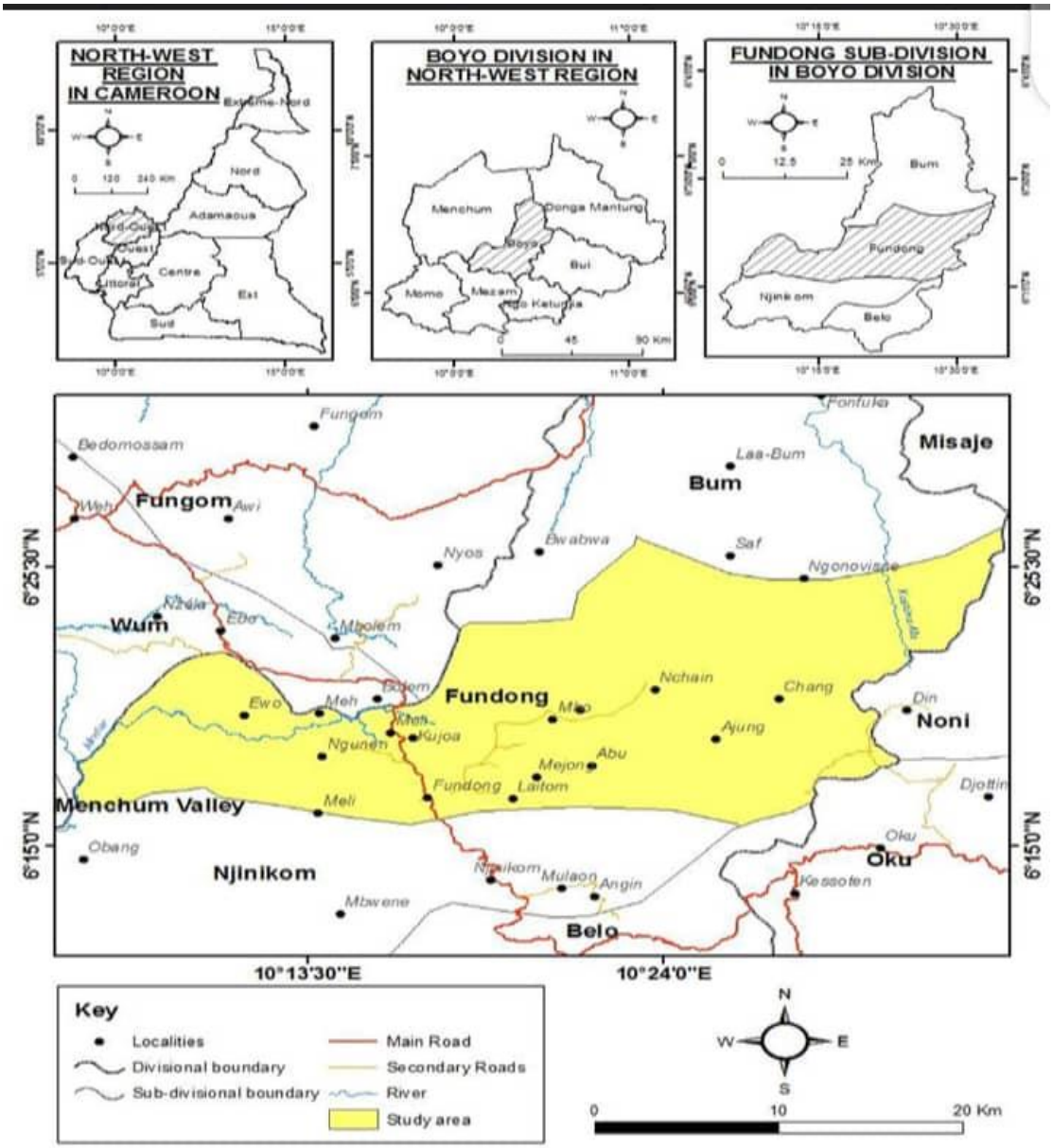

Figure I: Location of Fundong Subdivision in Boyo Division, North West Region, Cameroon

Fundong experiences a generally cold, windy, and wet climate, though it can also be warm, dry, and sunny during certain dry spells. Temperatures typically range from 15℃ to 38℃, with an average temperature between 24.5℃ and 29.7℃. The region receives an average annual rainfall of 2400mm and has a humidity level of 82%. There are two main seasons: a rainy season from mid-March to mid-October and a dry season that extends from mid-October to March. The Fundong Municipality is situated in the mountainous stretch of the western highlands within Cameroon's agro-ecological zone. The topography is characterized by slopes ranging from 40% to 70%, with undulating hills and deep valleys. The landscape is hilly, and the steep slopes contribute to higher erosion rates. While deep valleys and flat plain-like features exist, they are limited to certain depressions like Baiso. Fundong's name comes from Boyo Hill, a peak at 2220 meters above sea level located in Njinikom. The area also contains warm tropical swamps. Soil types in Fundong are primarily volcanic, with laterites, sands, and loams found in the depressions. In low-lying areas, the soils are thick, humus-rich, fertile, providing a conducive environment for agriculture. Lateritic and ferralitic soils are the dominant types in the region. Fundong's hydrology includes several major rivers, such as Nkoini, which forms the natural boundary with Njinikom. Other rivers include Jviaffief, which flows from the Ijim forest through Fundong to Menchum, and Jvia Ngwa, which flows through several villages and separates Fundong from the ZOA Council. There are also important streams like Jvia Ibolem and Jvia Mboh, which both feed into Jvia Ngwa. The area is home to notable springs and waterfalls, including Tchimni, Laikom,

Akeh, and Ajung. Flora in Fundong consists of tropical grasslands or humid savannah, with forest woodlands and regrowth savannah featuring grasses and shrubs. Common plant species include *Carica papaya, Prunus africana, Kigelia africana, Eucalyptus globulus,* and *Psidium guajava*, with *Prunus africana* being a particularly threatened medicinal plant.

The study was conducted in two areas with varying levels of anthropogenic disturbance: Fujua, a highly disturbed area, and Ijim, a less disturbed area of forested wetlands in Fundong. Fujua's high disturbance level is primarily due to human activities such as farming, gardening, fishing, logging, and cattle grazing. In contrast, Ijim has experienced minimal human interference, with disturbances mainly stemming from cattle transhumance and the collection of non-timber forest products by riparian communities. Both primary and secondary data collection methods were used for the study.

Primary data were gathered through key informant interviews using a guide that was typically composed of open-ended questions. The interviewees involved quarter heads, traditional practitioners, diviners, herbalists, municipal councilors, and farmers. These individuals were purposively chosen because of prior knowledge on their long standing interactions with the wetlands. The actual field scenario on the wetlands was appreciated through field observations. There were 40 key informants in the study which took place in March 2024. The study was conducted during a period of political instability in the region which made access to other parts of the Subdivision challenging. Secondary data were collected from journal articles, books, reports, and electronic sources.

III. RESULTS

Biodiversity loss in forested wetlands in Fondong Subdivision was found to be under the control of economic, natural, and political among other drivers. This study focused on the anthropogenic drivers as outlined below:

A. Economic Drivers

- **Logging**

The threats to forestry resources emanate from increasing demand for timber. Pushed by local demands and beyond, the extraction of trees from wetlands in Fundong has been on the increase. Wetland trees are important sources of fuel, timber, medicine, construction material, and carving material. Wanton logging has led to the creation of large areas of bare lands especially in Fujua where anthropogenic disturbance of wetlands is high. The outcome of logging of trees on wetlands in Fundong has been a destruction of habitats and, hence, loss of plant and animal species.

- **Farming**

Farming, both at subsistence and commercial scale, is the main driver of biodiversity loss in wetlands of the Fundong Subdivision. In Fujua, expansion and intensification of agricultural activities in the ecosystem has led to habitat loss, degradation, and fragmentation which have compromised the biodiversity of the area. Attracted by fertile soils, adequate and reliable rainfall, a high human population density has continued to place the flora and fauna of forested wetlands under pressure of farming. Market gardening in the wetlands provides local food security and economic opportunities especially in the dry season when there is readily available irrigation water in the immediate environment of the plants. Besides vegetables, wetlands also support the production of staple foods like cocoyam, cassava, and maize.

- **Cattle grazing**

Mountains are rich in pastures and water for agro-pastoral resources which sustain the livelihoods of many indigenous communities. As evident from Fujua and Ijim, the Fundong highlands offer a landscape which has remained active in grazing of cattle by Muslim populations. The transhumance herders continually degrade the forested wetlands in their quest for pasture. Biodiversity of the ecosystems is being diminished through soil compaction by the animals and burning of vegetation for pasture regeneration. Most at times, the fires progress beyond the forested wetlands into eucalyptus plantations and other ecosystem types.

B. Proximity

The forested wetlands of Fujua and Ijim are surrounded by the Laikom palace which is at the center of Fundong and just a few meters away from enormous human habitations. Such nearness has made it easier for the riparian communities to encroach the ecosystems for collection of fuelwood, non-timer products, medicines, and timber.

C. Weak Law Enforcement

Lack of institutional structures by government or traditional leadership that can empower protected areas to generate sufficient revenues potentially contributes to biodiversity loss. There are also conflicting mandates among institutions with some providing legitimacy to adverse biodiversity activities. While there are existing laws aimed at conserving biodiversity, enforcement has been weak in Fundong.

D. Population Increase

Increasing family sizes has been observed to be a major driver of encroachment and biodiversity loss in Fundong Subdivision. Since the middle of the 20th Century, the human population has been on an increase. Associated increases in housing and feeding needs have accelerated the destruction of natural habitats. An increased in farming activities and the exploitation of natural resources to meet human needs in Fundong have led to growing levels of pollution of wetlands. The larger the family size, the more farms in the ecosystem and the greater the human footprint on its biodiversity.

IV. DISCUSSION

This study highlighted four major drivers (economic, proximity, population increase and weak law enforcements) of biodiversity loss in Fundong. The results are in line with the findings of Prakash and Verma (2022) that overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change are human factors that adversely impact biodiversity in India. Prakash (2021) also observed that, the loss of biodiversity is mainly due to habitat destruction, over-harvesting, pollution and inappropriate as well as indiscriminate development and overexploitation of natural resources. According to Barlow *et al*. (2018), more than half of the global species diversity and vegetation is often subjected to rapidly increasing anthropogenic pressure which leads to biodiversity loss. The rapid increase in human numbers combines with high poverty and rising levels of consumption in depleting natural resources on which the livelihood of present and future generations depends (Gebretsadik, 2016). The growing trends of population with the high demand for food, energy, and housing have considerably changed landuse practices and severely degraded wetlands in Fundong Subdivision and other parts of Cameroon.

A key driver of biodiversity in the forested wetlands of Fundong was found to be farming and grazing. According to Ndenecho (2005), the Bamenda highlands ecoregion to which Fundong Subdivision belongs characterized by alternating seasons of rainfall and drought that favour farming and grazing activities. Farming and grazing have also been identified as crucial contributors of biodiversity in Tubah Subdivision of the North West Region of Cameroon.

V. CONCLUSION

The findings of this study reveal that the forested wetlands of Fundong Subdivision, located in the Boyo Highlands of the Northwest Region of Cameroon, are under significant ecological stress due to increasing anthropogenic activities which have contributed to the degradation and loss of biodiversity in the area. The loss of biodiversity in Fundong's forested wetlands poses a serious threat to ecological sustainability, local livelihoods, and future resource availability. The region's biodiversity is not only a natural heritage but also a critical component of the Kom people's cultural identity and economic survival. Therefore, effective conservation strategies must be both ecologically sound and socially inclusive.

Based on the findings of the study, the main policy proposals are the strengthening of environmental governance, community-based natural resource management, promotion of sustainable agricultural practices, regulation of logging and tree harvesting, population and landuse planning, as well as research and monitoring.

- There is a pressing need to enhance the capacity of local institutions, including municipal councils and traditional authorities, to enforce environmental regulations. Clear roles should be defined for customary institutions such as the *Kwifon* in the conservation of wetlands.
- Empowering local communities through participatory conservation initiatives can promote sustainable resource use. Community forest programs, benefit-sharing mechanisms, and environmental education should be encouraged to foster a sense of ownership and accountability among locals.
- Agricultural extension services should be improved to introduce eco-friendly farming techniques, such as agroforestry, contour farming, and soil conservation. These methods can help reduce pressure on wetland areas while maintaining food security.

- Logging activities must be regulated, and sustainable harvesting protocols should be introduced, particularly for threatened species like *Prunus africana*. This can be done through controlled permits, reforestation programs, and conservation education.
- Local development plans should integrate land-use zoning to control settlement expansion into ecologically sensitive areas. Family planning initiatives and awareness campaigns can help manage population growth and reduce environmental pressure.
- Regular biodiversity assessments and environmental monitoring are essential to track ecological changes over time and to guide adaptive management strategies.

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