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**Original Research Article**

# Land Use Dynamics and Implications on Socio-Economic Development of Bui Division, North West Region of Cameroon

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## Abstract

Land use dynamics are increasingly transforming rural landscapes and influencing socio-economic development in many parts of sub-Saharan Africa. Bui Division in the North West Region of Cameroon has experienced substantial land use changes over the last four decades due to population growth, agricultural expansion, urbanization, infrastructural development, and the prolonged socio-political crisis. This study examined land use dynamics and their implications for socio-economic development in Bui Division between 1985 and 2025. A mixed-methods research approach was adopted. Primary data were collected from 540 households through questionnaires, field observations, focus group discussions, and key informant interviews. Secondary data comprised Landsat satellite imagery (1985, 2000, 2015, and 2025), government reports, and published and unpublished sources. Geographic Information Systems (GIS) and remote sensing techniques were employed to classify land use and land cover changes. The findings revealed significant changes in land use patterns over the study period. Forest cover increased from 214.67 km² in 1985 to 255.28 km² in 2025, while settlement area expanded from 328.30 km² to 565.98 km² in 2015, then slight drop 447.66km² in 2015**.** Agricultural land fluctuated between 1,305.90 km² in 1985, 1226.90 in 2000, 1324.6km² in 2015 and 1,243.60 km² in 2025, reflecting changes in farming practices and land availability. Water bodies declined from 6.27 km² in 1985 to 3.62 km² in 2015**,** suggesting increasing pressure on water resources. These changes contributed to improved agricultural production, employment opportunities, market expansion, and infrastructure development. However, they also accelerated land fragmentation, soil degradation, declining water availability, conflicts over land resources, and increasing livelihood vulnerability. Population growth and changing economic activities remained the principal drivers of these transformations. Land use dynamics have therefore generated both positive and negative socio-economic outcomes in Bui Division. Promote sustainable land use planning, strengthen land governance, and support environmental conservation to ensure balanced socio-economic development and the sustainable use of natural resources.

**Keywords:** Land use dynamics, Socio-economic development, GIS, remote sensing, sustainable development.



## INTRODUCTION

Land is one of the most contested and indispensable resources in human society. Its patterns of use reflect the dynamic interactions among environmental conditions, population growth, economic activities, technological advancement, and institutional frameworks (Lambin *et al.,* 2003; Turner *et al.,* 2007). The conversion of natural land cover into agricultural, residential, commercial, and industrial land uses has significant implications for socio-economic development and environmental sustainability (Foley *et al.,* 2005). In Sub-Saharan Africa, where agriculture remains the dominant livelihood activity, land use is largely driven by population growth, market demand, customary land tenure systems, and government development policies (FAO, 2020).

In Cameroon, particularly in Bui Division of the North West Region, land constitutes the principal resource supporting agriculture, livestock production, settlement expansion, and other socio-economic activities. The Division is characterized by fertile volcanic soils, diverse agro-ecological conditions, and relatively high population densities, making it one of the country's major agricultural production zones (MINEPAT, 2011). However, increasing population pressure, changing land tenure practices, infrastructural development, and the socio-political crisis in the North

West Region have accelerated land use changes over the past decade. These changes are reflected in the expansion of cropland, deforestation, reduction of grazing lands, and the rapid growth of settlements such as Kumbo and Jakiri (Mbuh & Akei, 2021; Diom & Ella Ella, 2023). Such transformations have altered the natural landscape and continue to influence ecosystem services, agricultural productivity, and the sustainable management of water and land resources in Bui Division (Lambin *et al.,* 2003; Foley *et al.,* 2005).

In Cameroon, land use change has intensified over recent decades as a result of population growth, agricultural intensification, logging, mining, infrastructure development and urban expansion (MINEPDED, 2015). Although Cameroon is often described as "Africa in miniature" due to its ecological diversity and relatively abundant water resources, access to clean and reliable water remains uneven, particularly in rural and highland areas. Deforestation, cultivation on steep slopes, and encroachment into water catchments have contributed to watershed degradation, river pollution, and seasonal water shortages in many parts of the country Molua, E. L., & Lambi, C. M. (2006). These trends have raised national concerns over sustainable land use planning and the protection of water resources, especially in environmentally fragile zones.

The Western Highlands of Cameroon, part of the Cameroon Volcanic Line, constitute one of the country's most environmentally sensitive regions. Characterized by steep slopes, high rainfall, volcanic soils, and numerous river headwaters, the region plays a crucial role in water supply at local and regional scales (Lambi & Ndenecho, 2011). However, increasing population density, intensive farming, grazing pressure, deforestation, and settlement expansion have drastically transformed land use patterns. These dynamics have accelerated soil erosion, landslides, siltation of streams, and degradation of wetlands and water catchments (Fogwe, 2014). As a result, the natural capacity of the landscape to regulate water flow has been weakened, leading to declining water quality and seasonal water shortages in many highlands communitiesSince the 19$^{th}$ Century, Bui-division has transcended from being a traditional monoculturThe central question guiding this study is: How have land use dynamics in Bui Division influenced socio-economic development, and what are the implications for sustainable rural livelihoods? This study seeks to analyze patterns and drivers of land use change in Bui Division, assess the socio-economic impacts of these changes on livelihoods and income, and. Identify strategies for promoting sustainable land use and inclusive development.

**The Study**

The study is carried out in Bui Division. located in the North West Region of Cameroon which is bordered to the South West by Ngok-Ketunjia Division, North West by Boyo Division, North East by Donga-Mantung Division and in the South East by West Region Bui Division has an estimated population of 551,786 spread over a surface area of 2,297 km2 giving a density of 200 persons/km² (BUCREP, 2010).

## METHODOLOGY AND RESEARCH DESIGN

This study employs a mixed-methods approach, integrating qualitative and quantitative approaches to comprehensively analyze complex land use dynamics in Bui Division. Descriptive and spatial data were collected between July 2023 and September 2024 from diverse stakeholders, including crop farmers, grazers, forest conservators, and local administrative bodies.

**Data collection relied on a combination of primary and secondary sources:**

Fieldwork involved direct observations and the administration of questionnaires to 540 households across six subdivisions (Kumbo, Jakiri, Nkum, Noni, Mbvem, and Oku), selected via stratified random sampling. Additionally, Key Informant Interviews (KIIs) and focus group discussions were conducted with traditional chiefs, council authorities, agricultural officers, and herders.

Contextual literature, livestock statistics, and revenue data were compiled from the libraries of the Universities of Yaoundé I, Bamenda, and Buea, alongside Council Development Plans and divisional administrative archives.

### 2.3. Geo-Spatial and Cartographic Integration

To monitor spatial environmental transformations from 1985 to 2025, the study integrated remote sensing data using Landsat imagery (ETM 1985 and Landsat 8).Base shape files for administrative limits and localities were acquired from the National Institute of Cartography (NIC) and the National Institute of Statistics in Yaoundé, with field surveys used to ground-truth and correct localized spatial distortions.Primary survey data was digitized using EpiData (Version 3.2) and analyzed via SPSS (Version 21.0). Data scrubbing included Missing Value Analysis and exploratory statistics to ensure consistency and reliability. mapping software was utilized to generate multi-temporal land use/land cover (LULC) change maps.


**Figure 1: Location of study area**
**Source:** Extract of Cameroon administration maps/ NIC.

## RESULTS AND DISCUSSIONS

### Land Use Change Patterns

Between 1985 and 2025, Bui Division in the North West Region of Cameroon has experienced significant land use changes driven by rapid population growth, agricultural expansion, urbanization, infrastructure development, and climatic variability. Over the four decades, natural vegetation and forested landscapes have progressively been converted into cropland, grazing areas, and built-up settlements,

reflecting increasing pressure on land resources to meet socio-economic demands. These changes have altered the spatial distribution and composition of major land use classes, with important implications for ecosystem services, biodiversity conservation, soil stability, and water resources. Examining the patterns of land use change over this period provides valuable insights into the magnitude, direction, and drivers of landscape transformation in Bui Division, thereby informing sustainable land use planning and natural resource management.

**Table 1**: **Evolution of land use cover for Bui from 1985 to 2025**

| Land use (km2) | 1985 | 2000 | 2015 | 2025 |
|---|---|---|---|---|
| Savanna | 2745,15 | 2723,11 | 1187,05 | 2456,5 |
| Forest | 214,674 | 258,23 | 302,53 | 255,28 |
| Water | 6,274 | 3,22 | 3,93 | 2,75 |
| Bare surface/Farmland | 1305,9 | 1226,90 | 1324,6 | 1243,5 |
| Buildings | 328,3 | 387,98 | 565,55 | 447,66 |

**Source:** Generated from Landsat ETM, August 2024/NIC

Table 1 presents the changes in major land use and land cover categories in Bui Division between 1985 and 2025.The results indicate that all land use categories experienced varying degrees of change over the 40-year period, reflecting the influence of both natural and human-induced factors.

The area under savanna declined slightly from 2,745.15 km² in 1985 to 2,723.11 km² in 2000. A sharp reduction was observed in 2015, when the area decreased to 1,187.05 km², representing the most significant change during the study period. By 2025, however, the savanna increased to 2,456.50 km², although it remained below the 1985 level. The substantial decline up to 2015 can be attributed to the expansion of agricultural land, settlement development, and the conversion of natural vegetation into cultivated land. The partial recovery by 2025 may be associated with natural vegetation regeneration, abandonment of some farmlands due to rural out-migration and insecurity, and ongoing reforestation initiatives (Lambin *et al.,* 2003; Foley *et al.,* 2005).

Forest cover increased steadily from 214.67 km² in 1985 to 258.23 km² in 2000 and further to 302.53 km² in 2015. This increase may be linked to afforestation programmes, the expansion of eucalyptus plantations, and the regeneration of secondary forests in abandoned agricultural areas. However, forest cover declined to 255.28 km² in 2025, suggesting renewed pressure from agricultural expansion, fuelwood harvesting, timber extraction, and settlement growth. Such fluctuations are common in the North West Region, where competing demands for land continue to influence forest resources (FAO, 2020; MINEPAT, 2011).

The water category recorded a continuous overall decline during the study period. Water bodies covered 6.27 km² in 1985 but decreased to 3.22 km² in 2000. Although a slight increase to 3.93 km² occurred in 2015, the area further declined to 2.75 km² in 2025. The reduction in water surface area may be associated with prolonged dry seasons, climate variability, catchment degradation, sedimentation, and increasing abstraction of water for domestic and agricultural purposes. Land use changes around watersheds also contribute significantly to reduced water availability and quality (Molua & Lambi, 2006; IPCC, 2022).

The bare surface/farmland category fluctuated throughout the study period. It decreased from 1,305.90 km² in 1985 to 1,226.90 km² in 2000 before increasing to 1,324.60 km² in 2015. By 2025, it had reduced slightly to 1,243.50 km². The increase observed in 2015 reflects the expansion of crop cultivation driven by population growth, increasing food demand, and commercial agriculture, particularly the cultivation of potatoes, maize, beans, and vegetables. The slight decline after 2015 may be associated with reduced farming activities in some areas due to the socio-political crisis and the conversion of farmland into residential land (Lambin *et al.,* 2003; Mbuh & Akei, 2021).

The built-up area experienced considerable growth over the study period. Buildings occupied 328.30 km² in 1985, increasing to 387.98 km² in 2000 and reaching 565.55 km² in 2015. This trend reflects rapid urbanisation, population growth, improved road infrastructure, and the expansion of commercial and administrative activities in urban centres such as Kumbo and Jakiri. However, the built-up area declined to 447.66 km² in 2025. This reduction may be explained by the destruction of infrastructure, population displacement, reduced investment, and slower urban development associated with the ongoing socio-political crisis in the North West Region. Similar patterns have been reported in conflict-affected regions where insecurity alters settlement dynamics and land use patterns (International Crisis Group, 2017; UN-Habitat, 2020). In 1985, the total surface area occupied by savanna was 1745.45km2, forest 214.676km, water 6.274km 2, farmland/bare surfaces 1304.81 and buildings 387.98km2.

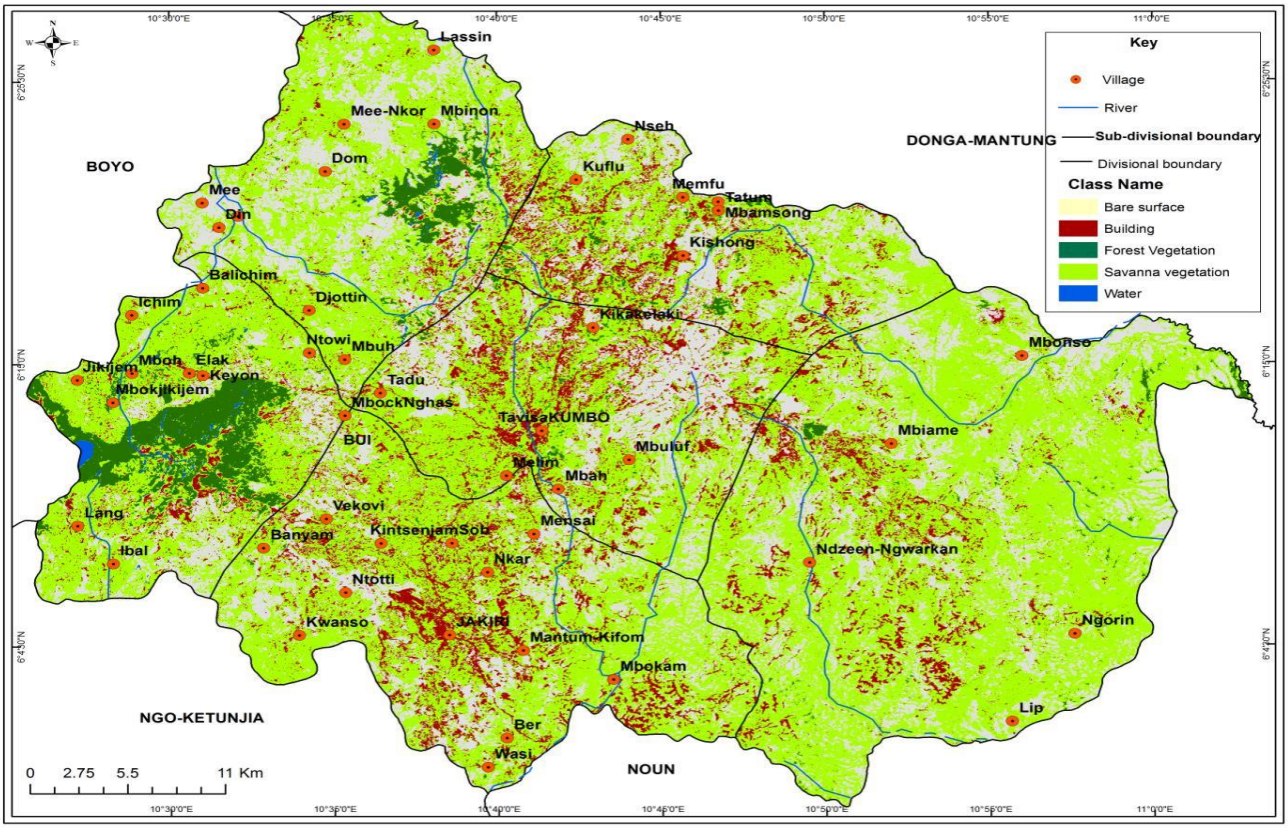


**Figure 2: Bui land use cover for Bui Division in the year 1985**
(Source: Generated from Landsat ETM, August 2024/NIC)

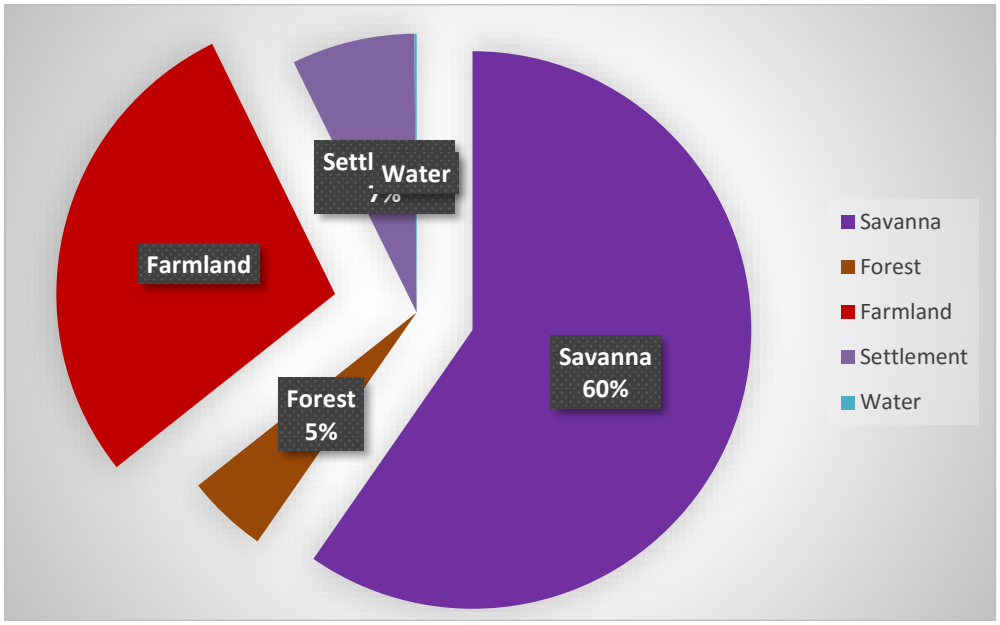


**Figure 3: Varying Land use cover in Bui Division in 1985**
**(Source: Generated from figure,2 2024)**

It can be observed on figure 3, that the savanna vegetation occupied the greatest percentage of the total land surface (60%), followed by farmlands (27%), Settlement(7%) Forest 5% while least area was occupied by water (1%). After 15 years (in 2000), a lot of changes occurred in the land use cover of Bui Division (Figure 4). In the year 2000, the total land surface occupied by savanna was 2723.11 km, forest258.23km2, water 3.22, farmlands 1226.90km² while the settlement occupied 287.98km²

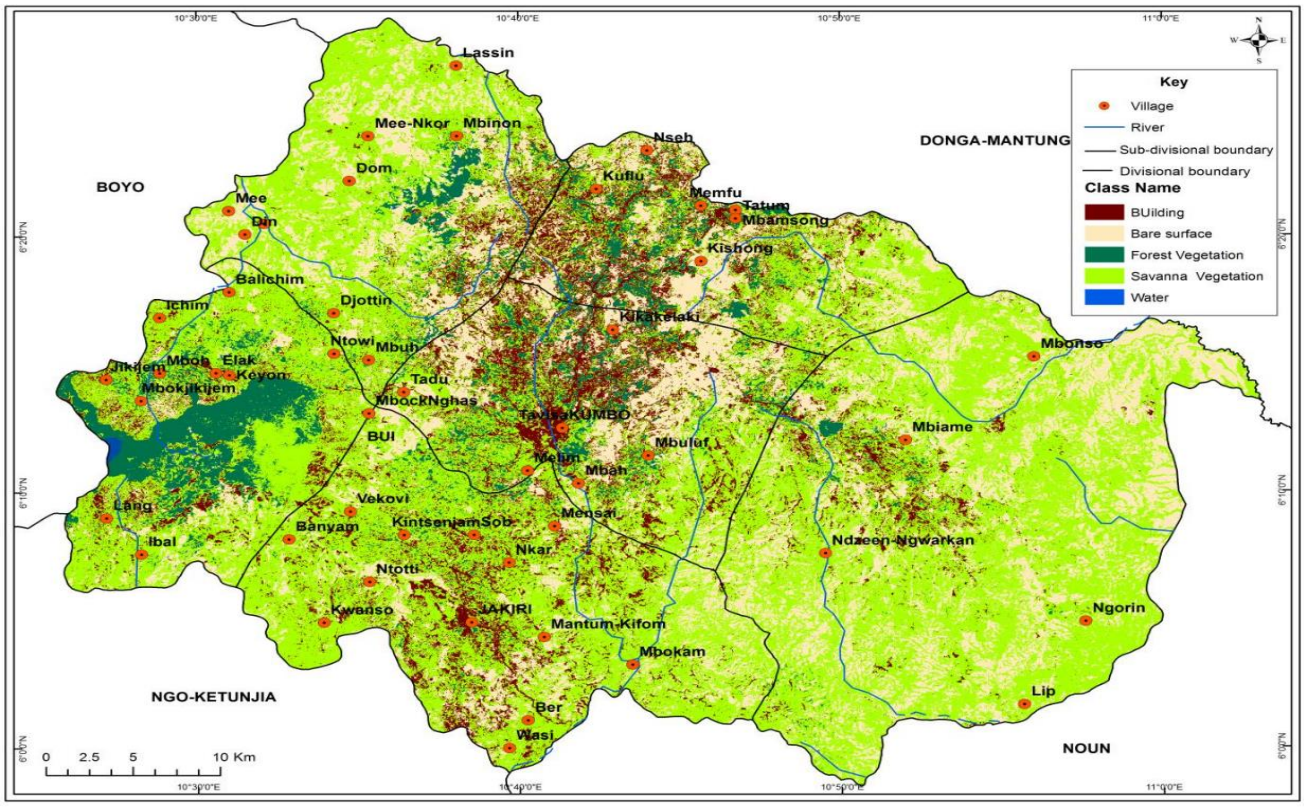


**Figure 4: Bui land use cover in the year 2000**
(Source: Generated from Landsat ETM, August 2024/NIC)

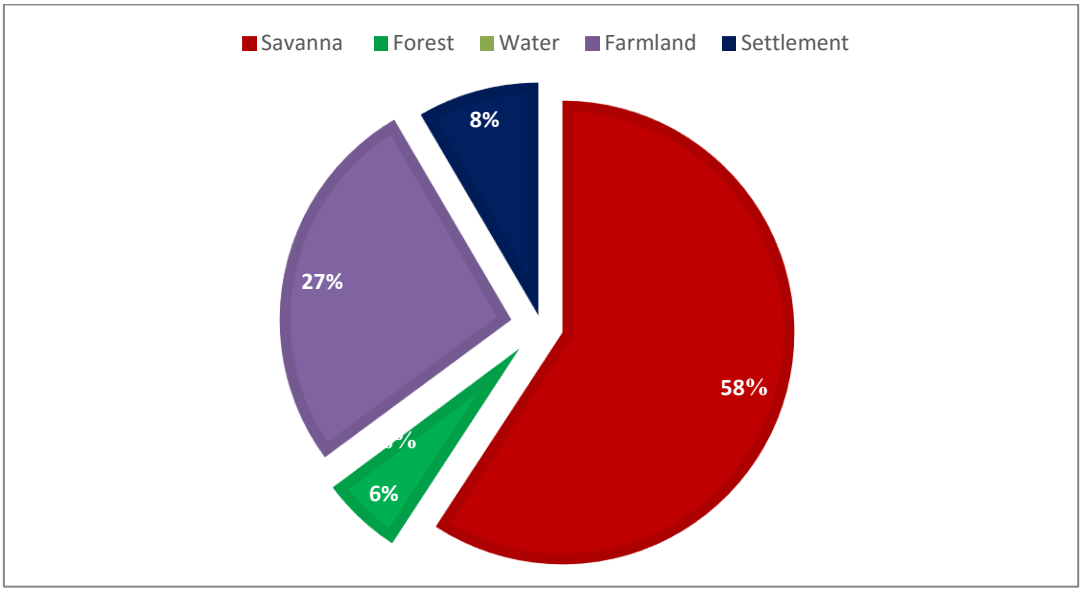


**Fig:5: land use cover in Bui Division in 2000**
**(Source: Generated from figure 4, 2024)**

It can be observed on figure 5, that the proportion of land covered by savanna in the year 2000 was 58% while the forest was 6%. This represents an increase of 1% for forest and 2% decrease for savanna from 1985 to 2000. The increase in the forest was due to an increase in the planting of tree crops such as kola nut, coffee, pear, mango and orange. Similarly, high rural exodus in the area in the 1985 led to the abandoning of some crop farms that developed into forest vegetation. In the year 2015, the total land surface occupied by savanna was 1187,05 km², representing 34% forest 302,53km2,(9%) water 3.93,(1%), farmlands 1324,6km²(39%) while the settlement occupied 565,98km².(17%),

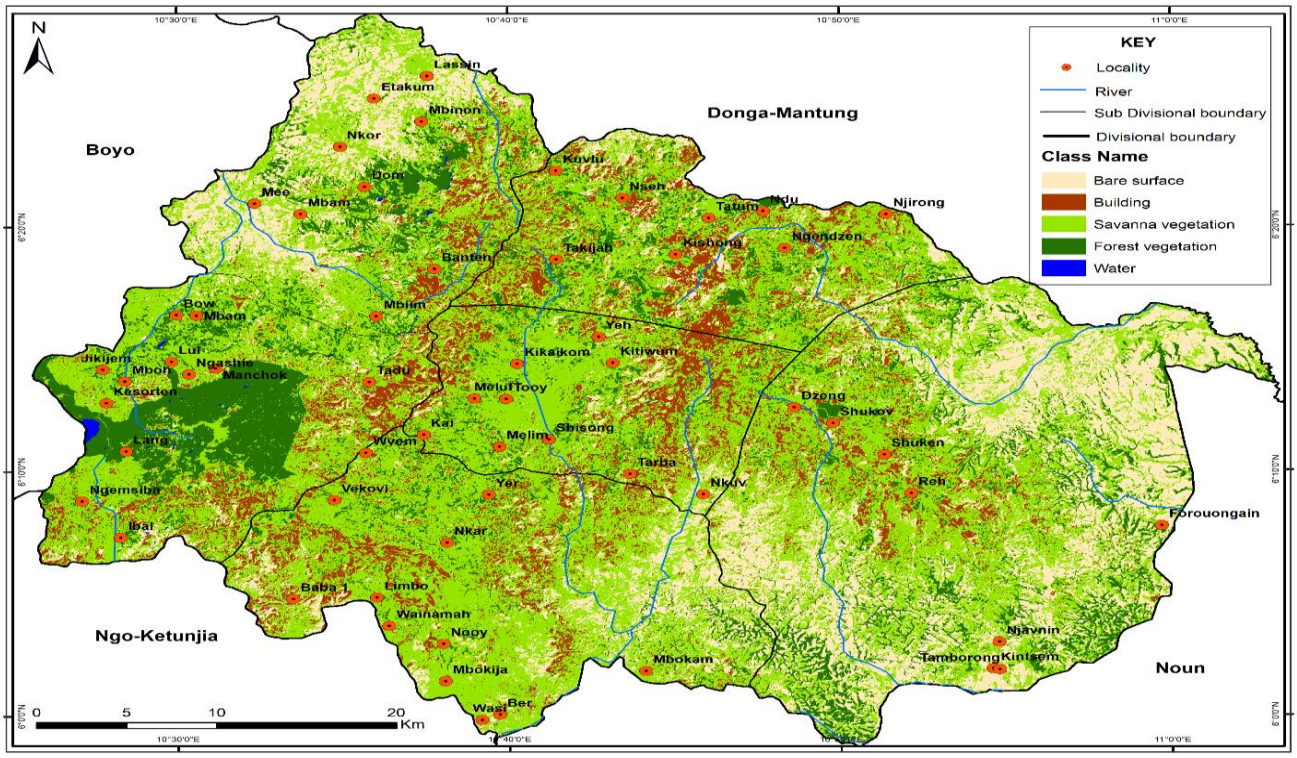


**Figure 6: Bui land use cover in the year 2015**
(Generated from Landsat ETM, August 2024/NIC)

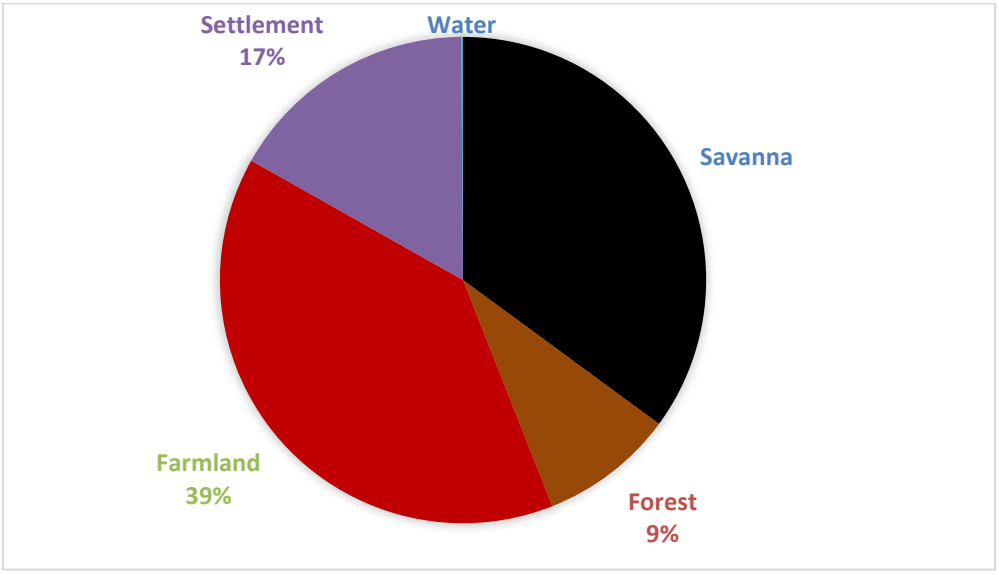


**Figure 7: Proportions of the different land use cover in Bui Division in 2015**
(Source: Generated from figure 6, 2024)

It can be observed on figure 36, that the percentage of land covered by savanna in the year 2015 was 34% while the forest was 9%. This represents an increase of 3% for forest and 24% decrease for savanna from 2000 to 2015.The increase in the forest was due to an increase in the planting of tree crops such as kola nut, coffee, pear, mango and orange and also eucalyptus for economic purposes. Similarly, high rural exodus in the area in the 2000 led to the abandoning of some crop farms that developed into forest vegetation. This can also be observed in the increase in area covered by settlements from 8% in 2000 to 17% in 2015.

In the year 2025, the total land surface occupied by savanna was 2426,2 km², forest 447,66km2, water 3,62 km², farmlands 1243,5km² while the settlement occupied 565,98km².

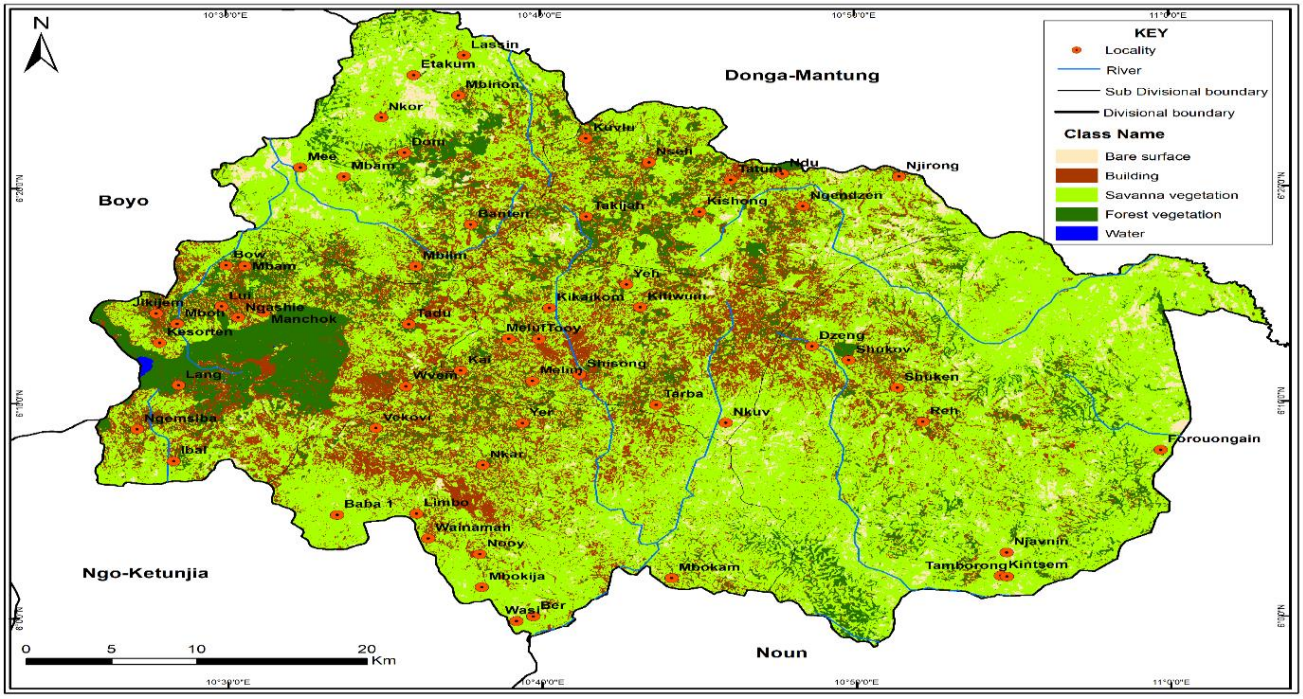


**Figure 8: Bui land use cover in the year 2025**
(Source: Generated from Landsat ETM, August 2024/NIC)

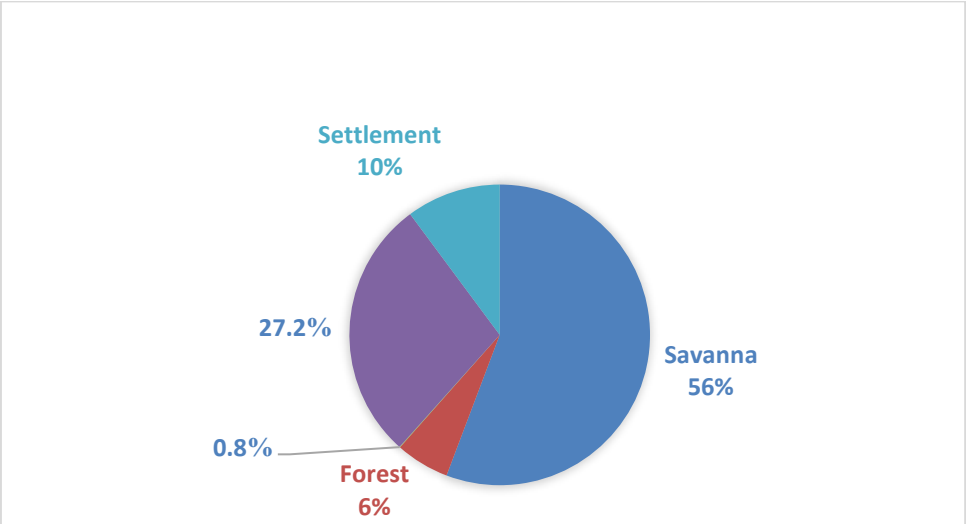


**Figure 9: land use cover in Bui Division in 2025**
**(Source: Generated from figure 8, 2024)**

Figure 8 shows that in 2025, savanna constituted approximately 56% of the total land cover in Bui Division, while forest accounted for 6%**.** Compared with 2015, savanna cover increased by approximately 22%**,** whereas forest cover declined by about 3%**.** The expansion of savanna vegetation is likely attributable to the abandonment of cultivated land following widespread rural out-migration associated with the socio-political crisis. The cessation of farming activities in several communities created favorable conditions for the regeneration of secondary savanna vegetation. Conversely, the decline in forest cover may reflect the removal of mature eucalyptus plantations following increased public awareness of their potential ecological impacts, particularly their high-water demand. In addition, the replacement of eucalyptus with indigenous tree species around water catchment areas as part of watershed restoration and conservation initiatives may have contributed to changes in forest composition and extent. The analysis further indicates a decline in built-up areas, with settlement cover decreasing from 17% in 2015 to 10% in 2025. This reduction is likely associated with conflict-induced population displacement, destruction of infrastructure, and a slowdown in urban expansion resulting from the prolonged socio-political crisis in the North West Region.

**Drivers of Land Use Dynamics in Bui**

***Demographic Growth (Land Fragmentation)***

As population density increases in areas like Kumbo and Jakiri, the traditional system of inheritance leads to land fragmentation. Larger family plots are subdivided into smaller and smaller parcels for each successive generation. This reduces the fallow periods necessary for soil regeneration and forces farmers to cultivate marginal lands or steep slopes. *Momo et al.,* (2018) noted that in the Western Highlands of Cameroon, demographic pressure is a primary driver for the conversion of sub-montane forests into small-scale agricultural mosaics.

**Economic Incentives and tenure systems (Cash Crop Expansion)**

The shift from subsistence farming to market-oriented production of potatoes, maize, and market gardening has incentivized the clearing of wetlands and forest patches. High demand in urban centers like Bafoussam and Douala encourages farmers in Bui to expand their "farms" (fields) into previously communal grazing lands or protected water catchment areas. *Signe et al.,* (2020) argue that the commercialization of agriculture in the Northwest Region has led to significant "land grabs" where fertile valley bottoms are drained for seasonal vegetable production.

Bui Division operates under a dual land tenure system: the formal State law and the Traditional/Customary law (under the Fons). Conflicts often arise because "titles" are rarely formalized, leading to overlapping claims between grazers (mostly Mbororo pastoralists) and farmers. When institutional oversight is weak, encroachment into forest reserves or water sheds becomes common as there is no clear enforcement of boundaries. Ndi (2017*)* highlights that the "ambiguity of land rights" in rural Cameroon facilitates land use conversion because there are no rigid legal barriers to prevent the transformation of grazing land into permanent crop fields.

**Political Instability (Displacement and Settlement Patterns)**

The Anglophone Crisis (beginning in 2016) has significantly altered how land is used in Bui. Many rural villagers have fled to "the bush" or more secure urban peripheries. This has led to the abandonment of farmlands in some areas (allowing for secondary forest regrowth) while causing over-congestion and rapid unplanned construction in safer zones or "sanctuary" settlements. *Zama et al.,* (2021) observe that conflict-induced displacement in the Northwest Region has caused a "spatial reconfiguration," where traditional land management systems have broken down due to the absence of local authorities and the displacement of the labor force.

**Socio-Economic Implications of land use dynamics**

**Positive Impacts of land use dynamics on socio-economic development**

Land use dynamics have significantly contributed to socio-economic development in Bui Division through agricultural expansion, settlement growth, infrastructure development, and livelihood diversification. The transformation of land resources has enhanced production, generated employment, and improved access to social services despite the associated environmental challenges.

**Land use dynamics and agricultural expansion**

Agricultural expansion has increased food production and household income. The conversion of savanna and fallow lands into farmland has enhanced the cultivation of maize, beans, potatoes, vegetables, and coffee. Remote sensing data indicate that agricultural land occupied approximately 1,305.90 km² in 1985, increased to 1,324.60 km² in 2015, and remained above 1,243 km² in 2025. This extensive agricultural land base has strengthened food availability and supported the livelihoods of a large proportion of the rural population (Tume *et al.,* 2019).

**Land use dynamics and Settlement expansion.**

Settlement expansion has improved access to social amenities and economic opportunities. Built-up areas increased from approximately 328.30 km² in 1985 to 565.98 km² in 2015, representing an increase of about 72.4%**.** Urban growth in Kumbo, Jakiri, and Oku has promoted the establishment of schools, health facilities, financial institutions, markets, and communication services. Improved access to these services has enhanced human capital development and living standards (United Nations Human Settlements Programme [UN-Habitat], 2022).

**Land use dynamics and Employment creation.**

Land use dynamics have created employment opportunities. Expansion in agriculture, construction, transport, commerce, and small-scale industries has absorbed a substantial proportion of the labour force. Increased demand for farm labour, traders, builders, drivers, and service providers has diversified rural livelihoods and reduced dependence on subsistence farming. Livelihood diversification is an important pathway for poverty reduction and rural development in many developing regions (Ellis, 2000).

**Land use dynamics and investment in forestry and agroforestry practices**

Land use changes have encouraged investment in forestry and agroforestry practices. Forest cover increased from approximately 214.67 km² in 1985 to 302.53 km² in 2015, representing an increase of about 40.92%**.** The expansion of eucalyptus plantations and community forestry initiatives has provided timber, fuel wood, poles, and income to many households. These

activities have contributed to livelihood diversification and local revenue generation.

**Table 2: Positive impact of land use dynamics on socio-economic development**

| S/N | Effective respondents | Agricultural expansion | Settlement expansion | Investment in forest and agro-forestry | Employment creation |
|---|---|---|---|---|---|
| Noni | 83 | 40 | 15 | 13 | 15 |
| Oku | 94 | 45 | 10 | 30 | 9 |
| Kumbo | 123 | 43 | 35 | 20 | 25 |
| Mbven | 50 | 23 | 17 | 07 | 03 |
| Nkum | 77 | 37 | 20 | 15 | 05 |
| Jakiri | 79 | 25 | 30 | 05 | 19 |
| Total | 506 | 213 | 127 | 90 | 76 |
| Percentage | 100% | | | | |

**Source:** Field survey 2025.

Table 2, shows that agricultural expansion was the most important positive impact, reported by 213 respondents (42.1%)**.** This indicates that changes in land use have increased the area available for crop production, thereby supporting food supply, household income and local markets in Bui Division. Settlement expansion was reported by 127 respondents (25.1%)**,** reflecting improved residential development and growth of service centers. Investment in forests and agroforestry accounted for 90 respondents (17.8%)**,** suggesting that tree planting and forest-related activities contribute to income diversification and environmental management. Employment creation was identified by 76 respondents (15.0%)**,** showing that land-based activities provide livelihood opportunities. Overall, the findings indicate that land use dynamics have contributed to socio-economic development through increased agricultural production, settlement growth, investment and employment opportunities.

**Negative Impact of land use dynamics on socio-economic development**

Land use dynamics in Bui Division have generated significant socio-economic challenges despite their contribution to agricultural expansion and urban development. Rapid conversion of forests, grasslands, and wetlands into farmland and settlements has increased pressure on natural resources and reduced ecosystem resilience (Lambin & Geist, 2006).

**Land use dynamics and declining water resources.**

Agricultural land fragmentation has emerged as a major constraint to rural livelihoods. Continuous subdivision of family land due to rapid population growth has reduced average farm sizes, thereby lowering agricultural productivity and household income. Bui Division recorded a population increase from approximately 551,786 in 2012 to an estimated 680,902 in 2021, representing an increase of about 23.4%. This growth has intensified competition for cultivable land and accelerated encroachment into marginal areas (BUCREP, 2010; United Nations, 2022).

**3.4.2. Land use dynamics and declining water resources.**

Land use change has contributed to declining water resources. Expansion of agriculture and settlements into catchment areas has reduced vegetation cover surrounding springs and streams. Satellite-derived land cover data indicate that the surface area occupied by water bodies declined from approximately 6.27 km² in 1985 to 2.75 km² in 2025, representing a reduction of about 43.85%. Reduced stream discharge has affected domestic water supply, irrigation, livestock production, and small-scale enterprises that depend on reliable water resources.

**Land use dynamics and Deforestation and vegetation loss**

Deforestation and vegetation loss have increased environmental hazards. Removal of indigenous vegetation has reduced biodiversity, increased surface runoff, and exposed fragile mountain slopes to landslides and flooding during the rainy season. Loss of forest resources has also reduced the availability of fuelwood, medicinal plants, and other non-timber forest products that support rural livelihoods (IPBES, 2019).

**Land use dynamics and conflicts over land resources**

Land use dynamics have intensified conflicts over land resources. Expansion of farmland into traditional grazing areas has increased disputes between crop farmers and pastoralists, particularly in Jakiri, Oku, and Nkum Sub-divisions. These conflicts often result in crop destruction, livestock losses, reduced agricultural investment, and declining household incomes (Ngwa, 2017).

**Table 3: Negative impact of land use dynamics on socio-economic development**

| Sub-Division | Effective respondent | Fragmentation of agricultural land | Declining water resources | Deforestation and vegetation loss | Conflicts over land resources |
|---|---|---|---|---|---|
| Noni | 83 | 20 | 23 | 25 | 15 |
| Oku | 94 | 20 | 27 | 34 | 13 |
| Kumbo | 123 | 27 | 53 | 30 | 13 |
| Mbven | 50 | 10 | 17 | 16 | 07 |
| Nkum | 77 | 12 | 37 | 20 | 08 |
| Jakiri | 79 | 11 | 31 | 27 | 10 |
| Total | 506 | 100 | 188 | 152 | 66 |
| Percentage | 100 | | | | |

**Source:** Field survey 2025.

Table 3 indicates that declining water resources constituted the major negative impact, reported by 188 respondents (37.2%). This suggests that changing land use, particularly agricultural expansion and vegetation clearance, may reduce water availability and affect domestic use, farming and other economic activities. Deforestation and vegetation loss followed with 152 respondents (30.0%), indicating increasing pressure on natural resources and the loss of forest-based livelihood opportunities. Fragmentation of agricultural land was reported by 100 respondents (19.8%), which may reduce farm size, limit agricultural efficiency and constrain long-term food production. Conflicts over land resources were reported by 66 respondents (13.0%), reflecting competition for increasingly scarce land among different users. Overall, the findings show that although land use dynamics promote development, they also create environmental and socio-economic pressures that can undermine sustainable development in Bui Division.

## CONCLUSION AND RECOMMENDATIONS

The findings demonstrate that land use dynamics have had both positive and negative implications for socio-economic development in Bui Division. On the positive side, agricultural expansion was the most important benefit, accounting for 213 respondents (42.1%), followed by settlement expansion with 127 respondents (25.1%), investment in forest and agroforestry with 90 respondents (17.8%), and employment creation with 76 respondents (15.0%). These changes have increased opportunities for food production, income generation, investment, settlement development and employment. This confirms the importance of land resources as a foundation for livelihoods, agricultural production and economic well-being (FAO, 2025).

However, the benefits are accompanied by significant socio-economic and environmental costs. Declining water resources emerged as the most prominent negative impact, reported by 188 respondents (37.2%), while deforestation and vegetation loss accounted for 152 respondents (30.0%). Agricultural land fragmentation affected 100 respondents (19.8%), whereas 66 respondents (13.0%) identified conflicts over land resources. These findings suggest that continued conversion and intensive use of land can place increasing pressure on water, vegetation and agricultural resources. The IPCC similarly recognizes land-use change and unsustainable land management as important causes of land degradation, with consequences for livelihoods and water security (IPCC, 2019). Deforestation can also disrupt water regulation, increase erosion and contribute to competition over natural resources (FAO, 2025).

Land use dynamics are a major driver of socio-economic transformation in Bui Division, but their long-term contribution to development will depend on how effectively land and water resources are managed. The current pattern presents a development dilemma: land conversion creates immediate agricultural, residential and economic benefits, but uncontrolled expansion may gradually undermine the natural resource base on which these benefits depend. Sustainable agricultural practices, agroforestry, protection of water catchments, improved land-use planning, secure land governance and community participation are therefore essential. As emphasized by FAO, integrated management of land, soil and water is necessary to sustain agricultural productivity, livelihoods and resilient development. Thus, sustainable land-use management should become a central strategy for achieving balanced socio-economic development and protecting the resource base of Bui Division for future generations.

### Recommendations

Strengthen forest and watershed conservation. Local councils, traditional authorities, and environmental agencies should prioritize afforestation, watershed restoration, and the protection of riparian zones. Restoring degraded catchment areas and enforcing 30–100 m buffer zones along major rivers and streams will improve water availability, reduce soil erosion, and enhance ecosystem resilience (IPCC, 2023).

### Promote Climate-smart Agriculture

Agricultural extension services should intensify the adoption of agroforestry, contour farming, crop rotation, conservation agriculture, and integrated soil fertility management. These practices will increase agricultural productivity while minimizing land degradation and protecting water resources (FAO, 2022).

**Strengthen Land Governance and Tenure Security**

Government should simplify land registration procedures, improve access to land titles, and strengthen the enforcement of customary and statutory land tenure systems. Clear and secure land rights will reduce conflicts, encourage long-term investment, and promote sustainable land management (World Bank, 2021).

**Invest in Resilient Rural Infrastructure**

National and local governments should prioritize the rehabilitation of farm-to-market roads, rural water supply systems, electricity networks, and post-harvest storage facilities. Improved infrastructure will enhance market access, reduce post-harvest losses, and stimulate rural economic development (African Development Bank, 2023).

**Institutionalize Land use Monitoring and Stakeholder Collaboration**

Government agencies should undertake GIS and remote sensing-based land use assessments every 3–5 years to support evidence-based planning and policy implementation. Collaboration among government institutions, traditional authorities, local communities, and civil society should be strengthened through regular environmental education, participatory land use planning, and community-based natural resource management initiatives (Lillesand *et al.,* 2021).

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