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SOIL COVER AND AGRICULTURAL LAND USE IN THE FAKO-MEME FOREST REGION, CAMEROON

Abstract

The purpose of this article is to show the characteristics of soil cover and impacts of agricultural Land use in the Fako-Meme Region of Cameroon. Blessed with a lot of agricultural potential, the Fako-Meme Region is regarded as an agricultural cornucopia in the South West Region of Cameroon. This region is naturally endowed with a rich variety of soils resources which are favourable for various agricultural activities, most especially the volcanic soils which has attracted the growth of large agro-industrial plantations and peasant agriculture. This explains why the region is heavily exploited as the inhabitants depend on it for their livelihood. The different soil types and their land use in the region and the impact of volcanic activity on soil cover in the region were investigated.

Data were collected from secondary sources, and with the help of GIS and remote sensing software the study area and land use maps were created. The Topographic map of Buea-Douala region and Landsat ETM image Files of 12 December, 2015 were downloaded from Global Land Cover Facility website and the various bands for each year were modulated and corrected to reveal the different land use types features using ENVI 4.3.

The finding revealed that anthropogenic activities like unsustainable agricultural practices have seriously contributed to the degradation of the soil cover. Population growth and its attendant problems of food security have accelerated the use of chemical fertilizers and the cultivation of marginal lands. Some indigenous strategies have been put in place to improve on the soil fertility of the region. The recommendations proposed calls for a proactive and adaptive management plans which would curb the high soil degradation rates and implement effective land use management policies in this eco-region.

Keywords: soil cover, soil types, anthropogenic impact, Fako-Meme Region, Cameroon

INTRODUCTION

Cameroon has been referred to as «Africa in Miniature». This statement is particularly valid not only with regards to its vegetation, which gives a representation of Africa but also in line with its soil cover that equally gives a representation of the soils in the Sub-region. The Fako-Meme Forest Region, which is an integral part of Cameroon, holds this same view. Like elsewhere in Cameroon, the geology of the underlying lithosphere influences the nature of aggregates or soils in the area. These

soils have equally been altered by anthropogenic activities, which help in exposing them to fluvial erosion and other weathering processes that this paper intends to examine. Population growth and its attendant problems of food security have pushed a handful of the population to use chemical fertilizers and cultivate on marginal land.

A number of works have been done by researchers on soils in Cameroon. However, much of these works have been focused on the Western Highlands and the Semi-arid regions of Cameroon. Amongst these are the works of [3] who studied soil modelling in the semiarid zone of Cameroon. His findings were limited only within the semiarid region. Another study of soil is that of [2] who studied the interactions of human mobility and farming systems on biodiversity and soil quality in the Western Highlands of Cameroon. His study looked at population growth and the drop of coffee a major cash crop which is influenced by the farming system and mobility of farmers. A general assessment of soil resources and soil fertility constraints in Cameroon was conducted by [11]. His study only revealed the main constraint behind unsustainable use of soils in Cameroon without proposing any solutions. Finally, an evaluation of the fertility of soils for increased maize production in the humid region of Cameroon was conducted by [7]. Since it is of the popular view that the Fako-Meme region has volcanic soils because of the presence of Mt Cameroon, a volcanic mountain, many researchers have undermined the fact that unsustainable agricultural practices remain a primordial cause of soil impoverishment. To this regard they have given a soil blind on the basis that the soils are permanently rich. The reasons why much scientific works have been concentrated in other regions and almost no direct work have been focused in this region. These researchers have equally focused their studies mainly on the challenges of soils in Cameroon without postulating how these issues will be solved in order for the soils to regain their fertility. It is for this reason that our study equally focussed on some indigenous adaptation strategies and future prospect to fight soil impoverishment in this region considered as the bread basket of Cameroon and its neighbouring CEMAC nations.

MATERIALS AND METHODS

Data were collected from secondary sources, and with the help of GIS and remote sensing software the study area and land use maps were created. The Topographic map of Buea-Douala region and Landsat ETM image Files of 12 December, 2015 were downloaded from Global Land Cover Facility website and the various bands for each year were modulated and corrected to reveal the different land use types features using ENVI 4.3.

RESULTS AND DISCUSSIONS

Location of study area. The Fako-Meme Forest Region is located in the South West Region of Cameroon. Geographically, it lies between Latitude $3^{\circ} 86'' - 5^{\circ} 4''$ N and Longitude $9^{\circ} 28'' - 9^{\circ} 49''$ E, covering a surface area of 4999.80Km^2 . Administratively,

it covers two of the six divisions of the region; It is bordered by Kupe Muanenguba Division to the North, the Atlantic Ocean to the South, the Littoral Region to the East and the Ndian Division to the West. This is presented on Figure 1.

Like elsewhere in Cameroon, the Precambrian shield is the most important geological structure, and consists of a large part of the metamorphic and old volcanic rocks [2] Within the Fako-Meme Forest Region, Mount Cameroon which is part of a larger volcanic belt referred to as the (Cameroon Volcanic Line) is an active volcano having erupted thirteen times in the last century (Table 1).

Table 1
The Historical Eruptions of Mount Cameroon Volcano for the Past Century [10]

Eruption Date	Eruption Style And Products	Duration	Key References
1909	Basaltic lava on the northern flank. Fissure eruption with strombolian activity	One Month	<i>Fitton et al., 1983</i>
1922	Summit eruption (explosive, Strombolian) and western flank fissure eruption of pahoehoe lava	Six months	<i>Fitton et al., 1983</i>
1954	Summit explosive eruption of ash and bombs but no lava	One month	<i>Fitton et al., 1983</i>
1959	North eastern flank eruption of aa lava fissure eruption at two altitudinal sites	One month	<i>Fitton et al., 1983</i>
1982	South western flank explosive and effusive fissure eruption of basaltic lava from one major cone	One month	<i>Fitton., al., 1983</i>
1999	South west flank fissure eruption at two altitudinal site of basaltic lava and scoria. Higher site explosive while lower site more effusive	One month	<i>Suh et al., 2003</i>
2000	Summit central explosive eruption and north flank fissure explosive and effusive eruption of scoria, ash and lava flow	One month	<i>Suh et al., 2003</i>

Soil types and their Land Use in the Region. The main soil types of the Fako-Meme Forest Region of Cameroon which is a dominant volcanic region depends on a number of factors which are: the age of the parent material, the landform characteristics on which they are formed and variations in climate due to the influence of the Mount Cameroon and the adjacent coast. From the land system analysis, four major and three minor soil types have come under differential agricultural utilization. These soils have been described by [3] and [1] under the following headings.

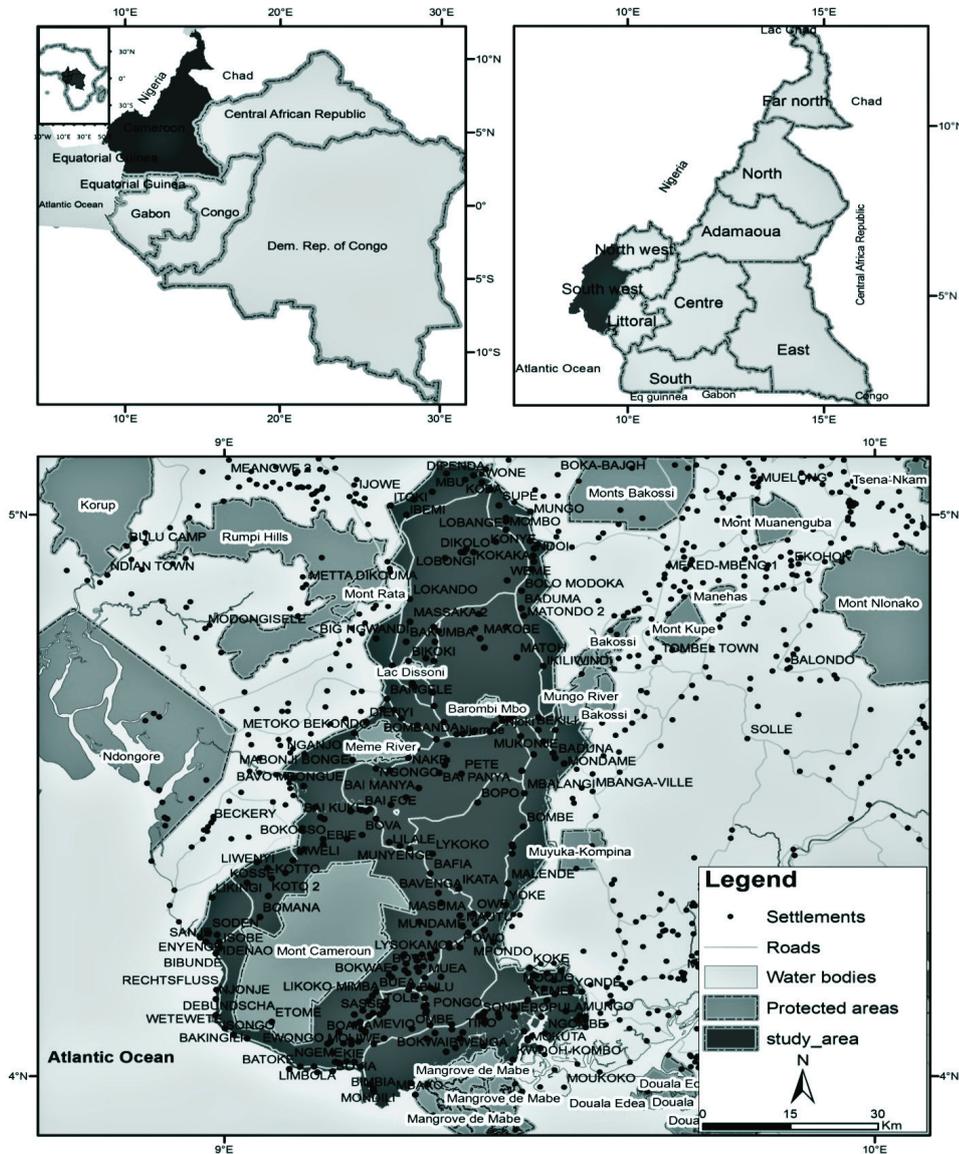


Figure 1. Location Map of Fako-Meme Forest Region of Cameroon Ferallitic Soils

These are the most widespread soils in the area. These soils have a high content of sesquioxides (iron and aluminium) and are low in exchangeable bases. They are generally sandy clay loams with a mean cation exchange capacity of 20 meq/100g and a pH range of 5.2 to 6.3, a mean organic carbon content of 4.6 % and very high phosphorus content (17 ppm), [7]. These soils are graded among the fertile soils in the area. They support the cultivation of tropical cash crops and food crops.

Volcanic Soils. This is the second type of soil common in the area. These are the most fertile soils in the area which favours plantation agriculture. The rich volcanic soils are derived from the continuous accumulation of lavas orchestrated by the weathering of lava. These soils are made up of scoracious materials. The reason why the Cameroon Development Cooperation has located its vast agro-industrial plantations of oil palms, rubber, tea, bananas and pepper. The physical properties of the soils are favourable for agriculture. Moreover, these soils are characterized by deep soils with high permeability and a stable micro-structure. With the exception of the shallow and sandy soil types, the soils are hardly susceptible to erosion. Their friable consistence under most conditions makes them easy to work. But because of the influence of steep slopes and the effect of altitude, they suffer from erosion hazards even though altitude equally offer temperate conditions for the cultivation of crops like irish potatoes, vegetables, tomatoes and cabbages.

Alluvial Soils. These are young soils developed from volcanic ash, cinders and are easily weathered volcanic materials (alluvial deposits) commonly found near volcanic vents or down slope or downwind from the volcano, where a sufficiently thick layer of ash has been deposited during eruptions. These soils lack any major marks of soil-forming processes due to periodic additions of alluvial deposits. They are found along the volcanic axis of Mount Cameroon. The principal soil forming process is rapid weathering of ash to produce amorphous or poorly crystalline silicate minerals such as allophone. Formation of alumina-humus complexes protects the organic matter from mineralization and leads to its accumulation in these soils. They have a low bulk density, are dark in colour and constitute the most productive soils for intensive agriculture in the country. They are highly erodible but support intensive agriculture because of their volcanic origin.

Hydromorphic Soils. These soil types are restricted to alluvial plains and valley bottoms. They are soils with signs of excess wetness as indicated by oxidation/re-doximorphic features. They are found in low-lying areas with shallow groundwater or valleys with impeded drainage. Water logging is their main limitation. With an altitude of not greater than 200m above sea level, this area is composed of deposition with sedimentary material which is characterized by better drained upper alluvium and swamps. These are mineral swamp forest alluviums, organic swamps, forest soils and sedge/grass swamp soils. With the availability of swamp forest (mangroves) composed of tress and humic soils, the area is equally used for various agricultural purposes. They have potential agricultural importance if drainage is undertaken. Although not covering large surfaces, this soil type is very distinct. It is often mapped in association with yellowish brown and reddish brown tropical clay soils. These soils are characterized by greyish colours or mottling due to permanent high or variable groundwater levels. The soil Texture varies with depth. They are common along the creeks of Tiko and Limbe.

Amongst these four major types of soils, there are equally patches of lateritic soil in the extreme North Eastern part of the study area around the Konye area. Another type of soil noticed in the study area with little impacts is the Brownish and Asso-

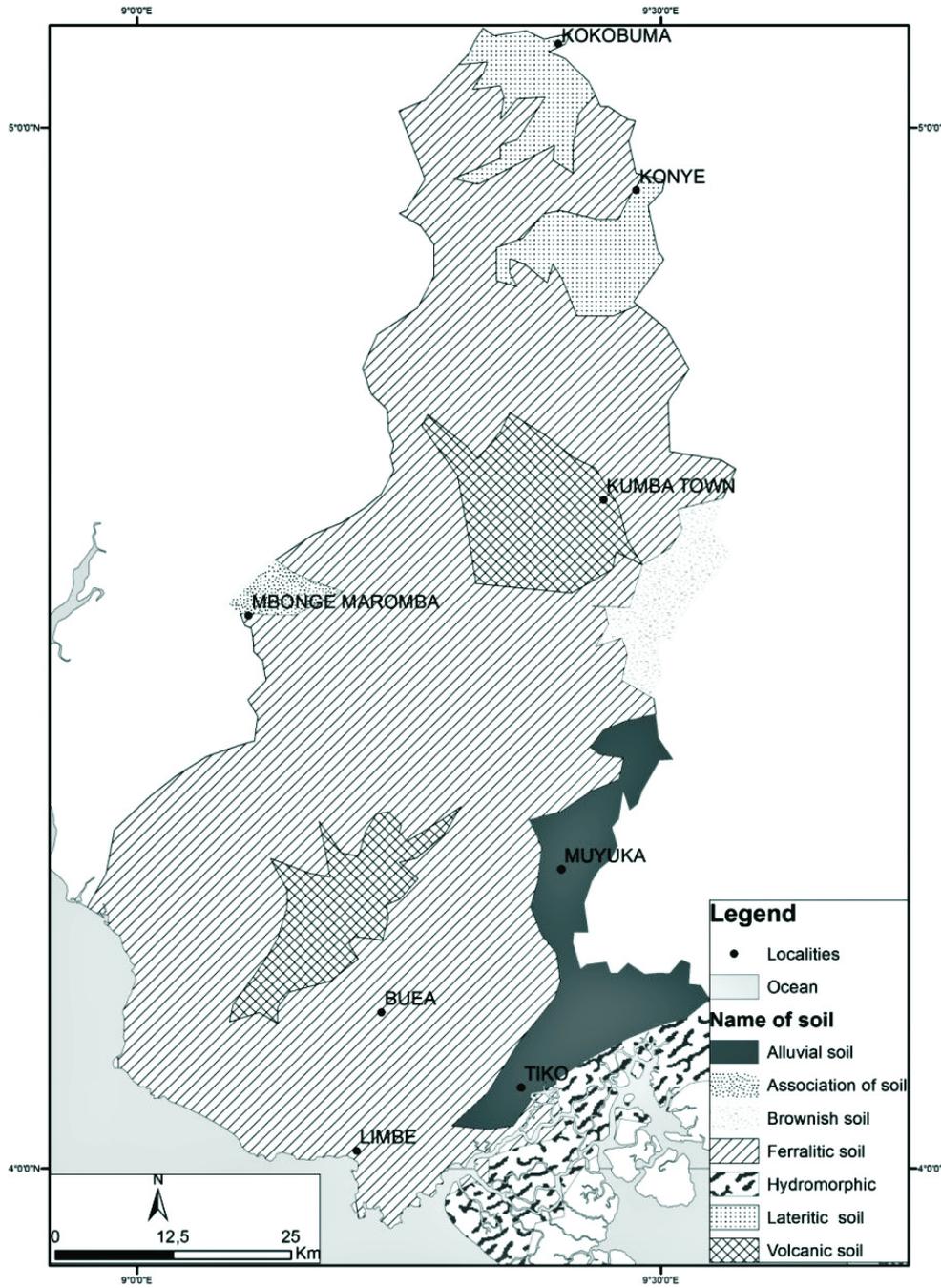


Figure 2. Soil Map of the Fako-Meme Forest Region of Cameroon [5]

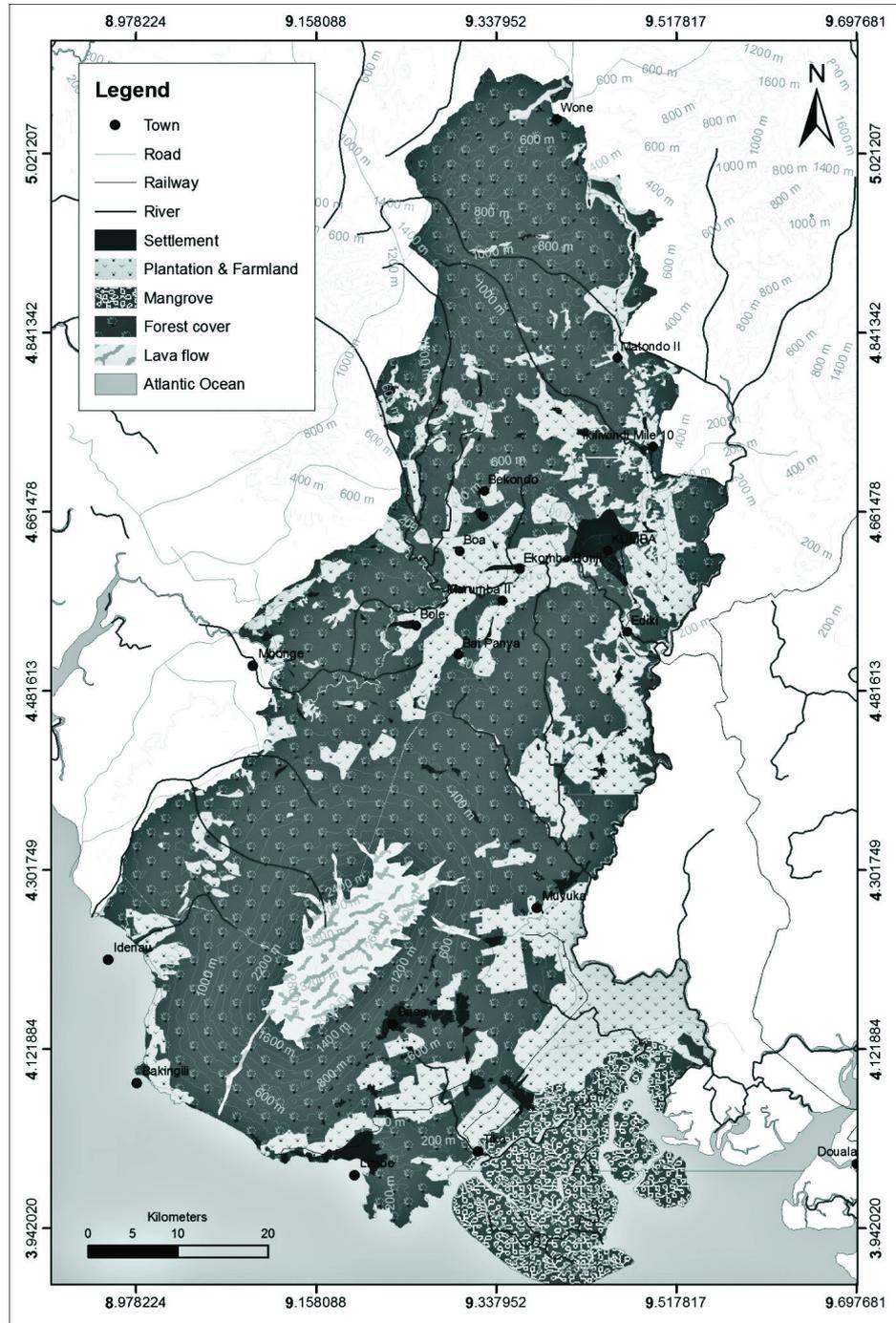


Figure 3. Land Use Map of the Fako-Meme Forest Region (2015) Computed from 12 December, 2015 Satellite Image

ciation of soils. The brownish soils are mostly found in the Mbonge Municipality while the Association of soils is visible in the Ediki and Mbalangi areas. The most interesting thing about these soil types is the fact that their origin lacks major marks of soil-forming processes. Due to their young nature they are generally fertile and equally support intensive agriculture.

These soils have seriously contributed to the luxuriant growth of vegetation. This vegetation presents a differentiation as we move from the mangrove at the coast to the steppe and prairie at the summit of Mount Cameroon. But the growing population pressure on land has aggravated the continuous utilization of the farmlands which are now seriously prone to impoverishing.

With regards to the fact that agriculture is the mainstay of the inhabitants of the Fako-Meme Forest Region, several agricultural land use systems are carried out here. This can be closely linked to the various land systems and facets of the different soil types identified. The Fako-Meme Forest Region is blessed with a lot of soil resources which are very favourable for various agricultural activities. This explains why the land is heavily exploited as the inhabitants depend on it for their livelihood.

Various land use systems that can be identified here include: the cultivation of cocoa which covers about 60% of the study area and large agro-industrial plantations which covers about 30% of the area. Vis-a-vis this cash crop cultivation, a variety of food crops such as plantains, yams, cocoyams, cassava, maize, egusi and a host of market gardening products are cultivated on these soils.

Soil improvement strategies. One of the major constraints to sustain agriculture in the elevated parts of the Fako-Meme Region (the eastern slopes of Mount Cameroon and the Rumpi Hills) is natural and accelerated erosion. The application of chemical fertilizers is equally very costly to the poor farmers under the prevailing socio-economic situation. Hence, in order to survive such precarious conditions the native farmers have developed some indigenous and less expensive strategies to improve soil fertility as a means to improve on their agricultural output. Some of the farmers practice contour ploughing in order to protect erosion. Others have embarked on dry season farming most especially in the valleys to grow crops with very short gestation period like maize and other leguminous plants. The use of green manure by indigenous farmers is one of the methods to increase agricultural yields. This green manure application is gradually replacing the application of chemical fertilisers which only helps to increase production cost of the farmer. The use of crop residue, the cultivation of leguminous crop species and improved mixed cropping in which nitrogen fixing crops are cultivated is encouraged. The application of ash from burned liter most especially in the cultivation of egusi is another well developed strategy to increase soil fertility and yields. The ash is considered as potash which increases the phosphorous content in the soil. The planting of fruit trees in the farms have been highly encouraged. These fruit trees will help to bind the soil particles together.

CONCLUSIONS

The Fako-Meme Forest Region of Cameroon comprises of four major and three minor soil types. These include the tropical clay soils, the volcanic soils, alluvial soils and the hydromorphic soils. The volcanic soils are as a result of plenty of tectonic movements and volcanic eruptions over time and the Basement Complex consisting of granites and gneisses. Within the mangrove environment and the Littoral Zones, there exist vast sedimentary deposits. These soils have greatly influenced the luxuriant growth of vegetation and putting in place of agro-industrial plantations especially at the foot of Mount Cameroon.

Taking into consideration the fact that agriculture is remain the main stay of the inhabitant of the Fako-Meme Region, a study of this magnitude on soil degradation is very vital for improving the agricultural sector. This study can therefore, be considered as a milestone towards resource inventory of the natural resource base and the development possibilities in this eco-region regarded as an agricultural cornucopia or better still the bread basket of Cameroon and its neighbouring Economic Community of Central African States (CEMAC). Therefore, this paper posits that much work should be done at the level of soil evolution and soils properties in the region.

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ГРУНТОВИЙ ПОКРИВ І СІЛЬСЬКОГОСПОДАРСЬКЕ ВИКОРИСТАННЯ ЗЕМЕЛЬ В ЛІСОВОМУ РЕГІОНІ ФАКО-МЕМЕ, КАМЕРУН

Резюме

Фако-Меме – лісова ділянка Камеруну, яка славиться багатою різноманітністю ґрунтів, що привертають увагу великих агропромислових підприємств та сільського господарства. Мета статті – вивчити вплив антропогенної діяльності на ґрунтовий покрив в регіоні, який вважається житницею країни. Інтенсифікація використання ґрунтових ресурсів в цьому регіоні і зростаючий тиск населення посилює безперервне використання одних і тих же сільськогосподарських земель. Застосування добрив для підтримання родючості ґрунтів є великим доказом того, що ці ґрунти виснажуються. Це є однією з головних екологічних проблем навколишнього середовища в регіоні. Проте, місцеве населення приймає деякі заходи для поліпшення родючості ґрунту. До них відносяться контурна оранка, використання сидератів і залишків ґрунту, вирощування бобових культур і землеробство в долинах під час сухого сезону.

Ключові слова: ґрунтовий покрив, типи ґрунтів, антропогенний вплив, Фако-Меме, Камерун.

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ПОЧВЕННИЙ ПОКРОВ И СЕЛЬСКОХОЗЯЙСТВЕННОЕ ИСПОЛЬЗОВАНИЕ ЗЕМЕЛЬ В ЛЕСНОМ РЕГИОНЕ ФАКО-МЕМЕ, КАМЕРУН

Резюме

Фако-Меме – лесной участок Камеруна, который славится богатым разнообразием почв, привлекает внимание крупных агропромышленных предприятий и

сельского хозяйства. Цель статьи – изучить влияние антропогенной деятельности на почвенный покров в регионе который считается житницей страны. Интенсификация использования почвенных ресурсов в этом регионе и растущее давление населения усугубило непрерывное использование одних и тех же сельскохозяйственных земель. Применение удобрений для поддержания плодородия почв является большим доказательством того, что эти почвы истощаются. Это является одной из главной экологической проблемой окружающей среды в регионе. Тем не менее, местное коренное население принимает некоторые меры для улучшения плодородия почвы. К ним относятся контурная вспашка, использование сидератов и остатков почвы, выращивание бобовых культур и земледелие в долинах во время сухого сезона.

Ключевые слова: почвенный покров, типы почв, антропогенное воздействие, Фако-Меме, Камерун