

THE PROBLEM OF SUSTAINING MOUNTAIN ECOSYSTEMS: A STUDY OF THE HIGHLANDS OF WEST CAMEROON

EZE BASSEY EZE
*Dept. of Geography and
Regional Planning
University of Calabar
Calabar - Nigeria*

And

NDENECHO EMMANUEL NEBA
*Dept. of Geography,
University of Yaounde I
E.N.S. Bambili (Tubah)
P.O. Bamenda
North West Province
Cameroon*

Summary

Mountains span 20 percent of the landscapes in the world and are the home to 10 percent of humanity. An addition 2 billion people live downstream from them and depend on their water, grassland, hydropower, timber and minerals. Seven of the world's 14 tropical "hotspots" of endemic plants threatened by imminent destruction have half their areas in tropical mountains. The forests, which occur in the West Cameroon Highlands, are unique. They have one of the highest levels of endemism in the whole of Africa, particularly among birds and vascular plants. Despite their scientific and natural resource potentials they have

received little conservation attention and are therefore in critical need of conservation consideration. The paper examines resource management issues in the Cameroon Highlands and attempts to conceptualize the management problems identified within the global landscape. The paper finally links these mountain conservation issues with resources management problems and policy directions in the Republic of Cameroon. The current concern over global climate change and biodiversity decline necessitates urgent action in the sustainable management and monitoring of changes in mountainous regions.

Introduction

Mountains feature prominently in the landscapes of the world. Roy (2001) estimates that they make up 20 percent of the physical areas of the solid earth and are the home to 10 percent of the world's population. Furthermore, at least two billion people depend on mountains for much of their food, energy source, timber and minerals. As much as half of the world's population and a large share of its biodiversity depend on mountain watersheds for fresh water. Seven of the world's 14 topical "hotspots" of endemic plants threatened by imminent destruction have half their area in tropical mountains. Mountains are a key factor in maintaining both geopolitical and environmental security and yet their faith has been largely ignored by governments and organisations worldwide (Denniston 1995). In western Cameroon, Volcanic activities in the last 100 million years has led to the formation of a chain of mountains of sufficient height and extent for the development of one of the rarest of West African habitats, that of montane forest (macleod, 1986).

Despite their scientific importance and natural resource potentials the montane forests of western Cameroon are receiving little conservation attention. The International Council for Bird Preservation (ICBP) became seriously concerned about the future of these forests, where eight threatened bird species occur (Collar and Stuart, 1985; Stuart 1986). In 1983, the ICBP Cameroon

Mountain Project was launched to investigate the conservation status of selected montane forest areas in the region. The Bamenda Highland Project and the Mountain Cameroon Project were the outcome of these studies. These forests were once widespread in the region but have been extensively cleared. The rich volcanic soils on which they grow are among the most fertile in the country. The area also has one of the highest population densities in Cameroon. The combination of these factors results in an enormous pressure to clear the remaining forests for agriculture and grazing. As a result of this neglect and marginalisation, the mountains themselves, their biodiversity and the people and their cultures are vulnerable to environmental, socio-economic and political change.

The paper maps and examines the problems of sustaining mountain peoples and their environment and attempts to contextualise the importance of mountains in the global landscape and their ecological significance as an aid to understanding the linkage of mountain issues with natural resource management problems and policy issues. This is particularly important because mountains with their sharp altitudinal gradients result in the distribution of species that may change markedly during environmental change and may be sensitive indicators of subsequent impacts to lowlands. This paper focuses on Mount Cameroon, Mount Kupe, Mount Oku, Mount Mbiame and Santa Peaks as case studies. However, the last remnants of these forests (montane) are found in the regions of Kupe Nbonako, Kupe-Manenguba, Manenguba, Bamboutos, Mambilla, Pinyin-Mbu, Njising, Tubah, Mendakwe-Santa Peak, Acha-Tugi, Mundum, Tanbenken, Kikum and Kedjosam.

Environmental History

The West Cameroon Highlands possess a unique flora and fauna, with numerous endemic species particularly among the birds and vascular plants. The high and often very localised degree of endemism is believed to have arisen during the

Pleistocene age when climatic changes forced tropical forests to retreat to the wetter mountainous areas of Africa, leaving tracts of forests or "refugia" cut off from one another. The most important refugia exist in the areas surrounding Mount Cameroon, Mount Kupe and the Bamenda Highlands. The history of evolution and distribution of montane forest species in cameroon has been reviewed by Macleod (1986), Hamilton (1982, 1976), Diamond and Hamilton (1980) and Stuart (1982). This is briefly summarised here in order to present the evolution of the unique flora and fauna in a regional and global context.

It is generally believed that past climatic changes have been instrumental in determining the present distribution of forest species, particularly of birds (Livingston, 1975). Evidence of fluctuations in the Pleistocene climate in tropical Africa is given by Hamilton (1982). Prior to 12,000 BP the climate seems to have been cold and dry. This must have resulted in the distribution of montane forest species in the Cameroon Highlands which is much different from that seen today. Since it was much colder then (mean annual temperatures 5-7°C lower than present), it is likely that the montane forests were displaced to lower altitudes. Since it was also drier, these forests were probably more restricted than they are now (Livingston, 1975; Hamilton, 1982). It is generally believed that the wettest places today are likely to have been the wettest places during this dry period (Livingstone, 1975). In Cameroon, the wettest places are Mount Cameroon, Mount Kupe-Nbonako area and the Bamenda Highlands (including Mt. Oku). It is therefore likely that montane forests of the Cameroon Highlands were restricted to these lower mountain slopes during the last glaciations, and became important forest refugia for many montane species of plant and animal.

The restricted and isolated distribution of small populations of montane flora and fauna in forest refugia is believed to have resulted in speciation and sub speciation. Since the period of isolation was fairly brief (around 20,000 BP years before the temperature rose and the forest expanded) most

differentiation was at subspecies level. Many of the montane forest species have been unable to disperse subsequently from the refugia and colonise other mountains. The refugia are thus characterized today by a large number of endemic sub-species. Evidence for this theory is noticeable in the avifauna and invertebrates, which have many endemic islands in the highlands and this can be seen in the distribution of various plant species, small mammals, amphibians and reptiles.

When the climate became mild and more humid, about 12,000 BP years ago, montane forests were probably displaced up to higher elevations by lowland forests, whilst increased humidity presumably made it possible for the forests to expand beyond the refugia to mountains previously too dry to support forest. The expansion of forests could have increased the opportunities of colonisation for long distance wanderers. This could explain the disjunct distributions of afro-montane vegetation and birds in East and West Africa (Hamilton, 1982). Moreau (1966) suggests that the floral and faunal affinities between East and West Africa are the result of a montane forest bridge which connected the two regions during the northern glaciations. The West Cameroon Highlands may stand as one of the last pillars of the previous mountain forest bridge through which Western and Eastern mountain fauna was connected. Whatever the explanation, the West Cameroon Highlands exhibit the Western limits of typical members of East African fauna (Alcipe abyssinica triceps, Apalis pulchra, Silvisorex granti, and Glagoides demidorii thomasi) and possess a vegetation with many East African affinities, particularly the Podocarpus/Arundinaria formation.

Radiocarbon dates of charcoal collected from the upper part of colluvium in the forest around the coastal plateau and Mount Cameroon region show that human impact on the forests can date back to 3000-2900 years BP. This is contemporaneous with the beginning of "Bantu migrations" into the region from their supposed homelands (Hori, 1986). Forest degradation

Thirty-six species montane forest birds have been recorded from Oku Mountain and other mountains. Two are endemic to the Bamenda Highlands (Macleod, 1986). Collar and Stuart (1985) identify four montane forest birds, which occur in the Bamenda Highlands (Oku) as being threatened by habitat loss. These are Bannerman's Turaco (one of the most threatened birds in Africa), Banded Wattle-eye, Green-breasted bush shrike and Bannerman's Weaver. In addition to the montane forest species, a further 85 species have been regarded in sub-montane areas.

The mammal fauna is less well known than the avifauna. In the Mount Oku area of the Bamenda Highlands large mammals are not abundant, due to indiscriminate hunting and forest clearance, which continue to threaten many species and have reduced them to small populations e.g. (Tragelaphus scriptus, Panthera pardus). Three species of primates are known to occur in very small populations these are the, Preuss' monkey (Cercopithecus preussi), vervet monkey (Cercopithecus acthiops) and baboons (papio anumbis). Preuss's monkey has been classified as endangered by the International Union for Conservation of Nature and Natural Resources (IUCN), since 1978. Several small mammals have subspecies which are endemic to the Mount Oku and Manenguba Mountain. This fauna is poorly known, probably with relatively few species occurring. An up-to-date detailed survey of mammals, particularly bats is a necessity.

In the Mount Cameroon region mammals such as the elephants are endangered. Other endangered animals include Euroticus, Cephalophus dorsalis and Nandumia binotata. Several species are vulnerable and those threatened include Galago alleni, Epirrus ebu, Hylomyseus famosus and Loxodonta africana. According to the Mount Cameroon Project threatened plant species include Rattan cane (Laccosperma spp., Eremospatha spp.; Oncocalamush spp.), Eru or Gnetum africana (Afang), cola (Cola accuminatata and Cola nitida), Prunus africanus and Enantia choranthat, Prunus africanus, Podocarpus and

Arundinaria alpina are threatened in the whole region (Balgah, 2001).

Reptiles and amphibians have not been systematically collected. A few species of frogs are only found on the main peaks of the Bamenda Highlands and nearby mountains where they are usually confined to the montane zone (Stuart, 1986). These mountains include Mount Oku, Mount Manenguba, Bamboutos mountains, Obubu Plateau, Mambila Plateau and Tchabal Mbabo). *Xenopus* is probably endemic to Lake Oku (Stuart, 1986). The highlands are littered with several Crater Lake basins that are habitat to unknown Herpetofauna. In Mount Oku the species of montane frogs are divided into two categories. Those that can tolerate deforestation (*Leptopelis nordequatorialis*) and those that cannot tolerate deforestation and are threatened by further destruction of the forest environment (*Wornaria bambutensis*, *Cadioglossa areas*) (Macleod, 1986).

Montane vegetation only remains as refugia. About 90% of forest species are found in all the refugia. Thirteen (18%) of the species are endemic to the West Cameroon Highlands. *Disperis nitida* is narrowly endemic to Mount Oku and a few nearby mountains. About 17 percent of the forest and forest edge species are not limited to montane forests. Most of these are widespread and characteristic of disturbed sites. 56 percent of montane species also occur on East African mountains while 32 percent occur on a few scattered mountain ranges to the west (Stuart, 1986). Moist montane forest is the climax community of the wetter mountains of West Cameroon. It is characterised by a low canopy at 10 – 20m with occasional trees up to 30m tall. There are rather few lianes, but the epiphyte load is very heavy with many ferns and bryophytes and orchids. Species- richness decreases with elevation.

Impacts of the Mountain Economy

The montane forests are of great ecological and economic importance. They contain a disjunct vegetation association found

nowhere else in West Africa, and several endangered species, which are totally dependent on these forests for survival. The mountains have several Crater Lake basins and are catchments for streams supplying many villages and towns and feeding some of the major drainage basins of the Niger, Congo basin and the Atlantic Ocean. The forests provide local employment and livelihood. For instance, there is honey, woodcarving and the extraction of Pygeum bark for medicinal uses. These activities contribute much to the well being of the people and are important to the local economies and have potentials for improvement. The mountains, their forests and lakes also have strong cultural significance. Goods and services provided by the mountains to those living in the region as well as to populations living in the surrounding lowland areas further include:

- Water for consumption, irrigation, energy production
 - Foods (from crop fields, domesticated and wild animals);
 - Wood for energy and construction;
 - Non-timber forest products (fibre, foodstuff and medicinal plants).
 - Mineral water from spring sources. There are more than 72 mineral and thermo-mineral spring sources in the region. Some are being industrially and commercially exploited;
- The services provided by the mountain ecosystem include;
- Rare biodiversity of local benefit and existence value/genetic potentials;
 - Provision of unique landscape as amenity (local amenity for migrants, tourists and those depending on the tourist industry). The mountains are spectacularly beautiful. The magnificent views, unique wildlife and rich culture all have great tourism potentials; and
 - Rich volcanic soils (andosols) with good agricultural potentials and capacity to support large human populations and export crop production (Figure 1).

From Fig 1, one can observe four categories of landscapes which are well inhabited.

These are the ubiquitous volcanic areas, the zone of basement complex, higher plateaux and alluvial plains. The average population density is shown by the two straight lines touching the abscissa (x-axis) and is between 70-120 persons 1 km^2 . Large towns in the area are Bamenda, Bali, Kumbo, Nkambe etc. Population densities are higher at higher altitudes.

Converging therefore on these highlands are subsistence mountain farmers whose population densities largely exceed 120 habitants/ Km^2 . And they are two driving forces: increasing land scarcity as populations grow both naturally and from immigration, and insecure land tenure and the inequitable distribution of and access to local natural resources due to ecological marginalisation of some social groups as a result of resource scarcities. This has resulted in serious distortion of the original ecological landscape even in forest reserves and sanctuaries (Fig.2). Violent socio-economic conflicts over access to key production resources are common. Increases in agricultural productivity often have not kept pace with population growth rates. While the national growth rate is about 3.2% per annum, the region experiences over 5% annual population growth rate in many areas. In most areas the average farm size per farm-family is about 0.5 to 0.8 hectares. As pressures mount to adopt commercial farming practices, traditional methods of resource management developed over centuries are lost. These ecological changes often lead to increased soil erosion and other forms of land degradation on the mountain forests, rangelands and marginal croplands. The potentials and assets of the montane forests under anthropic threats can be summarized as follows:

- Afromontane forests: Altitude; 1500 to 2000m:
 - ✓ Richness in medicinal plants: Pygeum, Voacanga, Bridelia
 - ✓ Untapped indigenous culture-based knowledge systems in medicine and land management

- ✓ Indigenous knowledge on medicinal plants
- ✓ Afro-alpine vegetable farming (fertile soils)
- ✓ Farming of local food crops (Rich soils)
- ✓ Diversity of wildlife population (diversity of eco-niches)
- ✓ High quality timber/wood (key-stone species) and non-timber forest products.
- ✓ High production of Arabica coffee (export crop).
- ✓ Numerous upland watersheds serving mountain and lowland communities
- ✓ High production of honey (several melliferous plants)
- ✓ Good natural pastures and grazing potential
- ✓ Sacred forest groves protected by religious beliefs and customary law.
- Afro-alpine grasslands: Altitude; 2000 to 3000m:
 - ✓ Rare biodiversity and biogenetic reserve
 - ✓ Several medicinal plants and intensive ethro-medicine and ethroveterinary medicine
 - ✓ Huge watersheds serving upland and lowland communities.
 - ✓ Extensive natural pastures (montane short grassland).
 - ✓ Spectacular wild splendours of eco-touristic significance
 - ✓ Intensive farming and market gardening (rich soils)]
 - ✓ Flourishing handicraft industry based on forests.
 - ✓ Availability of several sacred/ritual forests
 - ✓ Untapped indigenous knowledge in ethno-veterinary science, medicine and land resources.

The above environmental potentials or advantages of having both the mountain forests and grass lands in this area might be eternally lost unless urgent steps are taken to ensure and pursue resource conservation and sustainable development.

Emerging Threats

Agricultural encroachment is an important threat to biodiversity in the region. The highlands of West Cameroon present the richest agricultural lands in the country. Subsistence based agricultural development with its associated slash and burn cultivation are degrading several montane ecological niches (Fig.3). Industrially based agricultural development in the region dates back to 1890. Increases in demographic pressure combined with increasing market access are putting much pressure on the biological systems of the region. Over-grazing and degrading farming practices are an emerging concern. The unsustainable exploitation of non-timber forest products (NTFP) such as Prunus africana, Gnetum africana (Eru or Afang), Irvingia gabonensis (bush mango), Tetracarpidium (Cashew nut) and so on have encouraged the degradation of local resources. The situation is clearer in the mt. Kupe axis of the Bamenda highlands where only the area with out settlements have primary forest (Fig.4). In the Bamenda Highlands and Bamileke Plateau illegal grazing is a critical problem within the forest. Associated with illegal grazing is fire damage. Despite the national prohibition on uncontrolled bush fires, indiscriminate bush burning continue to pose a threat to the remaining forests. The handicraft industry is reliant on timber cut from montane forests. Yet there is no active identification, domestication and planting of tree species suitable for woodcarving. Cutting without planting constitutes both a threat to the remaining forest and a threat to the industry itself. Another industry, honey harvesting is responsible for forest fires and the death of trees containing wild honey. Degradation of the forest will seriously affect the honey industry, which is heavily dependent on the forest. Fuel wood extractions is another major activity causing montane forest degradation. However it is a secondary and not a primary process intensifying degradation. It comes after forest areas have been cleared for farming or damaged by fires. Hunting has also caused the decline in wildlife

and continues to pose a threat to remaining populations. Forest degradation apart from eroding key-stone species vital for the survival of food chains also causes the extinction of species by habitat loss.

The plan for the development of the lake basins as tourist sites include the construction of tourist facilities near lakeshores. This development should be carefully considered in view of the environmental values of the forests (wildlife and watershed conservation). Oral tradition recounts the migration of lakes in the region. Due to erosion and sedimentation of lake basins most of the lakes have become extinct with their aquatic ecosystems. It should also be emphasised that tourism development should never include the introduction of fish in the lakes. This will almost certainly wipe out the endemic Xenopus toad as has happened with other Xenopus species in East Africa (Macleod 1986).

The present use of mountain land is having a number of deleterious effects: forest degradation, range degradation, decrease in dry season water flow and socio-economic conflicts. On a global scale potential climate change particularly threatens these mountain ecosystems. Because mountains typically have steep temperature gradients over short distances, plants and animals there are among the most vulnerable to climate change. A warming of 3°C by 2050 – certainly possible, given scientists' projections of 1.5 to 4.5°C warming – would be roughly equivalent to an altitudinal shift upward of about 500metres (Denniston, 1995). Species already confined to the tops of mountains or below impassable barriers like rock outcroppings could be exterminated as they are ecologically squeezed out of their potential habitat. Since changes in climate would coincide with habitat degradation and other human stresses on montane biodiversity, the cumulative impacts on biodiversity could be very severe.

Discussion

The West Cameroon Highlands are in the Cameroon Volcanic Province. The region has one of the highest population densities in the country. As population pressure increases tens of

thousands are obliged to live at the flanks of volcanic mountains. People tend to crowd around the mountains in the region to take advantage of the rich volcanic soils. This is particularly prevalent in the tropics where other soils are poor. This volcanic province provides the only rich soils in the nation. The map of population density (figure 1) neatly coincides with past volcanic and present volcanic activity. Such soils provide two to three crops per year and provide the basis of much of Cameroon's rich agriculture. The West Cameroon Mountains have growing populations that are increasingly stripping their flanks bare of vegetation, eroding the biodiversity and soil fertility in order to earn a livelihood. Efforts have been made since the 1930s to protect some of the montane forests as reserves. The increasing population combined with the improved access to markets have led to a much more intensive system of farming without the traditional fallow periods that were used to restore soil productivity and regeneration.

In the Bamenda and Bamileke Highlands, the majority of soils are ultisols derived from Basalts, trachytes and granites with varying degrees of weathering. Precisely, the soils are acidic, low in major nutrients and have high phosphorus requirements. Furthermore, some food crop fields are found on steep slopes where erosion losses are phenomenal as is decline in soil fertility. Farmers after impoverishing soils at intermediate altitudes (1000 to 1500m) are obliged to migrate to higher altitudes (above 1500m) to form very dense population pockets on recent volcanic soils. Table 1 and figure 8 present some data on erosion in the Bamileke Plateau (Noun/Mbam River Basins). Accelerated erosion is a very serious problem in this section of the highland (Bamileke). With an annual soil loss of $66.3 \text{ tons/km}^2/\text{yr}$, the situation is grim.

Table 1: Characteristics of soil erosion in the Bamileke Plateau

YEAR	1970	1971	1972	1973	AVERAGE
Solid transport load in rivers (millions of tons)	3408	2792	2513	2492	2801.5
River discharge (m ³ /s)	682	562	524	528	574.0
Average concentration of solid transport load (g/m ³)	158	158	150	150	154.5
Annual erosion (soil loss) in drainage basin (tons/Km ² /year)	81	66	59	59	66.3
Equivalent depth of soil eroded (10 ⁻² mm)	6.2	5.1	4.5	4.5	5.3

Source: Olivry, J.C. (1978)

The result of this accelerated sub-aerial erosion is that crop yields are poor and natural montane and sub-montane forests are being rapidly cleared to augment impoverished farmland. The new lands are on steep and highly erodible lands. There has been a reduction in the land available for grazing resulting in the invasion of forest by cattle. Overgrazing and trampling have caused the complete loss of vegetation in some places. Serious erosion is occurring, aggravated by deliberate burning (figure 7 and 8). Over the past years there has been a noticeable decrease in dry season water flow in most areas. Hydroelectricity supply from the Edea station in the Sanaga River basin with a reservoir in the Noun basin is already presenting acute power shortages following declines in stream/river discharge. Intensive conservation measures are needed. Fig.7 especially shows that looking at the problem from the perspective of the systems theory may be most appropriate. This approach puts man at the centre of the environmental problems of the highland. Man's (human) population and behaviour in the area of agricultural cultivation, forest product extraction, lumbering, grazing and local industry has been responsible for the observed environmental change.

Efforts since the 1930s to conserve some of these forests have been in successful. Since 1985 the International Council for Bird Preservation and the World Wide fund for Nature

Conservation started some conservation work in Mount Oku, Kupe-Manenguba and Mount Cameroon. Presently the Bamenda Highlands Project is the remaining refugia in the Western Highlands. Denniston (1995) argues that integrated conservation and development provide no guarantee for sustainable growth and development because they are time-consuming to implement due to the intrinsic problems of reconciling the fundamentally distinct goals of conservation and development. Based on a study by Stanford's centre for conservation Biology in 1995 only 5 of 36 projects reviewed had positively contributed to the conservation of wildlife. According to Denniston the authors concluded that comprehensive ecological oversight of projects is usually lacking. They recommended two types of monitoring:

- To assess the total effects of the projects on biodiversity and overall ecosystem health by tracking indicator species across space and through time.
- To observe human impacts by comparing target species diversity and abundance in unregulated areas, managed buffer zones and core protected areas through time.

Since mountains are so physically, biologically and culturally diverse, integrated programmes at the community level are the linchpin to success in empowering local people to meet their needs and aspirations while conserving healthy mountain ecosystems. Sustainable resource management in mountain regions requires understanding that future changes will be driven simultaneously by global phenomena (e.g. greenhouse induced climate change) as well as local and regional resource management schemes. Activities pursuant to this objective will provide the links between scientific understanding of processes of change and the consequences of those changes for adaptation and mitigation options. According to the Mountain Research Initiative (Becker and Bugmann, 1999) what ought to be of particular interest is the feedback between management strategies and

trajectories of change; especially as such feedbacks threaten the ability of specific regions to support current and future livelihoods (Becker and Bugmann, 1999). Their research Initiative suggests three priority areas for assessment:

- changes in forest resources, with potential implications for agriculture, rates of erosion, slope stability and magnitude of floods, and biodiversity;
- intensification and/or extensification of agriculture/grazing, with potential implications for food security, rates of erosion and magnitude of floods, and biodiversity.
- Changes in water resources due to factors such as changing agricultural practices, changing seasonal or permanent population size, with implications for downstream water supplies, energy availability, flooding and sediment transfer.

Work on these themes must involve local people in defining and implementing research, recognising the complementarity between local knowledge and scientific investigation and promoting participatory approaches to biodiversity and natural resource management/conservation. Of particular importance is the historical perspectives which provide valuable means of exploring the sustainability of resource management strategies. Many mountains have a long history of human influence with interactions and feedbacks between human activities, land use, climate and environmental change. Reconstruction and understanding of these interactions provide an important foundation for development of sustainable management schemes for the future. With the current concern about the global change and mountain regions urgent action is needed in the rehabilitation, conservation, sustainable management and monitoring of Mountain regions.

Conclusion

The mountains of West Cameroon constitute a wonderful resource base for the people who inhabit this fragile environment. It is however the most remarkable feature of the ecological zone in terms of flora, fauna, landscapes, altitude, climate and biodiversity. This paper mapped and discussed the high level of degradation which has occurred in this endemic high land as a result of massive deforestation, soil erosion, stream sedimentation, mass wasting, cultivation of marginal lands, population pressure, flooding, biodiversity decline and land dispute. Consequently, the environmental history of the area is unfortunately that of regression and decline in land, forest and other biological resources. However, the most threatened natural resources of the area are endemic avifauna (rare birds), mammal fauna (frogs and other amphibians), montane flora (medicinal herbs) and the spectacular crater lakes, whose economic and ecological values are priceless.

Another emerging disturbing trend is that the current population in the area is increasing with altitude. This shows that the people are now moving up to higher elevations with respect to especially deforestation, farming, settlement and grazing. The paper suggests that for the survival of this high altitude ecological niche conservation efforts must involve and carry along the indigenous people. As for now further threats to the highland, which is also the major watershed of the region, can be reversed using programmes such as agroforestry, afforestation, sediment monitoring, slope stabilization, the avoidance of marginal lands and grass root environmental education.

REFERENCES

- Balgah, S. (2001): *Exploitation and Conservation of biological resources in the Mount Cameroon Region, Cameroon*. In: Lambi C, and Exe, B. (eds.). Readings in Geography. Unique Printers, Bamenda.
- Becker, A. and Bugmann, H. (1999): *Global change and mountain regions*. GBP report 49, GTOs Report 28 and IHDP Report 13. IGBP. Stockholm.
- Champaud, J. (1974): *Atlas Regional OUEST 2, Republique Unie du Cameroun*. ORSTOM.
- Collar, N. J. and Stuart, S.N. (1985): *Threatened birds of Africa and related islands*. The ICBP/IUCN Red Data Book. Part 1, Cambridge.
- Denniston, D. (1995): *Sustaining mountain peoples and environments*. In: A worldwatch Institute Report on Progress towards sustainable Society, Title: state of the World 1995. W.W. Norton and Company, New York.
- Diamond, A.W. and Hamilton, A.C (1980): *The distribution of Forest passerine birds and Quarternary climate change in tropical Africa*. Journ. Zool., London 191: 379-402.
- Hamilton, A.C. (1982): *Environmental history of East Africa: A study of the Quaternary*. London: Academic Press.
- Hamilton, A.C. (1976): *The significance of patterns of distribution shown by forest plants and animals in tropical Africa for the reconstruction of Upper-Pleistocene Palaeoenvironments: A review* Paleoecol. Afr. 9: 63 -97.

- Hori, N. (1986): *Geographical variation of superficial deposits and its significance in the late Quaternary environmental changes in the forested South Cameroon*. In: Kadomura, (ed.). *Geomorphology and environmental changes in tropical Africa: case studies in Cameroon and Kenya* Hokkaido University, Sapporo.
- Kadomura, H.; Hori, N.; Kuate, M., *et al.* (1986): *Late Quaternary environmental changes in Southern Cameroon: A synthesis*. In: Kadomura, H. (ed.) *Geomorphology and environmental changes in tropical Africa: case studies in Cameroon and Kenya*. Hokkaido University, Sapporo.
- Livingstone, D.A. (1975): *Late Quaternary climate change in Africa*. *Ann. Rev. Ecol. Syst.* 6: 249-280.
- Macleod, H. (1986): *Conservation of Oku Mountain forest Cameroon*. ICBP study Report No. 15. Cambridge.
- MCP (1998): *Report on the elaboration of a pluralistic sustainable structure for the management and conservation of natural resources in the mount Cameroon Region*. MCP, Buea.
- Moreau, R.E. (1966): *The bird faunas of Africa and its islands*. London: Academic Press.
- Roy, W. (2001): *A global viewpoint on mountains*. In: Dunoop, J. *et al* (eds) *culture and environment*. University of strachyde in Glasgow/University of Buea.

- Stuart, S.N. (1986): *Conservation of Cameroon montane forests*. Report of the ICBP. Cameroon montane forest survey. Nov. - 1993 - April - 1994. Cambridge.
- Tamura, T. (1986): *Regolith - stratigraphic study of Late - Quaternary environmental history in the West Cameroon Highlands and the Adamawa Plateau*. In: Kadomura, H. (ed) *Geomorphology and environmental changes in tropical Africa: case studies in Cameroon and Kenya*. Hakkoidao University, Sapporo.
- Wanzie, C. (1996): *Report of hunters' workshops on the elaboration of a strategy for the conservation and management of wildlife resources of the MCP region*. Mount Cameroon project, Buea.