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Multi-level Stakeholder Approach in the Sustainable Management of Natural Resources: The Case of Forest, Water and Soils in Bui-Division, North West Region of Cameroon

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Abstract: ***Forest depletion indicates an unsustainable resource management practices on a given landscape, accompanied at times by soil erosion, and landscape degradation. Conservation projects are often described as failure due to the wrong strategies adopted by projects managers such as non-adoption of local knowledge as well as advice from local communities. Demonstrating that sustainable management of natural resources is more efficient using multi-level stakeholder approach is the main objective of this write up. The quantitative and qualitative methods of data collection were applied; for quantitative method, the semi-structured questionnaires were administered to 870 households' members. The 'T' distribution table was used to test the hypothesis which states that; the decrease in forest depletion is due to the adoption of multi-level stakeholder approach of forest management. The results showed the calculated t = 2.30is greater than critical t = 1.812 at 0.05 level of frequency which led to the rejection of null hypothesis. For qualitative method, observations, in-depth interview and discussions in focus groups were carried out and the questions used here were open-ended. The GPS was used to map out the degraded portion of the forest as well as tracking forest resources left. It was found out that, from 1963 to 1970, 50% of the forests in Ngongbaa and Kilum were destroyed either by bush fires, agricultural activities or illegal exploiters of Prunus Africana. With the adoption of multi-level approach of forest management; more than 20,000 trees have been distributed by private projects since 2005 to restore degraded landscapes, and watersheds have been preserved with 15 streams taking their rise from it and nourishing a downstream population of over 57,893 inhabitants (spread over 14 villages). Management of resources is sustainable in the multi-level approach.***

Keywords: Resource management, sustainable development, depletion, natural resources, apiculture

1. Introduction

Natural resources provide the fundamental elements to life and economic progress. Resources such as soils and water ensure food security and poverty reduction. They are described as the foundational pillars of agriculture. Forest protect water sources, reduce the risk of natural disasters such as landslides and are homes to remaining terrestrial biodiversity. Forest contributes to the livelihoods of some 90% of the 1.2 billion people living in extreme poverty, with an estimated 25% of the world's poor depending fully or partly on forest products for subsistence needs, and indirectly support the natural environment that nourishes agriculture and the food supplies of nearly half the population of the developing countries [1].In Africa over 66% of the population is estimated to rely directly or indirectly on forests for livelihoods[2]. During the 20th century, 80% of the rain forests in Cameroon were converted to agricultural-forest mosaic [3]. According to [4] rural households living in forested areas in Africa and Asia derive over 20% of their income from forest. About ½ the income from forest is non cash and include; food, fodder, energy, medicine and household building materials.

Sustainable resource management in this context refers to management strategies that take into consideration the present and future needs of the population. At the beginning of forest conservation in Bui-Division, resource management practices did not favor the livelihood sustainability of the population as they did not provide alternative activities and opportunities that could answer the present needs of the population. The main technical constraints to increased crop production are in areas of soil and water conservation management. Worst still the population at times is not considered as part of the management team.[5]., [6]., [7], upheld that; the people living in and around protected areas are more vulnerable to the impact of denied access to resources as they are typically unrepresented when land use decisions are taken. In Africa; the ancestors are often regarded as real owners of land, landlords being the communicators between the living and the dead [8]. According to Hayward, [9]through the use of IUCN Red list to determine effective conservation strategies found out that; in order to ensure conservation, sustainable land management practices in logging and agriculture must be put in place in both developing and developed world in order to preserve habitats while still allowing people to earn a living. With this concept therefore, different countries started emphasizing on protection of natural resources of which forest is not left out.

After 1994, resource management projects adopted approaches that favored indigenous population as the community was considered and recognized as part of the management team. This research will seek to present how the adoption of multi-level approach succeeded in managing natural resources such as water, forest and soils in Bui-Division through the intervention of projects such as ANCO, CENDEP and CAMGEW. Meanwhile, the different

alternative activities geared towards ensuring the sustainability of livelihood will be analyzed.

2. Research Methods

a) Location of the study area

Bui is one of the administrative Divisions of the North West Region of Cameroon. It is located between latitude 6° 00 and 6° 31 N and Longitude 9°45 and 11° 51 E of the Greenwich meridian. Bui- Division covers a surface area of about 2300^2 km making for 13.3% of the land area of the North West Region. The study area is bounded to the North by Donga Mantung Division, to the South by Ngo-Ketunjia Division, to the East by the Noun Division (West Region) and to the West by Boyo Division. Bui-Division is divided into six Sub- Divisions such as; Jakiri (478^2km), Kumbo (520^2 km), Oku (244^2 km), Noni (314^2km), Mbven (698^2km) and Nkum.

b) Methods and Techniques

The quantitative and qualitative methods of data collection were applied in this research. Under quantitative method, the 'T' distribution table was used to test the hypothesis. The quantitative approach was applied to collect data from agriculturalists, forest users, and indigenous population in general. Data was gathered mainly from primary sources. Rapid Rural Appraisal (RRA) is the Participatory tool that was used in the collection of data information in this study area. The tools used comprised of: the problem tree, the historical profile, and the problem pyramid (which assisted in understanding the root cause of forest depletion). The semi- structural interview was an indispensable RRA tool which was used to accompany other tools. This demanded a check list because the semi-structured interview needed question guide that covered all essential aspects on which the interview was based. During such interviews, traditional authorities, project managers were interviewed. The semi-structured questionnaires, in-depth interview and discussions in focus groups were carried out. The first phase of the data collection was done in libraries, internet, as well as documentary centers were visited in order to consult books, articles which are related to the topic in question. The second phase consisted of the field work carried out in 2018 and 2019 respectively with 870 households randomly selected villages within the six sub-divisions. The participant observation was carried out accompanied by snap shots.

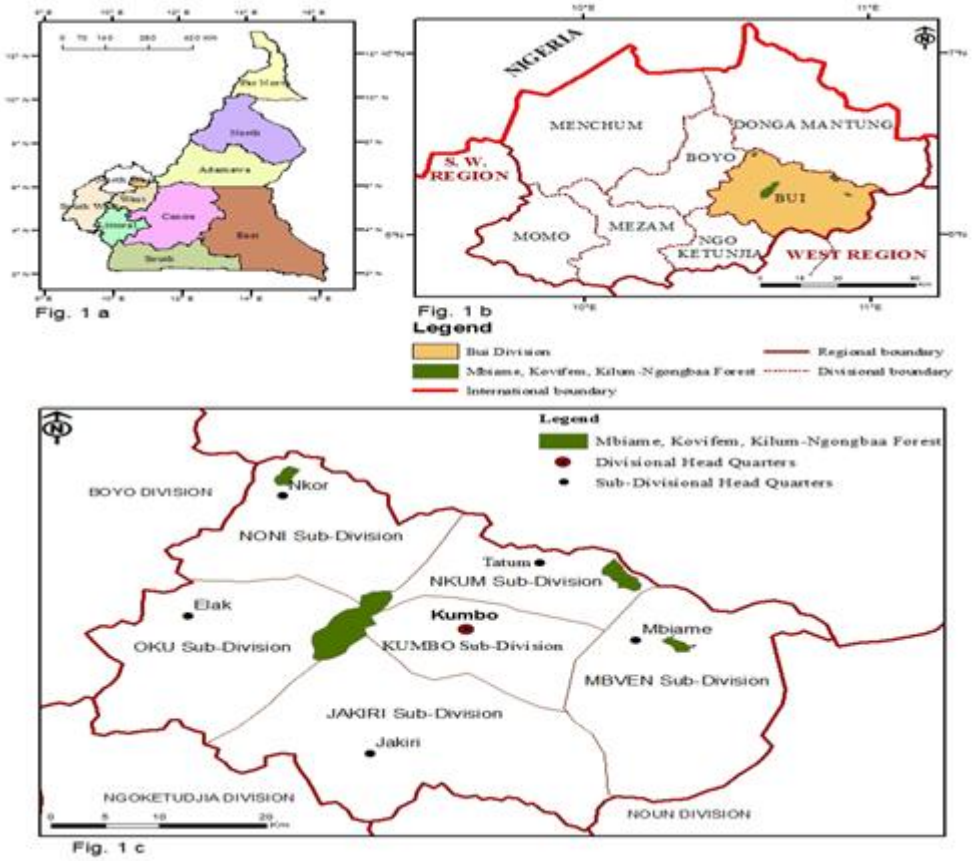

Figure 1: Location map of Bui-Division
Source: Adapted from World Resource Institute, (2014)

3. Results and Discussion

3.1. Top -down approach of resource management from 1950- 1987 as the cause of forest depletion and soil degradation in Bui- Division

The forest conservation race in Bui-Division began with the top-down approach used by the Cameroon government and later Birdlife international from 1950-1987 in the Kilum forest. This approach has been characterised by intense forest depletion and soil degradation. From 1960 to 1970s, the government took over the management of these forests. During this period, their forest was in the hands of the

forestry service. The government's earlier attempts to gazette forests in Bui-Division were not well strategized as they excluded indigenes as part of the conservation team. The cattle owners and farmers were not included in the FMC in some forests which brought in ineffectiveness in the conservation process. Through this exclusion, these agriculturalists were not sensitized on conservation and as such they remained outstanding obstacles to this process of conservation. It was manifested through numerous bush fires caused by farmers that contributed greatly in forests depletion. [10], found out that; conventional approaches of top-down controlled management to natural resources has often led to increased degradation of natural resources especially where governance is still the issue.

Secondly, the forest was seen as the main source of livelihood for indigenes.lack of alternative activities to sustain livelihood contributed to the failure by government to conserve forests from 1963.It has been estimated that close to 300.000 people live within a day's walk to the forest to provide for their daily needs. From 1973, as the population of the adjacent villages keeps on increasing, the village landlords cut a portion of forests and make it available to the villagers for agricultural exploitation. In return, the villagers will compensate them, by giving food items such as beans, corn, potatoes and cocoyam.Farming was fount out to be the initial cause of forest depletion since each year hundreds of people enter the forest for rearing of animals and cultivation of crops [11]. Meanwhile 85% of soil erosion in Bui-Division was found out to be caused by prolonged human activities on landscape such as deforestation, over grazing and cropping and that from 1963 to 1970, 50% of the forests in Ngongbaa and Kilum were destroyed either by bush fires, agricultural activities or illegal exploiters of Prunus *africana*.Natural resources in Cameroon are being depleted faster than they are renewed due to two main reasons; invasive agricultural clearing without soil fertility management to allow –long term farming use; and the use of forest as cash crops to support an inefficient economy seeking alternative income[12]., (1991), [13].

After several failed attempts in 1975 to gazette the forest reserve, the conservator was successful in demarcating part of the forest although the boundary was not universally respected [14]. All further attempts to completely demarcate the forest failed and by 1986, the forest had been reduced to 50% of it 1963 size because of agricultural encroachment and other human influences. With the potatoes innovation at that time, farmers found a lot of money from this activity which assisted them to provide their food, health, education and clothing. Due to the necessity to provide these needs, farmers found it difficult to leave these forests, thus continues forest depletion.The major problem faced in this domain of natural resource management was over exploitation by growing population [15]. These problems posed by mismanagement of natural resources became a global concern in the 1970, 1980, and 1990. This was manifested by the signing of national convention such as the stock ham convention of 1972, Montreal protocol of 1997 on climate change. Land contains a complex resource system that presents management challenges [16]. The improper land management result to problems such as soil erosion which ends up affecting agricultural activities through changes in soil quality. Soil erosion in particular changes the physical, chemical and biological characteristics of the soil which leads to a drop in potential agricultural productivity [17]. The main causes of soil erosion on agricultural landscape are; intensive cultivation, over grazing, poor management of arable soil and deforestation, unsustainable methods of production like bush burning [18].

The depletion of forest in Bui-Division has a long history and there are factors that can explain this phenomenon fig (2). This depletion affects the economic and social wellbeing of not only the present generation but the future ones as well. This is explained in forest depletion model.

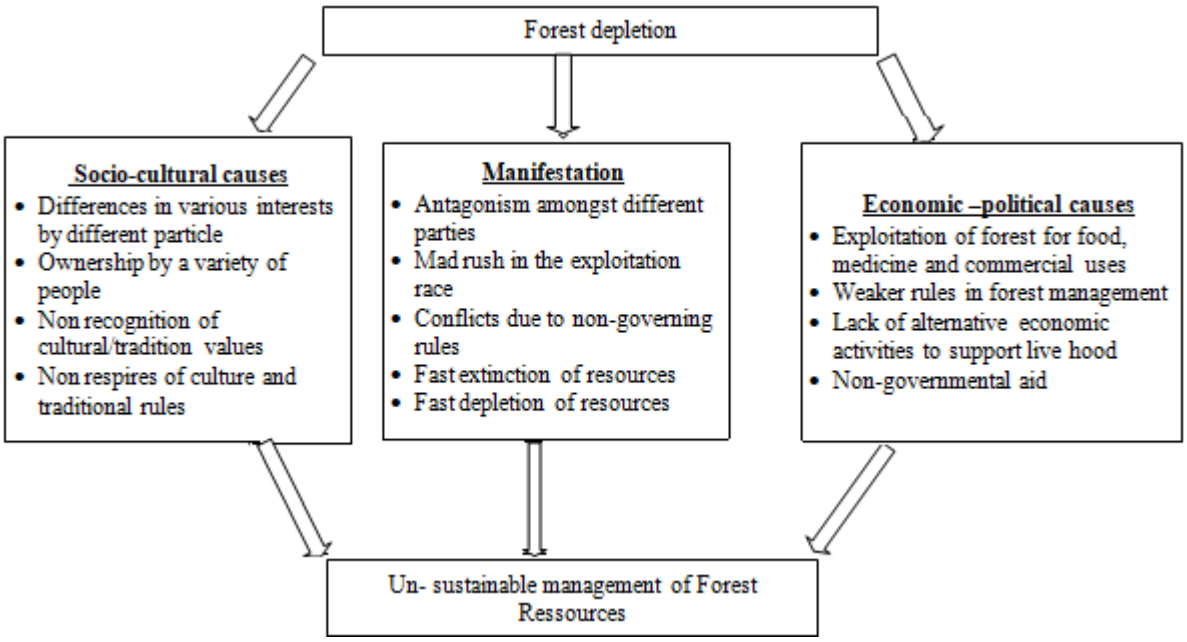

Figure 2: Forest depletion model in an unsustainable management system.
Source: field work (2018/2019)

Figure (2) is a model which explains the socio-cultural, economic and political causes of forest depletion in Bui-Division. For socio-cultural causes, factors such as the variations in different interests, ownership by different groups of people, non-recognition of cultural values influenced forest depletion in this area. Meanwhile for economic and political factors, the desire to exploit the forest for food, medicine, and commercial purposes, weaker rules in forest management, lack of alternative economic/income generating activities provoked forest depletion.

3.2. Multi-level stakeholder Approach to resource Management

Multi-level approach indicates that not all stakeholders are farmers, but off-site categories such as administrators, researchers and international organizations. The various dimensions of sustainability have been weighed against one another in a negotiated manner that is a participatory approach, approach that does not discriminate against or favor a particular actor category. e.g scientific knowledge must be coupled with indigenous knowledge to offer a better basis for decision making in negotiation processes. The real strength of the approach is that it does not provide predetermined concept, but offers a framework and a procedure for working towards a common point of view and defining the next steps to take, [19].

The multi-level approach to resource management is that which treats local indigenes not as destroyers of the resource who stand on the way of Conservation programs, but rated as Constituent members of the team who can perform positive roles in the implementation of a conservation program. The therefore entails the valorization of the role of different actors ranging from community to international actors.

In this system, there is a lot of interconnectedness, and land management decisions are well planned which has helped to minimize destruction and depletion. For example; household, village heads and community are answerable to the Fon directly. The Fon interconnect with National (administration like MINEF) as well as international (like the case of ANCO and CENDEP at Mbiame and Dom). The adoption of multilevel stakeholder approach led to the successful demarcation of the forest and the drawing of community boundaries such as Mbai community boundary, and Bihkov community boundaries, the Dom community etc. This has helped in regenerating the forest in Bui-Division. Under community forestry program, biodiversity has been improved, natural regeneration has taken place.

Multi-level system in this context is used to explain that management system which has as mean goal to ensure sustainability of resources. In this approach, consensus has been made possible at local level and has led to positive action on a number of forest management issues. This collaboration at higher level resulted in significant progress in biological diversity conservation and sustainable use. The hypothesis which was formulated to find out reasons for decrease in forest depletion was tested using Yes and No responses from indigenous population and forest users. This was validated and calculated as seen on table (2) below.

Table 2: A Contingency table depicting that the decrease in forests depletion is due to change in forest management system

No.	Surveyed Villages	The decrease in forests depletion is due to adoption of multi-level stakeholder approach of forest management										
		Yes	No	Neutral	$\bar{X}$	$\bar{Y}$	s_x^2	s_y^2	N_1	N_2	df	t
1	Jakiri	171	9	52								
2	Kumbo	229	3	138								
3	Noni	30	6	15								
4	Mbven	27	-	30	93	4.6666	7347.6	9.0666	6	6	10	1.812
5	Oku	61	5	5								
6	Nkum	40	5	44								
		558	28	284								

Source: field work (2018/2019)
$\infty = 0.05$

Critical t = 1.812
df = degree of freedom = $n_1+n_2-2=$
$\bar{X}$ = mean of "yes" responses
$\bar{Y}$ = mean of "No" responses
n = sample size
s_x^2 = standard deviation square root of X
s_y^2 = standard deviation square root of Y

Calculated

$$t = \frac{\bar{X} - \bar{Y}}{\sqrt{\frac{s_x^2}{n1-1} + \frac{s_y^2}{n1-1}}}$$

The fourth hypothesis was tested with the null and alternative hypothesis as follows:

Null hypothesis: The decrease in forests depletion is not due to changes in forest management system

Alternative hypothesis: The decrease in forests depletion is due to changes in forest management system
From table (2)
$\bar{X}$= 93
$\bar{Y}$ = 4.666
s_x^2 = 7347.6
s_y^2 = 9.0666
$n_1 = 6$, $n_2 = 6$

Calculated

$$t = \frac{\bar{X} - \bar{Y}}{\sqrt{\frac{s_x^2}{n1-1} + \frac{s_y^2}{n1-1}}}$$

$$= 93 - 4.666 \sqrt{\frac{7347.6}{n1-1} + \frac{9.0666}{n1-1}}$$

$$= 88.334 \sqrt{\frac{7347.6}{5} + \frac{9.0666}{5}}$$

$$= 88.334 \sqrt{1469.52 + 1.8133}$$

$$= \frac{88.334}{38.357} = 2.30$$

Calculate t = 2.30

According to calculations made in order to test the hypothesis table (2), the calculated t stood at 2.30; meanwhile the critical t was realized at 1.812. From this therefore, the calculated t (2.30) is greater than critical t (1.812) at df (10) and at 0.05 on the "t" distribution table. The null hypothesis was rejected meanwhile the alternative validated. This came to the conclusion that the decrease in forests depletion is due to the change in the management system. The new forest management system is characterized by multi-level system whose main objective is to ensure the sustainability of these forests. With this system, there is the participatory management of the forests. A lot of interconnectedness exists from households to community, Fon, National as well as international stakeholder.

3.3. Community involvement in the conservation race after 1987

A lot of effort has been made after 1987 by actors to understand needs of the people adjacent these forests. This consisted of coordinating separate ideas by different stakeholders into a balanced whole. It involved international conservation community, National and the local population. For Birdlife, their interest centered on ensuring the continued survival of the many rare and endemic species found on the unique forest. For the local population, there was a multiplicity of interests ranging from ensuring a water supply for the community to the use of various forest products to cultural concerns. This portrayed diversity in their interests.

The forest code in 1994 introduced the concept of community forest outside the permanent domain that is less than 5000 hectares to be managed by "communities" or villages. With this new legislation, management of forests is the role of village community concerned, through a technical assistance from forestry Administration (Article 3(16)) of degree of application, 1995); forests products of all kinds resulting from the management of community forests shall belong solely to the village communities concerned section 37(5) of the law, 1994). The community forest component was essentially to prepare the minds of adjacent population to be stakeholders in the management of forest. Forest management can effectively respond to the threats emerging from forest loss through involvement of local communities in forest management plans, [20].

The integration of ideas (interests) enabled the project MINEF, traditional authorities and the communities to work together in a truly collaborative way for the common goal of forest conservation. The working together facilitated the conservation race and led to the drawing of forest boundaries that subsequently hindered further encroachment. The drawing of these boundaries began with Kilum and Ngongbaa in 1987, followed by Kovi-vifem in 1994, Dom in 2002, and Mbiame in 2005. By 2003, 7.8% of Kilum forest area was regenerated and the forest boundary was marked with signs and trees, within which the forest remained fairly intact, compared 1987.

It was found out that, since 1994 more than 35% of the degraded 1970 portion has been regenerated due to adoption of multi-level approach of forest management fig (3). With the Multi-level approach, there is a lot of interconnectedness, and land management decisions are well planned which has helped to minimize destruction and depletion. For example; household, village heads and community are answerable to the Fon directly. The Fon interconnect with National (administration like MINEF) as well as international (like the case of ANCO and CENDEP at Mbiame and Dom). The adoption of multilevel approach led to the successful demarcation of the forest and the drawing of community boundaries such as Mbai community boundary, and Bihkov community boundaries etc. This has helped in regenerating the forest in Bui-Division.

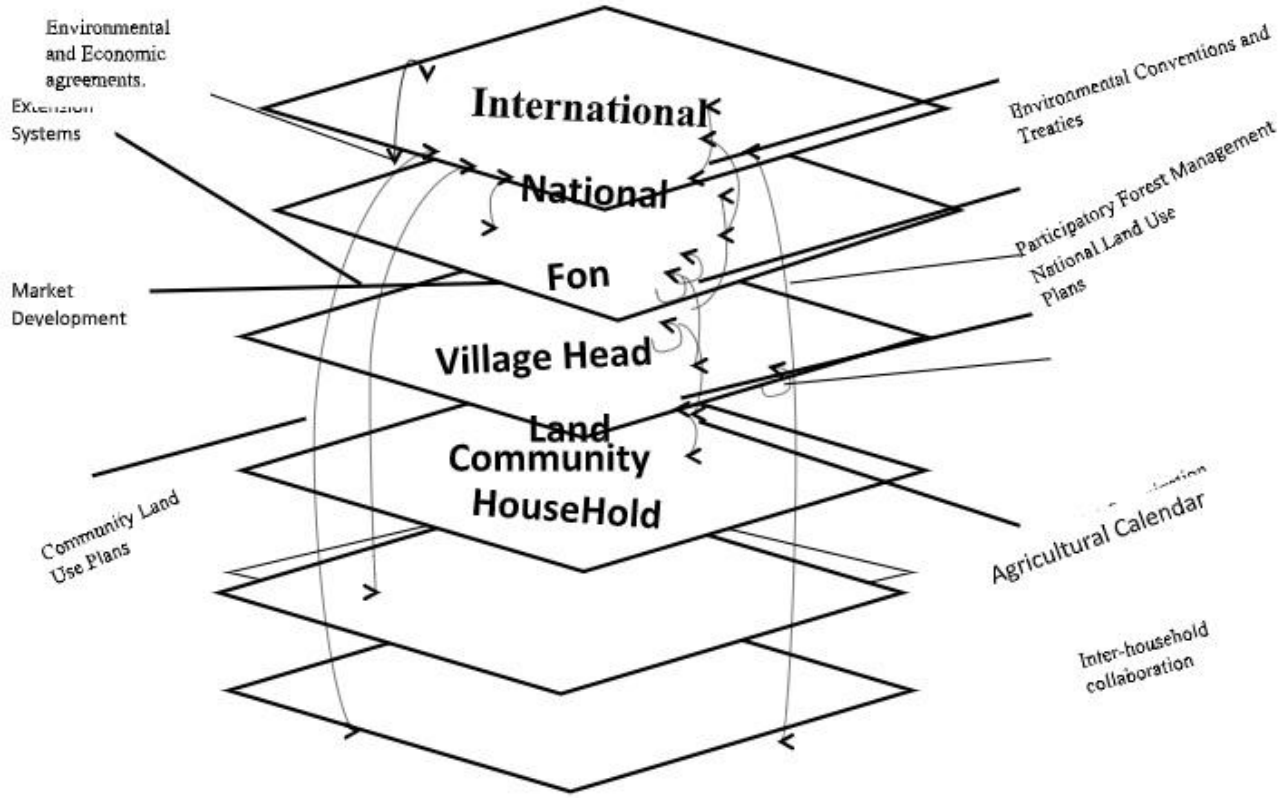

Figure 3: Activities and level of intervention in a multi-level stakeholder approach leadingto better resource management
Source: adapted from Hans,H. (1997) and field work (2018/2019)

3.4 Livelihood Sustainability Projects for Resource Management

Forest conservation with provision of alternative activities for livelihood sustainability is the best strategy to fight forest depletion and ensure sustainable resource management.while much paper work has been done in the form of laid down laws and policies, decrees have been signed on the issues of creating and managing protected areas in Cameroon for prosperity. In this light, there is need to move away from the paper work and rhetoric of providing alternative means of survival to adjacent population by making this option. A suggestion on the creation of an enabling environment is made which will gradually without violence make the adjacent population of the protected area to evacuate the area encroached upon and also take part in the conservation projects. Well-managed forests are major sources of livelihoods for the fringed communities [21].

CAMGEW distributed more than 900,000 seeds of Leucena, Tephrosia and Sesbania (for animal fodder) to over 139 farmers, including 38 women in 7 villages inKilum and Ngongbaa. These species are nitrogen fixing and can be grown together with crops including coffee, potatoes, beans, huckleberry, cabbage, yams, corn. In addition to providing nitrogen for crops, the trees provide shade and help prevent erosion on sloping ground. CAMGEW also distributed 60Kg of bracharia seeds for obtaining fodder in the dry season when other feed is scarce. In 2011, ANCO trained project community members in Dom on aspects of tree nursing thereby providing them with nursed trees as well as seed, pasture has been improved for grazing purposes. As for CENDEP since 2008, seedling productions have been carried out and about 11000 of such trees are produced and planted on 31 hectares of land Mbiame community forest. In 2011, ANCO assisted the community in income generating activities. Some of the trees planted on landscape like Prunus *Africana* is sold by indigenes to boost their income. Bee hives were provided and they trained them on market gardening activities, tree nurseries were provided, pasture was as well improve for the grazing of animals, erosion control farming (that is check against erosion), agroforestry projects were setup, forest boundaries were demarcated and areas that needed afforestation were identified. Therefore, as role they train bee farmers and links them to buyers so that they can sell their produce, link honey stakeholders facilitating knowledge exchange.

Bee keeping was found out to be one of the activities encouraged by conservators of different forests. Honey gotten as an output from bee hives fetch farmers a lot of money thereby reducing their quest for more forest products which indirectly contributes in the effective conservation of the forests.

The main advantage here is that the community's ownership of bee hives in forest pushes them to protect their bee hives from bush fires and harm thereby preventing forest degradation and thus participating in forest management. A workshop was organised by CAMGEW in 2012 and they estimated to train 120 persons' table (2). At the end, about 166 persons were trained.

Table 2: Number of people trained during the workshop in 2012

Workshop No.	Period of workshop	Total number of participants	Total number of men	Total number of women	Total number of youths
1	30th-31th January 2012	64	33	15	16
2	17th-18th Febuary 2012	33	06	05	22
3	19th-20th July 2012	31	04	07	20
4	3rd-4th August 2012	38	08	04	26
Total		166	51	31	84

Source: CAMGEW (2012) and field work (2018/2019)

Table (2) demonstrate efforts made by some actors of conservation to ensure the diffusion of innovation through training of indigenes on apicultural activities. This innovation has been diffusing from one participant to another thereby leading to gradual spread in the study area. The participants who gained from participating in several workshops are now transforming landscapes into apicultural landscapes through the introduction of bee hiveson landscapes plate (1). Encouraging apicultural activities on conserved forest: Bee keeping was found out to be one of the activities encouraged by conservators of different forests.

Plate 2: Strategies for Sustainable resource management

Photo 1 Photo 2

Photo (1-2): Tree nursing for forest regeneration and restoration of degraded landscapes. The integration of trees on farms away from conserved forests provide indigenes with forest resources like wood and medicine therefore ensuring effective forest conservation

Photo 3 Photo 4

Photo (3-4): The training of the population on apicultural activities helps in preventing the forest from bush fires thus ensuring sustainable conservation as the harvested honey from hives acts as source of income for indigenous population.

Photo: (9-12): Wirsiy .E. (2012) under CAMGEW project at Kilum forest

It was found out that; the main objective of conserving the DOM and Mbiame forest is to protect water shade and forest resources in this community. The Mbiame forest is one of such forest remnants in Cameroon and serves as watershed with 15 streams taking their rise from it and nourishing a downstream population of over 57,893 inhabitants (spread over 14 villages). Emphasis on sustainable livelihood is ensured by ANCO and CENDEP (The Centre for Nursery development and Euro propagation) and their projects are large integration of forest management that include RED and sustainable livelihood that are supportive to conservation. They carry out water protection project through reforestation and creation of trained local structures to manage the water shed.

An attempt to manage other natural resources such as soils and water can be successful and sustainable only when indigenes become part of the management team. According to [22], to develop and manage systems for water catchment protection that promote conservation of natural resources, there is an urgent need to discuss with the sector actors who utilize land in and around the water sheds. Conservation of the forest directly contributes in the preservation of water sources. Discouraging deforestation, crop cultivation and animal rearing around catchment areas; This is because these activities expose the soil and contributes in the drying up of catchments thus contributing to water crisis especially during dry periods**.** Encouraging afforestation with water retention trees around catchment areas such as; Karapa, Glyricidia, Vitex, doriana and Maesosis**.** Construction of hedges around catchment areas to prevent animal destruction.

Support the new approach to agricultural intensification and environmental protection by managing biological interactions that favors crop and animal productivity in a profitable and ecological sensitive manner such as agroforestry practices. Agroforestry trees have been used to construct fires breaks to reduce the effects of bush fires during dry periods. ANCO in 2011 promoted market gardening because, one of the leading reasons for cutting down forest was to cultivate vegetables. Effective agricultural practices can enable and sustain rural livelihood particularly in rapidly developing and transforming areas [25]. Quite a number of farmers received material support geared towards setting up income generating activities. These farmers equally acquired knowledge such as soil management. In this light farmers have been taught how to use agroforestry to prevent bush fires: Preventing bush fires on agrarian landscape are very important as they are a source of destruction to nitrogen fixing bacteria organisms on agrarian landscape. Discouraging the use of chemical fertilizers as they contributes negatively to man's health e,g It contributes to pollution of water bodies.

4. Conclusion

The unsustainable use of resources can lead to fast extension. Managing land resources sustainably ensures their continuity to provide important ecosystem service such as watershed protection and biodiversity conservation. Unsustainable land use practices such as bush burning increases land degradation and a reduction in ecosystem services which our land provides. For conservation policies to be successful, there is an urgent need for the inclusion of indigenous population as part of conservation team. The inclusion of indigenous people can make sensitization and the purpose of conservation known to entire people thereby limiting resistance on matters of conservation.

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