Sub category: Environmental impacts of development strategies

Author: Mphoweh jude Nzembayie, Dept. Geography, University of Yaounde I, Cameroon

Email: Mphowehjude@yahoo.fr, P.O. Box 8846 Yaounde, Cameroon

Theme: AGRO-INDUSTRIAL RICE CULTIVATION AND ITS ENVIRONMENTAL IMPACTS IN THE NDOP FLOOD PLAIN, NORTH WEST REGION, CAMEROON

The Ndop floodplain is estimated to have an area of 4000km^2 and directly sustains a population of 200,000 inhabitants of whom 70% are involved in activities like agriculture, fishing, grazing, hunting and gathering. In 1970, a large agro industrial scheme called the Upper Nun Valley Development Authority (U.N.V.D.A) was created in this region. Their main objective was to promote large scale rice cultivation as a means of promoting rural development, alleviating food crises and boosting the economy of this plain. During the early days of its creation, this scheme embarked on large scale clear-cutting and transformation of wetlands to cultivable fields. This entailed heavy destruction on the natural environment since swamp forests, date palms and raffia palms were all cleared away. Rice fields were developed, covering over 1,531.12 hectares. There was a total change of activity in this region from hunting, fishing and subsistence agriculture to rice cultivation. Over 6000 local residents got directly recruited by this company. Initially, the company registered success but recently due to a heavy importation of rice from other countries, this region was not able to keep pace with the competition. This led to a fall of the U.N.V.D.A, leaving most farmers stranded.

After research in this region, it was discovered that before the implantation of this agro industrial scheme, this region had a rich biodiversity of large mammals, reptiles and fish. The flora biodiversity was equally rich and luxuriant. More than 80% of the population were thus hunters and gatherers. But from the 1980s, much of these were extinct due to habitat destruction. This led to a conversion of over 70% of the locals to rice farmers. Over 90% of the population confirm initial satisfaction from the activities of the U.N.V.D.A but today, the fall of the company greatly accounts for the high level of unemployment and rural exodus in the region. The landscape has been highly degraded and many people can no longer return to their initial activities. This clearly validates the hypotheses that the U.N.V.D.A did more harm than good in this region. There is therefore a need for sustainable exploitation practices within this plain.

Key words*: Ndop flood plain, UNVDA, biodiversity, sustainable exploitation, extinct.*

1. Introduction

The Ndop flood plain before the late 1990s was one of the major bread baskets of Cameroon in terms of its agricultural outputs that were exported towards the main urban centers of the country. It is located in the North West Region of Cameroon between latitude 5°37'N to 6°14'N of the equator and between longitudes 10°23'E to 10°33'E (see figure1). The average altitude here is 1200m; the lowest and marshy areas are however 900m above sea level. This region experiences an average maximum daily temperature of about 27.22°C. The hottest months are December, January and February; with maximum average daily temperatures going up to 30ºC. Average monthly rainfall totals are estimated at about 273mm for the wettest months. The rainy season lasts here for over 8 months and the dry season for over 4 months. A combination of these factors favours agricultural practices in this region.

This floodplain is estimated to have an area of 4000km^2 and directly sustains a population of 200,000 inhabitants of whom 70% are involved in activities like agriculture, fishing, grazing, hunting and gathering. In 1970, a large agro industrial scheme called the Upper Nun Valley Development Authority (U.N.V.D.A) was created in this region. Their main objective was to promote large scale rice cultivation as a means of promoting rural development, alleviating food crises and boosting the economy of this plain. This came as a succession of other agricultural projects that had a similar vision but failed most often at the experimental phase. The activities of the UNVDA have remained remarkable in this region both from a socio economic and environmental perspective.

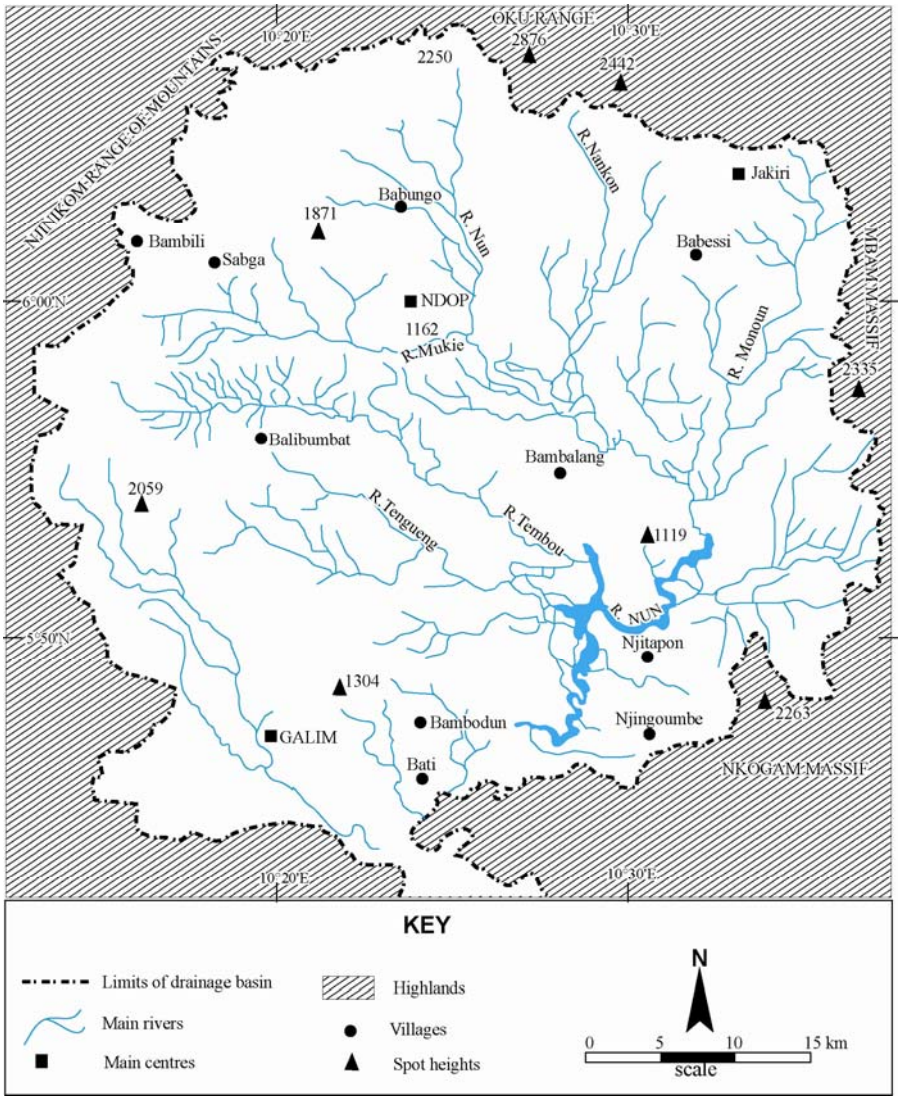

Figure 1: ***Ndop flood plain and its hydrographical network***

1.1. Statement of the problem

During the early days of the UNVDA's creation, the scheme embarked on large scale clear-cutting and transformation of wetlands to cultivable fields. This entailed heavy destruction of the natural environment since swamp forests, date palms and raffia palms were all cleared away. These were replaced by rice fields which covered over 1,531.12 hectares. There was a total change of activity in this region from hunting, fishing and subsistence agriculture as it was earlier, to rice cultivation. Over 6000 local residents got directly recruited by this company; meantime many others became involved in other sectors directly or indirectly linked to rice cultivation and/or commercialisation. Initially, this company registered success but recently due to a heavy importation of rice from other countries like China, Pakistan and India, this region

was not able to keep pace with the competition. This led to a fall of the U.N.V.D.A, leaving most farmers stranded. Within this context, the following research question was stated: What are the environmental repercussions left behind by this project and what is the future of those who changed activity to work for the U.N.V.D.A? The objective therefore was to assess the environmental impacts of this project and examine different problems faced by the locals in adapting to the fall of this company.

1.2. Background and literature review

The Ndop flood plain has often been a focal point of research due to its location within the Upper Noun basin which happens to be one of the major drainage basins in Cameroon. The origin of its people and their ethnic diversity has also created a centre of attraction. The area has an abundance of literature on issues like rice cultivation, agro-pastoralisim, its ecosystems and soils. Issues on wetlands are also becoming a focal point of research. Nouvelot *et al*, (1971) carried out studies on the hydrological network of the Upper Noun basin. Studies were carried out on several soil types and discharge rates of several streams in the region. Other issues linked to vegetation types and human settlements in this region were also addressed. Also, the practice of transhumance in this zone was seen to be favoured by climatic factors and above all the luxuriant wetland gramineous species. This activity is seen to alternate between the wetlands of the plain and the hill slopes, depending on seasonal variations (J. Boutrais, 1974 and Ngwa. 1985). The intensification of this activity is today seen to be having negative impacts on the wetlands of this region (Bongadzem, 2006).

Ngwa (1979) carried out studies on swamp rice production in the North West region. The first activities of rice cultivation right up to its large production under the U.N.V.D.A were seen as an important socio-economic sector in the region. The U.N.V.D.A is also seen as an important actor in the floodplains through the introduction of heavy machinery in the development of rice fields and drainage canals. Furthermore, agricultural practices in the region are equally seen as a major peasant occupation in the works of Nkwemoh, (1999), and Duma, (1999).These activities were judged as being responsible for the food security and abundance in the region. This success is enhanced by the favourable edaphic and climatic factors which also prevail in the region. However, with an increase in the population density, new farming strategies have been adopted and are seen to be detrimental to the environment and the natural vegetation cover. An example is the practice of bush burning, intensive use of fertilizers and seasonal food crop rotation in the

wetlands, which gives no opportunity for the natural vegetation cover to regenerate (Kisife, 2007)

Mbanga (2002, 2004), studied community participation and rural development in the area. The efforts of local groups in the domains of health, infrastructural development and above all agriculture were seen as vital for the development of this region.

From a socio-anthropological and historical perspective studies were undertaken by Valondeng, (2000) and Wana, (2003) respectively. These studies traced the origin of the people of this region, their settlement patterns, inter-chiefdom relationships and some of their activities. These studies also give an idea about the early settlers in this plain during the 18th and 19th century.

Research on wetlands in this region is another important avenue. Akendo (1998), Bongadzem (2006), Forpah, (2004), Koghan, (2004) and Mphoweh (2005) have carried out research on the ecological values and functions of the wetlands of this region. The implications of related land use practices on the wetlands of the area were also addressed, with special focus on wetland functions which generate an income. In the same line, Tanteh, (2004) carried out a historical overview of fishing activities and his studies showed that this activity's total production evolved towards a decrease due to the decline in fish in the area.

A cross section of this review of literature shows the importance of this plain in agricultural activities. However, no studies have yet focused on activities of the UNVDA with an intention of showing how the fall of the company has affected the local population who have to face the challenges of adapting to a new lifestyle and a change in their environment. This will henceforth be the originality of this paper.

1.3. *Methodology****:***

The principal hypothesis in this study was stated as follows: The activities of this company have done more harm than good to this region both to its environment and its people.

Methods of research included consultation of U.N.V.D.A archives from its period of creation in order to understand their different sectors of intervention, surfaces cultivated over time, kinds of machinery used and issues related to land development and redistribution. Resource persons of the UNVDA as well as local residents who were or are still actively involved in rice cultivation were also interviewed. A total of 250 questionnaires were

administered to residents of the different villages within this flood plain in order to understand issues relative to environmental and socio economic changes.

Analyses on a LANDSAT TM image of 2002 and a topographic map was carried out and complemented with ground verifications in order to understand probable changes on the physical landscape. Changes on the fauna biodiversity were studied by interviewing hunters and visiting the palaces of some villages in order to identify relics of animal skins in the museums that reflect the biodiversity some years back in this region.

2. Results

2.1. Major activities of the UNVDA on the flood plains from creation (1970) to fall

The activities of the UNVDA in the agricultural sector within this plain are better summarized on table 1. The table contains data from 1977 when activities intensified right up to the 2005 when the company experienced crises and stopped keeping track of its records. From the table it is observed that in 1977 when the company started its activities, it employed over 2500 farmers, developed over 824 hectares of land (which were allocated to farmers), and purchased 1,310 tons of rice worth 55, 695 00 FCFA, (about 85 684 Euros). At the start, the company's strategy was to transform the swamps to rice fields (through large scale use of machines like tractors and bulldozers (See photo 1), distribute it to registered farmers and monopolise the purchase of all rice within the plain. After obtaining huge stocks of rice, they were dried, hulled, packaged, branded and sold through out the country.

Photo 1: ***Development of rice fields using machines***

*Photo2****: Rice farmers planting rice***

Source: Mphoweh 2004

By this means, farmers hadn't to bother looking for a reliable market for their products. The UNVDA also improved on the road network within this plain so as to facilitate the evacuation of rice to warehouses and local markets.

Table 1: Rice production between 1977 and 2004

Production year	Number of rice farmers	Surface cultivated (ha)	Average area per farmer (ha)	Estimated production (t)	Tonnage purchased	Purchase cost (F.cfa)	Total cost (F.cfa)
1977/78	2,500	824	0.33	2,884	1,310	42.5	55,695,000
1978/79	2,575	869	0.34	3,041	1,612	42.5	68,510,000
1979/80	2,404	774	0.32	2,709	2,246	42.5	95,955,000
1980/81	2,638	894	0.25	3,129	2,433	55.0	133,815,000
1981/82	3,177	1,273	0.40	5,092	3,162	55.0	173,910,000
1982/83	3,225	1,231	0.38	4,924	3,900	62.0	241,800,000
1983/84	5,542	1,518	0.27	6,092	5,500	62.0	341,000,000
1984/85	6,400	1,753	0.27	7,012	5,753	78.0	386,686,000
1985/86	5,862	2,178	0.37	8,712	6,898	78.0	538,838,000
1986/87	5,687	2,058	0.36	8,232	6,124	78.0	477,672,000
1987/88	4,682	1,612	0.34	6,448	4,937	78.0	385,096,000
1988/89	3,475	1,087	0.31	4,348	1,608	30.0	48,240,000
1989/90	3,350	1,243	0.37	4,972	1,387	36.0	49,932,000
1990/91	3,754	1,215	0.32	4,860	2,448	36.0	88,128,000
1991/92	4,377	1,299	0.30	5,196	2,287	36.0	82,332,000
1992/93	4,386	1,247	0.28	4,988	2,445	36.0	88,020,000
1993/94	4,197	1,245	0.30	4,980	1,830	36.0	65,800,000
1994/95	4,554	1,426	0.31	3,565	0,733	53.0	38,849,000
1995/96	5,715	1,704	0.30	4,260	1,211	83.0	100,513,000
1996/97	5,617	1,744	0.31	4,360	0,578	84.0	48,552,000
1997/98	5,594	1,760	0.30	4,402	0,498	80.0	39,866,640
1998/1999	6,741	2,009	0.30	6,966	0,584	80.0	46,727,120
1999/2000	7,026	2,225	0.32	7,787	0,139	80.0	11,131,840
2000/2001	2,195	1,740	0.35	6,091	1,194	80.0	95,520,000
2001/2002	6,930	3,045	0.44	7,613	1,515	90.0	136,350,000
2002/2003	7,689	2,076	0.27	8,304	0,505	90.0	45,450,000
2003/2004	7,474	1,877	0.25	7,508	-	-	-
2004/2005	6,731	1,531.12	0.22	5,575.48	-	-	-

Source: UNVDA (2005)

Over the years, there were fluctuations in the functioning of this scheme. This is better perceived on figure 2.

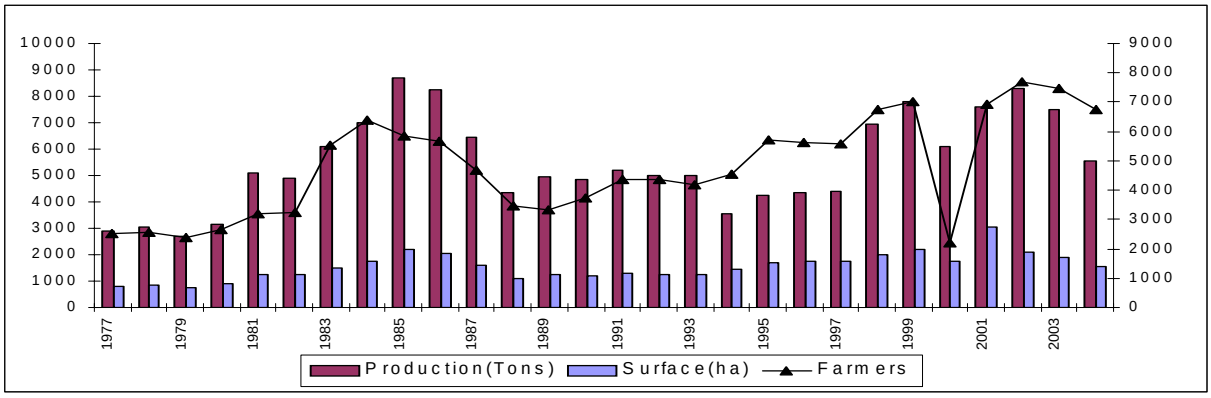

Figure 2: ***Fluctuations in surfaces cultivated, farmers involved and tonnage of rice bought by UNVDA, 1977 to 2003***

From figure 2, it can be seen that the U.N.V.D.A. heavily transformed the wetlands of the Ndop flood plain. By 1977, a surface area of 824 hectares had already been transformed and by the year 2002, the U.N.V.D.A. developed over 3045 hectares, which is the highest area so far developed within this period. In 2004/2005, which virtually reflects the present situation, the U.N.V.D.A. transformed over 1.531.12 hectares, involving over 6731 farmers. The area of rice fields developed reveals a net increase. It can be understood from this that the number of farmers increased on land surfaces which were fixed and this led to pressure on the land. Each local farmer on the average was entitled to a farm size ranging from 0.22 ha to 0.44 ha. The lowest average farm size per farmer occurred from 1984 to 1985 during which signals of economic crises were felt by the U.N.V.D.A and from 2003 to 2005 which reflects the present situation during which the company's financial output experienced a serious financial breakdown. Development of swamps and maintenance of infrastructure by this company became difficult and thus came to a close.

2.2. Environmental impacts of the UNVDA's activities on the flood plain

Several environmental problems could be associated today to the activities of the UNVDA. During the creation of this scheme, Environmental Impact Assessment studies were not carried out since at the time of its creation, it was not a prerequisite for the implantation of a scheme of this nature. This explains why vast expanses of land were simply cleared of their natural vegetation to ease extensive use of machinery. But this had serious repercussions as follows:

- Floods due to change in drainage patterns:

Due to the marshy nature of this terrain, dykes were created and canals dug in several areas of the plain. (See photo3 and 4).

Photo3: ***Dykes to regulate water flow***.
Source: Mphoweh 2005

Photo4: ***Stream regulators***
Foreground B: canal A: Dam

These modifications coupled with deforestation in the plain due to farming led to occasional floods in many parts of this region (also see photo 7).

- Extinction of fauna biodiversity:

The fauna biodiversity that thrived some time in this region was as a result of the favorable habitats that existed in the form of swamp forests. Macro fauna species of birds, reptiles and mammals in the years before the 1970s thrived in this region. This was evident when interviewing hunters and visiting palace museums of villages in this region. Over 18 local names were given for different fauna species that use to exist but have all disappeared from the region, examples include: elephants, gorillas, cheetahs, crocodiles, monkeys, waterbuck, cane cutters amongst others. Due to the unclear situation experienced on the field in distinguishing names of species due to the fact that most were extinct and only animal skins (see photo 2) could serve as relics, it was not very certain to obtain exact scientific names of these species. However, lessons learnt on the field from hunters and relics seen in the palaces prove that the biodiversity in this region was quite rich. This explains why hunting was an important activity here. Changes experienced in terms of the biodiversity are illustrated on figure 3. During the 1960s, the biodiversity was quite abundant and large mammals were available but later during the decades after the 1990s, most of these species got extinct.

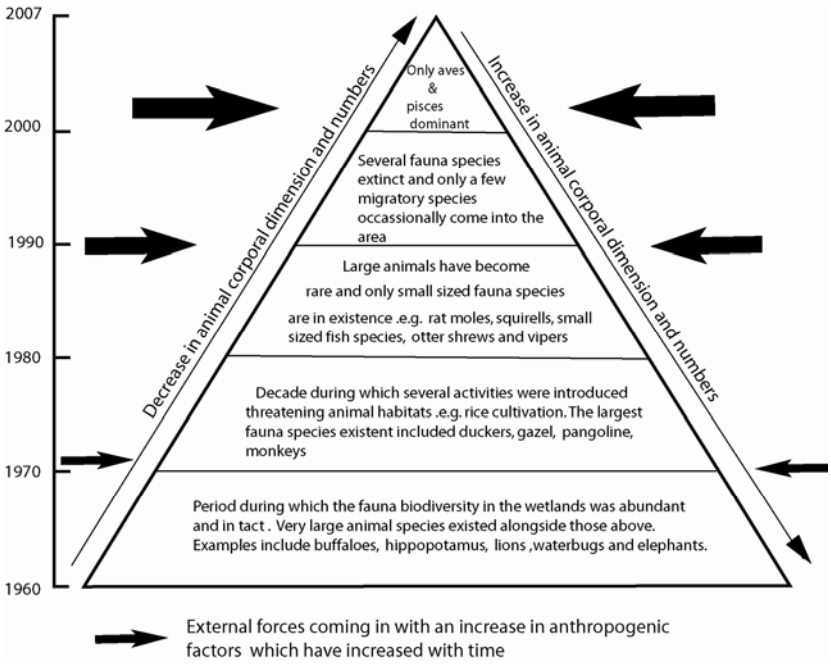

Figure 3: ***An illustration of the evolution of the biodiversity of Ndop Flood Plain***

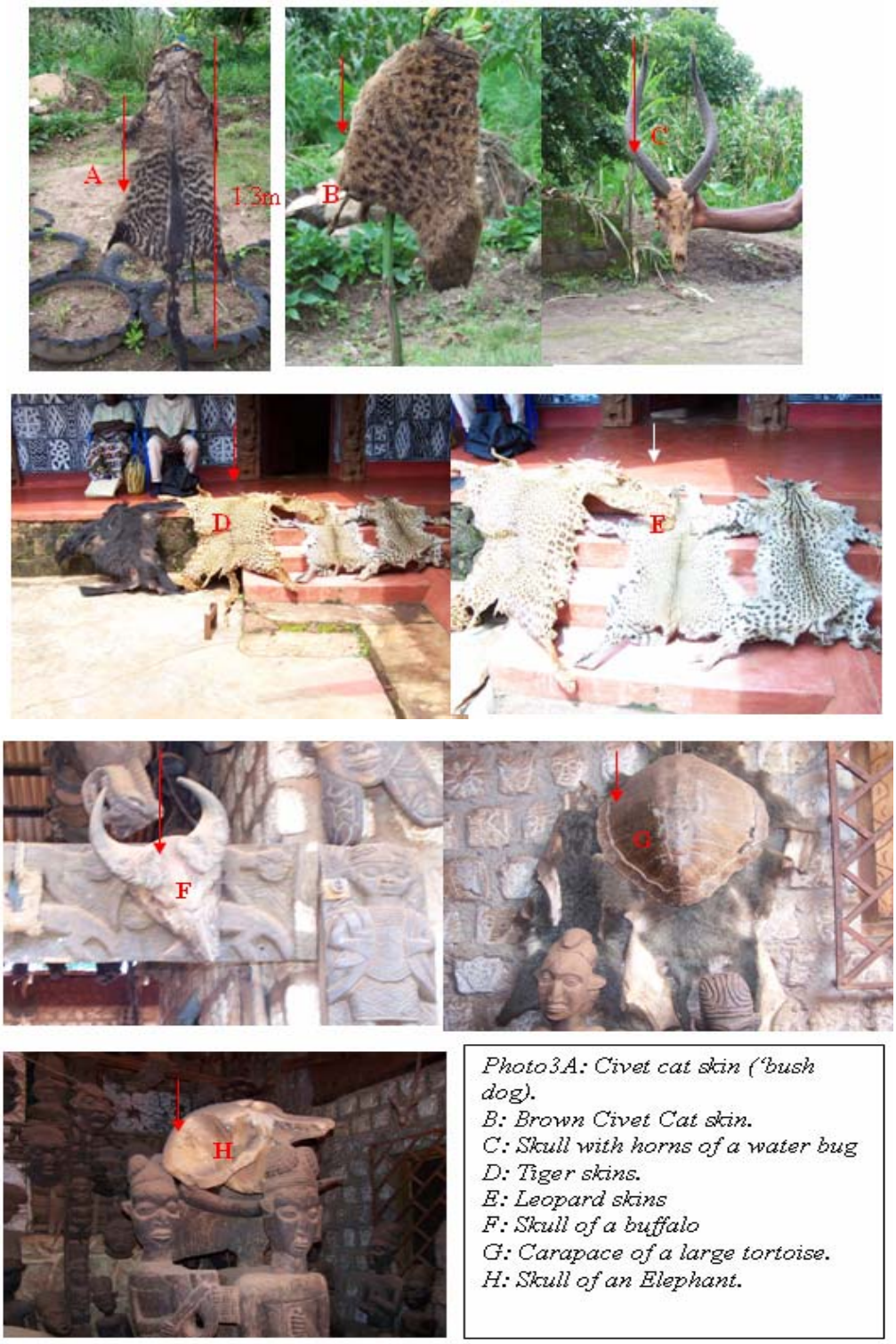

Photo 5: Relics of fauna biodiversity in Ndop Flood Plain

Source: Mphoweh (2005)

- Alga bloom and water weeds:

  Eutrophication is another major problem in this region. It is attributed to the heavy use of chemical fertilizers. The need for good harvests often warrants that farmers use fertilizers on rice fields twice per season. Since this is done on swamps, there is the tendency for fertilizers to drift into nearby ponds and streams which end up becoming rich in minerals, leading to algae bloom and sea weeds. At a start when the weed population is tolerable, it is an advantage for fishermen who suggest that this is a favorable fishing period. When this intensifies however, it leads to a drastic drop in fish population due to suffocation.

Photo 6: ***Water with algae A and water weeds B***

- Loss of flora regeneration potentials within the flood plains:

  Due to large scale cultivation within the wetlands, several flora species that use to exist therein were cleared off. There could be a possibility of regenerating the ecological values of these lands some day especially if they were left to fallow. Unfortunately, besides rice cultivation, the peasant population has developed other strategies of cultivating food crops within the wetlands. Once rice is harvested, fields are immediately ploughed and prepared for the next session of food crops such vegetables and maize that have a short vegetative season. This practice became common during the late 1990s when rice became less profitable and there was a need to survive by ensuring availability of food crops. Since rice fields are wet enough to sustain such practices during the dry season, they become a focal point for cultivation all year round. This occurs in the form of a seasonal crop rotational practice (Kisife, 2006). Such constant rotation of activities

gives no chance for the natural vegetation cover to regenerate. Hence, rice fields for more than 20 years since their existence in this plain hardly contain any other type of flora species apart from food crops that are planted over the seasons. Figure 4 illustrates the different phases of rotation on fields at different periods of the year.

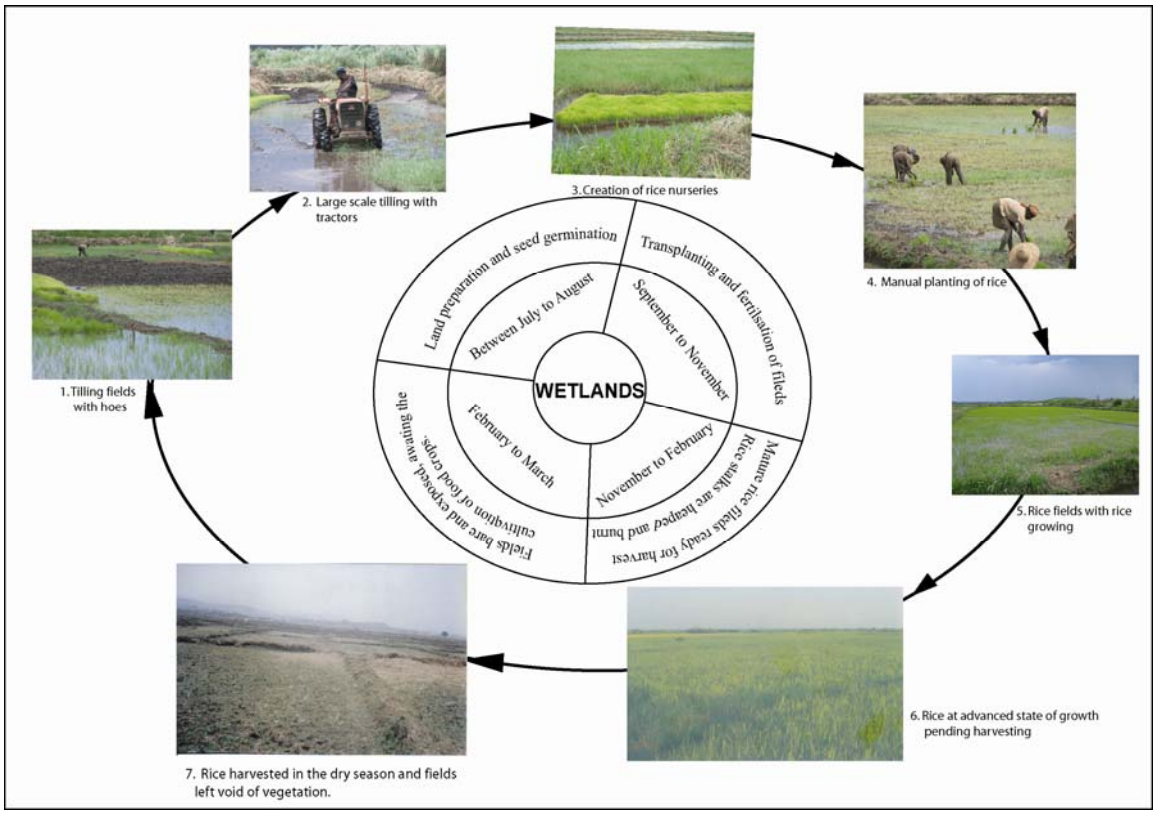

Figure 4: ***Seasonal crop rotation within the flood plains of Ndop***

Source: Mphoweh (2005 to 2006)

2.3. *Socio Economic Impacts related to the fall of the UNVDA*

Initially, this scheme registered success in several domains apart from agriculture. Road infrastructure, primary health facilities, employment, farmer loans and incentives are a few parallel domains in which it intervened. With the fall of this company, there became serious problems in most of these sectors. It also handicapped most people who had already become use to this lifestyle. Most facilities that were put in place by the UNVDA closed and farmers were abandoned to themselves. Since 1992 when the country experienced serious economic crisis, the UNVDA no longer monopolized the purchase and sale of rice, meaning farmers had to develop fields themselves and worst

still to look for the market. It is rather unfortunate that this period also marked the massive importation of rice from China, Pakistan and India much needed to complement home grown rice. The challenges of these changes became insurmountable especially as most imported rice species tended to be more appreciated in terms of quality and cost. The following points highlight some major difficulties faced by the local population.

- *No maintenance of farm to market roads*:

Photo 7 is gives a good visual imagination about the road network situation across this flood plain. Since these roads are no longer maintained, they tend to be severely damaged during the rainy season. The photo shows a vehicle crossing a flooded section of the road during the rainy season. At some point the vehicle gets completely sunk under water and people need to push it across.

Photo7: ***Floods affecting roads***
Background: Vehicle under flood water with people pushing it along
Source: Mphoweh (2003).

The UNVDA in the past was equipped with bulldozers that regularly maintained the road network of this region. But as the company started experiencing crises, this responsibility was abandoned. Given the marshy nature of this area, coupled with the impact of non-maintenance of drainage canals, many road networks linking different villages easily go out of use during the rainy season due to floods and in the dry season due to dust and pot holes.

- *Loss of employment and Rural exodus:*

This region during its years of boom attracted a large in-migrant population coming from other villages. Most people settled in the administrative centre in order to benefit from the services of the UNVDA as well as other social amenities developed by this company. This led to a rapid increase of the population from about 39505 inhabitants in 1976 to more than 200 000 inhabitants today (BUCREHP, 2007). The attractive force of this region on its neighbors is illustrated on figure 5 based on the gravity model of migration.

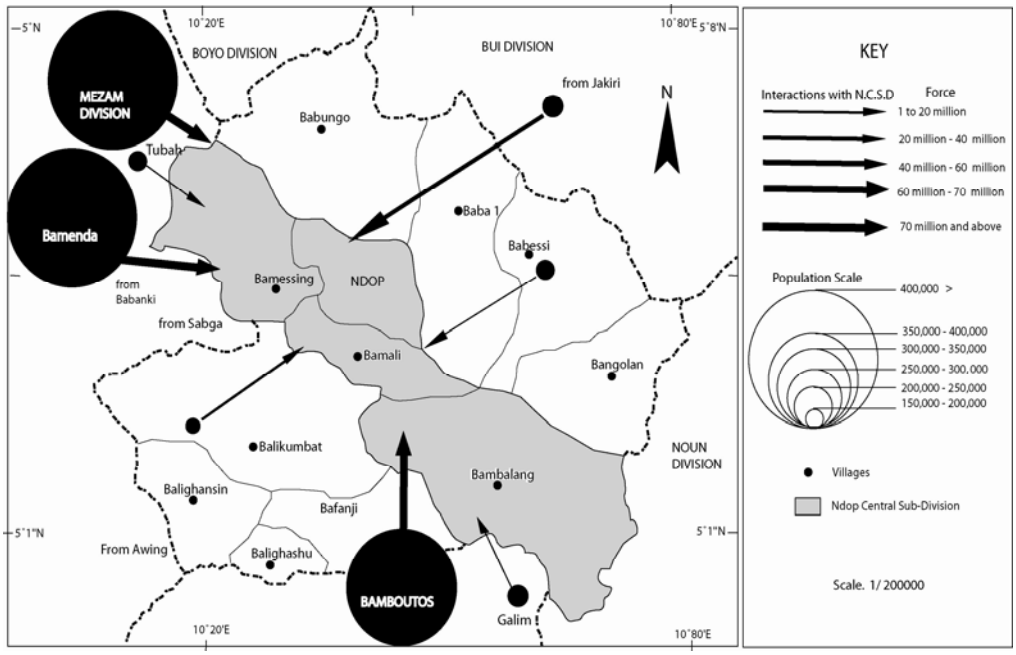

Figure 5: ***Interactions between villages in Ndop Central Subdivision (NCSD) and its neighbours based on the Gravity mode***

Source: Drawn by Mphoweh J.N. with projected population figures (BUCREB,1987), gravity model and distances estimated from topographic map of Bafoussam mission NB.32-X-XI. 1/ 200 000

Today, this large population exerts pressure on the natural environment through farming, hunting, wood carving, palm wine taping, crafts, fishing and grazing activities on resources that have become relatively scarce. These activities occupy over 70% of the population today. In the past, over 95% of the population carried out these activities, but the population at the time was relatively small and natural resources were abundant. Such activities are however no longer profitable as they were before the 1970s when forest resources were abundant, the wildlife population abundant as well as other resources like raffia palms which provided raw

material for handicraft activities like the weaving of straw bags, baskets and decorations. (See photo 5a and b).

Photo5a: basket ***Photo 5b: Straw bags***

Source: Mphoweh (2006)

A sampled opinion today on the 70% of those involved in these primary activities revealed that over 66% carry them out just as a part time activity besides other activities like long distance trade with other villages.

There is a difficulty in adapting to this present situation; hence many people tend to migrate to big cities to find other means of survival. This phenomenon is common amongst people within the age group from 18 to 35 years old. Unfortunately, this is the most active age group in this region who are much needed in development of their local communities. Over 68% of this age group will prefer to migrate to the city if given a chance. The city for those who have retired from there was not an easy place to be. This is partly justified by the fact that most of the people here are illiterate (see figure 12). Hence, getting a good job in the township is quite hard.

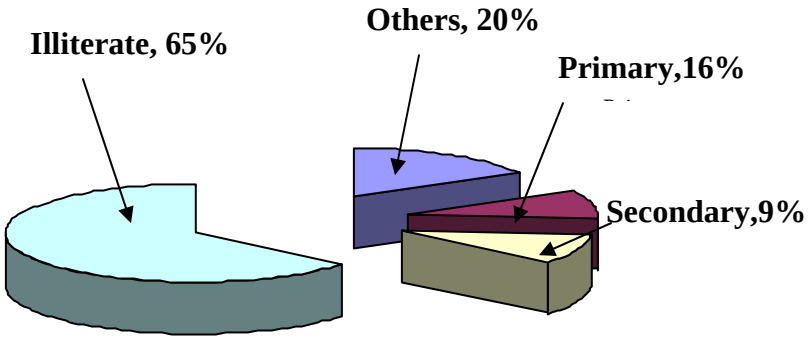

Figure 6: ***Educational level amongst the Ndop Population***

Source: Based on questionnaires (2005)

This handicap has not changed the trend of rural exodus in this region. After the age of 18, the tendency is to migrate to towns in search of a better future.

- *More labor input for lower outputs:*

During the period from 1970 to 1992 when the UNVDA monopolized rice purchase in this plain and sale in most parts of the country, the output from the sector was quite high. But today, faced with the challenges of globalization, the market has become liberalized and imports are coming in from other Asian nations where farmers are highly subsidized. This has led to a total collapse of this sector in Ndop. This situation is similar to what occurred in Ivory Coast where rice was massively imported during the 1970s; without considering local costs of production and the level of inflation at the time, this led to a collapse of the local industry (Phelinas, 1988).

As a consequence of the above farmers need to work more for little benefits. For example, one Kilogram of imported rice costs about 400 FCFA (about 0.8 US$) meanwhile the locally produced Ndop rice costs about 380 FCFA (about 0.76 US$). The prices are similar but the qualities are not the same. The imported species are very much appreciated because of their full grains and also the fact that they are more palatable.

It is clear that the population of Ndop is in a more difficult situation today than they were in the early 1970s before the creation of the UNVDA when they were auto sufficient and there was no need to migrate.

- *Fuel wood crises:*

Wood which is the main source of energy in this plain is used by over 97% of the population for household activities like cooking, heating and drying of cereals. With an increase in the population of this plain, marked by a decrease is swamp forest areas, wood became a scarce commodity. This is because the creation of rice fields warranted a clear-cutting of vast areas once covered with swamp forests, date palms and raffia palms. Although the population relying on this energy source is high, the resource still remains scarce.

It is evident from the preceding sections that there are several environmental and socio economic problems that set in due to the rise and fall of the UNVDA.

3. *Discussion*

The UNDVA's creation in 1970 came as a relief to village communities in the Flood plains of Ndop whom for long relied on primary activities directly linked to the management of their natural environment. For many years, this region contained abundant natural resources, which

occupied more than 90% of the people in sectors like handicraft, hunting, food crop cultivation, fishing amongst others. Transhumance as seen in the works of Boutrais 1974 and Ngwa 1975 was another activity that took advantage of the abundant natural vegetation. These activities are a rich cultural heritage from an integral village community that is believed to have come into existence during the 19th century (Wana, 2003). The UNVDA came to this plain as a booster of the local agricultural sector, employing a great fraction into a more commercial form of agriculture. For over 20 years, this company succeeded in improving living standards in this region. Today however, a failure by the government to secure local economies of this nature from the effects of globalization led to a fall of the company; a situation that is similar in some African countries like Ivory Coast in the 1970s (Phelinas, 1988). This situation plunged the population into a more difficult state than before, forcing many people to return to their initial activities. Unfortunately, the population has grown over the years and many natural resources have been depleted by the activities of the UNVDA. Abandoned to themselves, several social amenities have gone into ruin, necessitating the intervention of the government in ameliorating the infrastructural situation (Mbanga 2004). It is thus evident that the UNVDA did more harm than good to this community.

Conclusion

The Ndop flood plain has lots of potentials in agriculture especially, swamp rice cultivation. These potentials play an essential role in the livelihoods of several village communities. It is equally on these bases that the UNVDA launched an agricultural scheme that boosted the economy for over 20 years. A failure by the government to protect this scheme from external competition led to several environmental and socio economic problems that were addressed in this paper. Such problems are long lasting, giving the impression that this scheme was not sustainable and beneficial. The situation in this plain needs to be remedied by carrying out sustainable development projects that could ameliorate living standards and at the same time protect the environment from further damage. A good example of such a practice could be the application of agroforestry techniques on rice fields that have become food crop farms. By this means, tree species could be alley cropped in fields. In the long run, this will reduce floods and erosion on the one hand and on the other it will ensure soil conservation and fuel wood security. Participatory exercises and education of the local population is also much needed in fighting against environmental problems which in some cases is caused by ignorance.

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