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Communities, Surrounding Environments and Dam-generated Hydroelectric Power Projects in Cameroon

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Introduction

By the end of the twentieth century, the dam industry had choked more than half of the earth's major rivers with more than 50,000 large dams (Gujja and Perrin 1999). The consequences of these massive engineering programmes have been devastating. The world's large dams have wiped out flora and fauna species, flooded huge areas of wetlands, forests and farmlands and displaced tens of millions of people (International Commission on Large Dams 1998).The damming of a river creates a reservoir upstream from the dam and the reservoir waters spill out into the surrounding environments, flooding the natural habitats that existed before the dam's construction. Dam projects, which are useful in meeting the demand for water in desired times and in regulating stream regimes, have been important in economic development. Their benefits include controlling stream regimes, consequently preventing floods, providing domestic and irrigation water and generating energy. However, dams have also had some negative effects on the environment.

Wherever a dam is located, its ecological effects are the same, albeit by different magnitudes. According to recent studies, reservoirs contribute to greenhouse gas emissions as well (World Bank & United Nations Development Programme 1990).The initial filling of a reservoir floods the existing plant material, leading to the death and decomposition of carbon-rich plants (shrubs, grass and trees). The rotting organic matter releases large amounts of carbon into the atmosphere.

The decaying plant matter itself settles on the non-oxygenated bottom of the stagnant reservoir and eventually releases dissolved methane. This situation has led Uyigue (2006) to affirm strongly that 'dams are [non-renewable]'. There is therefore always a concern with balancing their economic against their negative effects. These conflicting perceptions of dams evidently illustrate the fact that dams are a mixed blessing.

The World Commission on Dams (WCD) (2000) reported that 60 per cent of the world's rivers have been affected by dams and diversions. The construction of dams may also result in the emission of greenhouse gases (GHG) from reservoirs due to rotten vegetation and carbon inflow from the catchments. It was estimated that the gross emissions from reservoirs may account for between 1and 28 per cent of the global warming potential of GHG emissions (WCD 2000). This challenges the conventional wisdom that hydropower produces only positive atmospheric effects such as a reduction in emissions of carbon dioxide, nitrous oxides, sulphuric oxides and particulate when compared with other power generation sources such as fossil fuels (Bosi 2000; Ugigue 2006:5–7). Dams also alter the natural distribution and timing of stream flow. Flood timing, duration and frequency are all critical for the survival of communities of plants and animals living downstream. This may lead to the loss of aquatic biodiversity, forest and wildlife habitat, and species population and composition.

The lives of many people and societies have been negatively affected by dams. By 2000 an estimated 40–80 million people worldwide had been physically displaced by dams (WCD 2000). In China alone, 10.2 million people were displaced between 1980 and 1990 (Asian Development Bank 1999). It has been extensively documented that there are gender inequalities in access and control of economic and natural resources within dam project areas. In Asia and Africa, women may have the right to use land and forest but are rarely allowed to own or inherit the land they use (Mehta and Srinivasan 1999). For affected communities, dams have widened gender disparities by imposing a disproportionate share of social costs on women. Dams adversely affect the cultural heritage of many communities through loss of cultural resources (temples, shrines, sacred elements of the landscape, artefacts and buildings). The other cultural impacts of dams include the submergence and degradation of archaeological resources (plants and animals remains, burial sites and archaeological elements).

Environmental change and social disruption resulting from the construction and operation of dams and the associated infrastructure development such as irrigation schemes can have significant adverse health outcomes for local populations and downstream communities (Sleigh and Jackson 2001). Among the resettled, access to drinking water, health services and ability to cope with the new social and physical environment affect health conditions. Numerous vector-borne diseases are associated with reservoir development in tropical areas.

Beyond policy preoccupations, this chapter attempts to locate the new challenges facing communities around dam projects in the context of uncertain climatic developments (assuming they persist). It considers how the government is coping with these unexpected developments, with, for example, punctual often politicised assistance as opposed to long-term measures to permanently overcome problems triggered by old as well as new projects. The issues addressed include the negative consequences, which question environmental impact assessment, the passive rather than the active participation of communities in projects within their ecosystem, hazard vulnerability and finally the situation of existing projects in the light of the new projects launched. The methodology adopts a holistic approach that integrates analysis from geography/environmental science, sociology and policy studies. We systematically reviewed the literature with an emphasis on the recent floods in Cameroon over the past few years, on any form of water resource development, operation and its impact on the population and environment.

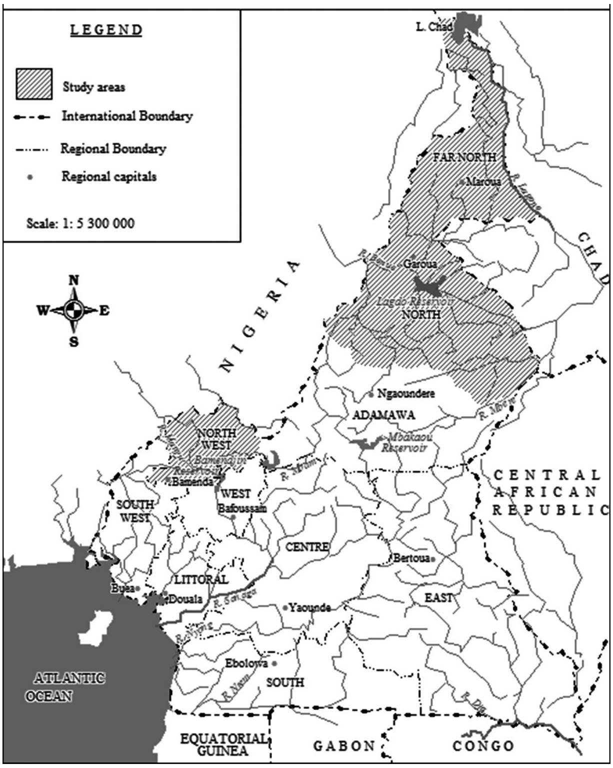
Hydroelectric Dams in Cameroon

The construction of dams for hydro-electricity generation dates as far back as the 1970s with the Lagdo and the Bamendjin dams (Figure 4.1). The Lagdo dam (Figure 4.2) was built between 1977 and 1982. The Lagdo dam constructed on the River Benue in the Northern Region (Region here refers administratively to the French *région* which, since the law on decentralisation, replaces the former Provinces) was built between 1977 and 1982 and is situated 50 kilometres south of the city of Garoua. Its reservoir is a lake which covers an area of 586 km². Its construction was intended to supply electricity to the northern part of the country and, by extension, allow the irrigation of 15,000 hectares of crops downstream. The dam is 308 m long, 40 m in height and 9 m thick. The Maga Dam (Figure 4.2), situated some 85 kilometres East of the town of Maga, was constructed in 1979 as part of the second SEMRY (Société d'expansion et de modernisation de la riziculture, a subsidiary of the Ministry of Agriculture) project, with the objective to expand and improve the cultivation of rice. The scheme that was constructed comprised a 7,000 hectare rice plantation irrigated with water supplied by the Maga reservoir, which, with its associated flood protection dikes, also served to protect the plantation against annual floods from the River Logone. The scheme was constructed at the onset of a prolonged drought. The dam extends from the village of Guirvidig in the west to Pouss in the east with associate dikes along the left bank of the Logone, extending for 100 kilometres from Yagoua to Tekele upstream and Pouss downstream respectively.

The Maga Dam has a full storage level of 312.5 m with a minimum operational level of 310.8 m. This dam covers a surface area of 400 km² with a direct catchment area 6,000 km². However, the volume at full storage level is 680 mm³ while at minimum it is 280 mm³ (SEMRY and Mott MacDonald 1978).

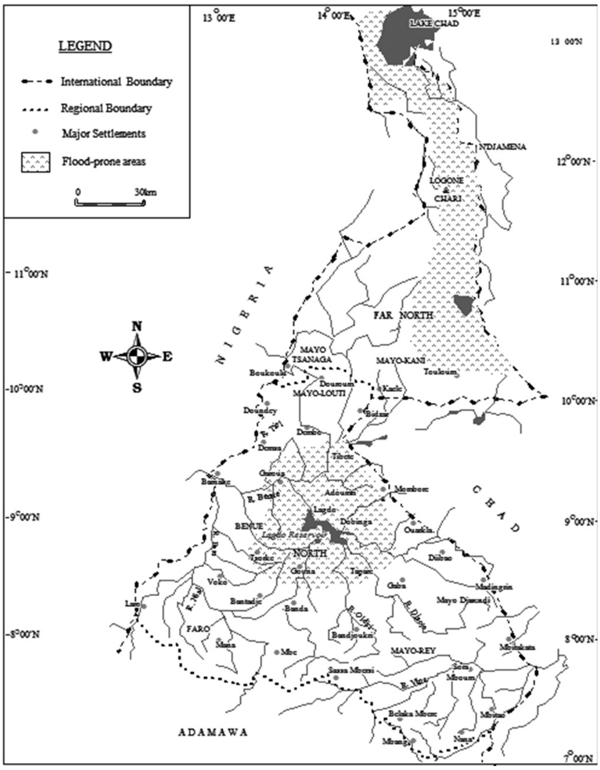
Ephemeral streams known as *mayos* drain the catchment area with peculiar ones being the Tsanaga and the Boula, whose catchments extend as far as the Mandara Mountains to the west. These *mayos* flow from August to October and are dry from November until July. Water flows into the reservoir from the Logone through three connections: the Mayo Gouerlou, the Djafga canal and the spillway. Inflows to the reservoir via the Mayo Gouerlou and the spillway are uncontrolled. The Maga Dam it should be noted was not designed with internal filters.

Figure 4.1: Map of Cameroon showing administrative regions and the location of some dam sites.



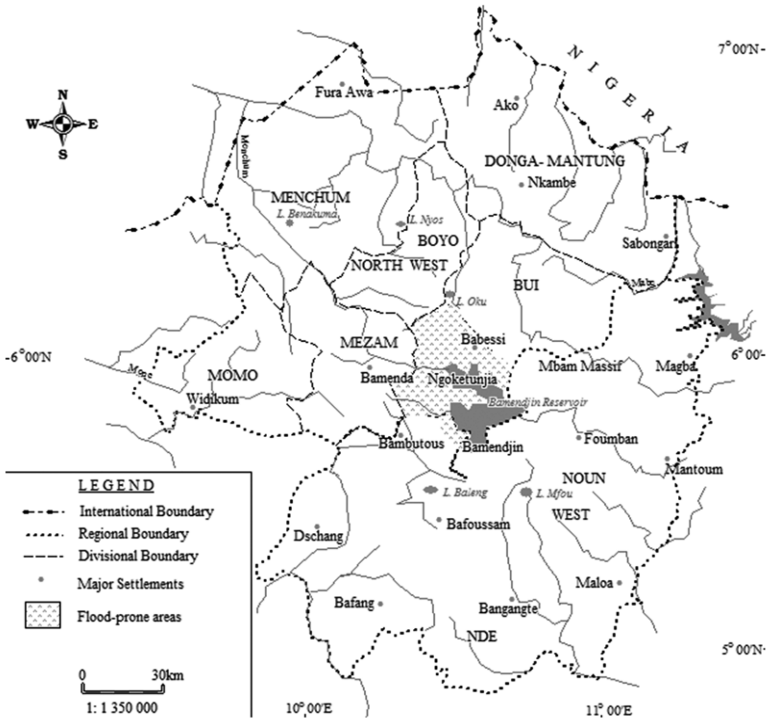
The Bamendjin Dam (Figure 4.3) was constructed in the early 1970s on volcanic lava across the mouth of the River Nun which drains the upper Nun Valley region. Surrounding the extensive lowland which makes up the Upper Nun Valley are volcanic hills and mountains such as the Mount Oku, Sabga chains of hills, the Mbam and the Nkogam. Given that the water level of the Sanaga needs to be maintained high enough to turn the turbines at Edea for example, the Bamendjin reservoir therefore acts as a regulator of the volume of water in the Sanaga.The first filling-up of the dam started in 1974 and the first partial release occurred from January to February 1975. At full capacity, this reservoir contains over 1,847 km^3 of water and in principle extends over a surface area of 333 km^2 although most often it attains 442 km^2. The impact of this dam was so negative that Boutrais (1974) questioned whether its construction was necessary. His argument was based on the fact that the drainage basin of the Nun was too small (2000 km^2) as compared to that of the R. Djerem at Mbakaou (20,000 km^2) and so could not sufficiently contribute as a regulator of water flow in the Sanaga.

Figure 4.2: The Maga and Lagdo dams



Dams were also subsequently created on the Mbakaou on the Lom on the Djerem on the Adamaoua Plateau and Mape to the east of the same plateau to boost the Sanaga after the Bamendjin had been completed (African Development Bank 1997:7). Within the perspective of enhancing the hydro-electricity capacity of the Sanaga based Song Lulu complex at the time of writing a new dam to produce a reservoir of 540 km^2 was being created at Lom Panga (Electricity Development Corporation 2012).

Figure 4.3: The Bamendjin dam



Surrounding Communities and Dam Projects

Most communities located adjacent to dam projects in Cameroon have experienced varying negative effects of dam related projects. This has come about especially as a consequence of a highly capricious climatic situation. The Logone basin of Cameroon constitutes one of the natural risk zones because of the constant rise and fall in the water level. The period from mid-August to mid-October is usually characterised by a drastic increase in the water levels because of heavy torrential rains. In an attempt to control the water level and avoid flood situations and droughts, the government of Cameroon constructed in the early 1970s a dike of about 85 kilometres on the left flank of the River Logone. This dike that runs from Yagoua to Pouss serves as a control mechanism to regulate the flow of the Logone on which the dam was built. By the end of the same decade, the government had built a 27 kilometre long dam at Magba. About forty years later, these constructions have considerably depreciated and worn out due to age and lack of adequate maintenance.

The total population living around the Maga scheme is estimated by SEMRY to be 20,000. However, many of these people live far away enough from the dam and would not necessarily be at risk in the event of a dam failure. Because the area downstream of the dam is so flat, the escaping water would spread over a large area with relatively low velocities and depth. Therefore it is reasonable to suppose that only the people living close to the dam would be at risk. Clearly the most vulnerable population is that of Maga village, because apart from the fact that they live close to the dam, the dam is higher adjacent to the village than elsewhere. Furthermore, there is no formal warning system in the area.

The construction of the Bamendjin dam brought about floods which affected a number of villages in the Bamboutos, Nun and Ngoketunjia Divisions (A Division being equivalent of the French-Cameroon département). Large proportions of some low-lying villages were submerged by flood waters with Mbissa, a ward in Bambalang, becoming an island. The negative dimensions of this dam provide evidence that it does not represent a success story. Indeed, this dam was not designed to provide electricity to the Upper Nun Valley which it occupies. Rather, its function was as a dry season reservoir for Cameroon's major hydro-electric installation hundreds of kilometres downstream on the River Sanaga at Edea, of which the River Nun is only a tributary. Like in many parts of the world which have experienced the construction of such monumental edifices, these are sometimes referred to as 'planning mistakes' or 'ecological disasters' (Lambi 1999).

It is true that the shear spread of floods and the consequent deposition of silt increases the amount of usable land. The alarming invasion of the lowlands and flood plains by water has increased areas of land under rice cultivation in the Far North and North West regions. Prior to the construction of the dams, rice cultivation was an entirely unknown farming practice (Lambi 1999). The dam thus encouraged, and also reinforced, an agricultural innovation that eventually proved to be a major cash cow for many farmers. This region is one of the areas in Cameroon with a high population density at 99.9 persons per square kilometre (Bureau Général de Recensement 2005). With such a population, far-reaching changes and adjustments came into play with regards to their economic and socio-cultural setting. This new physical environment then called for changes in land use pattern. From this perspective, rice cultivation and fishing were a welcome innovation. On the other hand, the flooding considerably altered former traditional farming and land holding traditions. Besides, everybody in the flooded area was compelled to adjust to the seasonal fluctuations incumbent on the changes in water level. Agricultural practices no longer depended on known seasonal fluctuations in climate, which could be predicted and managed by local peoples, but were dictated by flood patterns that could not be controlled by them. Such changes in the natural environment were compounded by the absence of an environmental impact assessment before the construction of the dam. Indeed only one study was ever conducted on this and limited to the prospects of rice cultivation (SEDA 1978) which itself did not arm the people against the likely outcomes of the project.

These dams have occasioned definite negative effects that are being replicated in new projects. Some of these are: the permanent loss of fertile farming lands to the artificial creation of a vast expanse of water, the permanent and irreversible loss of biodiversity, the creation of a new micro-climate, a change in the socio-economic diversity of the surrounding environs, and the introduction and spread of water-borne diseases. The latter are very well known to constitute a health risk to the inhabitants of the settlements within the vicinity or neighbourhood of these dams where the standing water from the floods provides a breeding habitat for vectors of malaria, schistosomiasis and onchocerciasis (Atangana et al. 1979; Audibert et al. 1990; Ripert 1985).

It is worth noting that the construction of dams in Cameroon is done principally with the motive of improving the provision of energy in response to the needs of communities. These projects which are well-intentioned are unfortunately poorly executed, seldom maintained and often do not account for the environmental repercussions that adjacent communities might face. Cameroon as a country has often been taken aback by a number of floods, disease outbreaks and other environmental hazards which plague communities closer to such giant water projects. This makes planning and disaster risk management very difficult.

Moreover, appraisals of impact on communities are always optimistic. In its evaluation report on the Mape Dam, the African Development Bank (1997:17) held that the socio-economic impact was satisfactory because 'two villages within the [dam] area [had been] electrified…A dynamic economic area [had been] established, comprising fishermen, traders and artisans'. Very often these villages are makeshift camps occupied by occasional migrants who, not being within the resettled areas, are the most vulnerable to the disasters. In the older dam project areas such as with the Mape the additional problem is that 'the financing mechanism of people related activities had not been planned at the time of project implementation' (African Development Bank 1997:17). It was therefore rare to find any concerns about the welfare of resettled people or vulnerable groups in project documents or impact assessment exercises. In this regard, no substantial transformation in livelihoods could be observed beyond incidental activities atunsustainable levels. In the case just cited the African Development Bank reported that in the resettlement area, 'the project had contributed to the development of productive activities generally undertaken by women, namely market gardening as well as fish salting, drying and smoking' (African Development Bank 1997:17). These activities are evidently not engineered by the dam project but are incidental fallouts in terms of precarious coping mechanisms as compared with real losses in terms of farmlands and other assets as a result of resettlement. Moreover, such projects took for granted that communities could be displaced with little option to resist because the projects were created in the name of development. That is why reference to resettled areas and communities do not feature in the assessments. This was evidently a period of a tough top-down administration within the authoritarian regime, which did not pay attention to the interests of local people and was when the World Bank had not yet introduced the conditionality of environmental impact assessment (EIA) or at least it was not yet a universal precondition.

In order to assess the real impact on surrounding communities we may need to revisit the 2012 flood events. On September 6 of that year, the water level was on the rise within the Maga Dam. The retaining dike at Maga, with a critical point of 312.50, went above this point to about 312.76. All valves in this dam were open to send out the excess water. The population was asked to evacuate the area. By 6 September 2012, 3,000 persons were homeless in Maga and twelve deaths were reported. In addition one person was missing and 4,500 were at risk. The situation forced the authorities of SEMRY, based in Yagoua, to open a number of its turbines to release the excess water. However, the canal at Virick was blocked by grass and sand forcing the water to over-flow its beds or banks flooding adjacent villages. Despite efforts made by SEMRY to clear this canal, the situation did not improve. Instead more water flowed in the Maga Dam increasing its level. The population of Maga, to protect their homes, used bags filled with sand offered by the government. This however did not solve the problem.

In the Logone and Chari Division, more than 1,000 people were made homeless. In all, 31,013 people were affected by the floods in this administrative division. In the Mayo Danay Division, flooding occurred between 15 and 23 August and several families faced adverse consequences. In the camp of Gaya in Pouss there were 300 families made up of about 2,500 persons.

In the North Region, four localities were affected in Mayo Rey and Benue Divisions. In Kaikai sub-locality, the people of Sokomai and its environs and some 15 victims from Vele were moved to schools. In this area ten dikes were threatening to give way. SEMRY offered these riverine populations 10,000 empty bags which they filled with earth to temper the advancing waters. In Garoua, 14 people were reported dead, six missing and several houses and property destroyed. Some localities along the bank of River Benue on the way to Mayo Rey Division remained in darkness for weeks following the floods. The heavy rains that affected most of the region completely cut-off access roads to areas such as Poli Sub-Division in Faro Division and the Ray Bouba in Mayo Rey Division from Garoua. In Benue Division, 118 villages were affected by the floods. Apart from several houses that were submerged, school children had to be relocated as water and flood took over their schools.

In 2012, water released from the Lagdo dam flooded surrounding areas including Adamawa State in Nigeria. The flooding resulted in more than ten deaths and loss of properties worth thousands of dollars. A bigger effect of the flooding was however in the lower River Benue region where more than 10,000 homes were submerged for more than two weeks. This left more than 10,000 hectares of farm land flooded and the streets of Makurdi town in Nigeria's Middle belt area were occupied by crocodiles amongst other dangerous aquatic animals. This is not the first time these problems have occurred. Uyigue (2006: 9)reports that the 'Obudu Dam spillway was damaged by storm in July 2003 which resulted in fatal disaster that claimed over 200 houses, several farmlands, settlements and business concerns. The disaster was allegedly caused by the release of excess water from the Lagdo Dam in [Cameroon] which overflowed the Benue and Niger River Banks'.

The floods from the Bamendjin affected the Babessi area where on 9 September 2012. 95 people from 26 families lost their homes while 59 houses and farmlands were totally destroyed.

Official Mitigation Efforts

The initial reaction of government to the affected people of the northern regions during the 2012 crisis was the disbursement of 550 million CFA francs for the acquisition of food, medication and provision for schools and resettlements (Table 4.14). Overall, the amount of relief funds from government amounted to CFA 1.5 billion. In the North Region, the government promised 30 million CFA francs as assistance to victims to take care of their immediate needs. Regional committees for the management of the crisis were set up. Basicrelief health care services were set up by the Ministry of Public Health in Pouss where medicines and health relief personnel were dispatched. A thousand improved housing facilities were provided by MINEPDED. The Ministry of Livestock made medication available for cattle while the defence ministry gave tents, medicine, school equipment, basic food items, bed covers and trunks to transport aid to the victims. Non-governmental organisations also assisted the people affected by this ecological catastrophe. Financial and material assistance for the floods in the North and North West Regions came from the President of the Republic, the Ministry of Territorial Administration and Decentralization (in-charge of disaster mitigation), the United Nation High Commission for Refugees and the Government of Morocco. Military engineering corps and health personnel were mobilised to erect tents, dig bore holes and provide basic sanitary facilities and dispensaries. As a result of the severity of the problem in Babessi, about 40 hectares of land was carved out for resettlement by government authorities.

Table 4.14: Distribution of financial assistance according to surrounding communities

Sub-division	Empty bags	Tents	Financial assistance (CFA)
Kousseri	6,000	100	120,000,000
Blangoua	3,000	0	42,400,000
Logone Birni	3,000	0	54,000,000
Hile-Alifa	2,000	04	64,600,000
Goulfe	2,000	02	63,600,000
Makary	4,000	06	68,900,000
Fotokol	2,000	02	25,500,000
Waza	1,000	02	27,500,000
Zina	2,000	04	27,500,000
Darak	5,000	0	54,500,000

Source: Cameroon Tribune No 10207, 25 October 2012, p. 5.

Beyond these immediate relief measures we need to understand permanent measures taken to mitigate possible problems of this nature occurring in future. It is understood under Cameroon Law that dam owners are responsible for the safety of their dams. In the case of the Maga Dam, this is ultimately owned by the Ministry of Agriculture through their subsidiary SEMRY. Although there is no formal safety plan at Maga, daily records are kept of the reservoir level and periodic inspections of the embankment are done. Warning systems work best when they provide local people with advance notice of a possible emergency so that they can retreat to a safe-haven on adjacent high ground. The only crude method of monitoring is the vigilance of the local people. To make matters worse, there is no adjacent high ground to which people can retreat. The construction of the 85 kilometre dike and the 27 kilometre long dam at Maga to control floods in the 1970s had temporarily mitigated the effect of the problem for some time. However, about forty years later, these buildings have considerably depreciated and become dilapidated due to age and lack of adequate maintenance. The dike on the River Logone is made up of three sections:

- the first section built with compact soil at a distance of 45 kilometres from Diguim to Begue-Palam;
- the second section built with non-compact material over a distance of about 30 kilometres from Begue-Palam to Pouss;
- the third section, built in the 1950s, goes from Pouss to Tekele over a distance of 29 kilometres.

Three factors explain the yearly rise in water levels be it in the River Logone or the Maga Dam. These include the high amounts of rainfall which were recorded here in the past year, the early arrival of heavy rains and the building (by neighbouring

Chad) of a parallel dike on the right bank of the River Logone. Consequently the rising waters of the Logone naturally discharge part of their surplus on the Cameroonian side, with the Chadian side being well protected. The seriousness of the floods partially due to the obsoleteness of the aforementioned defects necessitates action. This includes strengthening the dike along the River Logone from the extreme northern part of Cameroon (from Maroua to Kousseri), the rehabilitation of the dike at Maga, the dredging of the Mayo Vrick, and in the medium term the dredging of the Maga Dam. These flooded areas will provide fertile land for agriculture and this certainly augurs well for the rice, wheat, and other crop farms in this region. On the other hand, when the floods occur, water sources are polluted. Given the fact that cholera has created much desolation during the last two years in the northern part of Cameroon, it is feared that the recent floods could easily leave behind the same situation. The flood prone areas may also provide breeding grounds for mosquitoes with malaria as an attendant consequence.

The annual budget available for the maintenance of all ten dams managed by the Ministry of Agriculture in Cameroon is CFA 200 million. The exact amount allocated to Maga, Lagdo and Bamendjim Dams was not available to us at time of this study but assuming that all their dams face similarly acute problems, it should approximate to CFA 20 million or US$27,000. Funds allocated are not sufficient and there seems to be no monitoring system on the effect of climatic variations. There are two main threats facing the integrity of the dam. These are continued erosion of the upstream face and crest of the embankment due to wave attacks at high reservoir levels. If this continues unchecked it may result in one of the following: overtopping, sliding (failure) of the downstream slope, piping failure and overtopping of the embankment by a severe flood which would probably result in a breach of the dam.

It is important to note that the creation of these dams has been paid for with special development funds whose beneficiaries should have been the affected people. In principle, these special development funds can be critical resources for social development programmes in the communities affected, which are essentially poor. However, in practice, the situation is a far cry from that. There were reports of misappropriation of funds and non-compensation of some of the flood victims in the case of the Bamendjin dam. Human victims of dam projects are the unfortunate people whose homes are flooded and are forced to live a new way of life in their newly created resettlement areas as experiences from Cameroon show (Diaw 1990).

When the rains become too heavy and intense, as has been the case in recent years in the northern regions of Cameroon where a fragile ecological system has regularly caused rivers and other waterways to outflow their banks, there are tales of hardship including loss of life through drowning or of villages swept being away by running water. The region is, for the most part of the year, exposed to drought, and farmers and stock-breeders have to rely on the few months of the year when there are rains, to carry out their sustenance activities. However, when rains come at the same time, as in 2012, the rivers become a source of real danger. This often leads to humanitarian crises given the number of people affected and the contingency measures put in place which are far from adequate to properly address the problems. This is therefore the most propitious moment to take durable measures to pre-empt dangers to the environment and communities in the event of a failure of such structures. It is not enough to resettle people. Governments need to take steps to protect communities through measures they cannot afford themselves and educate them about the risks of living in dangerous zones. In that way, they can take ownership of their new environments, understand the real dangers and avoid a situation wherein, every year, governments rush in to provide temporary measures. The new projects are factoring these into their implementation programmes, as in the case of the Lom Pangar project, which has projected its GHG net emissions as against the ability to save the same and concluded that it is in its favour 'especially considering that its construction opens the door to a larger resource mobilization on the Sanaga' (EDC 2012: 17). It is also definitely aware of some permanent negative impacts such as 'increased pressure on land, increased land clearing, agricultural intensification and soil degradation' (African Development Bank 2012: 12). The few families that have been resettled have been so 'with their consent' (ibid.). A 'Local Community Development Support Plan' (involving 8000 people) is also envisaged (ibid.: 13). While their outcomes are expected, this is just what was lacking with previous projects.

The Ministry of the Economy, Planning and Regional Development has come up with its own emergency plan to address the immediate needs of the embattled people of the flooded areas in the North and Far North Regions. A number of measures have been envisaged to control the situation. It must be noted that no durable system had ever been used to ensure that the waters of the River Logone and Lake Maga are kept under control. Rudimentary technology has often been used to keep the waters away by the use of mud which could only but cede under pressure from mounting water. The dangers posed by the rising level of water can only be grasped by looking at other parts of the world where similar situations have caused considerable harm to human settlement and real humanitarian concerns.

A critical examination of policies executed so far reveals their shortcomings and the need for redress. There is an urgent need to integrate durability as a cornerstone of any attempt to correct the situation and plan for the future. Structures such as dykes should have a life span long enough to avoid keeping policy makers or local administrative and political authorities constantly on the alert. It is necessary to take measures that physically endure in the long term; just as it is also necessary to be more proactive in all other approaches. In a bid to contain flood threats, the Ministry of the Economy, Planning and Regional Development announced work on the protection dikes on Lake Maga in Mayo Danay Division of the Far North Region in 2012. It is still too early to say whether this will pre-empt the type of disaster witnessed in 2012. In the short term, funds have been disbursed for the treatment of the critical points of the protection dyke on the shores of the Logone River. Also, funds have been allocated for the clearing of the bed of the River Vrisk that evacuates water from Maga retaining lake. As a medium term measure, the protection dike along River Logone and the Maga dam wall are being stabilised using appropriate techniques.

Conclusion

Although dams are critical to the supply of hydropower, their adverse effect on environments and surrounding communities calls for action. One way is to think about the need to exploit other options of energy supply that are more environmentally friendly than dams. These alternative options may include wind power, solar energy, biomass and wave energy systems. The older dams need to be assessed for their environmental impact and certainly rehabilitated if they are to continue to operate. In these re-evaluations, the vulnerability of communities must be factored in. There is also need for early warning and monitoring systems to forestall catastrophes of the type that result from climatic vagaries. Lastly, more viable resettlement schemes must be developed, even for the older projects.

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