Integrated River Basin Management of the Sanaga River, Cameroon

Benefits and challenges of decentralised water management

by Jaap van der Waarde

1. THE SANAGA RIVER BASIN

The Sanaga River is the largest river in Cameroon and its basin covers almost a fourth of the country (Figure 1). It flows for 918 km from its source on the Adamawa Plateau to the mouth at the Atlantic Ocean near Douala and covers a drainage basin of about 140,000 km2. The average flow of the river is 2072 m^3/sec with a minimum flow of 473 m^3/sec in March and a maximum from August to November of 5700 m^3/sec. The river flows through 6 of the 10 provinces of Cameroon: Adamawa, North-West, West, East, Central and Littoral Provinces. Two hydropower plants have been installed on the Sanaga which produce some 95% of all electricity consumed in Cameroon. Three dams have been constructed on the river to create reservoirs in the headwaters providing sufficient flow in the dry season to allow power production. Population density in most of the basin is medium to low, possibly some 5-10% of the population of Cameroon of 16 million people live in the Sanaga basin.

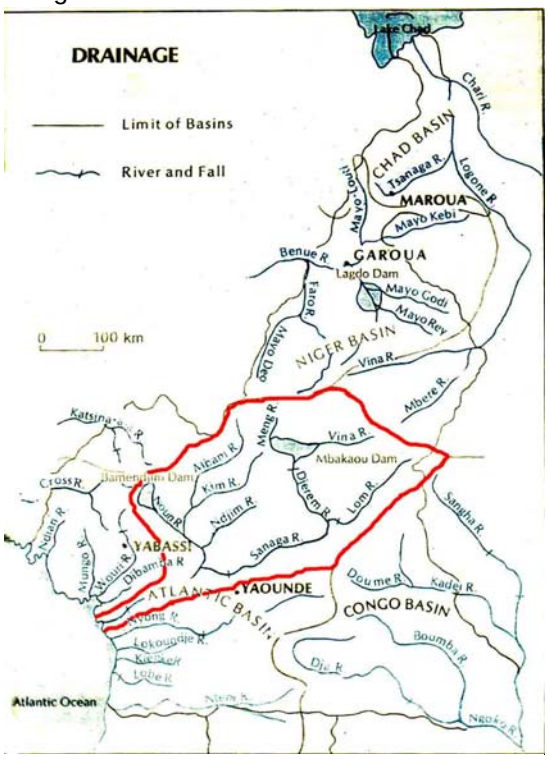

Figure 1 The Sanaga basin

The main source of the Sanaga is on the Adamawa Plateau situated at the centre of the country and with an average altitude of 1100 meters. The vegetation is mainly savannah grassland combined with woodland and gallery forests in the steep valleys. The region has a humid tropical climate with a dry season of 5 months and rainy season lasting 7 months, annual rainfall is between 1500 and 2000 mm/yr. In the dry season there is virtually no rain and most of the region is burned by local graziers to stimulate growth of fresh grass when the rains come. The average temperature is 21°C, daily maximum is 30°C throughout the year. The area is sparsely populated, wuth the main tribe, the Fulbe (Fulani) who are muslims practising a nomadic or sedentary livestock rearing lifestyle. Adamawa is home to large ranches for cattle rearing and produces 80% of all cattle in Cameroon. Limited shifting agriculture is practised with maize as the main crop.

The main tributaries in Adamawa are the Lom to the South and the Djerem to the North. The Mbakaou reservoir (2.6 billion m^3) in Djerem stores water for power production in the dry season. The Lom and Djerem converge into the Sanaga, flowing through the Southern plateau, a hilly landscape with volcanic domes. Annual rainfall in this part of the basin is between 1500 and 2000 mm/yr which falls in two distinct rainy seasons, a short season from March-April and a second, heavier, from September to October. The original vegetation on this plateau is equatorial rainforest and this still covers large tracts of the plateau. These forests are rich in biodiversity including lowland gorillas and chimpanzees. Human settlements have led to clearing of the forest to make way for agricultural lands. The area is moderately populated (20-69/km^2) with subsistence farming the main activity (slash-and-burn, followed by shifting cultivation). Cassava, plantains and jams are the main staple crops. Around Obala in the central province, small holder cocoa is an important product. Near Mbandjock major sugar cane plantations and processing industry is located. Song Loulou has the biggest hydropower plant in Cameroon with a capacity of 384 MW.

The Mbam originates in the Western Highlands and joins the Sanaga some 80 km upstream from the mouth of the river. This tributary provides some 37% of the flow of the Sanaga at the river mouth. Rainfall in the Highlands is between 2000 and 4000 cm/yr, with one rainy season that lasts from April to September and a cool climate. The Highlands are a biodiversity hotspot and home to an exceptional range of endemic species of plants and animals. The soils are highly fertile and the climate favourable for cattle rearing and crop

production. This is one of the most populated regions in Cameroon (> 60/km^2) and the main vegetable producing region in the country. Maize is the main staple crop but higher value crops like potatoes, ground nuts, tomatoes, carrots and other vegetables are produced, even for export. At Baffoussam a large brewery is located. In the Ndop valley the Bamenjin dam forms a storage reservoir for hydropower production (1.8 billion m^3). The Ndop valley is one of the biggest rice producing areas in Cameroon. Further upstream on the Mbam the Mapé reservoir (3.2 billion m^3) also provides a storage reservoir for hydropower. The people in these areas are called semi-Bantu, of which the Bamilike live around Bafoussam and the Tikar in the Ndop plains and northern Highlands. The Bamilike are industrious people and many of the business elite in Cameroon are from this tribe.

Further downstream the Sanaga flows to the Douala basin, a very low depression where most of Cameroon's rivers join the Atlantic Ocean and an area of extensive sedimentation. Rainfall on this coast is among the highest in the world and exceeds 4000 cm/yr. This area is part of the Cross-Sanaga-Bioko Coastal Forests ecoregion, comprising lowland and coastal forests and mangroves, with a very high animal biodiversity and a regional centre of endemism. Downstream from Edea, the Sanaga winds through extensive sand areas covered with swamp forests, an area very rich in birdlife and home to a sizeable population of West African Manatee. Part of this region, the Lake Ossa complex, is protected as a faunal reserve while the lower reaches of the Sanaga pass through the Douala-Edea forest reserve. The coastal beaches are important breeding grounds for various species of sea turtles. Only the first 20 km of the Sanaga up to Edea are navigable. Edea is home to the second biggest hydropower plant in the country (265 MW). The ALUCAM aluminium smelter in Edea is dependent on the Sanaga for process water and is also the single biggest energy consumer in Cameroon. The lower reaches of the Sanaga including its estuary are sparsely populated (< 20 /km^2) with the local population engaged in bivalve harvesting from the river and fishing. Large plantations exist of oil palm and rubber, notably around Dizangue near the Lake Ossa complex. The coastline is mostly inhabited by foreign fisherman, originating from Nigeria, Benin, Ghana and Togo fishing along the coast in larger fishing boats. Many of these people are illegal, transient settlers and their activities are mostly illegal, their settlements cut-off from basic needs like drinking water, health care and power.

Each province of Cameroon is under the jurisdiction of a governor appointed by the head of state. The province is divided into divisions and subdivisions, headed by a Senior Divisional Officer and a Divisional Officer respectively, all representing the central government in Yaoundé. At local level, the council by contrast is a directly elected body consisting of an elected mayor who in turn selects his/her councillors through a system of regional representation. At the local level the traditional authorities often have a strong say in local affairs like land dispute and water catchment protection. Villages can obtain long term ownership and manage smaller catchment areas as part of village water supply systems.

2. RIVER BASIN MANAGEMENT ISSUES

There are several issues in the Sanaga River basin related to water use and water shortage that have an impact on economic growth, the population and the environment (Figure 2).

Hydropower. The Sanaga River is the main source of hydropower in Cameroon. AES-SONEL, a joint venture between the Government of Cameroon and the American company AES, expects to more than double its electricity connections throughout the country by 2021. The biggest user of electricity, the ALUCAM aluminium industry, also intends to more than double its production in Cameroon. The power required should come from the planned Lom Pangar dam in the Sanaga River and a new hydropower plant and dam at the Nachtigal Falls in the Sanaga. The Lom Pangar dam will flood parts of important gorilla habitat and parts of the Chad Cameroon pipeline which has raised concerns with the World Bank and other NGOs. The economic benefits of the ALUCAM extension for Cameroon have not been explained in detail. ALUCAM receives electricity at a price far below the commercial rate while there is a general electricity shortage in the country. Extension however would lead to job creation while the dam would produce additional power to improve and extend the existing electricity supply in the southern part of the country. The Worldbank and partners have insisted on a better needs assessment and evaluation of alternatives.

Water for irrigation. Several agro-industries exist in the Sanaga River basin, such as sugar cane, tobacco, rice, vegetables and cattle rearing. Irrigation agriculture is still sparsely developed and water consumption in these sectors is highly likely to increase. Rice production in the Ndop valley has decreased over the years for

various reasons, including water shortages. The nearby Bamenjin reservoir however was never constructed with irrigation in mind, and the ricefields are upstream make the reservoir unsuitable as source of irrigation water. The water levels in the other reservoirs are also managed for hydropower needs without clear integrated uses and probably leave room for increased water use efficiency.

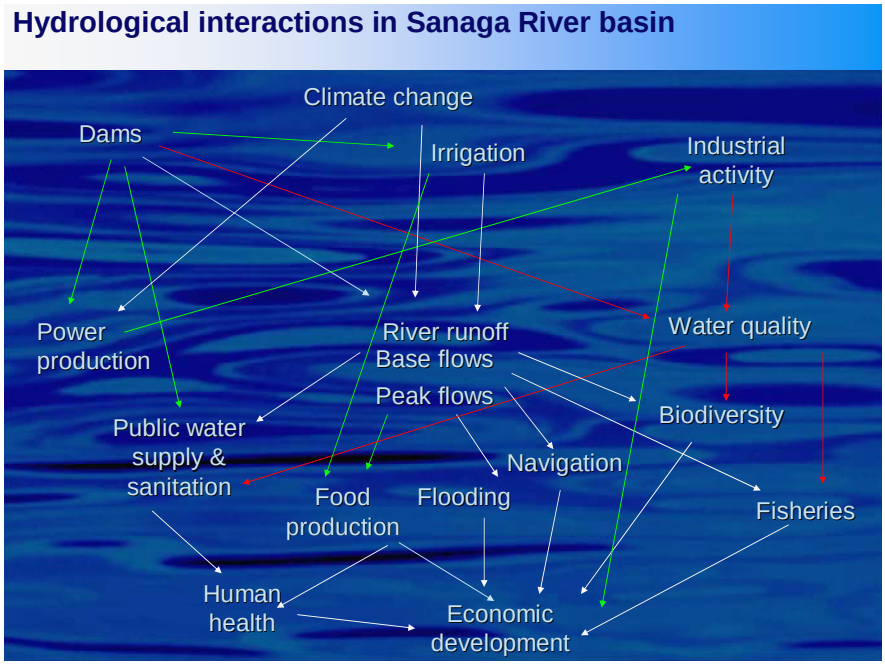

Figure 2 Sanaga River basin interactions. Green arrows: positive effect; red arrows, negative effect; white arrows: positive or negative effect.

Drinking water. Large areas of Cameroon experience drought during the dry season. In the headwaters of the Sanaga, councils buy water and trucks distribute water to affected villages. The national water company SNEC faces difficulties in maintaining water pressure in the main cities throughout the year. Water shortages are made worse by poor land management and farming methods like felling and burning of forests. Cameroon is in the process of privatising the urban drinking water sector and this year laid out the sector policy for decentralised urban drinking water supply.

Industrial needs. There are few industries located at the Sanaga River. One big water user, the paper industry CELLUCAM, went bankrupt years ago due to mismanagement. The brewery in Bafoussam uses groundwater but the sugar industry is dependent on the Sanaga. The potential for increased (agro) industrial development is there and river management of the Sanaga should take into account its effect on future industrial developments.

Poverty alleviation. The majority of people in the Sanaga Basin lives by subsistence farming and fishing and are poor. These people need the river and its associated wetlands for domestic use, for fish, as source of fertilizer for their lands during floods, for sand extracted from the river bottom as building material. The reservoirs are heavily over-fished, often by fishers originating from other parts of the country while the local population does not benefit.

Environmental needs. The biodiversity values of the Sanaga and its environs are among the highest in Africa. Most of these areas are under pressure due to over-fishing, logging, hunting and habitat destruction. Changes in the flow of the river will affect the downstream habitats, important for threatened birds and protected manatees. The Lom Pangar dam will flood Gorilla habitat and increase chances for encroachment and illegal activities in these forests. Water quality is probably effected by pesticide use in the plantations, chemicals against river blindness that are applied in the reservoirs and sediments wash into the rivers due to poor land management, information on water quality however is largely lacking.

3. CHANCES FOR INTEGRATED RIVER BASIN MANAGEMENT OF THE SANAGA RIVER

Triggers for change

The aim of Integrated River Basin Management (IRBM) is to ensure multifunctional use of a river and its basin for present and future generations. The Sanaga River faces many challenges that could properly be dealt with using an IRBM approach. Typical examples of these triggers for change towards IRBM that apply to the Sanaga River are conflicts of interest between upstream and downstream users, the need for integration and collaboration between sectors, the benefits of placing decision-making at the lowest appropriate level, the need

for stakeholder participation and decision making and last but not least the need for an effective system of water pricing and cost recovery. IRBM is generally identified at four levels: (1) operational management, (2) planning, (3) analytical support and (4) the institutional framework. This chapter discusses planning and the institutional framework of water management in the Sanaga Basin and evaluates the benefits of IRBM for the Sanaga River.

Driving factors

The driving factors for IRBM in Cameroon are found at different levels. At the international level, Cameroon has pledged to develop a policy on Integrated Water Resources Management (IWRM) as a result of the World Summit on Sustainable Development in 2002. The Dutch Government has provided technical and financial support to Cameroon through the Global Water Partnership in 2005 to set up a framework to develop such an IWRM policy. In Central Africa, 5 countries are developing a water policy (with support from the French Development Cooperation) dealing with regional water management. In the Sanaga River basin, there are several issues that could drive the process of IRBM and IWRM, summarized in Annex 1. Two categories of pressures should be highlighted here. *Demographic patterns and trends* can move towards higher population densities in the Sanaga Basin. Increasing water scarcity in the Northern Provinces may result in people moving south to the Sanaga Basin which currently is moderately to sparsely populated. Already most fisherman e.g. around the Bamendjin reservoir in the North West Province originate from the North. For Cameroon, the possibility of inter basin water transfer from the Congo to the retreating Lake Chad is therefore of major interest. *Resource use patterns and trends* show a continued drive towards logging of valuable timber, followed by subsistence farming on marginal lands and land degradation. Nationally and globally the need for crops (e.g. maize, manioc, onions), fruits (e.g. plantain, pineapple), flowers and more recently biofuels have sparked developments in the region that may well expand in the Sanaga Basin in the near future leading to increased water demand.

Planning for water management

Currently the process to come to an IWRM plan in Cameroon has increased speed with the installation of an Inter-Ministerial Committee on IWRM with a technical committee placed at the level of the Sub-Direction of Urban Water Supply and Sanitation. Planning can support IWRM in several ways: (1) it helps to identify problems and opportunities at an early stage, (2) an open and participatory planning process may increase support and acceptance of the final plan by all stakeholders and (3) it brings different water managers together resulting in knowledge sharing and better plans. A first inventory of problems and opportunities was made by the Cameroon Water Partnership (CWP) funded through the Dutch Water Initiative for Africa. This inventory is in the process of being refined by the inter-ministerial committee in collaboration with the CWP.

The next main step in policy development, stakeholder participation, is planned. A stakeholder analysis of water users in the Sanaga River Basin is presented in Annex 2. The largest group of stakeholders is formed by the local population dependent on river- and groundwater for drinking, artesianal fishing and mostly subsistence, rain-fed agriculture. These people are directly dependent on the water for their livelihood but are not or poorly organized. Equally at local level, the councils and traditional authorities have the task to serve the interest of the local population and can grant water use rights in water catchment areas for village water supply. These Water Management Committees own their catchments and have the duty to manage it for the public interest and also collect their own water user fees. The bigger water users, notably irrigation agriculture and industry, deal directly with the ministry of Energy and Water and pay water use taxes to the state. Monitoring of water quantity and quality appears to be a responsibility shared between the environment ministry (MINEP), the Ministry of Energy and Water and the Centre for Hydrological Research of the Science Ministry.

It will be a challenge to get all stakeholders properly involved in the planning process, but essential nevertheless. The biggest water users, most of them partly or majority owned by foreign businesses, have so far shown little interest to participate in the IWRM process. Possibly their benefit of joining in this process is not clear or insufficient. External drivers (changes in legal and fiscal framework, access to investment loans e.g.) or internal drivers (corporate policies regarding social and environmental responsibility) may change this situation. The local population is poorly organized and integration of these groups into a participatory decision process needs formation of groups of stakeholders at local level, sensitization meetings at local level, time and money.

Next, a comprehensive and participatory assessment of the full range of policy, institutional and technical options needs to be done. Alternatives to large projects, like e.g. the contemplated cross-basin water transfer to Lake Tchad or the planned hydropower constructions on the Sanaga River, do often exist and the needs for water, food and energy need to be assessed to support the right choice. Ecological integrity of river systems needs to be assured for the benefit of downstream ecosystems and communities that depend on them. A transparent benefit sharing mechanism should be put in place, with clear and legally binding mitigation measures or compensatory settlements for negatively impacted people. An appropriate mix of regulatory and non-regulatory measures, including incentives and sanctions, and ensuring compliance with these measures, can finally help to build confidence and support for the implemented policies.

Institutional framework.
Water management in Cameroon is highly centralised and the water law of 1998 lays out the general tasks and responsibilities for the state in this field. The law has several texts of application, and according to officials many more are in the process of being discussed or drafted. The urban drinking water sector is currently in the process of reorganisation and decentralisation of responsibilities to concession holder CAMWATER, with a privatised operator of the network facilities FERMIER. Financing upgrading and extension of the national urban drinking water supply sector is budgeted at national level with strong international donor support. Water use for commercial purposes is regulated through several decrees of implementation in which the taxes for installing a water extraction unit and unit prices are described. The tax is based on the volume of water extracted and the quality (nitrogen, suspended matter, organic material) of discharged water, all payable to the state through the ministry of water. The ministry of water has a separate account to receive money for projects dealing with sustainable water development and water purification, most likely to be funded externally.

Management tools to influence water demand are largely lacking. The tax base decreases with increasing water use, which does not stimulate reducing water consumption. There is no increment in the tax base with increasing concentrations of contaminants in effluents, nor maximum limits, giving no incentives to reduce water contamination. The existing legal and institutional framework typically follows a sectoral and centralistic approach with no or little room for decentralised water management, apart from local (village) drinking water supply schemes.

Barriers and opportunities
As for now, there is no vision on water management for the Sanaga River basin. There is no (publicized) long term strategy for electricity production, and no basin wide planning of water needs. The needs and benefits of different forms of water use in the basin, e.g. hydropower production, aluminium smelting, irrigation farming etc, are not clear and transparency and provision of information about these sectors is poor. Collection of water-related data in the Sanaga Basin by the government is very limited, probably AES-SONEL, ALUCAM, and SNEC collect data but these are not available in the public domain. Cameroon has limited experience with participatory decision making processes and e.g. public participation in Environmental Impact Assessment has proven to need more input from the state and economic actors to become really effective.

The aim of the current IWRM planning process is possibly not to decentralize water management in Cameroon. Costing of water services may well remain at the national taxation level, not through a decentralized body that collects its own user fees. Other, existing organizations and programs implementing decentralization (e.g. FEICOM, MIDENOU, GP-DERUDEP) have been slow to achieve results on the ground. Privatization on the other hand, like e.g. the case of the electricity company SONEL, has resulted in fast changes but these were not always beneficial to small and medium size consumers. Decentralizing water management in Cameroon therefore will need time, resources and perseverance from stakeholders, including the state. The benefits for decentralization of water management however are significant: better integration of water storage, fishing and irrigation agriculture around the reservoirs; bringing upstream and downstream users together to manage flows in the river allowing various forms of water use along the river while sustaining ecosystems and livelihoods downstream; introduction of water demand management with direct benefits for local stakeholders etc. All lead to a more efficient, sustainable and equitable use of water resources.

4. CONCLUSIONS
Moving from a situation where major decisions regarding the water sector are taken almost entirely at the central government level with little public participation towards a system of integrated river basin management with decentralized powers and based on participatory decision making, needs a different approach to

governance in general. This process is more or less dependent on ongoing decentralization efforts in Cameroon including regional development, council financing and the drinking water sector. The creation of a vision on IWRM is only possibly in an environment of full participation of equally empowered and properly informed stakeholders. The current IWRM planning process is a promising approach but needs dissemination of information and capacity building of poorly organized and poorly represented stakeholders like farmers, fisherman and the environment. A participatory needs assessment and evaluation of alternatives in this planning process is essential.

IRBM has several compelling benefits for the Sanaga River basin and should be seriously studied. The planned construction of new hydropower facilities on the Sanaga River may act as a catalyst to design an IRBM policy for the Sanaga River, with budgets from international financing organizations to facilitate public participation. A pilot study on the Sanaga River basin (or other pilot sites) can than be used to design and implement successful decentralized river basin management bodies across Cameroon as part of a national IWRM strategy.

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The following people were interviewed in the course of this study:
Hycinth Banseka, Global Water Partnership Cameroon; Jacques Dubuc, ALCAN; Terri Hathaway, International Rivers Network; Jean Pierre Bidjocka, Ministry of Energy and Water resources; Gregory Niba, formerly UNVDA (rice cooperative near Bamenjin reservoir).

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Annex 1. Threat analysis Sanaga River Cameroon

Causes of the key problems	Scale of pressure	Underlying causes	Possible responses
Increased water consumption	Irrigation agriculture, drinking water production, industrial water use are all increasing. Smaller rivers and marshes are drying up, water shortages are becoming more frequent, extensive and severe in the dry season.	Population growth. Growing economy. Poorly regulated and enforced water use policy. Inefficient water consumption (leaking pipes, non-economic industrial processes, lack of water demand policy instruments).	Implement water demand policy with proper instruments (subsidies, taxes, permits).
Alternation of the natural hydrological regime	New hydropower dams will change flows to an unknown extent. Changed flows will effect fisheries, bivalve harvesting, biodiversity.	Increased demand for electricity to electrify the whole country. Increased electricity demand by Aluminum smelter.	Alternative energy policy, site selection or mitigation of effects.
Changes in sedimentation	Clearing of riparian vegetation upstream leads to increased run-of and silting up of reservoirs. Reservoirs reduce sediment transport downstream leading to erosion of the riverbed downstream.	Poor land-use planning and enforcement. Limited sediment control in reservoir management.	Capacity building of local actors, land use planning. Improve law enforcement. Reservoir management and environmental flows.
Loss of natural resources	Unsustainable fishing in river and reservoirs leads to loss of biodiversity. Lakes have been stocked with exotic fish, leading to extinction of local fish. Uncontrolled mining of sand from rivers.	Population growth. Unsustainable fishing techniques. Lack of capacity with local population and administration.	Capacity building to improve fishing techniques. Landscape use planning. Improve law enforcement.
Pollution	Unknown. Possibly extensive, particularly downstream from major industries and plantations.	Incomplete environmental legislation, insufficient monitoring and enforcement, lack of felt need.	Provide data and expertise for new text of application regarding environmental norms. Strengthen or initiate environmental monitoring program.
Loss of biodiversity in the river	Migratory fish are blocked by dams. Birds breeding on sandbanks loose suitable habitat. Manatee population may be effected. Reduced sedimentation negatively impacts bivalves (shells) and thus riparian communities and birds.	Dams, need for electricity.	Study impacts. Identify most sensitive components of biodiversity. Identify actions in river management that can remediate or prevent these effects, e.g. guarantee minimal base flow in certain periods of the year.

Annex 2. Stakeholder analysis Sanaga River

Stakeholders per category: **1. Water shortage**	'Stake'	Importance in relation to key problems	Potential role
Makes use or benefits from NR Communities upstream. Farming cooperatives (rice). Grazier communities. AES SONEL. SNEC (CAMWATER, Fermier). Ecosystems (represented by NGOs).	Communities need the water to live. Farming cooperatives like UNVDA need the water to irrigate their crops. Graziers need the water for their cattle. AES SONEL gets silt in their reservoirs, loosing capacity, and loose water due to unsustainable use upstream. The drinking water utilities provide urban and peri-urban water. Ecosystems need water to function.	Communities are the main beneficiaries but also cause much of the problems. Farmers and graziers are effected in their income. AES SONEL faces increased costs and profit loss. Drinking water utilities face shortages in the dry season, reduced water quality, higher costs. Ecosystems have important livelihood functions.	Communities develop vision about effective water use, training in sustainable techniques. Cattle farms professionalize water management. AES-SONEL possibly pays for environmental services. Drinking water utilities invest in technology. NGOs can provide information about minimal ecological water requirements.
Responsible for NR Local councils. Traditional authorities. GoC. AES-SONEL.	Local councils serve the population and implement 'water policies'. Traditional authorities distribute user rights of land and associated water. Provincial delegations implement and control national guidelines. GoC designs and implement laws and policies. AES-SONEL manages the water levels in the reservoirs and Sanaga flows for power production.	Traditional authorities have a major influence on local communities. Councils can stimulate or prevent developments affecting water use. Provincial delegations can support councils in local policy developments, mobilize funds. The GoC can adopt national laws and regulations setting working frameworks for lower authorities. AES-SONEL has the power to manage flows in the Sanaga with consideration of other users.	Traditional authorities can place bans on non-sustainable agricultural methods and abstain from giving vulnerable lands out for farming. Councils adopt local policies dealing with water management, perform capacity building of local actors including Water Management Committees. Provincial delegations implement and promote national laws and regulations at local level. The GoC to review its legislation dealing with water use, including water demand policies and decentralizing powers and responsibilities. AES-SONEL can adjust their water management or mitigate its effects. Many of these responsibilities could be transferred to a to be established Sanaga River Basin Authority.
Specific interest in the problems NGOs working on water supply or biodiversity conservation. Agricultural	International NGOs, embassies that support water supply projects can be supportive of activities leading to	Decreasing water shortages will have a beneficial effect on the environment as a whole.	Co-fund specific activities. Lobby at regional, national and international level. Facilitate the

cooperatives.	increased water supply and decreased habitat loss. Conservation NGOs will be interested joining activities that lead to habitat restoration and protection. Farming associations may want to be involved as they have members in the area or may want to learn from the activities.	Implementation of international agreements (MDGs, Ramsar etc).	process.
Has most knowledge or is most capable. International NGOs (WWF, WCS, SNV, FAO etc). Research institutions (IRAD, CRH).	Want to achieve development goals. Want to disseminate knowledge, gain projects.	Cannot prevent problems, but can provide valuable information to steer decision making.	Can help with sustainable farming-conservation techniques, provide data on the river.

NR: Natural resource