

# Integrated water resource management: Gaps and challenges from stakeholders of the Mou-Nkier watershed, North West region, Cameroon

Tsi Evaristus Angwafo<sup>1\*</sup>, Vernasius Nyambi Mbufung<sup>1</sup>, Alvine Larissa Meyabeme Elono<sup>1</sup> and Mathias Fru Fonteh<sup>2</sup>

<sup>1</sup>Department of Forestry, Faculty of Agronomy and Agricultural Sciences (FASA), University of Dschang, P.O. Box 222 Dschang, Cameroon.

<sup>2</sup>Department of Agricultural Engineering, Faculty of Agronomy and Agricultural Sciences (FASA), University of Dschang, P.O. Box 222 Dschang, Cameroon.

Accepted 21 June, 2016

---

## ABSTRACT

Investigation on the gaps and challenges of integrated water resource management faced by stakeholders of the Mou-Nkier watershed was conducted during the period of January to June 2015. The aim is establishing a database for the sustainable management of water resources within the Mou-Nkier watershed. The method of World Wildlife Fund (WWF) was used to identify stakeholders involved. Results revealed that the main activity that depends on water was farming. The water needs in m<sup>3</sup>/day were estimated to be as follows: 2,522,317 for irrigation, 2562 for domestic use, 280 for livestock and 14.95 for services. Out of the 48 stakeholders in the Mou-Nkier watershed, seventeen were government institutions (35.4%), fifteen were NGO's (31.3%), seven private institutions (14.6%), eight international organizations (16.7%) and other organizations (2%). The interaction amongst the stakeholders was weak. Out of 300 people interviewed, only 25 understood the concept of Integrated Water Resource Management (IWRM) and their level of involvement in the water resources management was very low. After explaining how the method operates, 295 persons agreed it was an appropriate method to tackle their water resources problems. Water is generally abundant during the rainy season and becomes a very rare commodity during the dry season. This has led to problems such as erosion, water borne diseases, floods and the loss of properties and lives.

**Keywords:** Integrated water resources, gaps, challenges, stakeholders, watershed, Cameroon.

---

\*Corresponding author. E-mail: tsievaristus@yahoo.co.nz.

---

## INTRODUCTION

Water is one of the vital natural resources, a key driver of socio-economic development and the natural resource that sustains every form of life on earth (Kristina and Heather, 2015). More so, it provides complex networks between natural resources and human beings since agricultural, industrial, domestic, recreational, environmental and human activities directly or indirectly depend on water and its resources. A watershed can be defined as the area of land where all of the water that is under it or drains off it goes into the same place (USEPA, 2012). According to Suhas and Kaushal (2001),

watersheds are not simply the hydrological unit but also socio-political-ecological entity which plays crucial roles (determining food, social and economical security and provides life support services to rural people). Looking at the above definitions, a watershed can be seen as an area of land, a bounded hydrologic system, within which all living things are inextricably linked by their common water course, where humans settle and where simple logic demanded that they become part of the community.

The quality and quantity of water on a watershed may

differ from one area of a watershed to another due to the different activities on the watershed (Mengnjo et al., 2013). In Mou-Nkier, different human activities are carried out on different areas of the watershed (cattle rearing and gardening are done on the hills while rice farming, maize cultivation and huckleberry farming are done in the valleys) (Kometa and Ashu, 2012). By so doing, problems arise on different areas on the watershed and the traditional management approach based on point problem solving is employed which is not responding adequately. To solve these problems, the Integrated Water Resource Management (IWRM) approach should be employed.

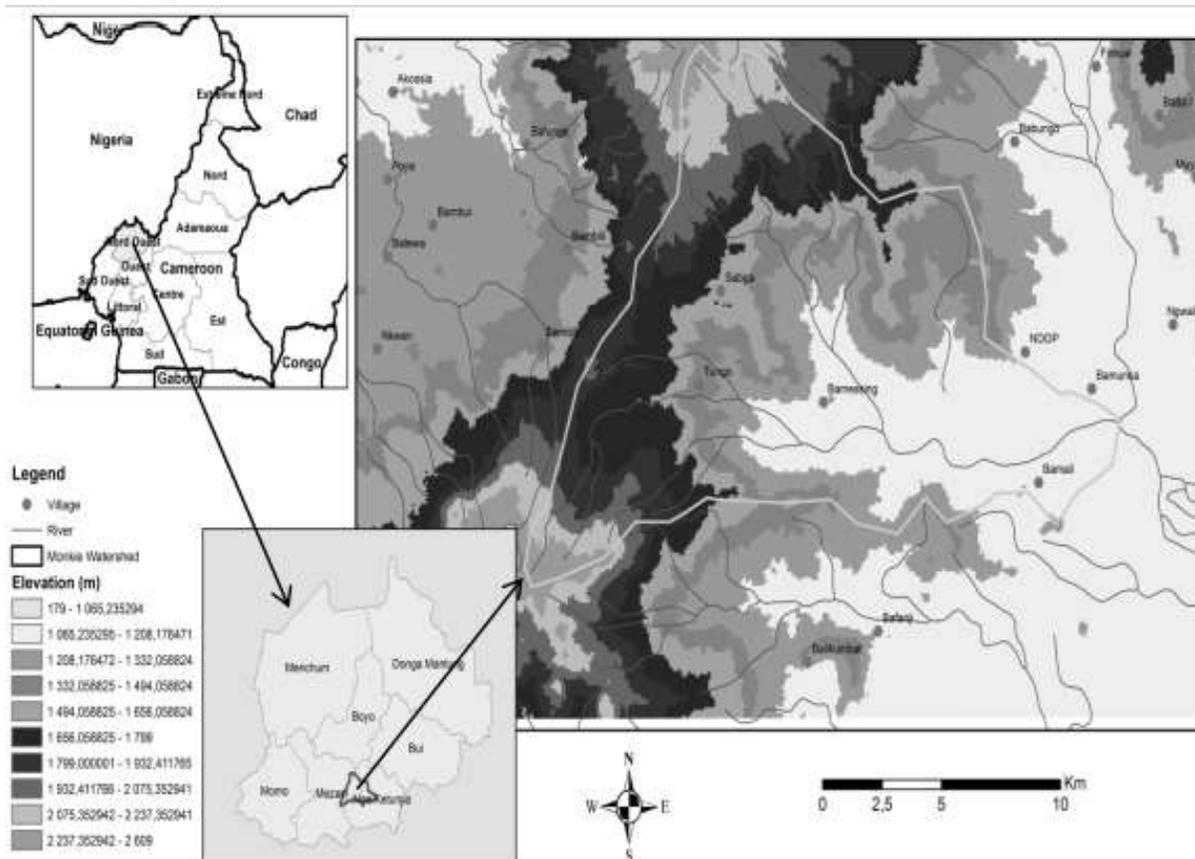
IWRM is a systematic process for the sustainable development, allocation and monitoring of water resources used in the context of social, economic and environmental objectives. It is based on the understanding that all the different users of water resources are interdependent. Hence, it is a process which promotes the coordinated development and management of water, land and related resources in order to maximize the resultant economic and social welfare in an equitable manner, without compromising the sustainability of vital ecosystems (GWP-TAC, 2000). Therefore the present work has as general objective, to

generate general information concerning the stakeholders of the Mou-Nkier watershed which will serve as benchmark data for the sustainable management of water, land and related resources. More specifically, the work will find out the activities that depend on water in Mou-Nkier, and identify the stakeholders of the water sector and carry out an analysis of the stakeholders. The results from this analysis will provide a baseline for an appropriate IWRM approach adapted to the Mou-Nkier watershed.

## MATERIALS AND METHODS

### Area of study

Mou-Nkier watershed is located in Ndop and Tubah Sub-Divisions along the ring road, east of Bamenda in the North-West Region of the Republic of Cameroon. It contains two villages of the Ndop Central Sub-Division (Bamessing and Bamali) and one village in Tubah Sub-Division (Kedjom Ketinguh). It is bounded to the west by Bambili, to the south by Balikumbat, Babungo to the north and Bamunka to the east (Aaron, 2008). Mou-Nkier is located between latitudes  $6^{\circ}04'55.2''\text{N}$  and  $5^{\circ}54'55.9''\text{N}$  and longitudes  $10^{\circ}14'43''\text{E}$  and  $10^{\circ}28'34.3''\text{E}$ . The area is a gentle undulating plain bounded by the Sabga and Wainama chain Hills (Koghan, 2004). The Mou-Nkier watershed covers a surface area of  $224.62 \text{ km}^2$  (Figure 1).



**Figure 1.** Location map of the Mou-Nkier watershed North West Region, Cameroon.

**Method**

The method of WWF (2000) was used to identify the stakeholders involved. The questions that guided authors to identify the stakeholders were:

- i) Who are the people/groups/institutions that are interested in the intended initiative?
- ii) What is their role (polluter, regulators, direct consumers, indirect consumers, etc)?
- iii) Who are the potential beneficiaries?
- iv) Who might be adversely impacted?
- v) Who has constrains about the initiative?
- vi) Who may impact the initiative?
- vii) Who are the powers to influence?

The following sampling methods were used on selected respondents; purposive sampling, expert sampling, snowball sampling, the diversity sampling and proportionate quota sampling. Three hundred persons were interviewed which involved 200 farmers (Huckle berry farmers, rice farmers, maize farmers, Irish potatoes farmers, onion farmer, gardeners, poultry farmers), 30 cattle rarer, 20 other livestock producers (pigs, sheep, goat and

horse), and 50 administrators.

**RESULTS**

The activities that depend on water in Mou-Nkier are summarized in Table 1.

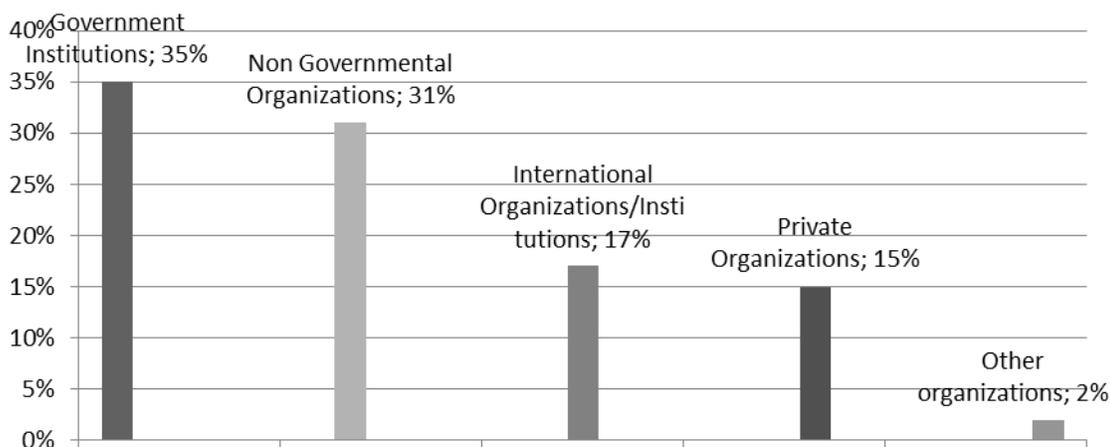
**Types of stakeholders**

The institutional framework of different stakeholders was identified and classified as follows: Government institution/public institutions, civil society (NGO's, associations), International organizations and some private institutions.

Out of the 48 groups or associations or companies of stakeholders identified in the Mou-Nkier watershed, seventeen were government institutions (35.4%), fifteen were NGO's (31.3%), seven private institutions (14.6%) and eight international organizations (16.7%) (Figure 2).

**Table 1.** Water dependent activities and their examples.

Activities	Examples
Domestic	Flushing of toilets, bathing, washing of cloths, washing of dishes, cooking and drinking
Livestock production	Rearing of cattle, sheep, pigs, horses and poultry
Crops cultivation	Rice, maize, Irish potatoes, huckleberry, onion, cabbages, cassava, tomatoes and pepper



**Figure 2.** Percentages of the various organizations/ Institutions involve in water resources management.

**Area of intervention in relation to the water sector**

Stakeholders carry out specific task on the watershed or on the water resources but some stakeholders carry out more than one task. The roles of some of the stakeholders are presented in Table 2.

It was observed that most of the stakeholder's groups were involved in water supply and sanitation (20.7%)

while the least is fisheries and livestock (6.90%) (Figure 3).

The stakeholders were also classified according to their influence and importance and the following results were obtained nineteen (19) had high influence and high importance, twelve (12) high influence and low importance, fifteen (15) had low influence and high importance and two (2) had low influence and low importance. The results are presented in Table 3.

**Table 2.** Stakeholders and the roles they are set to play on the watershed.

<b>Stakeholder</b>	<b>Role or activity</b>
Ministry of Agriculture and Rural Development (MINADER)	Irrigation for agriculture Water supply
Ministry of Public Health	Identify and control water related diseases Ensure quality portable water Elaborates hygiene, sanitation and environmental cleanliness policies
MIDENO/GP development participatory project DERUDEP authourity/ decentralized rural devet North west Grassfield rural devet	Construction of water schemes to improve living conditions of the rural population Capacity building on water related issues
Plan Cameroon	Environmental protection Education and promotion of health related activities to the population Capacity building
Water Management Authorities of Bamessing, Bamali and Kedjom Ketinguh	Supply portable water to their villages Collect and manage funds for their water projects Protect their watershed surroundings Report any encroachment into the protected watershed to the administration
Swiss Development Association (HELVETAS) Cameroon	Capacity building Watershed protection Support water supply projects
Tubah Council	Lead stakeholders in policy matters Support village water supply projects financially Provide training to water managers
Ndop Council	Lead stakeholders in policy matters Support village water supply projects financially Provide training to water managers Supply portable water to some villages within its municipality
Heifer project Internal (HPI)	Training groups in farming technics Provide training on small live stock
Institute of Research and Rural Development (IRAD) Farmers	Carry out research and provide results to farmers for the improvement of their yield Provide training to farmers Carry out farming activities which requires water from the watershed
Ministry of Environment, Nature Protection and Sustainable Development	Elaboration and execution of the national policy on the environment Conservation of natural resources and biodiversity Regulation of forest exploitation to ensure constant supply of water
Strategic Humanitarian Development Association (SHUMAS)	Help in Integrated sustainable rural development Afforestation and capacity building
Society for initiative in Rural Development and Environmental Protection (SIRDEP)	Environmental protection Promote sustainable agriculture
Muslim Youths Environmental Club	Environmental education, sanitation and sanitation Afforestation

Table 2. Continues.

FAP	Afforestation and capacity building
Paradise on Earth and	Collection and management of waste Plants conservation and environmental protection
Community Initiative for Sustainable Development (COMMISUD)	Environmental education Natural resource management
Association of Environmental teachers and schools Environmental Club of the North West (ASEC-NW)	Development of sustainable lifestyle for the conservation of natural resources through schools
Ministry of Fisheries and Livestock Industry (MINEPIA)	Ensure enough water supply for a better management of livestock and fisheries resources Control livestock and fisheries activities
Association of cattle breeders (MBOSCUDA)	Encourages sustainable grazing of cattle Capacity building on watershed Natural resource management through pasture improvement Prevention of farmers-grazers conflicts Capacity building
Grazers	Constructs water points for their cattle Graze their cattle on the watershed
Rural Training College (RTC) Senior Agricultural technicians (TSA)	Train agricultural technician
University of Bamenda	Carry out research on agriculture, forestry and environmental studies. Will potentially carry out water analysis
WHINCONET	Conservation of natural resources
Upper Noun Valley Development Authority (UNVDA)	Constructs dams and create canals for irrigation Training and capacity building Cultivation and rice processing
CRTV Radio Hot Coco Afrique Nouvelle Foundation Radio Abakwa FM Ndop Community Radio Cameroon Tribune The Herald News Paper The Post News Paper	Broadcasting of important information to the public
GWP-Cameroon	Give support to the development of the national IWRM plan and water partnerships
Churches/Mosque	Broadcasting of important information to the public

Table 2. Continues.

National water council	Studies and makes proposals to the government of measures to ensure the conservation, protection and sustainable use of water; Recommendations to the state on the conservation, protection and sustainable use of water resources; Proposals to the state on the elaboration and implementation of development plans in the water and sanitation sectors.
DFID	Promotion of the implementation of national strategies on sustainable development and a reversal loss on the environment Promote the rational exploitation of forest resources and the protection of the ecosystem
Food and Agricultural Organization (FAO)	Promotion of agriculture and food security Promotion of forestry and sustainable development Development of the fishery and livestock
Elites/Village Development Association	Contributes for development (monetary contribution) Seek funds from external donors Give advice to the village WMA
Ministry of Transport - World Bank - European Union	Management of water through the meteorological department of the ministry Provide support for development

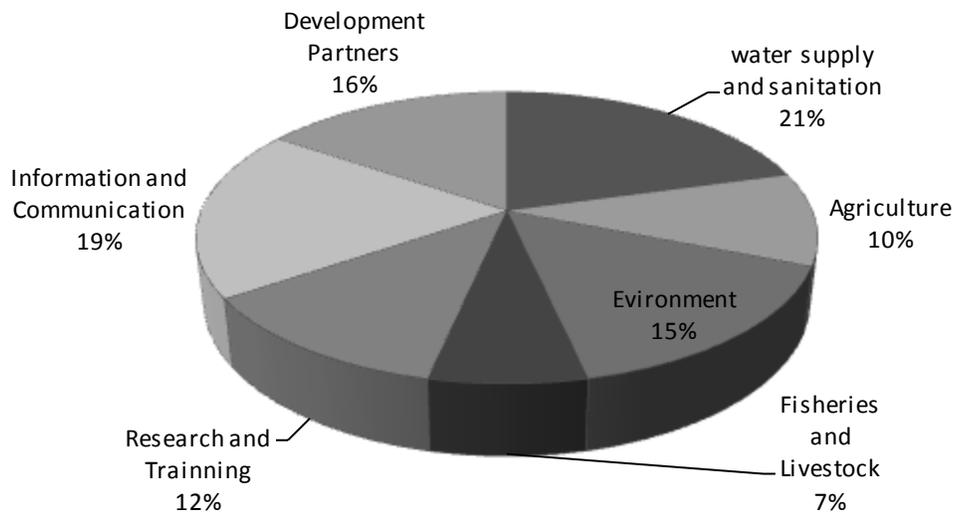


Figure 3. Percentages of the areas of intervention of stakeholders within the Mou-Nkier watershed.

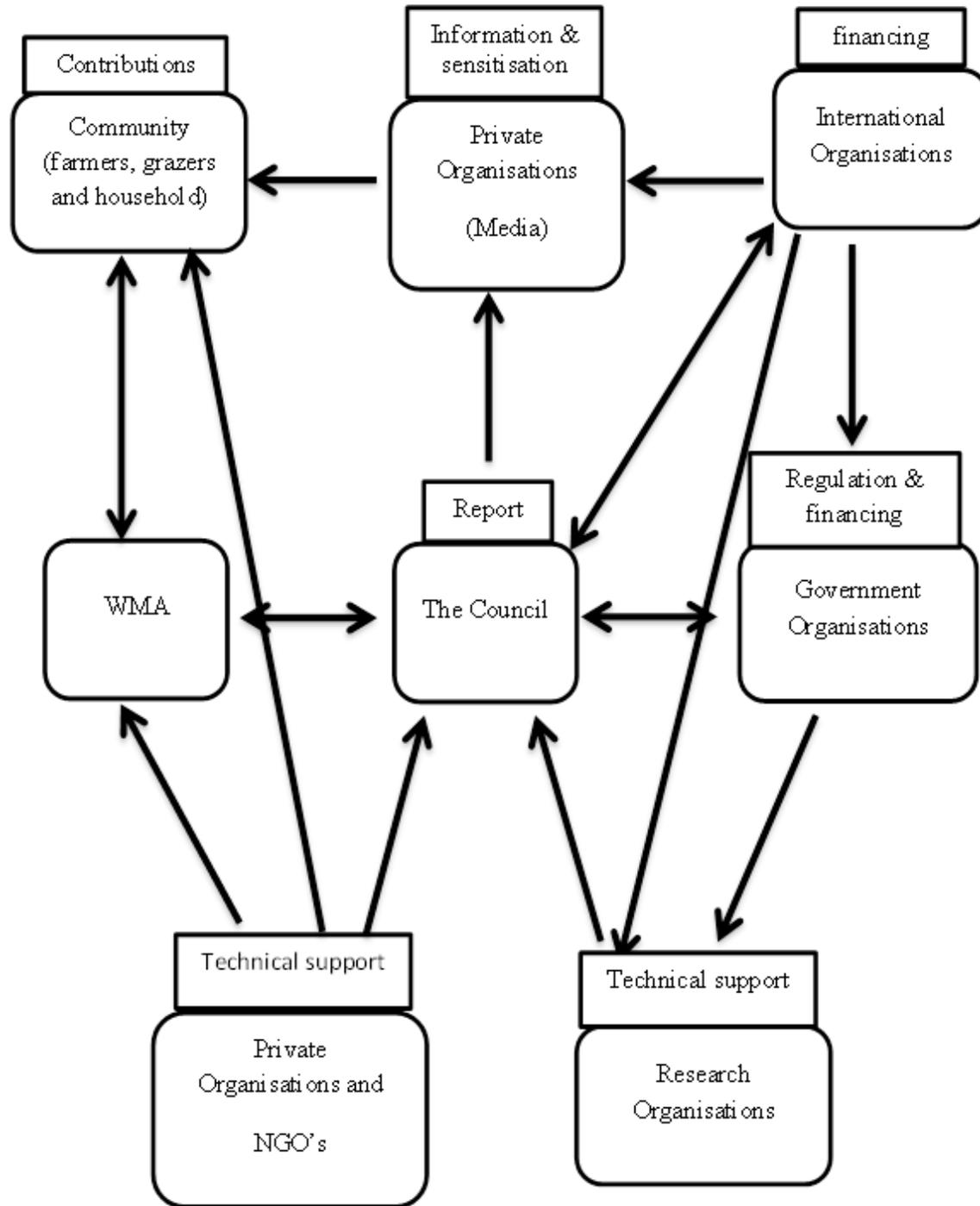
**Interaction amongst the stakeholders**

There was very little interaction and coordination between the stakeholders. In fact part of the watershed and resources were left to the various village water management authorities while Ndop council manages its water source as water from the watershed supplies the municipality. The other stakeholders like MINEPIA, MINADER and the farmers were concerned only with

their activities and care less if these activities are affecting other stakeholders negatively. Out of 300 people selected from the 48 stakeholders groups and interviewed, only 25 persons understood what IWRM approach method meant, and their level of involvement in the water resources management was very low. After explaining how the method operates, 295 persons agreed it was an appropriate method to tackle their water resources problems.

**Table 3.** Classification of stakeholders according to their importance and Influence in the water resources management process.

<b>Stakeholder</b>	<b>Importance</b>	<b>Influence</b>
Ministry of Agriculture and Rural Development (MINADER)	High	High
Ministry of Towns	High	High
Ministry of Transport	High	High
Ministry of Public Health	High	High
Ministry of Planification	High	High
National Water Council	High	High
MIDENO/GP DERUDEP	High	High
Plan Cameroon	Low	High
Water Management Authorities of Bamessing, Bamali and Kedjom Ketinguh	High	High
HELVETAS CAMEROON	Low	High
Tubah Council	High	High
Ndop Council	High	High
Netherlands Development Association (SNV)	High	Low
HPI	High	Low
IRAD	High	High
Farmers	High	Low
Ministry of Environment, Nature Protection and Sustainable Development	High	High
SHUMAS	High	Low
SIRDEP	High	Low
Muslim Youths Environmental Club	High	Low
FAP	High	Low
Paradise on Earth	High	Low
COMMISUD	Low	High
ASEC-NW	Low	High
MINEPIA	High	High
Association of cattle breeders	High	Low
C/o MBOSCUDA	High	Low
Grazers	High	Low
TSA	Low	Low
RTC	Low	Low
University of Bamenda	High	Low
WHINCONET	High	Low
UNVDA	High	High
CRTV	Low	High
Radio Hot Coco	Low	High
Afrique Nouvelle	Low	High
Foundation Radio	Low	High
Abakwa FM	Low	High
Ndop Community Radio	Low	High
Cameroon Tribune	Low	High
The Herald News Paper	Low	High
The Post News Paper	Low	High
GWP-Cameroon	Low	High
Churches/Mosque	Low	High
DFID	High	High
FAO	High	High
Elites/Village Development Association	High	High
World Bank	High	High
European Union	High	High



**Figure 4** Proposed Interaction of stakeholders within the Mou-Nkier watershed and the council.

## DISCUSSION

There are many stakeholders on the Mou-Nkier watershed performing various roles but their roles are not clear cut. This has brought about the overlapping of functions (Table 2) and inefficiency as two or more stakeholders are supposed to do the same thing and finally none does the job. The lack of communication

amongst stakeholders has contributed to disorder in the watershed (stakeholders doing what is beneficial to them alone and maybe detrimental to others). When stakeholders finish a project on the watershed, there is no continuity hence the problems solved resurface after sometime. For these reasons this proposition of stakeholders' interaction was established (Figure 4). This proposal shows the council at the center to coordinate

**Table 4.** Stakeholders groups or organizations and their functions to ease communication.

Organization	Function
Local community	Contribution (financial and physical)
Private organization (media)	Information and sensitization
Councils	Give report on the process (coordination)
Government institutions	Financing and regulation of activities
Research institutions	Carry out research and provide results and technical support
Water management authorities	Collect contributions and give to the council and give information to the community
Non-Governmental Organizations	Provide technical support
International institutions	Provide funds

activities and water resources on the watershed. The other stakeholders support the council as shown on Table 4.

The community should contribute money to the councils through the WMA of the various villages. The councils should give a report on how the money is spent and other information to the community through the WMA. That is the WMA forms a liaison between the community and the councils. Private organizations and NGOs provide technical support to the councils and the WMA. Research institutions also give technical support to the councils that is providing research results to the councils. Since research needs a lot of financing, the research institutions should be supported financially by the government and international organizations. Non-governmental organizations should also finance the councils while the government institutions regulate the activities of the council. In exchange the council should report its activities to the government and international organizations. International organizations should also finance private organizations (media) by sponsoring environmental programs that passes information from the councils to the public. There is a need for a coordinating body and the councils are best placed to play that role since they are government institutions close to the population. With the process of decentralization, the councils are placed at the center of the management process of the water resources. With such interaction, participation, coordination and transparency are ensured.

Figure 4 presents the proposed interaction between stakeholders of Mou-Nkier watershed and the councils. The other stakeholders support the councils in their various domain of specialization.

## CONCLUSION

The Mou-Nkier watershed is not only a watershed that provides water to the Ndop population and its environs; it is also rich in biodiversity (21 wildlife species, 26 trees species, 10 grass species and 6 legumes species) (WHINCONET et al., 2007). With the many activities being carried out on the Mou-Nkier watershed the water resources and the biodiversity are at risk. It will be very

important and necessary to create a watershed management committee made up of all the stakeholders to protect and manage the watershed in a sustainable way.

## REFERENCES

- Aaron D, 2008. A Phonological Sketch of Kenswey Nsey (Bamessing). Yaoundé: SIL Cameroon.
- GWP-TAC (Global Water Partnership Technical Advisory Committee), 2000. Integrated Water Resource Management. Denmark: Global Water Partnership, TAC Background paper No 4, (p67).
- Koghan S, 2004. Change in ecological character of wetlands: the case of the Ber Plain in Bui Division. Unpublished post-graduate dissertation, University of Yaoundé 1, Cameroon.
- Kometa S, Ashu M, 2012. Watershed degradation in the Bamendjin area of the North West Region of Cameroon and its implication for development. *J Sustain Dev*, 5(9): 74-77.
- Kristina D, Heather C, 2015. Water use trends in the United States. California: Pacific Institute.
- Mengnjo J, Fantong Y, Engome R, Takeshi O, Ndonwi S, 2013. Sources of bacteriological contamination of shallow groundwater and health effects in Ndop plain, Northwest Cameroon. *J Environ Sci Water Res*, 2(4): 127-132.
- Suhas P, Kaushal K, 2001. Watershed Management Concept and Principles (ICRISAT). India.
- USEPA, 2012. What is a watershed? <http://water.epa.gov/type/watersheds/whatis.cfm>. Last date of access 12/12/2015.
- WHINCONET, Verina I, Alfred N, 2007. Plant and Animal Guide for the Western Cameroon Highlands. Bamenda, Cameroon.
- WWF (World Wildlife Fund), 2000. Stakeholder collaboration. Building bridges for conservation. WWF Ecoregion conservation strategies unit. Washington DC, USA: WWF, 77 pp.

---

**Citation:** Angwafo TE, Mbufung VN, Elono ALM, Fonteh MF, 2016. Integrated water resource management: Gaps and challenges from stakeholders of the Mou-Nkier watershed, North West region, Cameroon. *Int J Ecol Ecosolution*, 3(2): 21-29.

---