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CoS-SIS Convergence of Sciences
Strengthening Agricultural Innovation Systems
Programme

Consolidating the CoS-SIS Research Agenda

*Proceedings of the CoS-SIS Cotonou, Benin Workshop
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*Editors
Arnold van Huis,
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Agro-pastoral dam use and management in relation to the presence of crocodiles in northern Bénin: technical and institutional constraints and opportunities

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Abstract

Agro-pastoral dams are water holes constructed by Bénin government and many other donors to provide water for livestock and for agricultural development. These dams have been invaded by crocodiles which have affected the use of these dams.

This study seeks to examine in some depth all the activities around agro-pastoral dams, (i) to map stakeholders involved in dam use and management, (ii) to identify important institutional and technical constraints and opportunities related to water use, (iii) identify conflicts around water resources and (iv) to determine the role of crocodiles in this complex environment.

Agro-pastoral dams are used for many purposes including: fish production, vegetable production, swimming, and bathing and washing kitchenware and clothes. These activities involve many stakeholders with different backgrounds, knowledge, views, purposes and assumptions. Users of these dams tend to be confronted with different kinds of conflicts mainly because they fail to respect formal and informal institutional rules that apply there.

The optimization of agro-pastoral dam use and management with the perspective of integrated water resources management should address institutional challenges, protection and restoration of natural systems capturing society's views, educating and communicating with users of the dams. Technical solutions are no longer sufficient to tackle the intricate problems we face today around agro-pastoral dams. Scaling issues need to be explored to understand the complex dynamics of institutional resource regimes and to improve the match between biophysical and actor based scales.

Key words: agro-pastoral dams, multiple use, crocodile, institution, innovation.

Introduction

Water for household use (Hadjer et al. 2005) and water and grazing requirements for livestock (de Leeuw et al. 1995) is the major constraint for the development of livestock production in Bénin. The severe drought of 1970 which caused high mortality rate of ruminants (cattle, sheep and goat) in northern Bénin compelled the government of Bénin Republic to promote the development of agro-pastoral dams in order to provide additional drinking water to livestock. Many other activities take place around these dams; these include: fish production, vegetable production, swimming and washing involving many actors with different backgrounds, knowledge, views and assumptions. Users of the dams face different kind of conflicts. This situation presents a complex problem.

The promotion of water points is one of the priorities of Bénin government for the promotion of the agricultural sector and this priority has been chosen as major resource to boost the agricultural sector by supporting and improving systems of production (MAEP 2008).

In the optimization of agro-pastoral dams, it is noted (Kpéra 2002; MAEP 2008; Capo-Chichi et al. 2009; Kpéra 2009; Gabelle 2010) that the invasion of dams by crocodiles is considered one of the main constraints for fish production and for the sustainability of infrastructures. Crocodiles become a new problem in the existing complex situation. At the same time crocodile species are considered as threatened at national and international levels leading to an integral protection of species (CITES 2010). Therefore, it becomes necessity to find innovative ways to optimize dams use and management through integration of water resources management. Integrated water management means putting all of the pieces together, namely social, environmental and technical aspects which must be considered (Pahl-Wostl et al. 2004).

The objectives of this diagnostic and baseline study are to (i) study in depth all the activities around agro-pastoral dams, (ii) map stakeholders involved in dam use and management, (iii) identify important institutional and technical constraints and opportunities related to water use, identify different conflicts around water resources and (iv) characterize the role of crocodiles in this complex environment.

Methodology

Research setting

The study was carried out in Nikki Municipality located in the Borgou District in North-Eastern Bénin (Figure 1).

Data collection

We started our research by gathering archival data and information from different departments in charge of water and livestock management.

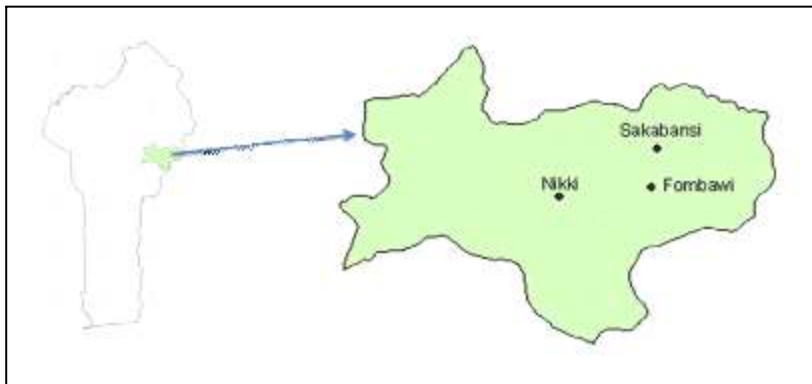


Figure 1. Localisation of Nikki, Sakabansi and Fombawi dams in northern Bénin

We organized nineteen (19) focus group discussions (Wong 2008) in the 3 villages with people farming around dams, herders, vegetable producers, fishermen, dam management committees, the municipality staff, women washing dishes and clothes around dams, and children who swim in the dam). For triangulation, additional data were collected respectively by 12, 8 and 7 individual iterative interviews in Nikki, Sakabansi and Fombawi. Snowball technique was used to identify potential stakeholders and the respondents were not randomly selected. As many stakeholders are involved in agro-pastoral dams management and use in Nikki Municipality, we also used the stakeholder analysis tool (Varvasovszky & Brugha 2000) to identify actors' involvement and characteristics. We mainly studied stakeholders' interests (advantages/disadvantages), capacity to change the situation (power), willingness to change the situation, and relationships with other stakeholders. We also organized 2 stakeholder meetings with key actors representing the core of the Concertation and Innovation Group (CIG). Participatory exercises (brainstorming, prioritization, and problem analysis) and

open discussions were used to identify additional constraints and opportunities. Different Participatory Rural Appraisal (PRA) tools were used as was deemed appropriate. Other methods, such as farmers' own classification of constraints ranking were also used to understand people's priorities in dams.

Results

Activities and practices around agro-pastoral dams

Watering livestock and humans

Livestock in the three dam environments consisted of cattle, sheep and goats that belong to 4 groups of herders: group 1: local farmers with 2-10 heads; group 2: local herders with more than 50-500 heads, group 3: herders from districts bordering Nikki (Perere, Kalalé, Ségbana), and group 4: herders from countries bordering Bénin (Nigeria, Niger and Burkina-Faso). Herders in groups 3 and 4 own 500-1000 heads of cattle. Shortage of water and grass, particularly during the dry season, constantly forces pastoralists to migrate together with their livestock for long distances from Niger, Nigeria and Burkina Faso to Bénin in order to maintain their sources of subsistence. Besides, agro-pastoral dams are also major sources of drinking water for local people.

In total, the construction of agro-pastoral dams was very beneficial for local people, national and international transhumance herders for they can obtain water for livestock without making long distance and also because of the permanent availability of water in dams all the year.

Fish production

The second economic activity of particular interest to local people around agro-pastoral dams is fish farming although this activity is not open to everybody but only to dam management committees and the municipality of Nikki. People are very enthusiastic about fish production because their diet is mainly meat based.

Many species of fish are farmed in dams; these are mainly Ciclids (*Tilapia niloticus*, *Tilapia guineensis*, *Sarotherodon galilaeus*, *Sarotherodon sp.*, *Clarias sp.*, *Synodontis sp. etc.*). Fish farming is supported by the Participative Artisanal Fisheries Development Support Programme (PADPPA). According to local people and the extension service, decrease in fish production in the whole district is mainly explained by the silting up of dams, the increasing of dryness and the lack of dam maintenance.

Vegetables production

- *Nikki*

Two associations have been involved in vegetables production. These are: Ansouroukoua association with 80 members (60 women and 20 men) and Donmarou association with 40 members (10 men and 30 women). The cropping area is located up-stream of the dam into the watershed and around 800 meters from the dam. So people do not directly use water from the dam but they dig small wells of 2-3 meters deep to provide water to sprinkle on the vegetables. Vegetables production is an off-season activity that takes place only during the dry season (January to May). The main vegetable products are tomato, hot pepper, okra, spinach, carrot, lettuce, cabbage, sticky leaves and other traditional vegetables. The production of vegetables is a second activity for all the Association members. Producers sell their products in Nikki town and sometimes in Tchikandou market (Nigeria) located at 22 km from Nikki and estimate their revenues to vary from 33,000 to 112,000 F CFA.

- *Fombawi*

Thirty two (32) women are organized into associations for vegetables production in Fombawi. As Nikki's producers, they also cultivate tomato, hot pepper, okra, spinach, sticky leaves and other traditional vegetables. Contrary to Nikki, plots are located down-stream of the dam and women fetch water from the dam using bowls. Plots are located at 10-20 meters just behind the dyke. Animal manure is used as fertilizer and plants ash to control pests even though they stated that it is not efficient for all kinds of pests.

After harvesting, products are sold in the village and the maximum revenue realized is 18,500 F CFA. Since 2009, women have stopped producing vegetables because the fence of the garden and their products were often destroyed by cattle. In addition, products were destroyed by bush fires lighted by dishonest people searching for giant field mouse.

- *Sakabansi*

In Sakabansi, vegetable production is an activity of women groups in associations. As in Nikki, vegetable plots are located up-stream and women produce the same vegetables as in Fombawi and also sell products in the village and retain some for home consumption. Compared to Nikki and Fombawi, in Sakabansi women own small plots. As in Nikki, producers dig small wells near their plots to water plants. They estimated wasting much time by getting water directly from the dam. In Sakabansi, incomes from vegetables production vary

from 12,800 to 32,000 FCFA. Women very much appreciated this activity because they are motivated to improve their livelihoods. These vegetable producers are primarily concerned with the sustainable use of water and land, with emphasis on the maximum use of dams' resources. What is important for them is their day-to-day life.

Washing dishes and clothes

In the three villages, dam water is also used for washing dishes and clothes. Every day from 10.00 am to 16.00 pm, it is common to see many women washing their dishes or/and their family's clothes. This practice is mainly observed during the dry season which is characterized by water shortage. Women locate themselves at the water edge (30-50 meters from dams) and use bowls to fetch water. In the three dams, women do their washing without worrying about crocodiles.

Swimming

Despite the presence of crocodiles into the 3 dams, people, mostly children, swim in the dams as local swimming pools. In Nikki, the local council has banned swimming because 4 to 7 people die every year by drowning. Some people accused crocodiles of attacking and killing victims. Other people believe that there is a spirit in the dam that always kills swimmers. Regarding the attack of swimmers by crocodiles, fishermen denied this claim, saying that they never see crocodile wounds on victims when they were pulled out of the water. Nowadays, people stop swimming into the dam because the dam is continually kept guarded by safe guards. In Fombawi, people, even women, formally swam in the dam despite the high number of crocodiles occurring there. In 2007, a child was bitten on his arm by a crocodile when he was swimming. Consequently, the dam management committee decided to ban swimming in the dam. However, children continue to swim. In Sakabansi, also despite the banning, some people still swim into the dam. Many victims by drowning were noted but no humans attack by crocodiles.

Use of water for construction

Dam water is used in the construction of houses and roads in Nikki and for houses construction in Sakabansi and Fombawi. People fetch water in drums and flasks carried by motorbikes or trailed behind by cattle.

The use of dam water for construction is supposed to attract a fee of 2,000 F CFA/ per house under construction. But some people refuse to pay this amount because they claim that dam water a common good and everybody has the right to use freely.

Crop and cotton farming around dams

Many farms are located around the 3 agro-pastoral dams. Main crops cultivated are maize, groundnut, soybeans, millet, sorghum, yam and cotton. It is common to see farms located at 50 m from the dam (example of Fombawi). Apart from Nikki, where most of farmers who farm in a radius of 1 km from the dam, the ones from the other 2 villages are still cropping around dams. The cropping system is characterized by the use of mineral fertilizers (N, P, and K), organochlorin and organophosphorus pesticides. Some farmers also use organochlorin and internationally banned organophosphorus pesticides in Bénin (lindane, endosulfan, leptachlore, DDT and dieldrin) which are easily purchased from Chikandou Market (in Nigeria).

Farming around agro-pastoral dams is a major issue that needs to be addressed for the sustainability of dams and for survival of humans and livestock.

Roles of crocodiles

Crocodiles occur in the three dams but at different scales. According to local people, they are rare in Nikki (< 20/dam), abundant (20-100/dam) and most abundant in Fombawi (> 200 crocodiles/dam). The invasion of agro-pastoral dams by crocodiles took place after the construction of dams which means 1972 for Nikki, 1985 for Sakabansi and 1989 for Fombawi. Crocodiles are locally called “*Kouan*” by the Boo ethnic group, “*Karakou*” by Bariba ethnic group and “*Nonda or Nonrouwa*” by Peulh ethnic group.

Old people confirmed the previous presence of large distribution of crocodiles in rivers and ponds. The decrease in the number of crocodiles is caused by the increase of dryness in the area, the destruction of their natural habitats because of urbanization, crocodile poaching for meat, skins and organs, and the lack of motivation for environment management. In the 3 villages, people have considered crocodiles as “the heart” of dams because for them, the availability of water depends on crocodiles. People stated that crocodiles maintain water in dams by digging holes that can reach the ground water. For this reason, some crocodiles have been protected and escaped poaching. In addition, in Fombawi, crocodiles have been conserved long time for their cultural role that because the cultural identity of this village. Humans and crocodiles were living in the village without any problems. Villagers and crocodiles mutually respected each other.

Stakeholders involved in agro-pastoral dam use and management

Table 1 summarizes the results of a stakeholders analysis, highlighting their positions, interests, power and relationships with other stakeholders.

Institutions in dams use and management

Formal and informal rules in dam use and management are numerous and vary from one activity to another and from one stakeholder to another. Since 2005, Bénin has been engaged in the process of decentralization that aims to give local people a sense of responsibility for the management of their own area, contributing to democracy to take root locally and the promotion of sustainable development. Therefore, with the measures articulated in articles 84 to 107 of the law N°97-029, many authorities have been left to District care in many domains such as environment, hygiene and public health. Then, rural infrastructures (bas-fonds, agro-pastoral dams, ground water) are managed by the local council with the collaboration of local people. Any decision-making concerning dams management is taken at sub-district level by the “chef d’arrondissement”. Several formal and informal rules have been set by the Municipality in relation to agro-pastoral dams use and management. Table 2 presents the different institutions governing agro-pastoral dams.

As shown in table 2, formal and informal rules in agro-pastoral dams are mainly for dam users. The most pitiful observation is that people fail to respect institutions which lead to different conflicts that arise among stakeholders.

Conflicts generated in the use and the management of agro-pastoral dams

Farmers-herders conflict

Farmers and herders are always in perpetual conflict because each party wants to maximize resources (water and grass). Conflicts occur for many reasons:

- In order to extend their land, farmers deliberately decide to obstruct livestock roads.
- Herders, mostly transhumance avoid using transhumance corridors in order to escape from grazing tax collectors by making their own ways into farms causing damages to farmers.
- Herders find sometimes transhumance corridors too long; so they shorten their journeys by illegally passing through farms.
- Livestock is mainly conducted by children and teenagers who mostly abandon the animals and spend their time playing. Then animals roam into farms and destroy crops.

- Lack of tolerance between the two parties. Herders have been always considered as foreigners. Resident farmers are land owners and have more voice than herders.

The main consequences are: destruction of crops and livestock, injuries on farmers and herders, perennial tension between herders and farmers.

Humans-crocodiles conflict

Humans-crocodiles conflicts are not as severe as farmers-herders conflicts. However, it occurs in the study area and one of people's concerns. The main reasons of conflict are: destruction of dams infrastructure (holes into the dyke), high crocodiles predation on fish, crocodile destruction of fishing materials (nets), attack on dogs and rarely on sheep and goats.

The first source of conflict between crocodiles and dams' managers is the destruction of the dyke of dams. In the three agropastoral dams, crocodiles are predators of fish species and they destroy fishermen' fishing nets. Crocodile predation on fish is also harmful to them. In Nikki and Sakabansi, this conflict it ends by the by fishermen killing crocodiles.

Crocodiles also attack domestic animals such as dogs, sheep and goats. Attacks on dogs are more common than attack on sheep and goats. People said that crocodiles and dogs are natural enemies. In 2010, 4 attacks, 6 attacks and 4 attacks of dogs were recorded respectively in Nikki, Sakabansi and Fombawi.

Regarding Fombawi, whatever is the damage, people are tolerant because crocodiles are part of their culture and traditional rules (informal rules) which protect them from being killed.

Table 1. Stakeholders analysis: Stakeholders position, interests, power and relation with other stakeholders

N°	Stakeholders	Position	Interest (Advantages /disadvantages)	Power	Relationship with others
1	Municipality	Supporter	<ul style="list-style-type: none"> - Get more financial resource for local development - Optimize dams income - More decision making power - More attention to local priorities 	High power	2; 3; 4; 5; 6; 7; 8; 9; 10; 11; 12; 13
2	Management Committee	Supporter	<ul style="list-style-type: none"> - Participation in the process - Control of the process 	Medium power	1; 3; 4; 6; 7; 9; 10; 11; 12
3	PADPPA	Supporter	<ul style="list-style-type: none"> - Improvement of fish production in dams - Increase of local people income - Contribute to dams sustainable use and management - Develop involvement of local population in the planning and development strategies - Optimize positive impacts of dams and mitigate negative ones 	Medium power	1; 2; 8; 9;
4	CeRPA	Supporter	<ul style="list-style-type: none"> - Advice users and managers in sustainable management - Improvement of fish production into dams 	Medium power	1; 2; 4; 5; 6; 7; 8; 9; 10; 11; 12;13
5	Forests and Natural resources Service	Supporter	<ul style="list-style-type: none"> - Guarantee of sustainable use of natural resources 	Low power	1; 2; 3;
6	Rural Engineering Department	Supporter	<ul style="list-style-type: none"> - Guarantee infrastructures durability 	Low power	1; 4
7	UCOPER	Supporter	<ul style="list-style-type: none"> - Participate in conflict management - Defend herders' interests - Participate in the process 	Medium power	1, 3; 9; 10; 13

N°	Stakeholders	Position	Interest (Advantages /disadvantages)	Power	Relationship with others
8	Local population	Opponent/ supporter	- Participation in the process - Getting freely access to dams and natural resources - No respect of formal and informal rules	Low power	1; 3; 4; 5; 6; 7; 9; 10; 11; 12
9	Farmers/farmers association	Opponent	- Participation in the process - Getting freely access to dams and natural resources	Low power	1; 6
10	Herders	Supporter/ Opponent	- Being involve in dams income management - Improvement of water quality to their livestock - Participation in the process	Low power	1; 2; 4; 6; 13
11	Fishermen	Supporter	- Intensification of fish production	Low power	1; 2; 3; 4
12	Vegetable producers	Supporter/ Opponent	- Getting freely access to dams and natural resources		1; 3; 4
13	SNV	Supporter	- To jam farmers-breeders conflict - Promote sustainable agriculture	Medium-power	1; 3; 4; 7

Table 2. Institutions governing agro-pastoral dams resources use and management

	Institutions		Responsibilities
	Formal rules	Informal rules	
Dam management	- Income offish production is divided by 3: 1/3 for fishermen, 1/3 for the local council and 1/3 for dams management committee members - Dams' incomes serve for local development		Municipality
Dam use	All the decisions concerning agro-pastoral dams is taken by the Municipality (Articles 84 to107 of the law N°97-029)	- Banning of construction of houses around dams - Payment of taxes for houses construction and to water livestock - Banning of washing and swimming into dams - Access to humans and livestock in banned along the dyke - Corridors are delimited and served to livestock to access to dams - Banning of installation of farms in a radius of 1000 m around dam - Washing is allowed only down-stream to the dam Fishing is only opened to dams' managers - Vegetable production is done in down-stream to dams - Vegetation fire is lighted from October 15 to November 30.	Management committee
Crocodile conservation	Crocodiles are classed in appendix I of CITES	- Crocodile are protected animals species	Forests and natural resources management

Table 3. Technical and institutional constraints to dams use and management, strategies adopted by people to face constraints and possible solutions proposed by stakeholders to lift up these constraints

Practices	Technical and institutional constraints	Strategies adopted by people to face constraints	Possible solutions proposed by stakeholders to eliminate the constraints
Fish production	Silting up of dams	Reforestation of the water edge	- Dragging of dams - Reforestation of the water edge
	Low fishing yield	-	Dragging of dams Stocking dams with more productive fish
	Crocodiles predation on fish	Killing of crocodiles on the sly	- Reduction of crocodiles number into dams - Construction of another dams where crocodiles removed from the other dams can be stocked for tourism activity
	Crocodiles destroying nets and lines	Killing of crocodiles on the sly	Same as above
	Lack of fishing materials	-	Finding of NGOs in getting additional material
	Robberies of fish	-	Finding of permanent safe guard
	Invasion of aquatic plants	weeding	Identification these plants and finding of natural enemies of aquatics plants

Practices	Technical and institutional constraints	Strategies adopted by people to face constraints	Possible solutions proposed by stakeholders to eliminate the constraints
	Lack of statistics on fish production per dam	-	Permanent data collection on fish production per dam
	Bad organization of fish farming	-	Define a good dams management plan with will include the organization fish production.
Vegetable production	Decrease of yield due to diseases and pests	Use of botanical pesticides in Nikki	Identification of pests and finding best pesticides against pests
	Lack of mineral fertilizers	-	Negotiation with farmers organization in providing mineral fertilizer to Nikki producers
	Lack of materials and seeds	-	Finding of NGOs that could help producers in getting materials and seeds
	Destruction of fences by cattle in Fombaw	Abandon of the activity	- Finding of wire netting - Negotiation with cattle owners to keep their animal far away from vegetable plots
	Difficult access to micro credit	-	Facilitation in accessing to credit
	Difficult to access to potential markets	-	Finding of strategies to reach potential and permanent buyers and markets
Conduction of livestock to dams	Conflicts between herders and farmers	UCOPER and SNV intervene as mediators in conflict management	- New delimitation of transhumance corridors - Sanctions for no respect of corridors
Domestic activities	Water polluted	Forbidden in washing and cleaning into dams	- Reduction of water pollution
Dam management	No respect of formal and informal rules	-	Identification of sanctions for non respect of institutions
	Lack of formal management plan for dams	PADDPA helped in drafting a management plan for Nikki and Sakabansi dams	- Adoption and validation of management plan proposed by PADPPA with the participation of all the stakeholders
	Lack of granted act for dams	-	Provide all the agropastoral dams a granted act for land protection
	Prejudiced mismanagement of dam income	- Organization of fishing on the sly by fishermen and dams management team members	Redefinition of
	There are too much in formal rules in dams use and management	-	Formalization (written down) of informal rules
	There is no management plan for Sakabansi dam	-	Design a management plan for Sakabansi dam

After the 2 stakeholders workshops, stakeholders identified the following technical and institutional constraints (see Table 3) according to their importance: 1-silting up of the dam, 2-water pollution, 3-invasion of aquatic plants, 4-crocodiles predation on fish and destruction of water infrastructures, 4-low motivation of the municipality in the monitoring of dam, 5-lack of equipments for fishing and vegetable production, 6-absence of formal document as dam management plan, 7-non respect of informal rules of dam, 8-no granted act for dams.

Regarding opportunities, these are: access to market (Nikki closed to Nigeria); local people's motivation, PADPPA is a Key stakeholder that greatly assists in dam management; existence of management plan for the dams drafted together by all the stakeholders with the help of PADDDPA; existence of draft of local code for dams management; dams Management Plan can be funded by the departmental Development Plan (PDC), optimization of agro-pastoral dams is one of Bénin Government priorities for poverty alleviation throughout the programme PUASA; existence of endogenous conservation of crocodiles in Fombawi bordering agro-pastoral dams and water ponds. All these opportunities should help in minimizing technical and institutional impediments related to dams use and management and to crocodile conservation.

Discussion

The vicious cycle of dam management

With decentralization, the municipality is empowered to manage agro-pastoral dams. Before decentralization, dams were managed by management committees under the supervision of CeRPA. Incomes from fish production were collected by committee members and saved in village bank accounts. This money was used for different purposes including: school construction, village pharmacy, hospital, micro-credits, and for different events in villages. With the engagement of the Bénin government since 2005 in a decentralization process, the situation has changed. All the incomes of dams are managed by the local council. Over the last five years, people have been asking what about dam incomes and what they have been used for. People were expected to get feedback from local councils but nothing is done till now. Local people are disengaged from the municipality. Therefore, local people continually accuse dams management teams of mismanaging the dams. Decentralization involves the transfer of power, responsibilities and finance from central government to sub-national levels of government at provincial and/or local levels. Another issue is that there is a no separation between politics and development. To win local elections, politicians tend to favor or people belonging to their party thus implying the non-respect of institutions by dam users and the municipality. Local people believe that development has to do with cooperation, collective action for the common good, social services, infrastructure and production. *According to Engberg-Pedersen 2003*, "Politics" and "development" are evidently loose terms that in the present context are being used normatively. *Engberg-Pedersen added that "La politique"* in particular is difficult to define, and its content depends on the perspective of its user. What some derogatorily describe as politics others consider an important step toward

development. Finally, the challenge in implementing decentralization is highly challenging at national and local levels. For (Cheema & Rondinelli 2007) the problems associated with implementation of decentralization are especially serious in societies with inequitable social and economic structures and high levels of poverty and illiteracy. The question is not how to avoid politics but how to cope with it, and the distinction between development and politics is interesting not because of its description of social processes, but because it reflects a scepticism and anxiety with respect to political processes.

Institutions in agro-pastoral dams: shifting responsibilities

Formal and informal institutions have been defined for dam use and management. Unfortunately, people do not respect them. Rather, people seem to respect traditional rules (eg. endogenous conservation of crocodiles) than republican laws. The institutional context presented many dilemmas for improving the critical situation of agro-pastoral dams. For example any attempt to break the impasse of the vicious circle of dams management meets with stiff resistance. Furthermore, local political decisions were difficult in the multiparty system adopted by the Beninese in the democratization process. The difficult situations of the stakeholders are exploited by the politicians during their campaigns who promise to take some actions on the dams (eg. farming around dams), while the political opponents would promise the re-establishment of cropping practices to the stakeholders to obtain their votes.

According to van Huis et al. 2010. , Innovation is normally seen as technical change. Institutional development like markets, access to inputs, farmers' political influence, and rent seeking tend to follow a vertical axis. When institutional factors are very involved, it does not matter whether the technology is weak or strong, satisfactory progress will not be made.

Herder-farmer conflict management

Herder-farmer conflicts are the most violent conflicts observed in the northern Bénin. Although, transhumance corridors were delimited to tackle the issue, the conflict remains persistent and bloody. This means that the problem is not only technical but also an institutional issue. The abuse of traditional host/stranger relationships has led to heightened conflict. Besides, herders were less interested in politics because their livelihoods depend on their livestock. The creation of UCOPER that intervene in conflict management is praiseworthy but not sufficient to entirely eliminate herder-farmer conflict. For this reason, many actions need to be taken with the collaboration of the Concertation and

Concentration and Innovation Group (CIG):

- Promote new herder institutions for the management of rangelands and the assertion of herders' rights at local and national levels to control access to resources.
- Incorporate farmers and herders in groups responsible for local management of natural resources (water and land).
- Negotiate arrangements for multiple land use amongst all groups using the same land.
- Encourage communities to build their own institutions for management of conflicts for local resources by giving them the legal power and responsibility to do so.
- Ensure that development schemes do not have a negative impact on existing pastoralist and transhumance grazing patterns.
- Provide training to farmer and herder groups in conflict management and resolution techniques.

Invasion of agro-pastoral dams by crocodiles: hope or constraint?

The invasion of agro-pastoral dams by crocodiles should be considered a hope for recovery of crocodile population that were decimated in 1970 due the increase of the skin prize in the international market. But crocodile invasion of the dams was considered a constraint for those developing new livelihood strategies (eg. fish production). According to (Madden 2004), "Human-wildlife conflict occurs when the needs and behaviour of wildlife impact negatively on the goals of humans or when the goals of humans negatively impact the needs of wildlife. Without properly addressing human-wildlife conflict in the effort to conserve wildlife and their habitat, conservation efforts will become unstable as well as the support of local communities (Madden 2004).

To avoid conflict in the environments of dams, local people proposed the relocation of adult crocodiles from dams to another place for tourism. The idea is not so bad but the question is how to secure the three dams to avoid another invasion by adult crocodiles since most of dams in Nikki are located in the same watershed. In addition, what will happen when juvenile and sub-adults crocodile become adults. Human-crocodiles conflict, as we understand it today, is not always inevitable and has not been the norm in all cultures and communities. In the case of Fombawi, evidence of human-crocodile co-evolution and cultural tolerance to crocodile may offer clues as to how coexistence can be achieved in Nikki and Sakabansi. As suggested by (Manfredo & Dayer 2004), assessment and understanding of the conflict should include social, cultural, historical,

biological, ecological, political, historical, economic, and geographical components and should be made and reviewed, along with any action plans, by all stakeholders.

Conclusion: Thoughts on the diagnostic and baseline studies and the way forward

Our diagnostic and baseline studies provide an overview of happenings around agro-pastoral dams in Nikki, Sakabansi and Fombawi dams in Northern Bénin. Many technical and institutional constraints and opportunities were identified from these studies. Stakeholders are knowledgeable about dam management. During the next two years, research on the sustainable use and management of agro-pastoral dams for more efficient integrated water management will focus attention on the following main constraints identified by the Concertation and Innovation Group during the stakeholders workshop: (i) different strategies or practices to reduce water pollution for human, livestock and crocodiles; (ii) study on endogenous knowledge on crocodile habitat use and crocodiles movement in the 3 agro-pastoral dams and crocodile conservation strategies; (iii) strategies for herder-farmer conflict reduction, strategies of optimization of fish farming and vegetable production, different strategies or practices to slow down dams silting up, stakeholders interaction & adoption of the management plan for agro-pastoral dams.

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