

Challenges of Integrated River Basin Management in the Case of a Non-perennial River in Djibouti (East Africa)

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Abstract

Unexpected flood had struck parts of the capital town of Djibouti many times in the past. In 1994, such flooding killed more than 100 people and a decade later, it had claimed over 300 (according to United Nations' sources in 2004). Those heavily affected were the inhabitants along the plains of the "Ambouli Oued", who depend on vegetable gardens for sustenance. These floods generally occur with their associated diseases such as cholera outbreaks. Evacuating the people from the flood-prone areas and providing them with alternative place of settlement seem not to work well. This paper exposes the complexity of the problem in the case of this catchment and explores the necessity of adopting an integrated approach to solve it. It is not an easy challenge to convince decision-makers due to conflicting land and water uses that are numerous in this area, namely: (i) protection of the capital against flooding, (ii) small-scale agriculture in place, (iii) protection of the fragile aquifer, (iv) development of new projects (harbour, urbanisation), and (v) protection of the environment. Among the many constraints are lack of data and human resources, weak institutional arrangements, lack of collective memory, fatalism of decision makers, weak implication of the land and water users, and importantly enough the weight of development aid agencies that decide with their own agenda.

Key words : Djibouti, Flood, Integrated River Basin Management, Non perennial river

Introduction : the context

The Republic of Djibouti is a tiny country of the Horn of Africa, independent from France since 1977. It is classified as both a least developed and a low-income, food-deficit country. The UNDP Human Development Report for 2000 ranked Djibouti among the "low human development" countries (149th out of 174 countries). Located in a geo-strategic place of East Africa, along a major oil route, the state receives large compensations for the presence of French Troops and more recently, since 2002 from the US Army. Traditional donors (European Union, African Development Bank, Arab countries, France, Japan) as well as private investors are relatively active.

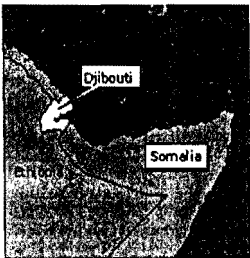


Figure 1 : location in East Africa

There is no permanent river in the Republic of Djibouti. Indeed the climate is considered to be arid to hyper arid. Mean Annual Precipitation averages 147 mm, in a very erratic and uneven way. Extreme values have been observed such as 9,5 mm in 1980 and 693 mm in 1989. Watercourses are here called "oued" in reference to the Arab word "wadi". Flash runoff is the way the oueds run, generally through few annual events during very short periods (FAO, 1995). The *Ambouli Oued* is one of the main non-perennial rivers of the country. Its 600-km² catchment has an elongated shape and steep slopes in its upper watershed. It joins the Red Sea in Djibouti-ville and the slope is almost zero (0,3 %) in the five kilometers-long last reach. Hydrology data are scarce, since the network established by a German research programme (Muller et al, 1982) in the eighties has been completely dismantled. There is only one meteorological station for the whole country, at Ambouli International Airport.

In this article the authors wish to present the challenges and analyze the thorny process of giving birth to infrastructures aimed at protecting the capital-city of Djibouti. They point out the necessity to develop an integrated river basin approach. Since the flow is not permanent and the floods relatively rare, the task is a real challenge.

Mitigating the *Ambouli oued* floods' effects

The country has always experienced problems of flooding, quoted as the third problem affecting the country after drought and earthquake (Igad, 2004).

In March 2004, the Presidency of the Republic asked the Ministry of Agriculture, Livestock and Sea, in charge of Water Resources, to reactivate a previous plan called "*integrated watershed development of the Ambouli oued*". The aim is to protect the city of Djibouti-ville against flooding but also to limit silting in the new harbour in construction. A working group has been created and meetings started in order to define terms of reference of such a study. But during the night of April 12th 2004, a catastrophic flash flood event took place, killing dozens of people and destroying goods and infrastructures. After these dreadful events, European Union, a major donor in Djibouti, proposed to partly finance protection works and in order to do so, launched a pre-feasibility study.

Method

This paper is based on an analysis of existing documents and interviews of decision-makers and water users during the last flood. The authors have accompanied, in October 2004 experts (from COWI-BCEOM) during the prefaisability study. A total of eight interdepartmental meetings took place during the last six months. The point of view of donors (World Bank, European Union, French Embassy, Japan) is also examined. The institutional arrangements to conduct such project, as well as the administrative complexity and problems of responsibility are assessed.

Results

The last flood: an obvious lack of information and organisation



Fig 2. The victims were mainly living in the Ambouli gardens (Courtesy French Army)

Heavy Rains (106 mm, Djibouti Airport station) came in few hours. Although it is very difficult to estimate the peak flow without gauging stations, BCEOM estimated that the flood was a 15 years return period event (Perrin et al, 2004). The 1100 m³/s peak flow came suddenly, during the night, while the tide was high. The fact that no flush flood took place in the last couple of years made the outset full of sediments. Furthermore the minor bed is not clearly identified. Possibly several obstacles slowed down the water: a bridge and a concrete road downstream. Intensive vegetable gardens in the minor bed (fig. 2) were initially accused to have played a major

role. They formed indeed a "bottleneck" in the last reach before the sea: no more than 20 meters wide when the normal size of minor bed measures more than 50 meters. However the experts estimated it was not the major reason for the disaster (Perrin et al, 2004).

The main explanation is different: the *Ambouli oued* had very different watercourses in the past, with frequent ones flowing East, while it flows at present to the North after a 90-degrees angle (see Spot image Fig.4).

Although the official death toll stands at 58, other sources such as WHO's report said the number of dead reaches 300 people (WHO, 2004). Without a doubt many victims were very poor people, refugees from neighbouring countries, watchmen or labourers living in the gardens (Fewsnet, 2004).

Damages included complete destruction of about 100 houses located in the direct path of the waterflow. 20 000 houses suffered losses of one sort or another (Fewsnet, 2004), a road in construction was destroyed as well as the railway, a school, a dispensary, many cars and water supply pipes. Basic services were suspended for several days. The majority of the 236 gardens was swept out. The total cost for Djibouti was estimated to be 10 millions US\$ (Ministry of Interior, quoted in Fewsnet, 2004).

Prevention of the disaster as well as organisation of assistance went very badly (Perrin et al, 2004). Without external troops' involvement, the death toll could have been worse. Indeed many people were saved thanks to helicopters.

Only the preventive measures against the possible cholera outbreak were well conducted thanks to UN agencies and other donors.

The death toll is increasing with time

In its recent history, Djibouti has been affected by a succession of floods with not less than seven major events since independence.

Table 1 : the last floods in Djibouti-ville

Year	Death toll*	Affected*	Estimated Population of the town***	Estimated Peak Flow m3/s (BCEOM)	Estimated Return period
1977	0	85 000	160 000		
1978	0	106 000	170 000		
1981	25	102 000	190 000		
1989	10	150 000	270 000	1250	20 years
1993	0	20 000	290 000		
1994	145	120 000	300 000	1500	25 years
2004	51 or 300**	100 000	400 000	1100	15 years

Source: * EM-DAT, ** WHO, *** Ministry of Habitat

The death toll seems to increase with time although the magnitude of flow has not increased significantly. Human pressure is probably the major reason. Indeed, since independence, the town has grown steadily with a high birth rate, immigration from war-prone neighbouring countries as well as massive rural exodus.

A key conclusion of BCEOM's work is that the **magnitude of the last flood was not exceptional**: what could have been the impacts of a 100 or a 1000 years return period event? Hundreds of victims, billions of dollars: no estimates have been done yet but one can imagine dreadful figures. Furthermore two major public infrastructures, the drinking water supply plan and the powerstation are precisely located in flood-prone areas. The disruption of these services could seriously hamper the development of the whole economy of this fragile country.

Water Users ignore each other

The low Ambouli watershed is characterized by the development of many human activities. The town regroups about 75 % of the population of the country and concentrates 95 % of the economy. The location of Djibouti-ville, as a capital of this former French overseas territory was decided in 1888 precisely because of the presence of fresh water from *the Ambouli oued*. Progressively with the development of the town, this resource was not sufficient and more than hundred boreholes (number 1 on figure 3) were drilled on fissured basalts.

At the same time peri-urban irrigated gardens mushroomed and were even encouraged by the state: farmers of Yemeni origin came to grow vegetables and develop dairy milk production (2).

With urban pressure (3) many infrastructures were constructed near the river despite legislation taken by the state, including schools and dispensaries but also new roads (4).

Consequently with urban expansion, demand for material of construction is partly furnished by gravels (sand collection are numerous in the basin : number 5).

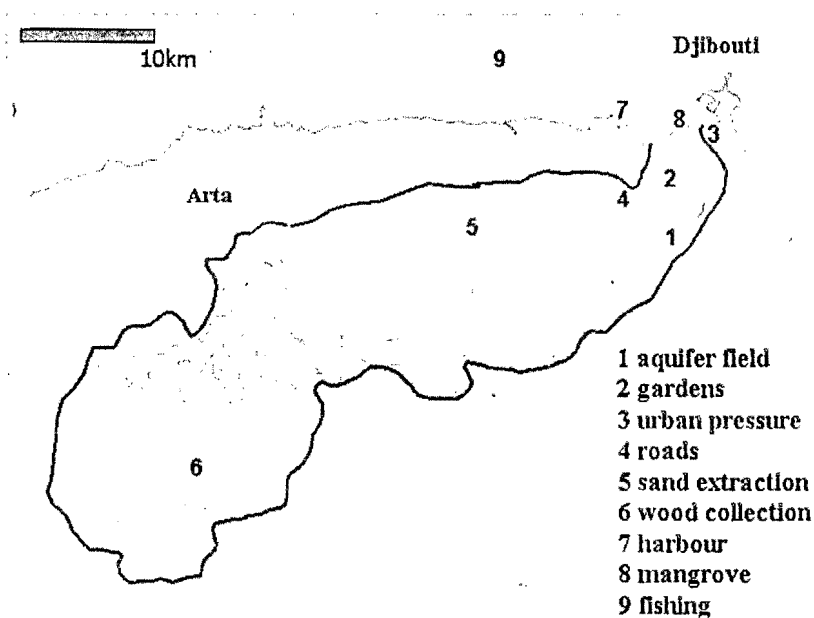


Fig 3. identified water users in the basin

Upstream, in rural areas where around 10 000 persons are living , the land of the watershed provides firewood (6), and food for extensive livestock (mainly goats). There are already signs of over-grazing in this the fragile acacia-based ecosystem.

Downstream, near the shores three indirect users have been identified: the harbour (7), the environment (mangrove and coral reefs: 8), and finally the fishermen (9). These users are indirectly concerned by floods but must not be forgotten during the impact study of a future project.

Table 2 : Ambouli watershed users

	<i>Users of the watershed</i>	<i>Links with the floods</i>	<i>Economic importance</i>	<i>Livelihoods</i>
1	<i>Aquifer, water supply</i>	Wells' destruction, pollution	+++	
2	<i>Agriculture, livestock</i>	Human victims and destruction of gardens and animals	++	+++
3	<i>Urbanism, troops</i>	Human victims indirect water-related diseases	+++	+
4	<i>Infrastructures : rail, roads, bridge</i>	Destruction , slow down the flow	++	
5	<i>Gravels extraction</i>	Sand brought by floods	+	+

6	Wood collection and pastoralism	Acceleration of flow, erosion	-	++
7	Future harbour	Silting	++	-
8	Mangrove and coral reefs	Direct effects	-	-
9	Fishermen	Pollution but also organic matter	+	++

From discussions with users and experts, several observations can be made :

Users pay no attention to the effects of their activities on users other downstream. Every one thinks individually, although interactions are obvious.

People have little memory of flooding especially in the case of such non-perennial river. Even the French Army has installed troops and families in a very vulnerable part of the city . Most of the dead in 2004 were said to be Oromos, illegal migrants from Ethiopia, impossible to control as they hide themselves in order to avoid expulsion. There even ignore the risks of living there since there are often new immigrants in the country.

The government stands weak in preventing people to live in this area and cooperation between departments is deficient. Thus in October 2004, only 6 months after the dreadful flood people started to reconstruct many dwellings despite official warnings from Ministry of Habitat. Indeed the Ministry of Interior is incapable to enforce the law.

One must keep in mind that people have little working opportunities and this peri-urban agriculture is a fantastic source of jobs and money. The authors met a gardener reconstructing his plot after he lost his 5 brothers and sisters. Similar activities such as extractions of gravels or wood collection were fustigated after the flood but again no police action was put in place.

Furthermore **no responsibility was assumed** in the aftermath of the flood. Insurers have not reimbursed anything. Nobody was accused of negligence, neither the state (in charge of protecting the citizens), nor the City Council (in charge of infrastructure development). Fatalism was the main driving explanation of the disaster.

No plan yet to prevent the next disaster

Finally, even 9 months after the drama, **no early warning system has been established**, even a rudimentary one. This system is however absolutely indispensable considering the speed of the phenomenons. For instance during the 1994 flood, no rain occurred in Djibouti-ville but only in the upstream basin. In a country with three armies and very sophisticated satellite imagery monitoring, efficient weather forecast and early warning system should be realistic (if not easy) objectives to achieve.

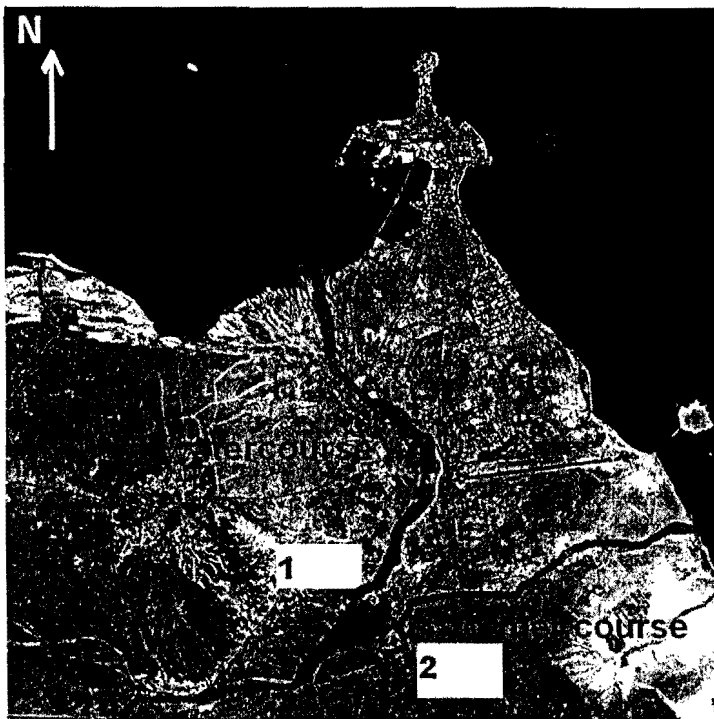


Fig 4: Spot image of Djibouti-ville area, showing the project. A dam (1) will be constructed. In case of extreme flow the surplus will flow to the East in the Douda Oued through a spillway (2)

Three main stakes are considered: (i) protecting the city but also (ii) reinforcing water resources for Djibouti (iii) preserving the gardens from destruction.

After investigation and visit of all possible dam sites the following proposal is done.

It is proposed to build a multi-purpose dam that can divert the exceeding flow in its natural and former course (see fig 4). Design must be done considering a "1000 years return period". This level of safety is needed since people are physically threatened. A 3000 m³/s peak flow and a volume of event of 34 M m³ will be considered for project design.

Since the topography is quite flat, a 15 meters-high earth dam is proposed. It will store

3 to 5 M m³ and maintain artificial floods for the gardens.

Making the project a reality now

As said before, flooding has always been an issue here and many studies have been launched in the past. But no significant infrastructure has been completed yet. In the mean time urbanization has been pursued without consideration of flooding risks.

After the 1989 floods, terms of Reference for a masterplan for an Integrated Project were prepared but the project was abandoned...until the 1994 flood. Then a new version of the Terms of Reference was prepared but no plan was drawn...until 2004, when a new disaster happened. In sum it seems that each time destructive floods happened, assignments are promised. But each time, since nobody press the case, neither users nor authorities, the project does not take off.

It is now time for action. Keeping the pace is possible, because today funding is a reality thanks to European Union. The cost is huge: 30 M US\$ (with 12 millions for infrastructures and 18 for basin development) . But it is not more than the total cost of two to three of flooding events. And of course saving lives is an immeasurable gain.

Avoiding silting up of the future dam

Considering desertification underway in the basin, high rain intensity and steep slopes, consultants (Perrin et al 2004) think erosion is the major dilemma to solve. The lifetime of the dam could be limited to less than 20 years with the current level of sedimentation (Perrin et al, 2004). Therefore soil conservation measures are crucial. The budget proposed for that

task is significant, more expensive than the infrastructures themselves. How can one achieve that objective of avoiding costly mistakes?

A striking necessity for Integrated Water Resources Management

The new project was prepared by a consultant with donors and departments assistance **but yet without users' involvement**. This lack of public participation in the debate is probably a mistake. Mobilization of users is a guarantee of public pressure to really achieve the program. It must start now during the next stage : the feasibility study

Involvement of people must become a very high priority. Mobilisation of population in the upper basin must start now and be carried on during 15 years. The ideal would be to get the assistance of NGOs in order to manage this local participation. But NGOS are rare and inexperienced in Djibouti.

The main funding agency (EU) is also worried: **who will manage such project** when public services are insufficiently trained and often disorganized. The idea to create a Catchment Management Agency (CMA) regrouping all stakeholders is probably relevant.

Finally it is still necessary to look for supplemental funding for this ambitious project. The World Bank has promised a 5 millions dollars but to fix schools , dispensaries and a dyke destroyed during the 2004 flood. Japan could be involved in the funding of land conservation but wants to quantify the risks of investing in long-time involvement with communities. Only a strong mobilization of users will oblige donors to sit around the table.

Conclusion

Flooding is likely to persist in these flood-prone areas of Djibouti-ville. Drastic measures have to be taken quickly, especially to build an early warning system.

The government of Djibouti has now in hands a first-class proposal prepared by European Union . The huge cost presented will be easily cost-effective if one considers the possible costs of 100 or worse a 1000 years return event.

But many efforts have still to be made to see the project becoming reality:

- first of all there is a need of political commitment to grasp the project. If the project is again elapsed for several years, a new catastrophe is predictable. The laws concerning housing must be applied and nobody can be authorised to stay in the minor bed of the Oued. Again a flood early warning system is the priority. It needs to integrate weather forecasts, detection (rainfall and flood levels), communication (relay of information to flood response team), and decision to evacuate.
- second is sharing information with all and making the scheme a common project of water users of the *Ambouli oued basin*. Mobilisation of energies from the whole basin is compulsory to avoid silting up of the dam. Awareness of existing dangers should be a collective battle. It also must be understood as a real opportunity to fight poverty in these peri-urban areas.
- Finally the government has now to handle the crisis effectively by maintaining pressure on donors to get the funding going. But it has to prove also that is able to make efforts on its national budget for instance in order to maintain effectively the future infrastructures. The idea of creating a basin agency, independent to government and representing all the users must be quickly investigated.

References

- EM-DAT: The OFDA/CRED International Disaster Database www.em-dat.net - Université Catholique de Louvain - Brussels - Belgium . <http://www.em-dat.net/disasters/Visualisation/tmp/xls/6419.xls>
- FAO Irrigation in Africa in figures - L'irrigation en Afrique en chiffres. Food and Agriculture Organization of the United Nations Rome, 1995 ISSN 1020-1203. From <http://www.fao.org/docrep/V8260B/V8260B0o.htm>
- IGAD, 2004 Regional Workshop to enhance the capability of IGAD members states. Application of Space Technology in Disaster Risk Management. COUNTRY REPORT OF DJIBOUTI 17 – 21 February 2004 [Nairobi]
- Ministry of Habitat, Republic of Djibouti, 1998 Schéma directeur de Djibouti et identification de projet prioritaires
- Müller W et al., 1982. Inventaire et mise en valeur des ressources en eau de la République de Djibouti. Rapport préparé par pour le projet N° 78.2233.1, Coopération hydrogéologique allemande. Bundesanstalt für Geowissenschaften und Rohstoffe. Hanover, Germany (in French)
- Perrin J., Daval. E. , 2004. Etude de pré faisabilité d'un projet d'aménagement intégré de l'Oued Ambouli. First version October 2004. BCEOM/COWI European Union - Delegation of Djibouti. (in French)
- Fewsnet (Famine Early Warning System Network), 2003 An Assessment of Food and Livelihood Security in Djibouti Ville USAID October 2003
- Fewsnet, 2004 Djibouti Food Security Update. USAID June 2004. <http://www.fews.net/centers/innerSections.aspx?f=dj&pageID=monthlies>
- World Health Organisation – Republic of Djibouti. Assessment Report on the April 2004 Floods. <http://www.who.int/disasters/repo/13002.pdf>