

Water rights and rules, and management in spate irrigation systems

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Spate irrigation is a floodwater harvesting and management system. Floodwater is unpredictable in occurrence and amount. It is emitted through wadis (ephemeral streams) and diverted to fields using earthen or concrete structures. Primarily based on the research conducted in some spate irrigation systems in Eritrea, Yemen and Pakistan, this paper discusses the impact on floodwater management of several water rights and rules, and the enforcement approaches used by various local organizations. It analyses if and how the water rights and rules have been tailored in response to changes in events in time, such as increase in irrigated area and structural modernizations; and how these affected the floodwater management. It assesses why national/provincial water laws became necessary for floodwater management following the modernization. The paper concludes by outlining what water rights and rules can achieve when applied in situations they were prepared for, and how negative their consequences can be otherwise.

Keywords: Enforcement, floodwater management, local organizations, spate irrigation, water rights and rules

Introduction

This contribution describes the water rights and rules in spate irrigation and discusses their role in water management. There are three reasons why we hope this paper can make a contribution to the central theme of this workshop (and hence took the effort to write it down). First is that it puts water rights in perspective. Different from perennial irrigation, in spate irrigation water rights are not fixed quantities or entitlements. Instead they are operating rules that respond to a variety of circumstances. This variety of circumstances is at the core of spate irrigation. The reason to emphasize this point is to move away from naïve and simplistic understanding of water rights, where water rights are seen as mechanisms to create distinctive ownership. In this naïve understanding - that can be traced back to work of the Douglas North on early land rights (North and Thomas, 1977) and the subsequent work in the field of New Institutional Economics - property rights are seen as the main institution to claim entitlements. At policy level water rights reform is often simplified as the intervention that will either help protect weaker interests on the strength of the property claim or alternatively help achieve better economic efficiency by facilitating trade and exchange of rights. The point we want to make is that water rights in spate irrigation (as in other fields of water management) are inseparable from the way water management is organized and that the rights are part of a bundle of responsibilities to the common group. Water rights are not something that precedes water management or can be used in isolation to change water management and water distribution.

The second reason to prepare this paper is that water rights and water allocation in spate irrigation rules differ between societies. In this paper we hope to provide some examples from Eritrea, Yemen and Pakistan. It is important to understand that there are higher forces at work to determine what rules and rights are to be implemented and that water rights are not only the product of the resource system itself. The last reason is to discuss how water rights change in the course of developing infrastructure, particularly in spate irrigation. Rights relate very much to operational rules and operational rules change with changing infrastructure - with different possibilities for upstream control and different common maintenance requirements. The set up of the paper is as follows. It first discusses the different operational rules and practices - giving examples from different societies. It then discusses the way local organizations and institutions have enforced (with various degrees of effectiveness) these water rights and rules, even have tried to codify it. Next, the paper discusses how some of the water rights and rules have changed over the past decades under the influence of particular external investment programmes. To start, however, we want to briefly describe what spate irrigation is.

Spate irrigation

Spate irrigation is a resource system, whereby floodwater is emitted through normally dry wadis (ephemeral streams) and conveyed to irrigable fields. It is a pre-planting system, where the flood season precedes the crop production period. In most spate irrigation systems in Eritrea, Yemen and Pakistan, the major floods occur between June and September, which is the time of heavy rainfall in upper catchments; and crop growth takes place between October and February exclusively depending on the water stored in the soil. To establish a spate irrigation system, there should be a mountainous or hilly topography that generates runoff; and adjacent low-lying fields with deep soils able to store ample moisture for the crops during periods with no precipitation (Mehari et al., 2004).

Spate irrigation systems support livelihoods of the often poorest segments of the rural population in the Middle East, West Asia, North and East Africa (Steenbergen 1997a and 1997b). The most comprehensive estimate of the land coverage of spate irrigation systems is the one compiled by FAO (1999) (see Table 1). It must not, however, be assumed that spate irrigation is practiced only in those countries listed in Table 1. The existence of spate irrigation is reported from Chile, Bolivia, Iran, Afghanistan, Mauritania, Senegal, Ethiopia and Kenya; but there is no reliable estimate of its land coverage.

Table 1. Spate irrigated versus total irrigated area in some countries of the world (FAO, 1999)

Country/Region	Year of irrigation data	Spate irrigation in ha (1)	Total irrigation in ha (2)	%of spate irrigation coverage (1/2)
Eritrea	1993	15,630	28,124	56
Yemen	1987/1997	98,320	481,520	40
Algeria	1992	110,000	555,500	20
Morocco	1989	165,000	1,258,200	13
Pakistan	1990	1,402,448	15,729,448	9
Tunisia	1991	30,000	385,000	8
Sudan	1995	46,200	1,946,200	2.5

In spate irrigation systems uncertainty is a given. The unpredictability in timing, volume and sequence of floodwater is the main cause of uncertainties and risks in crop production under spate irrigation systems. It also can in theory confuse cooperation and create a free-for-all competition. Water rights and water distribution rules in spate irrigation, however, regulate access to water and - when enforced - minimize conflict. Water rights and water distribution rules also define the likelihood of irrigation for different areas and hence serve as the key to the collective maintenance and rebuilding of diversion infrastructure. Particularly, where floodwater users depend on one another for maintaining flood channels and (re)constructing diversion structures and this work is substantial, agreement on how water is distributed is a precondition for co-operation. Water distribution rules will also make it easier to predict which land will be irrigated. As such they encourage pre-flooding land preparation, which is important for adequate water storage and moisture conservation and key to high yields.

Water rights and rules in managing unpredictable floodwater

To manage the unpredictable nature of floodwater and reduce the risk of conflicts, several categories of water rights and rules are in place in different spate irrigation systems. The most common and widely applied rights and rules (Steenbergen, 2004 and Mehari et al., 2003) relate to the:

- demarcation of land that is entitled to irrigation;

- breaching of bunds;
- proportion of the floodwater going to different canals and fields;
- sequence in which the different canals and fields are irrigated;
- depth of irrigation that each field is entitled to receive;
- access to second (and third) water turns;
- distribution of large and small floods.

These categories of water rights and rules are discussed below with some relevant illustrative examples from Eritrea, Yemen and Pakistan.

Rights and rules on land demarcation

Demarcation rights and rules are common in the lowland spate irrigated areas in Eritrea, Yemen and Pakistan where water is scarce and land is abundant, and are almost inexistent in the central highlands of the countries where water is relatively more plentiful than land. Demarcation rights and rules define the boundary of the area entitled to irrigation and set priorities to access to water depending on the year of establishment of the different fields. Instead of merely regulating seasonal water supplies, the demarcation rules also predict what will happen when changes in the entire system occur. Spate systems are dynamic. Among others, changes in the course of rivers; breaching, silting up or scouring of canals; rising of fields above irrigable command levels, are frequent and can occur on yearly basis. Demarcation rules are conservative, because, in the wake of these changes they try to re-establish the prior situation. They often protect the prior rights of downstream landowners by restricting or even prohibiting new land development upstream, which could have resulted in the diversion of floodwater to new territories and a redefinition of the group of shareholders. To cite an example, in the Wadi Laba, Eritrea, about 1,400 ha (besides the annually irrigated 2,600 ha) were distributed in 1993 in the upstream Sheeb-Kethin area. The concerned farmers were, however, clearly informed that they would have to abide by the demarcation rule: new fields can only be allocated water after all the previously established fields have received the quantity of water granted to them by the other various rules. Due to the strict adherence to this rule, only 50 ha of the 1,400 ha have been established so far and the water right of downstream farmers has been preserved. In Eritrea, fields are considered to be fully established when they accumulate a minimum depth of about 10 cm of alluvial sediments. With mean annual sediment deposition of about 3 cm, this would require at least three flood seasons.

Rights and rules on breaching of bunds

Rights and rules concerning the breaching of the bunds of diversion and distribution structures and fields are widely applied in areas where the entire riverbed is blocked by earthen bunds, and the access of water to downstream canals and fields depends on the breaking of the immediate upstream structures. In many cases, the earthen and brushwood bunds are constructed in such a way that they breach during large flood (>100 m³/s) events. This prevents damage to many upstream structures and fields while increasing the probability of irrigation of the downstream fields.

In several spate irrigation systems in Eritrea, Yemen and Pakistan, there are rules on when farmers can break bunds. For instance, once the area served by an upstream bund is fully irrigated or when a certain period of the flood season has lapsed. Boxes 1 and 2 present examples of some of such rules from Eritrea and Pakistan.

Box 1. Rights and rules on breaking bunds in the Wadi Laba and Mai-ule, Eritrea, established in 1900: our survey, 2003

In July and August, the peak flood months, if the large floods do not break the upstream *agims* and *musghas* (diversion and distribution structures), the upstream farmers have the obligation to allow the downstream farmers to break them purposely to allow the flow of water to their fields. July and August floods are considered to be rich in nutrients and all farmers are entitled to have a share. It is the responsibility of both the downstream and upstream farmers to timely maintain the structures to increase the probability of diverting the next flood(s).

In September, where floods are assumed to be low in nutrients and marginally important for crop production, the upstream farmers are not obliged to allow the breakage of their bunds.

If an upstream field receives an irrigation depth of a knee height, about 50 cm (see rule on depth of irrigation), the landowner of the immediate downstream field has the right to break the relevant bund and irrigate his field. If the downstream field holder is not on site during the irrigation period, the upstream farmer is not obliged to break his bund.

Box 2. Rights and rules on Nari system, Kacchi, Pakistan, prepared in 1917 on revision of old rules: our compilation, 2004

From 10 May to 15 August, the landowners of the upper Nari are allowed to make *gandas* (earthen bunds) in the Nari River.

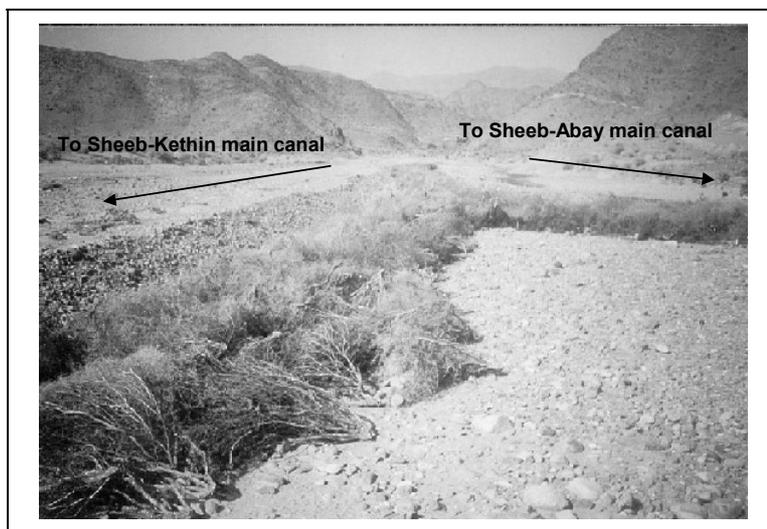
When the land served by one *ganda* in the Upper Nari is fully irrigated, the landowners in that *ganda* must allow landowners of the next *ganda* to break it.

After 15 August, the landowners of the Lower Nari are allowed to make *ganda* in the Nari River. Landowners in the upper Nari are not allowed to irrigate their land during this period or let the water go to waste. Water is not allowed to go waste to the low-lying areas East and West of the Nari River. Guide bunds will prevent water flowing to these areas. All landowners will contribute towards these bunds with farmers in Lower Nari paying twice the amount per hectare in case bunds on the upper Nari are broken.

Rights and rules on floodwater division

The rights and rules on floodwater division guide the distribution of water among different canals. In the indigenous systems in Eritrea, both proportional and rotational distributions of floodwater are practiced among the main and branch canals. During medium (25-50 m³/s) and medium-large (25-100 m³/s) floods, proportional distribution is used. This has a dual purpose. First, it irrigates two or more different areas at the same time. Secondly, by dividing the flow, it minimizes collateral damages such as destruction of structures and erosion of field bunds. During small and small-medium floods (<25 m³/s), rotational distribution is the choice. The flow of these floods, if divided, may not have the strength to reach even the most upstream fields.

In many indigenous spate irrigation systems, flow division is made flexible in order to adjust to changing bed levels of the wadi and the canals, and to variations of the flow. One example of a flexible flow division is the Wadi Laba indigenous distribution structure (See Photograph 1). The structure is constructed from earthen material. Its downstream section is reinforced with brushwood that can be easily moved in and outwards to change its orientation as needed. The structure divides the flow from the wadi to two main canals - Sheeb-Kethin and Sheeb-Abay. The management of the structure is the sole responsibility of the farmers' leaders of the five main canals in Laba. Prior to each anticipated flood event, all the five leaders gather on the site. Taking into account the size of the different areas irrigated in the previous floods, they make a collective decision on how to adjust the structure so that the flows to each area are fair.



Photograph 1. Wadi Laba indigenous main diversion structure, the *Jelwet*: ours, 2000

Rights and rules on sequence

The rights and rules on sequence supplement the rights and rules on division of floodwater. They describe the route that water follows within the area entitled to irrigation by clearly spelling out which main and branch canals have priority right to water, and which fields are entitled to receive water first. The sequence usually adjusts to the level of the floods. In the indigenous Wadi Laba and Mai-ule spate irrigation systems, Eritrea, the underlining rule is: upstream canals and fields have absolute priority right to small, small-medium and medium

floods; and the downstream canals and fields have an equal priority rights to medium-large and large floods. This rule created a perception of fairness of water distribution among the farmers and strengthened the degree of cooperation among them. Most of the indigenous structures are constructed from earthen and brushwood materials. They are susceptible to frequent destruction by floodwater. The downstream and upstream farmers depend on each other for timely maintenance of the structures.

In the indigenous spate irrigation systems in the Tihama Plain, Yemen, the fundamental sequence rule, locally called '*al aela fil aela*', grants an absolute priority right to the upstream farmers regardless of the size of the flow. The downstream farmers are not, however, denied the right to surplus water after the upstream farmers have withdrawn sufficient quantity of water in accordance with their right. '*Al aela fil aela*' is an Arabic phrase, which when literally translated means 'the top is always at the top'; in this case, at the top list to get water. This rule might seem very unfair to the downstream farmers and might give the impression that the upstream have been utilizing almost all the floodwater. That was not usually the case. The indigenous structures have been frequently breached by large floods providing ample water to the downstream farmers, which in some years was more than the quantity of water received by the upstream.

Rules on depth of irrigation

The rules on depth of irrigation are not common in spate-irrigated areas in Pakistan, but are standard practices in Eritrea and Yemen where field-to-field water distribution system is practiced. In this distribution system, a farmer takes his turn, as soon as his neighbour completes the inundation of his land. He does so by breaking a relevant section of the bund surrounding the field of the upstream landowner. In this practice, fierce competitions usually arise among neighbours, which in many cases lead to conflicts. Probably, the rules on water depth were introduced mainly to mitigate such conflicts. In contrast, when each field (usually of very large size) is fed by its own separate intake, as is the case in many spate irrigation systems in Pakistan, such conflicts are rare, which might be the reason why the rules on the depth of inundation are unusual.

The rules on depth of irrigation could be viewed as complementary to the rights and rules on sequence, because they quantify the amount of water a certain field could receive during its turn. In Eritrea (Wadi Laba and Mai-ule) and Yemen (the Tihama Plain), the rule on irrigation depth states: each field is entitled to a depth of a knee-height (about 50 cm) at each turn. When the rule was first introduced hundred years ago, the farmers attempted to ensure its implementation by limiting the height of the field bunds to around 50 cm. With time, however, this became impractical. The sediments deposited in the fields are the only sources for maintaining the field bunds. Nevertheless, the degree of damage done to the bunds is not the only factor that determines the amount of sediments to be removed from the fields. Even when there is no maintenance work to be done, certain quantity of sediments need to be removed from some fields in order to keep the fields' level within that of the irrigable command area of the concerned structures and canals. The excavated sediments are re-deposited in the only convenient disposal places - the field bunds. This resulted in irregularities in the height of many field bunds. In Wadi Laba and Mai-ule, and the Tihama, the field bunds' heights range from 0.30 m to 1 m.

The farmers explained that the rule on breaking bunds, when first introduced before nearly hundred years only referred to the breaking of the bunds of the diversion and division structures. It was only ten years later that it was modified to include the breaking of field bunds when the farmers realized that it was impractical to standardize and limit the maximum height of field bunds to 0.50 m.

Rules on second turns

Several crops, although they can survive on one turn of water application, give significantly higher returns when they are irrigated more than once. Sorghum, wheat and cotton are examples. In the case of sorghum, which is the main crop in Wadi Laba and Mai-ule systems in Eritrea, the farmers informed that with one, two and three irrigation turns, they can harvest a maximum of 1 ton/ha, 2.5 tons/ha and 3.5 tons/ha respectively. Hence, to ensure that the majority of the fields receive at least one turn, thus guaranteeing most of the households to earn the minimum possible yield of food crops, a rule was introduced in the 1920's that defined the access to second turns. The rule states: regardless of its location, the type of crop grown in it, and the social and economic status of its owner, a field is allowed a second turn only after all the other fields that are entitled to irrigation (in line with the rule on demarcation), have received one turn. This rule has, however, some

practical shortcomings. The degree to which it is possible to honour it depends on the size of the flood. If the floods are small with no strength to reach the dry fields (especially under the prevailing field-to-field system), the only option would be to apply them to the area, which is already irrigated.

In Wadi Tuban, Yemen and Rod Kanwah, Pakistan, the rules on second turns are different than those in Wadi Laba and Mai-ule. They limit the access to second turns only to the most important subsistence crops, wheat in Pakistan and red sorghum in Yemen.

Rules on large and small floods

Finally, the water distribution may differ according to the size of the floods. One example given is the automatic flow division when floods are large and able to break the bunds in the various flood channels. In other systems there are explicit rules on how to accommodate small and larger floods. Small floods tend to be diverted to the upper sections of the command area, if only because small floods are not likely to travel that far. A rare example of explicit rules dealing with floods of different sizes concerns the Irrigation Plan for Wadi Tuban in Yemen (see Box 3).

Box 3. Water allocation rules for Wadi Tuban, Yemen: our survey, 2004

To ensure efficient use of spate water, irrigation is planned as follows:

When the spate flow is small (5 to 15 m³/s), priority is given to the canals in the upper reach of the Wadi.

When the spate flow has a medium size (15 to 25 m³/s), priority is given to canals in the middle reach of the Wadi.

When the spate flow is large (25 to 40 m³/s), the flow is directed either to Wadi Kabir or Wadi Saghir in the lower reach of the delta depending on which one has the right to receive the spate water.

When the spate flow exceeds 40 m³/s, the flow is divided equally between Wadi Kabir and Wadi Saghir.

Enforcement of water rights and rules

The type of enforcement strategies and the degree to which the water rights and rules can be enforced varies mainly depending on the social structure of the communities and the level of the overall governance in the area. In the spate systems in Eritrea, Yemen and Pakistan, the enforcement of water rights and rules can be related to the following three factors:

- local organizations and institutions;
- relationship between water rights and rules, and maintenance;
- codification.

Local organizations and institutions

Until 1970's, for the past six hundred years, the enforcement of the water rights and rules in many spate systems in Yemen had been the responsibility of the local '*Sheikhs* al-wadis' who were appointed by, and who worked under the direct and strict instructions of the local '*Sultans*'. '*Sheikhs*' is an Arabic term that usually refers to 'religious leaders'. In this case, however, '*Sheikhs*' means 'chiefs' who may or may not have any religious ranks. Hence, the phrase '*Sheikhs* al-wadi' refers to 'chiefs of the wadis'. '*Sultans*' is also an Arabic word and as used here, roughly means 'supreme leaders'.

Many communities in the Tihama Plain, Yemen that depended on spate irrigation for their livelihood comprised of several tribes. The '*Sheikhs*' and '*Sultans*' who had the leading role in the enforcement of the water rights and rules always belonged to the tribe that had the largest number of members; was the most powerful in terms of material and capital wealth; was believed to be the most native in the area. *Sheikhs* and *Sultans* were very respected and feared leaders. Their leadership was passed on hierarchical basis to the eldest son. In the Muslim spate irrigation communities in Yemen, the female gender had no right to be *Sultan* or *Sheikh*.

In Yemen, there were no other people or institutions that could challenge the ruling of the *Sultans* and *Sheikhs* regarding the implementation of the local water rights and rules. They had the final word, which all members of all the tribes within the concerned communities had to abide by, either willingly or unwillingly. Many of the interviewed elderly farmers in Wadi Tuban, Zabid, Mawr and Siham explained that the *Sheikhs* and *Sultans* were authoritarian, but they gave them credit for their effectiveness in safeguarding the water rights of the downstream farmers. To provide an example, in Wadi Tuban, Yemen, the *Sheikh*-al-wadi had the full power to impose sanctions on upstream farmers who take water in violations of the rules and/or without his permission. The sanctions, which were frequently applied upon approval by the *Sultan*, included:

- the concerned farmers were not allowed to grow any crop on their fields, and the immediate downstream farmers had the right to grow crops on the irrigated fields of their upstream neighbors;
- if crops were already cultivated, the yields had to be given to the immediate downstream farmers.

The interviewed farmers informed that due to mainly the high degree of heterogeneity in the level of power of the tribes, conflicts in the Tihama Plain were very intense and serious. The *Sultans* and *Sheikhs* were not able to prevent such conflicts from happening, but were often successful in settling them.

Following huge investments in the 1970's in structurally modernizing the indigenous spate irrigation systems in Yemen in general and the Tihama Plain in particular, the introduction of formal government and the collectivisation of agriculture in South Yemen, the task of managing the spate irrigation systems was transferred from the *Sultans* and *Sheikhs* to Government employees and staff in agricultural co-operatives, who over the years were faced with reduced funding inflows and erosion of authority. The majority of the interviewed farmers also spell out that after the reunification of Southern and Northern Yemen, the central Government further diminished the role of the co-operatives with out putting in place an alternative institution that could better handle the spate irrigation management, effectively creating a governance vacuum. Al-Eryani and Al-Amrani (1998), in support of this assertion, stated that due to the decline in the role of the co-operatives in the management of spate irrigation systems, a worrying vacuum was left that resulted in more conflicts between the upstream and downstream users.

The social structure of the Wadi Laba and Mai-ule communities in Eritrea differed significantly from that of the Tihama communities in Yemen. The Wadi Laba and Mai-ule communities did not comprise of a dominant tribe and had no *Sultans* and *Sheikhs* with absolute authority to enforce water rights and rules. Almost all members of the communities in the Wadi Laba and Mai-ule were largely homogenous in terms of land ownership, and material and capital wealth. Their landholding ranged from 0.5 to 2 ha, with the majority of the households owning 1 ha. Nearly all were poor living from hand to mouth.

For the past hundred years, till 2001, the authority of enforcing the water rights and rules in the Wadi Laba and Mai-ule was shared among the farmers' organization, and the Government institutions - the Local Administration and the Local Ministry of Agriculture. The farmers' organization came into being around 1900's and its key players were the *Teshkil* (Plural: *Teshakil*), *Ternafti* (Plural: *Ternefti*) and *Abay-Ad*. '*Teshkil*' is a local term that means a 'sub-group leader'. The *Teshkil* commanded a group of 20 to 40 farmers who usually irrigated through one branch canal. *The Teshkil* was responsible for implementing all the water rights and rules that apply to the farmers within his command. It was only on his request or on a request of a group of farmers unsatisfied with his judgment in, for example, resolving some conflicts that the respective *Ternafti* could interfere. *Ternafti* is also a local term that refers to a 'group leader'. The *Ternafti* had the authority to enforce rules and rights that govern the sharing of water among two or more groups of farmers led by a *Teshkil*. When conflicts arose between upstream and downstream farmers due to, for instance, the improper location and/or adjustment of a certain structure, and the *Ternafti* failed to satisfactorily solve them, he could request the *Abay-Ad* as a first step and the Local Administration as the last chance for mediation. Two or more *Teshakil* could also make the same request if the *Ternafti* did not. In solving conflicts, the Local Administration visited the site with experts from the Local Ministry of Agriculture and made a verdict, which was final and binding. '*Abay-Ad*' is a local phrase that means 'village elders'. These were a group of old men widely respected for their skill and impartiality in solving conflicts.

The concerned farmers elected the *Teshakil and Ternefti*. There was no time limit on the number of terms and years they could serve. If most farmers concluded that they were not performing well, however, they could remove them from their power by a simple majority vote. As was the case in Yemen, in the Muslim communities in the Wadi Laba and Mai-ule, females were not allowed to have any leadership position and to participate in any decision making of issues that affected the water management in spate irrigation systems. The cultural and social beliefs that led to such a restriction in women's participation, are still in place.

Unlike the *Sultans* and *Sheikhs*, the *Ternefti* and *Teshakil* had no power to impose harsh sanctions against those who violated the rules. Nevertheless, the farmers' organizations in the Wadi Laba and Mai-ule were able to successfully enforce the water rights and rules, protect the rights of the downstream farmers and minimize conflicts. Among the factors that led to this achievements included: the existence of the homogenous society that strongly believed in equity of water distribution; the fact that the *Ternefti* and *Teshakil* were democratically elected and were largely viewed as 'accountable' by their customers - the farmers; the unambiguous sharing of responsibilities between the leaders of the farmers' organization and those in the Government institutions.

Here, by 'accountable', it is meant that the farmer leaders effectively understand and represent the specific interests of the farmers. The degree of 'accountability' of any farmers' organization leaders greatly depends on:

- the nature of the relationship of the farmers' organizations with the respective Government institutions involved in the management of the system;
- the nature of the farmers' organizations themselves.

The nature of the relationships between farmers' organizations and the Government institutions range from "autonomy" to "dependence" in both the 'financial' and 'organizational' dimension (Hunt, 1990b). The more autonomous the farmers' organizations, the less influenced their leaders are by higher officials in the Government offices and the more accountable are to their customers - the local farmers. The farmers' organizations in the indigenous Wadi Laba and Mai-ule systems could be considered fully autonomous in the 'organizational dimension'- the 'organizational control of water'- as they were entirely responsible for making all decisions on how water should be shared and it was only on their request that Government institutions interfered. They could also be assumed as largely autonomous in the 'financial dimension' because most of the maintenance work of the indigenous structures had been largely accomplished by mobilizing the human labor and draft animals of the local communities. The Government institutions only provided some materials such as shovels, spades - even that on a request from the organizations.

The 'nature of farmers' organizations' refers to how inclusive the organizations are of the various wealth groups and the male and the female gender members of the community; and how representative their leaders are. There was no big gap between the rich and the poor in the Wadi Laba and Mai-ule communities and hence the wealth category did not apply. As stated earlier, the female members of the society, although allowed to be members of the organizations, they did not have decision-making voices and they were not allowed to elect or be elected. This exclusion of the female gender did not, however, affect the accountability of the organizations and their leaders as far as their activities in enforcement of water rights and rules were concerned. The household heads, usually the men, were fully represented in the organizations, and it was they who actually owned the land and who made all the decisions on behalf of all the household members. Even in the case of the fewer than 5 % female-headed households in Wadi Laba and Mai-ule (widowed or divorced women), it was the close male relatives of the women who served as representatives of the households in making all the necessary decisions.

Relationship between water rights and rules and maintenance

The links between the water rights and rules, and the organization and execution of maintenance tasks can be categorized into three aspects. To start with the first aspect, in many spate irrigation systems, the right to floodwater is tantamount to one's contribution to maintenance of main and branch canals and structures. If one fails to contribute, one cannot simply be allowed to irrigate his field. This was a common practice in the indigenous systems in the Tihama, Yemen, but inexistent in many of the indigenous systems in Eritrea. As mentioned earlier, in Eritrea, most of communities engaged in spate irrigation were homogeneously poor and their livelihood entirely depended on their spate irrigated fields. There was a strong believe in the society that

prohibiting a certain field access to water, because its owner - the household head - failed to report for maintenance duty, is not the right decision. Such an action was viewed as depriving the whole family of their very basic food for a mistake done by one of its members - the household head. Hence, in the indigenous Wadi Laba and Mai-ule systems, contributing labour was not a prerequisite for preserving your water right. The second aspect of the link relates the water rights and rules, and 'the critical mass' - the minimum amount of labour and materials needed for maintenance. In the indigenous Wadi Laba and Mai-ule and the Tihama spate irrigation systems, maintenance task was largely dependent on human labour and draft animals. In such situation, large task force was required, which could only be made available through strong cooperation between upstream and downstream farmers. The fact that tail-end farmers were only interested to share the burden of maintenance if they were not systematically deprived of their water right, made 'the critical mass factor' vital for serving as a check on too large an inequity in water sharing. To come to the third aspect of the link, water sharing rights and rules, in particular the rules on demarcation help to identify the group of farmers who are entitled to floodwater and who have interest in jointly undertaking the necessary maintenance job. Without the demarcation rules, it is very difficult to form a group of partners, making the organization and cost sharing of the recurrent maintenance work problematic.

The significance of the 'critical mass' has considerably diminished in many systems in the Tihama and may be affected in the Wadi Laba and Mai-ule systems in Eritrea mainly due to the structural modernization of the indigenous structures; and mechanization of the maintenance, which is usually undertaken by Government institutions. This is elaborated in the section: 'modifying/changing water rights and rules'.

Codification of rules

In all the spate irrigation systems in Eritrea, there are no complete records of water rights and rules either in the relevant Government institutions or the farmers' organizations. In most cases, however, the rules and rights are presented in plain unambiguous language, which has helped to easily and correctly disseminate them among large (greater than three thousand households) communities via word of mouth. In Wadi Zabid, the Tihama Plain in Yemen, the renowned Islamic Scholar Sheikh Bin Ibrahim Al-Gabarty is believed to have first recorded the rules and rights for distributing floodwater about six hundred years ago. Rights and rules on floodwater distribution in the Suleman range in Pakistan were codified by the revenue administration during the period of the British Colony in 1872. The documents, which are still available in a register, the Kulyat Rodwar, contain a list of all villages responsible for contributing labour for maintenance of the various bunds. The document also identifies a special functionary that was responsible for enforcing the rules. The Kulyat Rodwar and the rights and responsibilities contained therein are not updated, but the creation of this functionaries serves to keep the system flexible, as it allows the built-up of an institutional memory of 'jurisprudence'.

There is a large added value in codifying water rights and rules into written documents such as laws and regulations. It could at the least serve as basis for clarifying disagreements in interpretations and introduce a neutral factor in any dispute. The continued use made of the Kulyat Rodwar registry in Pakistan is a proof of the importance and relevance of codifying. Yet, codifying water rights and rules may not as such be sufficient to ensure that they are observed, and to mitigate conflicts. The ubiquitous disputes in Wadi Zabid, where powerful parties stand accused of violating the water rights and rules in spite of the presence of the more than six centuries old records; and the hardly existent vehement conflicts in Wadi Laba and Mai-Ule, although non of the rules and rights are codified; illustrate the point.

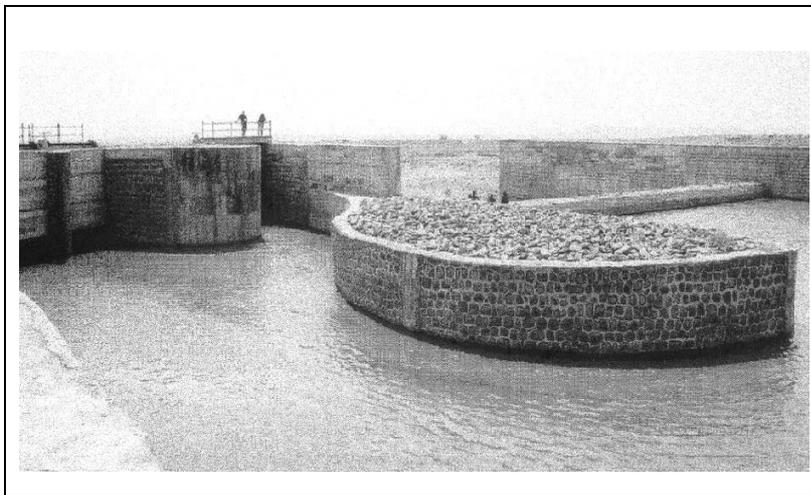
Modifying/changing water rights and rules, and their implications

If water rights and rules in spate irrigation systems are to continue to deliver, they must necessarily adjust to new situations created by various factors - new land development, changing in crop pattern, structural modernization (infrastructure investment); shift in power relations and change in levels of enforcement.

In this section, with the help of examples from Eritrea, Yemen and Pakistan, the consequences of tailoring some of the water rights and rules and the managing organizations in response to some of the mentioned factors, and a failure to do so, are discussed.

To start with the case from Eritrea, in the Wadi Laba, due to increase in the number of inhabitants, the land under spate irrigation increased from about 1,400 ha to nearly 2,600 ha between 1900 and 1990. As a result, the farmers explained that for twenty years (1960 to 1980), they consistently witnessed that even during the best flood seasons, their existing rules failed to guarantee that all the fields received at least a single turn. To deal with this new reality, by around mid 1980's, the farmers added a phrase to the 'water right on sequence' - 'in a new flood season, dry fields first'. Its full interpretation is that regardless of the location of the fields, in a new flood season, the fields that did not get a single irrigation turn in the previous flood season are irrigated once before any of the other fields get a single turn. An overwhelming majority of the interviewed farmers seemed content with the degree of the impact this modification had in preserving the perception of the fairness of water distribution that existed prior to the land expansion.

To provide another example from Wadi Laba, the structural modernization that was completed in 2001 replaced the flexible main indigenous structure (see Photograph 1) with a rigid permanent weir (see Photograph 2), and many other secondary earthen distribution structures with gabion.



Photograph 2. Section of Wadi Laba diversion weir: ours, 2003

The modern structures necessitate a different type of maintenance. They do not depend on labour and the collection of brushwood, but instead require earthmoving machinery, such as loaders, bulldozers and trucks, which in turn call for different organizations, managerially, financially and technically. The main factor in the past that was key for the enforcement of the water rights and rules during the indigenous systems was 'the critical mass' - the need for a large number of farmers that would work on collective maintenance. There is a risk that the different maintenance requirements will change the way that water distribution is organized. Though it is too early to say, in 2003 flood season, there were fifteen occasions witnessed by the authors when the upstream farmers utilized large floods and irrigated their fields two to three times before downstream fields got a single turn. These caused a lot of conflicts. The most downstream 300 ha did not receive a single turn in 2002 and 2003. The earlier rule on sequence and large and small floods was not applied, partly also because the new infrastructure attenuated the floods and effectively reduced the number of big floods, which were the ones that served the tail areas previously.

Over 30 years of management of spate systems by large Government irrigation institutions in Yemen have proven that such institutions have difficulty handling the task solely. Some of the factors include: poorly defined sharing of responsibilities and the long communication lines, which lead to slow decision making process; lack of adequate funding; little 'accountability' towards the bulk of users. More than anything the chronic under funding of maintenance and the loss of vigour in the operation and maintenance departments was the undoing. It left a vacuum where it was not clear who was responsible for water distribution, yet no one doing the hard work of timely maintenance.

If the relatively fair distribution of the floodwater that existed prior to modernization is to be preserved and the economic homogeneity of the Wadi Laba communities is to be largely conserved, the farmers' organizations in Wadi Laba and Mai-ule, which has run the system for hundred years and has good knowledge of floodwater management practices; must continue to take the lead role. To perform this task, the farmers' organization needs to have financial and organizational autonomy and hence its accountability. Great strides have been made with the establishment of the Wadi Laba and Mai-ule farmers' organization (also commonly called the Sheeb Farmers' Association) with almost full membership of all farmers in the area and the universal endorsement of its by-laws. The leadership of this new organization is very much on the time-tested system of *Ternefti* and *Tesahkil*. The main challenges in the coming period are the internal organization, the water distribution, the collection of adequate funding (also in the occasional disaster year), the running of earthmoving equipment and the operational fine-tuning of the modernized system. In addition, there are issues concerning some national and provincial laws that need to be considered. These are discussed below.

For the past hundred years, till 2001, the Wadi Laba communities neither relied on national or provincial laws and policies to manage their indigenous spate irrigation systems, nor did they bother to clarify what impact those policies and laws could have on the floodwater management. Since the structural modernization in 2001, however, some farmers and their leaders are frequently asking the question: after the huge financial investments, will the Government still allow us to continue to own and utilize 'our' land and floodwater? The urgency to get an answer to this question emanates from the perceived fear of the farmers that the Government may implement the '1994 Land Proclamation' to disposes them of the land they have considered theirs for decades. In Eritrea in general, and in the Wadi Laba and Mai-ule spate irrigated areas in particular, owning or having land usufructuary right is a prerequisite to securing a water right for agricultural production.

For decades, the farmers in Wadi Laba and Mai-ule have practiced the traditional land tenure system, the *Risti*. When literally translated, '*Risti*' means 'inherited land from the founding fathers'. Under this tenure system, ownership of land in a certain village(s) is vested on the *Enda* (plural: *Endas*) - the extended family that has direct lineage to the founding fathers of the village(s). The system is highly discriminatory against women. Besides, as it allows partition of the land through inheritance, it may also cause land fragmentation and render the farm plots economically non-feasible. However, the major tenets of the *Risti* (see Box 4) collectively provide strong sense of land and hence water security to the eligible landholders.

Box 4. The main tenets of the *Risti* land tenure system in Wadi Laba and Mai-ule: our survey, 2004

The *Enda* holds a lifetime ownership of land within the territories of its native village (villages). The land is distributed equally among the male *Enda* members. Only widowed women are allowed to own half of the parcel of land granted to men.

An individual member of the *Enda* has the right to utilize his plot for the production of whatever crops he wants. He has also an absolute right to inherit his land to his sons, lease or mortgage it. He can only sell the land, however, with the consent of the extended family- mainly the father, grandfather and the first cousins.

The village assembly, the *Baito*, together with the Wadi Laba and Mai-ule farmers' organizations are responsible for screening those eligible for the *Risti* land, distributing the available land equally among the eligible; and carrying out other related land administration tasks. They, however, have neither the right nor the power to confiscate a land allocated to a verified *Enda* member.

The 1994 Land proclamation refers to the *Risti* and the other indigenous tenure systems as obsolete, progress-impeding and incompatible with the contemporary demands of the country. Thus, one of its stated objectives is to replace/reform the traditional tenure system with a new dynamic system. Most of the provisions of the Proclamation (see Box 5) are important milestones, particularly in providing gender equity, and preserving the economic viability of the arable land. When some of its provisions are read against the background of the *Risti*, however, they seem to have given too much power to the Government at the expense of the farmers' organizations. This power shift may create (as it seems is the case in Wadi Laba and Mai-ule) tenure insecurity.

Box 5. Some of the provisions of the 1994 Land Proclamation: our compilation, 2004

The Government of the State of Eritrea is the sole owner of all land.

All citizens of Eritrea above the age of 18 are eligible to usufructuary right regardless of sex, race, clan, *Enda* or beliefs. Any individual may lease his/her usufructuary right over the land in whole or in part, but under no circumstance can he sell the land.

To preserve the economic viability of farmlands, partition of land through inheritance is prohibited.

A Land Administration Body (LAB) consisting of a representative of the Governments' Land Commission (GLC), members of the village assembly and farmers' organization leaders, and different local government bodies is responsible for classifying land and distributing it equally to the eligible by virtue of the proclamation and to those who make a living by farming. The LAB is a subordinate executive body with respect to Land distribution and it carries its functions under strict orders and directives from the GLC.

The Government or its appropriate government body has the absolute right and the power to expropriate land that people (regardless of their clans, *Endas*, race, sex, beliefs) have been settling on or have been using for agricultural or other activities, for purposes of various development and capital investment projects aimed at boosting national reconstruction or other similar objectives. This provision further states that compensation will be given whenever a land is confiscated, but it does not elaborate what such compensation will be, who decides on the nature of such compensation and whether or not the individual landholder or the farmers' organizations that represent him can challenge any compensation arrangements made by the GLC.

The provision of the Land Proclamation that grants the Government absolute power and right of land appropriation is the one frequently singled-out by almost all the interviewed Wadi Laba and Mai-ule farmers who expressed fear and nervousness with regard to their land and water security. The majority of the farmers believe that the Government would alter the cropping pattern from the current entire focus on food crops to high value cash crops to boost national production and recover the huge (about four million US\$) investments made for the modernization of the Wadi Laba and Mai-ule systems. In an attempt to justify this assertion, the farmers point to the continuous push that they claim is being made by the Local Government and the Local Ministry of Agriculture to introduce cotton crop, despite their reservations. The farmers foresee that in the near future their status will be turned from landowners (users) into daily laborers under Government payroll. They contend that although they trust the Government will do all it can to provide reasonable compensation should it confiscate their land; no compensation will have a comparable value as the land they currently own and to which they attach a lot of pride. The farmers argue that they should be the ones to decide whether or not to hand over their land once the Government reveals its compensation plans.

The farmers' analyses of the post-modernization situation of their irrigation systems, although it seems to have evolved from a genuine perception of land and hence water insecurity, it may as well end up being just a logical speculation. The Government has clearly stated that the objective of modernizing the Wadi Laba and Mai-ule systems is to improve the living standards of the concerned communities; and that it will ultimately entrust the operation and management responsibility of the systems to the farmers' organizations. If this noble objective is to be translated to reality, however, real and active farmers' participation throughout the ground-laying process and activities (this has yet to properly start) for the management transfer is vital. Nevertheless, such farmers' participation may not be achieved unless the perceived (by the farmers) land and water insecurities - justified or not - are addressed. We believe that introducing some complementary (to the Land Proclamation) easily understandable provincial/sub-provisional laws may be useful to this end. Among others, these may spell out: in the post modernization era, what kind of land and water user rights do the spate irrigation communities have? What decision making power do these user rights bestow on the farmers' organizations as far as the cropping system, modifying/changing water rights and rules, and other important land and water utilization activities are concerned? Do the farmers' organizations and the communities as a whole have any new obligations they need to fulfill if they are to retain these rights? If yes, what are they?

Another related issue that needs to be given due consideration is the legality of the Wadi Laba and Mai-ule farmers' organizations. Although the organizations are officially recognized at the sub-province level - official in a sense that the sub-province Local Government and the Ministry of Agriculture acknowledge the organizations as important partners in the management of the irrigation system - the organizations can not yet be considered as having a full legal status. Their establishment and existence is not supported by any official decree or law, nor do they have the legal authority to, for instance, make direct contacts with donor agencies; own property such as machinery; operate independent bank accounts. We presume that it is useful

to introduce national/provincial laws that strengthen the legality of the organizations and provide them the authorities they need to cope with the new management challenges of the modernized systems.

To come to the example from Yemen, in Wadi Zabid, Siham and Mawr spate irrigation systems, the structural modernizations done in the 1970's replaced the indigenous earthen and brushwood structures with concrete weirs. This resulted in almost complete control of the floodwater by the upstream users. The '*al aela fil aela*' rule, although it granted an absolute priority right to the upstream farmers, as stated earlier, it did not usually cause unfairness of water distribution during the indigenous systems. This was because the indigenous structures were frequently washed away delivering water to the downstream. In contrast, the weirs seldom breach. Hence, applying the '*al aela fil aela*' rule effectively led to the 'capture' of the floodwater by the upstream. Due to mainly the vacuum of governance created after the fall of the *Sultans* and *Sheikhs*, who were replaced by 'weak' Local Government, the '*al aela fil aela*' rule was not modified to meet the demands of the new reality. Instead, the upstream farmers strictly applied it. Moreover, encouraged by the abundance of water furnished to them and the absence of any effective countervailing power, the upstream farmers shifted from the cultivation of food crops to more water demanding highly profitable banana crop on the basis of conjunctive use of groundwater and spate flow. This further reduced the amount of water that could have reached the downstream. The Local Government did not interfere to stop this change in cropping pattern. The ultimate consequence is that many of the downstream fields are now abandoned and their owners are earning their living on a crop-sharing arrangement by serving as daily labourers in the fields of the now rich upstream landlords. In Wadi Zabid, where the crop-sharing arrangement is more common, the tenants do all the labour work (from plating till harvest) for a return of a quarter of the harvest in kind.

The term 'weak' here refers to a Local Government which lacks: in-depth knowledge about local water rights and laws and approaches and strategies to enforce them; accountability to the poor segments of the farmers; the power to correct some unfair land and water utilization decisions taken by some individuals or communities.

As to the example from Pakistan, in Anambar Plain in Balochistan, one of the introduced modern weirs significantly changed the indigenous water distribution system. The weir was constructed to divert spate flows to upstream fields. It performed this function, but also considerably reduced the base flow to the downstream fields. This deprived the downstream farmers of their basic access to water granted to them by the water rules that had been implemented for years. Essentially, the design was made with a major oversight as to the prevailing water distribution rules. Hence, the weir became the main cause for many tensions and conflicts. Unlike in the Yemen case, the upstream community, faced with an equally socio-economically powerful downstream community, did not manage to maintain the water control power offered to it by the weir and did not shift from food crops to highly profitable commercial crops. As conflicts became unbearable, the two communities - in harmony - reached a mutual agreement - they purposely blew up the weir (see Photograph 3) and returned to their indigenous structures and water sharing arrangement.



Photograph 3. Deliberately destroyed diversion weir in Anambar Plain, Pakistan: ours, 1997

Conclusions

Water rights and rules mitigate the unpredictable floodwater supplies to a large extent by introducing a series of interdependent flexible regulation mechanisms that define acceptable practices on how water should be shared during each flood occurrence. They protect the rights of the farmers entitled to flood water; define the type of water sharing system and the sequence that should be followed in the event of different flood sizes; limit the amount of water a certain field receives at each turn; outline which field and when it is entitled for a second turn. Collectively, the water rights and rules create a perception of fairness of water distribution between the upstream and downstream farmers thus generating an atmosphere of cooperation between them. This in turn, enables the attainment of the 'critical mass' needed for accomplishing the important component of the floodwater management - timely maintenance of the indigenous structures. To perform these tasks, however, the water rights and rules must be observed by the majority of the farmers. This could be achieved only when there are local organizations, which are accountable to most farmers and that apply enforcement approaches that take into account the social structure of the concerned communities.

The water rights and rules are drafted and implemented in a way that they meet the floodwater management needs in a given situation. They need to be constantly tailored and the enforcement organizations and the strategies they use timely adjusted to cope with changes in events in time, if the above stated achievements are to be sustainable. Should this not be done, as was the case in some systems in Eritrea, Yemen and Pakistan, the water rights and rules can end-up being frequently violated and become sources of unfairness of water distributions and conflicts. This in turn could:

1. pave the way for disintegration of the long established local farmers' organizations; and cause the creation of a gap between the poor and the rich in what were rather wealth-wise homogenous societies;
2. accelerate the downfall of downstream farmers, leaving them unprotected against the illegal capture of the floodwater by the upstream farmers;
3. result in deliberate destruction of investment.

In general, national and provisional policies and laws have hardly any direct impact on the floodwater management in the spate irrigation systems. The water distribution and maintenance is operated by local water rights and rules and they are sufficient. Where national legislation could become helpful, however, is in providing farmers' organizations legal recognition and legal authorities to perform activities that would enable them to be financially and organizationally autonomous. This requires more than legislation however - it also necessitates sincere efforts to support the local organizations and graft them on earlier local organizations and avoid dual structures (traditional and formal) are created.

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