

# 7 Water Rights and Rules, and Management in Spate Irrigation Systems in Eritrea, Yemen and Pakistan

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## Abstract

Spate irrigation is a system of harvesting and managing flood water. In spate irrigation, flood water is emitted from *wadis* (ephemeral streams) and diverted to fields using earthen or concrete structures. By nature, flood water is unpredictable in occurrence, timing and volume, which puts special challenges to the farmers who use, co-share and co-manage the resource. Primarily based on the research conducted in spate irrigation systems in Eritrea, Yemen and Pakistan, this chapter discusses the interlinkage between local flood water management and water rights and rules, and the enforcement mechanisms in place. It assesses how formal national/provincial land and water laws affect local flood water management and argues that what matters most are the local rules for cooperation and sharing the resource and, hence, that formal water and land rights for spate irrigation should recognize local water rights and management.

*Keywords:* customary practices, enforcement, flood water management, irrigation management transfer, local organizations, spate irrigation, water rights and rules, Eritrea, Yemen, Pakistan.

## Introduction

This chapter describes the water rights and rules in spate irrigation and discusses their role in water management. There are three ways in which this chapter contributes to the central theme of this volume. The first is by analyzing the complexity and robustness of local water rights. Spate irrigation water rights, which are different from perennial irrigation water rights, are not fixed quantities or entitlements. Instead, they are operating rules that respond to a variety of circumstances, which are at the core of spate

irrigation. We emphasize this point to move away from naive and simplistic understanding of formal water rights, where water rights are seen as mechanisms to create distinctive ownership. In this naive understanding – that can be traced back to the work of 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 made in this chapter 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 way this chapter contributes to the central theme of this volume is by recognizing that water rights and water allocation in spate irrigation rules differ between societies, although there are also cross-cutting similarities. In this chapter we hope to provide some examples from Eritrea, Yemen and Pakistan (see Fig. 7.1). It is important to understand not only that water rights are the product of the resource system (the spate irrigation system) but that there are higher forces at work (e.g. the presence of politically

and financially influential farmers) that determine what rules and rights have to be implemented.

The last is by discussing how water rights change in the course of developing infrastructure, particularly in spate irrigation. Rights relate very much to operational rules, and these rules change with changing infrastructure – with different possibilities for upstream control and different common maintenance requirements.

This chapter is divided as follows. First, it discusses the different operational rules and practices – giving examples from different societies. Then, it discusses the way local organizations and institutions have enforced (with various degrees of effectiveness) these water rights and rules, and have even tried to codify them. Next, it 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 with, however, we want to describe briefly what spate irrigation is.

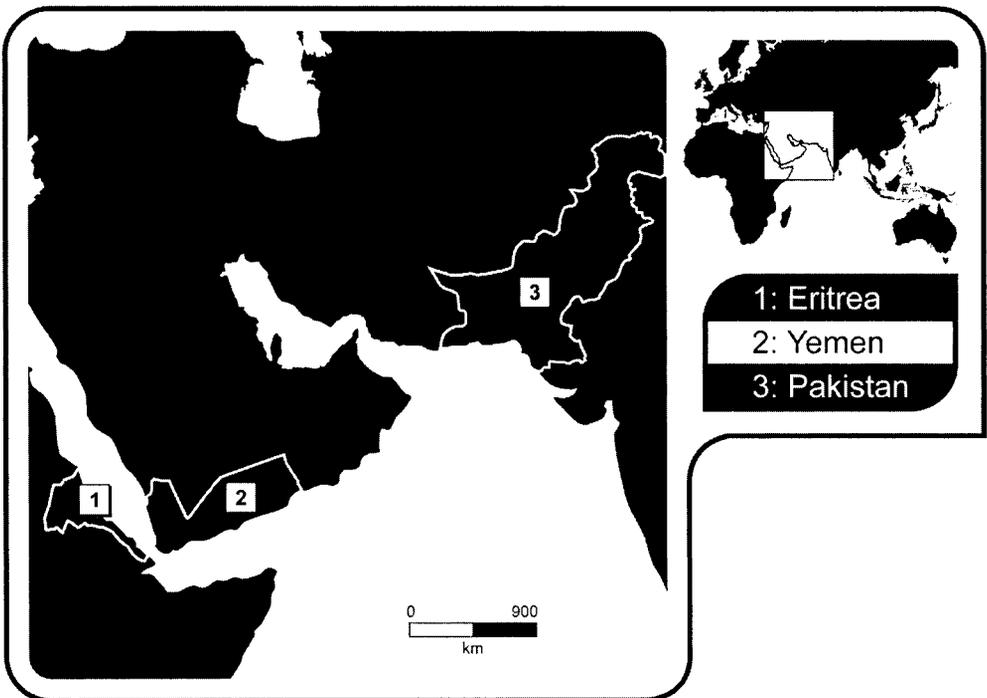


Fig. 7.1. Map study areas.

## Spate Irrigation

Spate irrigation is a resource system, whereby flood water is emitted through normally dry wadis 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 run-off; and adjacent, low-lying fields with deep soils able to store ample moisture for the crops during periods of no precipitation (Mehari *et al.*, 2005).

Spate irrigation systems support livelihoods of often the poorest segments of the rural population in the Middle East, west Asia and North and East Africa (van Steenberg, 1997). An estimate of the land coverage of spate irrigation systems in some countries, which the authors compiled from various sources, is presented in Table 7.1. Apart from the names of countries listed in Table 7.1, the existence of spate irrigation is reported in Chile, Bolivia, Iran, Afghanistan, Mauritania, Senegal, Ethiopia and Kenya; but there is no reliable estimate of its land coverage.

In spate irrigation systems uncertainty is a given. The unpredictability in timing, volume and sequence of flood water is the main cause of uncertainties and risks in crop production

under spate irrigation systems. It can also, 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. In particular, where flood water 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 cooperation. 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 Flood Water

To manage the unpredictable nature of flood water 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 (Mehari *et al.*, 2003; van Steenberg, 2004) relate to the following:

- Demarcation of land that is entitled to irrigation.

**Table 7.1.** Spate-irrigated versus total irrigated area in selected countries.

Country	Year of data collection	Total irrigated area (ha)	Spate-irrigated area (ha)	Total irrigated area covered by spate irrigation (%)
Algeria	1997	560,000	70,000	13
Eritrea	2005	28,000	15,630	56
Libya	1997	470,000	53,000	11
Mongolia	1993	84,300	27,000	32
Morocco	1997	1,258,200	165,000	13
Pakistan	2005	17,580,000	1,450,000	8
Somalia	1984	200,000	150,000	75
Sudan	1997	1,946,000	280,000	14
Tunisia	1997	481,520	98,320	20
Yemen	2003	485,000	193,000	40

- Breaching of bunds.
- Proportion of the flood water 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; yet, they are almost non-existent 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 and rising of fields above irrigable command levels are frequent and can occur on a 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 flood water to new territories and a redefinition of the group of shareholders.

To cite an example: in the Wadi Laba, Eritrea, about 1400 ha (besides the annually irrigated 2600 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 could be allocated water only after all the previously established

fields had 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 1400 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 a 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 river bed is blocked by earthen bunds, and access of water to downstream canals and fields depends on the breaking of these immediate upstream structures. In many cases, the earthen and brushwood bunds are constructed in such a way that they breach during large flood ( $> 100 \text{ m}^3/\text{s}$ ) 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 breach 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 7.1 and 7.2 present examples of some of such rules from Eritrea and Pakistan, respectively.

### **Rights and rules on flood water division**

The rights and rules on flood water division guide the distribution of water among different canals. In the indigenous systems in Eritrea, both proportional and rotational distributions of flood water are practised among the main and branch canals. During medium ( $25\text{--}50 \text{ m}^3/\text{s}$ ) and medium-large ( $25\text{--}100 \text{ m}^3/\text{s}$ ) floods, proportional distribution is used. This has a dual purpose. First, it irrigates two or more different areas at the same time. Second, by dividing the flow, it minimizes collateral damages such as destruction of structures and

**Box 7.1.** Rights and rules on breaching bunds in the Wadi Laba and Mai-ule, Eritrea, established in 1900 (from authors' survey, 2003).

- In July and August, the peak flood months, if the large floods do not breach the upstream *agims* and *musghas* (diversion and distribution structures, respectively), the upstream farmers have the obligation to allow the downstream farmers to breach 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 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 up to knee height (about 50 cm – see rule on depth of irrigation), the landowner of the immediate downstream field has the right to breach 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 breach his bund.

**Box 7.2.** Rights and rules on the Nari system, Kacchi, Pakistan, prepared in 1917 on revision of the old rules (from authors' 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 breach it.
- After 15 August, the landowners of the Lower Nari are allowed to make a *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 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 the Lower Nari paying twice the amount per hectare in case bunds on the upper Nari are broken.

erosion of field bunds. During small and small–medium floods ( $< 25 \text{ m}^3/\text{s}$ ), rotational distribution is the choice. The flow of these floods, if divided, may not have the strength to reach the most upstream fields. The rights and rules in the Nari system in Pakistan are given in Box 7.2.

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. 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 farmer leaders of the five main canals in Laba. Prior to each anticipated flood event, all 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.

### Rights and rules on sequence

The rights and rules on sequence supplement the rights and rules on the division of flood water. 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 of Eritrea, the underlining rule is: upstream canals and fields have absolute priority right over small, small–medium and medium floods; and the downstream canals and fields have an equal priority rights over medium–large and large

floods. This rule has created a perception of fairness of water distribution among the farmers and strengthened the degree of cooperation between them. Most of the indigenous structures are constructed from earthen and brushwood materials. They are susceptible to frequent destruction by flood water. The downstream and upstream farmers depend on one another 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* (this Arabic phrase, when literally translated, means 'the top is always at the top'; in this case, at the top of the list to obtain water) 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 a sufficient quantity of water in accordance with their right. This rule might seem very unfair to the downstream farmers and might give the impression that the upstream farmers have been utilizing almost all the flood water. That has not usually been the case. The indigenous structures have frequently been 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 the field-to-field water distribution system is practised. 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 competition usually arises among neighbours, which in many cases leads 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 that each field is entitled to a depth of a knee height (about 50 cm) at each turn. When the rule was first introduced 100 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 quantities of sediments need to be removed from some fields in order to keep the field 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 has resulted in irregularities in the height of many field bunds. In Wadi Laba and Mai-ule, and in the Tihama, the height of field bunds ranges from 0.30 to 1.0 m.

The farmers explained that the rule on breaking bunds, when first introduced a little over a 100 years ago, referred only to the breaking of the bunds of the diversion and division structures. It was only 10 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

Although several crops, such as sorghum, wheat and cotton, can survive on one turn of water application, they yield significantly higher returns when irrigated more than once. 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 could harvest a maximum of 1, 2.5 and 3.5 t/ha, respectively. Hence, to ensure that the majority of the fields receive at least one turn, thus guaranteeing that most of the households earn the minimum possible yield of food crops, a rule was introduced in the 1920s that defined the access to second turns. This rule states that, 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 from those in Wadi Laba and Mai-ule; they limit the access to second turns only for 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 breach 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 7.3).

### Enforcement of Water Rights and Rules

The type of enforcement strategies and the degree to which the water rights and rules can be enforced vary, depending mainly 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

For 600 years until the 1970s, 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 in Arabic usually refers to religious leaders. In this case, however, Sheikhs means chiefs, who may or may not have any religious ranks. Hence, Sheikhs al-wadis refers to ‘chiefs of the wadis’. ‘Sultans’ is also an Arabic word and, as used here, means roughly ‘supreme leaders’.

Many communities comprising several tribes in the Tihama Plain, Yemen, had depended on spate irrigation for their livelihood. 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, the most powerful in terms of material and capital wealth and believed to be the most native in the area. Sheikhs and Sultans were very respected and feared leaders. Their leadership was passed to the eldest son on a hierarchical basis. In the Muslim spate irrigation communities in Yemen, a female had no right to be a Sultan or a 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 gave them credit for their effectiveness in safeguarding the water rights of the downstream

**Box 7.3.** Water allocation rules for Wadi Tuban, Yemen (from authors' survey, 2004).

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

- When the spate flow is small (5–15 m<sup>3</sup>/s), priority is given to the canals in the upper reach of the wadi.
- When the spate flow is moderate (15–25 m<sup>3</sup>/s), priority is given to canals in the middle reach of the wadi.
- When the spate flow is large (25–40 m<sup>3</sup>/s), the flow is directed to either 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 m<sup>3</sup>/s, the flow is divided equally between Wadi Kabir and Wadi Saghir.

farmers. To exemplify, in Wadi Tuban, Yemen, the Sheikh-al-wadi had the full power to impose sanctions on upstream farmers who took water in violation of the rules and/or without his permission. The sanctions, which were frequently applied upon approval by the Sultan, included the following:

- The farmers concerned 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 neighbours.
- If crops were already being cultivated, the yields had to be given to the immediate downstream farmers.

The interviewed farmers informed us that, due mainly to 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 the occurrence of such conflicts, but they were often successful in settling them.

Following huge investments in the 1970s in structurally modernizing the indigenous spate irrigation systems in Yemen in general and in the Tihama Plain in particular, and the introduction of formal government rules and the collectivization 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 cooperatives who, over the years, had to face reduced funding inflows and erosion of authority. The majority of the interviewed farmers also spelled out that, after the reunification of southern and northern Yemen, the central government further diminished the role of the cooperatives without 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 cooperatives 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 a dominant tribe and had no Sultans or 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. Each of their landholdings ranged from 0.5 to 2.0 ha, with the majority of the households owning 1 ha. Nearly all were poor, living from hand to mouth.

For 100 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 the 1900s and its key players were the *Teshkil* (plural: *Teshakil*), *Ternafi* (plural: *Ternefti*) and *Abay-Ad* (village elders). *Teshkil* is a local term that means a 'subgroup 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 applied to the farmers within his command. It was only on his request or on the request of a group of farmers unsatisfied with his judgement in, for example, resolving some conflicts, that the respective *Ternafi* could interfere. *Ternafi* is also a local term that refers to a 'group leader'. The *Ternafi* had the authority to enforce rules and rights that governed 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 Ternafi 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. The Abay-Ad were a group of old men widely respected for their skill and impartiality in solving conflicts. Two or more Teshakil could also make the same request if the Ternafi did not do so. In solving conflicts, the local administration visited the site with experts from the local Ministry of Agriculture and gave a verdict, which was final and binding.

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 or to participate in any decision making in 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 achievement are: (i) the existence of the homogenous society that strongly believed in equity of water distribution; (ii) the fact that the Ternefti and Teshakil were democratically elected and were largely viewed as 'accountable' by their customers – the farmers; and (iii) the unambiguous sharing of responsibilities between the leaders of the farmers' organization and those in the government institutions.

Here, 'accountable' means 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 following:

- 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 ranges from 'autonomy' to 'dependence' in both the 'financial' and 'organizational' dimension (Hunt, 1990). The more autonomous the farmers' organizations the less their leaders are influenced by higher officials in the government offices and the more accountable they 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 labour and draught animals of the local communities. The government institutions provided only some materials such as shovels and spades – even that on 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, did not have decision-making voices and they were not allowed to elect or be elected. This exclusion of the females 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 the behaviour 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 flood water is tantamount to one's contribution to maintenance of main and branch canals and structures. If one fails to contribute, one can simply not be allowed to irrigate one's field. This was a common practice in the indigenous systems in the Tihama, Yemen, but non-existent in many of the indigenous systems in Eritrea. As mentioned earlier, in Eritrea, most of the communities engaged in spate irrigation were homogeneously poor and their livelihood depended entirely on their spate-irrigated fields. There was a strong belief in the society that prohibiting a certain field access to water, because its owner – the household head – had failed to report for maintenance duty, was not the right decision. Such an action was viewed as depriving the whole family of their very basic food for a mistake perpetrated 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 one's water right.

The second aspect of the link relates to 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, the maintenance task was largely dependent on human labour and draught animals. In such a situation, a large task force was required, which could only be made available through strong cooperation

between upstream and downstream farmers. That tail-end farmers were only interested in sharing the burden of maintenance, if not for the fact that they were 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 entitled to flood water and who have an 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, usually undertaken by government institutions. This is elaborated in the section on 'modifying/changing water rights and rules'.

### **Codification of rules**

In all the spate irrigation systems in Eritrea, whether in the relevant government institutions or the farmers' organizations, there are no complete records of water rights and rules. In most cases, however, the rules and rights are presented in plain, unambiguous language, which has helped to disseminate them easily and correctly among large (greater than 3000 households) communities by 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 flood water about 600 years ago. Rights and rules on flood water distribution in the Suleman range in Pakistan were codified by the revenue administration during the period of the British rule 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

who was responsible for enforcing the rules. The Kulyat Rodwar and the rights and responsibilities contained therein have not been updated, but the creation of these functionaries serves to keep the system flexible, as it allows the build-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 serve at least as a basis for clarifying disagreements in interpretations and introducing 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 or 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 barely existent vehement conflicts in Wadi Laba and Mai-Ule, although none of the rules and rights are codified, all illustrate the point.

### **Modifying and Changing Water Rights and Rules, and 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, changes in crop pattern, structural modernization (infrastructural investment), shift in power relations and change in levels of enforcement.

In this section, with the help of examples from Eritrea, Yemen and Pakistan, we discuss 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.

To start with the case from Eritrea, in the Wadi Laba, due to an increase in the number of inhabitants the land under spate irrigation increased from about 1400 ha to nearly 2600 ha between 1900 and 1990. As a result, the farmers explained that for 20 years (1960–1980) 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 the mid-1980s the farmers had added a phrase to the 'water right on sequence' – as '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 had 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 with a rigid, permanent weir, and many other secondary earthen distribution structures with gabion (cylindrical baskets filled with earth, rubble, etc.). 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 to the enforcement of the water rights and rules during the indigenous systems was 'the critical mass' – the need for a large number of farmers who 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 the 2003 flood season the authors witnessed 15 occasions when the upstream farmers utilized large floods and irrigated their fields two to three times before downstream fields got a single turn. This caused a lot of conflicts. The 300 ha furthest downstream did not receive a single turn in 2002 and 2003. The earlier rule on sequence and large and small floods was not applied, partly because the new infrastructure attenuated the floods and effectively reduced the number of big floods, which were the ones that had previously served the tail areas.

Over 30 years of management of spate systems by large government irrigation institutions in Yemen have proved that such institu-

tions have difficulty in handling the task all by themselves. Some of the factors include: (i) poorly defined sharing of responsibilities and the long communication lines, which lead to a slow decision-making process; (ii) lack of adequate funding; and (iii) little 'accountability' towards the bulk of users. More than anything, the chronic underfunding of maintenance and the loss of vigour in the operation and maintenance departments were the undoing. It left a vacuum where it was not clear who was responsible for water distribution, with no one doing the hard work of timely maintenance.

If the relatively fair distribution of the flood water that existed prior to modernization is to be preserved and the economic homogeneity of the Wadi Laba communities largely conserved, the farmers' organizations in Wadi Laba and Mai-ule, which have run the system for 100 years and have a good knowledge of flood water management practices, must continue to take the lead role. To perform this task, the farmers' organizations need to have financial and organizational autonomy, and hence their 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 based on the time-tested system of Ternefti and Tesahkil. The main challenges in the coming period are the internal organization, the water distribution, the acquisition 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 100 years, till 2001, the Wadi Laba communities did not rely 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 had on flood water management. Since the structural modernization in 2001, however, some farmers and their leaders are frequently asking this question: after the huge financial investments, will the govern-

ment still allow us to continue to own and utilize 'our' land and flood water? The urgency of receiving a reply to this question emanates from the perceived fear of the farmers that the government may implement the '1994 Land Proclamation' to dispossess them of the land they had 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 practised the traditional land tenure system, the *Risti* (literally translated, inherited land from the founding fathers). Under this tenure system, ownership of land in a certain village or villages 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 7.4) collectively provide a strong sense of land, and hence water, security to the eligible landholders.

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 7.5) are important milestones, particularly in the provision of gender equity and preservation of 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 seems is the case in Wadi Laba and Mai-ule) tenure insecurity.

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 respect to their land and water security. The majority of the farmers

**Box 7.4.** The main tenets of the Risti land tenure system in Wadi Laba and Mai-ule (from authors' survey, 2004).

- The Enda holds a lifetime ownership of land within the territories of its native village(s). 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 bequeath his land to his sons, lease or mortgage it. He can sell the land, however, only 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 land allocated to a verified Enda member.

**Box 7.5.** Some of the provisions of the 1994 Land Proclamation (from authors' compilation, 2004).

- The Government of the State of Eritrea is the sole owner of all land of that country.
- 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/she 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 Government's 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 clan, Enda, 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 land is confiscated, but it does not elaborate what such compensation will be, who decides on the nature of such compensation or whether or not the individual landholder or the farmers' organizations that represent him can challenge any compensation arrangements made by the GLC.

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 US\$4 million) 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 a cotton crop, despite their reservations. The farmers foresee that in the near future their status will be changed from landowners (users) to daily labourers 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 they attach a lot of pride to the land they currently own. 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 postmodernization situation of their irrigation systems, although it seems to have evolved from a genuine perception of land and hence water insecurity, 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 into reality, however, real and active farmers' participation throughout the ground-laying process and activities (this has yet to properly start) for the management transfer are vital.

Nevertheless, such farmers' participation may not be achieved unless the land and water insecurities perceived by the farmers – justified or not – are addressed. We believe that the introduction of some complementary (to the Land Proclamation), easily understandable provincial/sub-provisional laws may be useful toward this end. Among others, these may spell out: (i) in the postmodernization era, what kind of land and water user rights do the spate irrigation communities have? (ii) 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? (iii) Do the farmers' organizations and the communities as a whole have any new obligations they need to fulfil if they are to retain these rights? And (iv) 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 these organizations are officially recognized at the sub-provincial level – official in a sense that the sub-provincial local government and the Ministry of Agriculture acknowledge the organizations as important partners in the management of the irrigation system – these organizations cannot yet be considered as having full legal status. Their establishment and existence are 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 or 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 authority they need to cope with the new management challenges of the modernized systems.

Regarding the example from Yemen, in the spate irrigation systems of Wadi Zabid, Siham and Mawr, the structural modernizations carried out in the 1970s replaced the indigenous

earthen and brushwood structures with concrete weirs. This resulted in almost complete control of the flood water by the upstream users. Although the *al aela fil aela* rule 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 downstream. In contrast, the weirs seldom breach. Hence, applying the *al aela fil aela* rule effectively led to the 'capture' of the flood water by the upstream lands.

Due mainly to the vacuum of governance created after the fall of the Sultans and Sheikhs, who were replaced by 'weak' local governments, 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 the more water-demanding but 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 downstream. The local government did not interfere to stop this change in the 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 perform all the labour (from planting till harvest) for a return of one-quarter of the harvest in kind.

The term 'weak' here refers to a local government lacking in-depth knowledge of: (i) local water rights and laws and approaches and strategies to enforce them; (ii) accountability to the poor segments of the farmers; and (iii) the power to correct some unfair land and water utilization decisions taken by some individuals or communities.

Regarding 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 it 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 and returned to their indigenous structures and water-sharing arrangement.

### Conclusions

Water rights and rules mitigate unpredictable flood water 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 play the following roles: (i) protecting the rights of the farmers entitled to flood water; (ii) defining the type of water-sharing system and the sequence that should be followed in the event of different flood sizes; (iii) limiting the amount of water a certain field receives at each turn; and (iv) outlining which field, and when, is entitled to 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 flood water 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 can be achieved only when there are local organizations accountable to most farmers and which 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 meets the flood water management needs in a given situation. They need to be constantly tailored, and the enforcement organizations and the strategies they use are adjusted to cope with changes in events over 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 that, in turn, could result in the following:

- 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.
- Accelerate the downfall of downstream farmers, leaving them unprotected against the illegal capture of the flood water by upstream farmers.
- Result in deliberate destruction of investment.

In general, national and provisional policies and laws have hardly any direct impact on the flood water management in the spate irrigation systems. The water distribution and maintenance are carried out according to local water rights and rules and they are sufficient. Where national legislation could become helpful, however, is in providing farmers' organizations with legal recognition and legal authorities with the means 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 to earlier local organizations and avoid the creation of dual structures (traditional and formal).

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