

Indigenous Customs Relating to Water Rights and Use Under Conditions of the Springs (Al-Ghyoul) Irrigation in Yemen

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Abstract: The aims of this study include gathering and documenting the indigenous traditional norms and knowledge of Al-Ghyoul water resources shares and distributions in selected Yemeni Region. It also studies, analyzes, identifies common and variable practices and problems under the conditions of different communities/regions. It also attempts to formulate appropriate actions to remedy threatening obstacles. The field data collection for the study covered selected governorates where such traditional irrigation systems prevail like Taiz, Bib, Hadhramaut, Shabwah. It used a descriptive approach through literature review, like documents and reports, field observations, survey questionnaire, individual interviews with key informant (KII), and discussion meetings with specialists, local officials, local leaders, and farmers. The study identifies some prevailing norms and mores that characterize traditional Al-Ghyoul irrigations systems including the rules of water shares distribution, rehabilitation and maintenance as well as conflict resolution. However, it observed some slight variation from one location to another. Some of the inherited local customs have been changing due to the introduction of modern technologies and socio-political changes, draught and climatic change. This in turn has negatively affected the common indigenous irrigation practices. The study concluded with some recommendations for future consideration.

Keywords: Water rights, Indigenous Knowledge, Springs (Al-Ghyoul), Water use, Yemen.

1. INTRODUCTION

Since ancient times, mankind had been concerned with matters of water harvesting and its fair distribution. The circulating traditions and mores as well as the divine religions had also endorsed and legitimized this aspect, not only in terms of common ownership of the rights of participation and equality in the water shares but also the rights of animals and the environment in it through a set of prevailing customs and traditions, which in most of them do not deviate from what the divine religions have legislated. However, the rapid developments in the modern era and the successes achieved by technological development in the world have neglected such norms and traditions, as fascinated by what the developed countries have realized in this regard. The developing world countries, including Yemen in particular, took this experience out of their belief that it is the magic solution in solving their development problems through development projects and other programs funded by donor institutions. However, many of the goals and activities related to development have not succeeded enough in developing countries. Accordingly, researchers, policymakers, and donor institutions have recognized the failure of development projects is due to that neglect of local values and norms.

The beginning of the international interest in such an issue has sprung in 1992 Rudi Jeanyero conference on the environment, as well as in the international conference on water held in Dublin – Ireland with support of the United Nations Environment Program (UNEP) in 1992. Among the most prominent issues that have been agreed upon are: Water is a social and economic benefit, and water management must be looked at in an integrated and participatory manner (Farooqi et al., 2002).

Water is one of the most important determinants of economic and social development in Yemen, which has suffered from water scarcity since ancient times. Yemen is considered one of the world's poorest countries in water. Residents are constantly fighting over sources of water and its acquisition of any size.

Al-Ghyoul¹ water is not only used for irrigation but also utilized largely for drinking and domestic use. There are no government laws or legislation to rationalize the uses of Al-Ghyoul (springs) water for irrigation, drinking, and domestic use. At the same time, the local community has developed customs and habits that regulate the distribution of water rations and the maintenance of water sources and canals.

These norms are constantly changing due to the transfer of ownership of lands dependent on irrigation from them, the distribution of this land to heirs according to Islamic law (Shari'ah), and/or the migration of the population. Consequently, land ownership is transferred to others according to prevailing norms.

Some earlier studies have elaborated on traditional water rights and use under conditions of flood irrigation (wadis) (Muharram, Alsharjabi & Mutahar, 2019). However, the Water rights of users differ in fountains and springs (Al-Ghyoul) as compared to that of "spate irrigation" represented by the traditional principle of "the higher comes first" known as (Al-Jubarti law)². While in Al-Ghyoul areas the distribution of water shares, is based on the historical ownership of families and tribes of these water sources, as well as the land size owned nearby the source of water. Similarly, in the case of water distribution for drinking and domestic use, it depends on family size and the number of animals that each family owns.

The state and the local authorities do not supervise the Al-Ghyoul (springs) and their canals, as is the case in the spate irrigation facilities, but are the responsibility of the local communities themselves. Residents resort to the state only in the event of an intense conflict between them over water shares. The Water Law no. (33) of 2002 has strengthened the rights to use water resources by individuals as well as the transfer of their ownership, as indicated in Article no. (29) which states that:

"The traditional usufructs' rights and accompanying rights remain untouched as before, the issuance of this law, with respect to water from springs, fountains, streams, natural streams and surface wells (with a depth not exceeding 60m). These rights are preserved and kept by their owners as existing rights without prejudice to the rules of registration, provided that they remain reserved for the purposes intended for them. If they are transferred to the ownership of others, these rights are obligatorily transferred to the new owner. And in the case of splitting the land benefiting from the water, the water is distributed according to the plot areas resulting from splitting". (Agoyemen.net/lib,)

This is the case in terms of ownership of water sources and their distribution shares in all regions of Yemen, including the transfer of their ownership, as Baquhaizel and others (1996) indicated that the water distribution shares are related to the size of the land and its ownership is transferred in the event of sale of land or inheritance. The maintenance and restoration of water source structures and canals are carried out by the beneficiaries, and the costs are calculated and distributed according to the size of holdings.

Some of these springs and their canals have certain endowments (Waqfs) for their restoration and maintenance under the supervision of people who are trusted in these communities and bequeathed to them generation after generation.

Due to the scarcity of water and the deterioration of its facilities, if found at all, in addition to the population growth and the emergence of new influential people in the area, conflicts and disputes arise between families, individuals, and tribes over these resources. Everyone wants to acquire the largest amount of water and as a result, the conflict rages, and weapons of all kinds are used causing many deaths, injuries, and material losses. An example of this is what happened in a conflict between two villages in Jabal Sabr-Taiz governorate during 1997 - 2012 between Qoradhah village and Almerzah village which left behind 12 persons killed and continued for more than 15 years (hespress.com/un-oeil-sur). Another example is that which happened in Dhamar Governorate between Aljarashah village and Asbeel village³.

It should be noted here that many springs that have dried up or their water has decreased due to successive periods of drought and also due to the random widespread drilling of underground tube-wells. This indicated Al-Hayyani (2012)⁴ who stated that the random drilling of wells in water basins has a direct effect on the drying of springs and fountains.

¹ The term Ghail (spring) or Al-Ghail is Singular, while Al-Ghyoul is Plural (springs).

² Ibn Mudhafar, 1361 H (1941).

³ Alkamali, Zakaria. (2014). The Water war calmed down after 17 years.

⁴ www.Afedmag.com/web

Baquaiq et. al. (2001) ascribed the cause of the dry water spring and fountains to the expansion of the random drilling of wells in addition to successive periods of drought, which led to the encroachment of water salt to intermix with waters of fountains and cause pollution. A report by Alsagaf & Almoid (2002) indicating that many springs and streams in the water basin of Jahran plain – Dhamar Governorate, have dried up several years ago due to the excessive withdrawal of groundwater from the basin. This situation forced many residents of rural and remote areas to migrate to cities.

There are many variables in the management of natural resources, including water, which are not limited to a particular country or society but sweep many countries and societies in the world. Biswas (2002) pointed out that many forces exert pressure on environmental resource management to take into account the fears and worries of all concerned parties about these universal threats as well as to introduce clear systems for the values within water policy options.

In this paper, the authors will deal with the prevailing traditions and customs relating to the distribution of spring (Al-Ghyuol) water rations and maintaining their facilities in various regions of the Republic of Yemen.

Objectives:

The aims of the present paper are:

- Gathering and documenting the prevailing indigenous traditional norms and knowledge of Al-Gghyous water resources shares and distributions in selected Yemeni regions.
- Studying and analyzing the collected traditions and customs relating to the distribution of springs (Al-Ghyuol) water rations and maintaining their facilities in different regions of the Republic of Yemen.
- To Articulate some lessons learned and possible recommendations from those traditions and customs concerning the utilization and maintenance of springs (Al-Ghyiuol).

2. SCOPE AND METHODOLOGY

The study was based on collecting and reviewing available documents and reports concerning customs and traditions relating to water usage rights and maintenance of springs (Alghyuol). For this purpose, visits were undertaken to relevant agencies including departments of line ministries in Sana'a such as the Ministry of Agriculture and Irrigation (MAI), Water and Environment (MWE), the Natural Water Resources Authority (NWRA), the Agricultural Cooperative Union (ACU), and the water & environmental center – Sana'a university.

This study involved also field visits to some Yemeni areas relying on spring (Al-Ghyuol) irrigation, namely; Ibb, Taiz, Hadhramaut, Sana'a, and Shabwah Governorates (Figure 1).

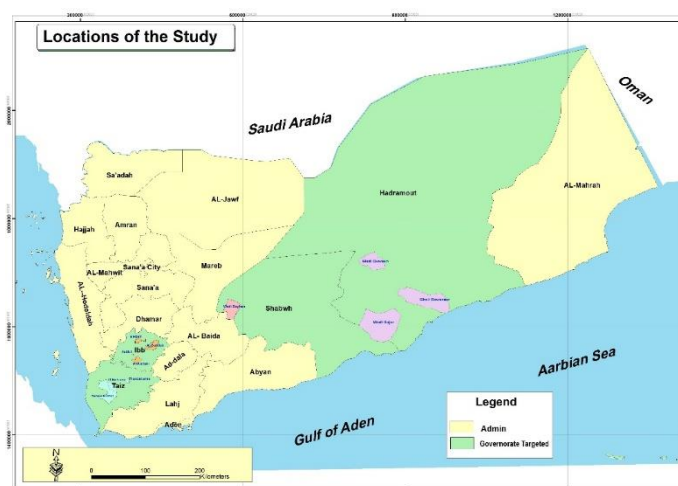


Figure 1: Loactions (in pink) of the Al-Ghyuol Study in selected Yemeni Governorates

The study employed the descriptive and historical research method and analysis to realize its aims. Researchers have collected required information mainly from available projects' reports and documents as well as through key informant's interviews (Figure 2 and Figure 3). The data was collected during the period (from April to August 2013). Meetings were also held with farmers, experts/specialists, and officials in the study sites covered.



Figure 2 interview with one of the key informants in Wadi Hajr area, Hadhramout Gov.



Figure 3 Main author in a meeting with some concerned officials in the area of Wadi Hajr, Hadhramout Gov.

The information gathered from different sources was carefully and critically reviewed and analyzed to scrutinize objectively by the objectives of the study. Based on the analysis of collected information, some conclusions are drawn up and suggestions were also formulated.

3. STUDY RESULTS

a) **The Highlands Region:**

Al-Ghyuol water in most mountainous areas is usually used for domestic use as well as for irrigation if the water quantity is greater than that needed for drinking. Consequently, water distributions differ slightly for domestic use from that for irrigation, as depicted in the following paragraphs.

The common water rights in the Yemeni central highlands, especially in the areas that depend on the spring (Al-Ghail) irrigation, are similar to that in other areas, with some differences in naming and site-specific norms. The dominant system for the distribution of water shares is that the higher lands receive water first or field-to-field irrigation system. The organization of irrigation water and the distribution of water shares is made by a selected person called "irrigation supervisor", who oversees the distribution of irrigation water. This person is often called "Al-Modawel" who can, sometimes, intervene and determine the priority of irrigation for some fields that need to be urgently irrigated even if this intervention violates the existing norm, but usually, his decision is respected by others.

In the case of domestic use of this water, the distribution of available water in some areas is distributed according to the size of the family and the number of animals owned by the family. Usually, the distribution is carried out by the head of the village/quarter in specific quantities, especially in dry periods. In the past few decades, much of the water from these springs/streams was transported to homes or the village reservoir by pipelines and sometimes with the help of pumps. The state and international organizations have contributed to the costs of these networks or part of them. And it follows the same common distribution mechanism. Maintenance and restoration of water sources and transport networks are usually taken care of by the beneficiaries. In some areas, the water of fountains is distributed according to the family's entitlement to ownership of the water source, or according to what is spent by a family or person in the restoration and maintenance of the facilities of this source. So, the one who does this work gets the lion's share of water as will be mentioned later in this paper.

(i) **Taiz Governorate:**

1) **Alakma Wadi in Mow'zaa district** of Taiz governorate was selected as a case study area where there are some differences in water shares from other wadis. Here, in addition to the conventional irrigation system, "the higher lands receive water first", which prevails in the Summer season during the abundance of water, there exists another water distribution system in the winter when there is water shortage. During the season of water shortage, the owner of land in need of water may be granted priority with the consent of the preceding fellow farmer deserving irrigation for his land. Here, water distribution is made by consent of all people where Al-Modawel nominates several trustful



Figure 4 While interviewing farmers in Al-Ghyuol areas – Taiz Gov.

beneficiaries, particularly those who have the knowledge and experience to visit the fields and estimate which worth water first, especially those planted with vegetables, regardless of the priorities given in the general rule of the field-to-field system. Al-Modawel, as usual, is elected by people in a general meeting with an assistant called "Al-Motabea".

Alakma valley has several channels known as "Almadhareb, plural of Madhrab". The "Almasrub" (irrigation supervisor) – or Almodawel – elected in a gathering of beneficiaries may continue in his work throughout his life and inherit it to his sons if proved competent.

The main tasks of Al-Modawel, in Alakma Wadi, are mostly similar to other cases in highlands, but some extended tasks of Al-Modawel were mentioned in this wadi such as:

- Distributing water shares.
- Settling disputes.
- Meeting beneficiaries and deciding who should irrigate first.
- Estimating the cost of maintenance.
- Coerce beneficiaries' contribution to maintenance.
- Determining the type of crop and land area to be planted by each beneficiary according to the quantity of available water and to avoid any problem caused by insufficient water quantity.
- Mobilization of beneficiaries and workers during large scale maintenance and collecting the cost of maintenance from beneficiaries based on the size of land property.

The assistant to the "irrigation supervisor" in this area has a different name called "Al-Motabea" who has, more or less, similar tasks to those of Al-Kadeem(s) mentioned in the other case study⁵. The tasks of Almutabe'a are:

- Collect cost of maintenance.
- Determining the extent of damage in channels.
- Serving as a link between Almodawel and beneficiaries.

Al-Modawels and Al-Motabeas usually do not receive any money for their work. Disputes here are concentrated more on channel breakdowns and conflicts over water shares but are resolved in consultation and consent in the presence of key figures in the Wadi.

2) **The Thu'abat area of Taiz**, farmers depend on Al-Ghail water for irrigation since ancient times, and the distribution of water shares in it is inherited for more than a thousand years. The first founder of this system is Malek Alaqmar (the King of the Moons)⁶. As Sheikh Abdo Ahmed Saif⁷, one of the key informants interviewed pointed out that irrigation water is distributed through a channel reaching 4 km in length and built of gypsum (Alqadhadh) according to the utmost accurate allotment for all lands included within the fenced area. This water share allocation is distributed and inherited from one generation to another. Therefore, channel maintenance is very rare because of the durable materials used in its construction.

⁵ In Alakmah valley, just like in the case of all other valleys/Ghyoul, the Almodawel selects his "assistants". The exception was only in one valley called "Alkhair valley" of Alhujariah – Taiz, where there exists no assistants to Almodawel.

⁶ The "King of the moons" is a mythical figure interested in astronomy and the stars, and some others refer this name to King Saif bin Dhi Yazan, known in history as one of the Yemeni leaders/rulers. It is said that he had a very beautiful daughter for whom he built a palace and assigned ten beautiful bondwomen like moons, and he used to have ten sons who govern different areas. Therefore, he is named the King of the moons (Source: King Saif the Knight of Yemen, vol. 1-2. Google Book)

⁷ This Sheikh was one of those key informants met by the researchers in Saber mountain. He is an old man and provided research team copy of the ruling issued by the Judge Al-Aryani over the distribution of water.

Almusrub (irrigation Supervisor) looking after the distribution of irrigation shares, is a person who was chosen by the beneficiaries and in the event of his satisfactory performance, he stays in this assignment for long periods. His task, though not receiving any incentives/payments for his work, does not differ much from the tasks of the Almasrub of Ibb governorate.

3) **Irrigation in Wadi Lasabbah, Al-Barh area** of Taiz also depends on Al-Ghail for irrigation which continues throughout the year, as well as on spate irrigation that occurs during the wet season. The water is distributed according to the rule of the "highest-then-the-higher", and the water of the valley is equally shared, be it from Al-Ghail and/or from the torrent between the northern valley (lower layer) and the southern (upper layer). Also, those who have to obtain water can get it without waiting for their turn to come, especially vegetable growers. Al-Ghail water is distributed and the supervision on maintenance is carried out by the irrigation supervisor (Almasrub)⁸, and that each channel has its Almasrub assisted by what is known as the (Maqdami Alshurajj)⁹.

In the southern channel, the Almasrub (irrigation supervisor) is the one who owns most of the lands in the valley. Usually, Almasrub and Maqdami Alshurajj are chosen by the beneficiaries in a meeting that takes place in the valley and both continue their duties unless resign or disrupt their tasks. Thus, another Almasrub is chosen and sometimes he is returned to his work and selects an assistant (Maqdami Alshurajj) to be approved by all. Concerning runoff water, the water shares and the maintenance of canals (al-Aswam) are assigned by the Sheikh, who chooses an assistant for him called also Almasrub, but who differs from the one supervising the irrigation water coming from Al-Ghail.

There are some documents (judgment) that have arbitrated the dispute or resolved the conflict over the ownership and distribution of water. Some examples of these documented arbitrations are as depicted in following section.

4) **The issue of Dispute over Water Shares in al-Anba Watercourse in the Countryside of Taiz Governorate:**

In Al-anba area of Taiz, one of the well-to-do persons repaired the source of the water and its collection. He repaired the canals (the waterways), expanded the pool, and restored it, which led to an increase in the quantities of water. For his effort and fund, he linked the water through pipes to his house to meet his water needs. But some of the families in the surrounding who benefit from the water source objected to his act, and the conflict and disagreement between them intensified for a long time, which drained a lot of effort and money.

After the agreement between the disputing parties to resort to the judiciary and arbitration to resolve the dispute, it was decided that three full days of the total days be allocated for distribution and a deduction from the head for those who carried out the maintenance and expansion process of the water facility. The water was redistributed over twenty-six days instead of the 23 days that prevailed in the past before the maintenance and expansion, provided that this water is not used for anything other than his household needs (it is not to be used for cultivation or sale).

The ruling also stipulated that the quantities of water flowing to the person who restored and expanded the source of water should not exceed about a quarter of an inch only. As a result of the other party's claim for their losses during the conflict, the first party (who performed the restoration) gave up a day and a half to the other party (this arbitration ruling was issued in 1973).

(ii) **Ibb Governorate**

1) **Al-Saddah District:** In Al-Saddah area of Ibb governorate, was selected as a case study, for being an old system in which irrigation water from springs (Al-Ghyoul) prevails. This system is based on the election of a person named "Al-Modawel" for a period of 2-3 years, sometimes up to 5 years, but he could be re-elected again if there is no objection by the beneficiaries. He is selected from the village that has the last irrigated fields. Several persons (3-5) are also elected to assist Al-Modawel who are known as "Al-Kadeem"¹⁰. This number is determined by the number of beneficiaries, the vastness of the area, and its divisions.

⁸ Almasrub: is the irrigation assistant who receive and undertake action as per the instructions of Almodawel/ Almutabe'a.

⁹ Maqadami is traditionally known as the person that is preferred by people and they put him before them; or a person chosen by others for a certain task and not considered by them as a leader.

¹⁰ Almodawel, Alkadeem and Almodawel are used to mean same thing and used inter-changeably in different areas. The infiltrator is the person who carries out the instructions from the median

In the case of damages to the channels, beneficiaries are gathered using drums beating where affected farmers are called to participate in the maintenance work specified by Al-Mudawel which can last from one day to several days and is usually done at the end of the Autumn season (Mid-August – Mid October).

Each village or group of beneficiaries is assigned part of the channel to maintain, but the regular maintenance is done by the Al-Mudawel and/or his assistants.



Figure 5 A group discussion meeting with farmers in Alsdah District, Ibb Gov.

The main tasks of Al-Mudawel (irrigation supervisor) include:

- Distribution of water shares
- Resolving disputes over the distribution of water shares
- Cleaning irrigation channels with the help of Al-Kadeem
- Monitoring of offenders
- Preventing violators, who break the norms for getting water
- Determining the type of maintenance of the channel(s) required.
- Collecting cost of maintenance or damage repair whenever rehabilitation work is required.

Functions of Al-Kadeem (Assistant water supervisor) identified include:

- Implementing assignments and/or directions of Al-Modawel.
- Inspecting the channel, day and night.
- Performing daily simple maintenance and cleaning of the channel.
- Collecting the costs of maintenance from beneficiaries.
- Acting as a link between the beneficiaries and Al-Modawel in most cases.

Al-Modawel and Al-Kadeems are getting paid a service fee, part of the crop production which is a quarter of a tenth of the yield in the case of maize or barley crops; and the eighth of the tenth in the case of sorghum and wheat crops. For the Qat crop, the beneficiary pays 10-20 bundles, or 3 - 4 thousand Yemeni Riyals (YR). All fees/rates are paid once annually.

2) Water rights in Al-Audain: Like the rest of the areas relying on irrigation from Al-Ghyoul, like Alsaddah district, and/or the dam, the fields are irrigated with the highest lands receiving water first. In case of necessity, the Almodawel (irrigation supervisor) determines the field that should be given priority in irrigation. His decision is usually respected.

About flood irrigation depending on rain occurrence, there is no special system of its own, as the rain in this region is quite high on one side and on the other hand its duration is limited to a short time of several minutes to a few hours, which is difficult to control.

Operation and maintenance in Wadi Al-Dur and Wadi Anah - Al-Audain:

Water shares and channel maintenance costs are allotted by the Almodawel who is elected by the beneficiaries and the Sheikh approves his nomination by inviting the beneficiaries to a general meeting (Qat showing session) or an assembly during the daytime. In such a gathering, Almodawel can be exempted from his task and another Mudawel can be elected. Sometimes such meetings may involve also the selection of assistants to Almodawel, called Almuwaze'a "Alkadeem", who will help him in carrying out his duties.

The Almodawel is paid against his work in the winter season a cash amounts ranging from 200 to 1,000 riyals from each beneficiary, each according to the size of his land area. For the summer season, he does not receive any money from the beneficiaries, because the effort at this time is lacking, and the water is abundant.

Usually, the Almodawel continues on his assignment for a period of up to 5 years, then another one is appointed, while he can be re-elected if he does his job well.

3) The Region of Jableh, Ibb Governorate: In this region, the water shares are distributed by the Almodawel, who was chosen by the beneficiaries and inherited from olden times. It should be noted here that the position of the Almodawel is restricted to one family which it inherited from olden parents; and that it is one of the largest landowners in the region. Usually, the Almodawel chooses his assistant called "Alsaqi" from among the beneficiaries. Their duties in Jableh do not differ from the previous one of (Alaudain)¹¹, except applying irrigation in favor of incapable or absent farmers in exchange for some amounts and assist collecting maintenance costs. Moreover, Almodawel in Jableh area does not receive any sums of money against his work, while Alsaqi (the assistant) receives small amounts of money from the beneficiaries.

4) The Case of the Al-Kafr District, the Governorate of Ibb:**a) The Gayl of Shawdhab –Bani- Saff**

This water source here used to belong to one family, and the water shares were distributed among the brothers according to what each of them owned from the land that relied on irrigation from the water source.

The total number of days of water share distributed to them was thirty days. After a long period, the conditions changed and the land was distributed according to inheritance, with part of the lands purchased by others, the dispute over the water shares was concluded with the new situation. Arbitration was made between the disputing owners of the lands that irrigate from a Shawdhab freshwater spring, whether the land was under coffee or plowing for the water share of each of them. Since the ownership of the land has changed because of the purchase from one person to another or the fragmentation due to inheritance from generation to generation, water was distributed over 33 days and a half days and nights. This ruling date back to the year 1354 AH, (i.e. 1974 AD).

The water share was distributed according to the area of the land for each family or person who owned part of these lands that historically depend on irrigation from this water source. Due to the difficulty of measuring the quantities of water flowing from the source, it is difficult for us to determine the water quantity per unit area of the land.

The arbitration judgment indicated the area that belongs to each person/family and determined the number of days due to them according to the area. We went back to documents older than this historical document, which dates back to 1060 AH (1650). and found that the water of this spring was divided between the brothers of one family according to what each of

Qat (Catha edulis), a plant belonging to the family Celastrineae, is grown in several countries in South East Africa and Yemen. According to the World health organization (WHO), it is a narcotic plant, and not allowed to entry to many countries in the world. Costumers chow the Qat leaves and young branches to feel happy, socialize and relax.

Source:

http://www.who.int/medicines/areas/quality_safety/4.4KhatCritReview.pdf

¹¹ Tasks are the same but the fee/payment vary between locations.

them owns of land area and the total number of days was only 30 days. As was shown previously, the number of days of water distribution increased to 33 days in the second half of the twentieth century.

b) The case of Ghail Alhajjar, Bani Saba-Al-Kafr, Governorate of Ibb:

Another example of distributing the water of the Alghyoul (springs) among the beneficiaries is the provision of the ruling on the AlHajjar Gail, Bani Saba, AlKafr district, Ibb Governorate. The dispute intensified between the beneficiaries due to the multiplicity of the beneficiaries and their differences after the transfer of the properties of the lands benefiting from this water stream. The division of water shares was based on a previous ruling issued by Sheikh Ahmed Al Hababi (1870) among the people of the villages of Al-Dabr and Qebbal in Bani Saba. Three senior sheikhs in the region were first arbitrated who in turn, chose another expert person who is more experienced in customs and traditions and familiar with the ownership of lands entitled for water, as a reference or an authority for them to distribute water shares.

The water distribution was made for each Al-Habl (rope)¹² on basis of the ration distribution rule known as Alfard (the individual)¹³. The newly developed reformed lands were bypassed after the ruling between the two villages, provided that irrigation (watering) starts from the northern side and water shares were distributed according to the area size owned by each party. The lands in which construction was carried out were deprived of the water shares. This ruling was presented to the Judge of Alkafr district for approval.

The distribution of water shares began on Saturday for the village of Qebhal, starting with a piece of Alhajjar village for the sons of Qaid Ali and the next, in accordance with the principle of highest followed by the higher. The water shares were distributed over the whole area in 28 days each based on the landholding area owned. Some farmers deserved half an hour or an hour or a quarter, and some of them have had 8 hours or more or less.

It should be noted that the indicated above water shares are distributed in years of distress and water scarcity. But, when water is abundant, whoever needs irrigation should irrigate his land as needed at any time.

The water shares are distributed by a person chosen by the local community by consensus. This person is called Al-Mandhar, and who is a juristic personality of an elderly person with a preponderant mind and permanently settled in the village. His work is a voluntary work without a fee. When distributing water, he takes into account giving a priority first to field crops, then coffee and finally to qat crop¹⁴. This person known as the Al-Mandhar solves problems pertaining to water priority and irrigation duration between the litigants. The maintenance of waterways is carried out by the beneficiaries. Each beneficiary cares about the channel that connects to his field and the main canal. It is maintained from time to time by common voluntary work involving everyone (a copy of the Judge's ruling is in annex no. 2).

(iii) Water rights in Hadramawt:

1) Agricultural Association of Ghail Bawazeer - Hadhramaut Governorate:

Irrigation in Ghail Bawazeer area depends on the water of the Al-Ghail. The distribution of water shares follows the principle of "the highest-then-the-higher". Sometimes the condition of the crop that needs water is estimated and considered. Water shares and the maintenance of irrigation canals are distributed by the association, which was established in the mid-sixties of the past century. It is a multi-purpose association and that the maintenance of canals is one of its activities.



Figure 6 An overview of the Ghail Bawazir (Bawazir Stream) Canal.

For the distribution of the water rations in Ghail Bawazir, the beneficiaries use the star system which rely on the shade of the sun and the location of stars in the night time. Accordingly, the distribution of water shares is based on what

¹² Alhabl (the rope) is a measurement unit of land equals to twenty cubits and a half (one cubit is 45 cm).

¹³ Each Alfard irrigates Forty Habs.

¹⁴ A synopsis was provided on this crop earlier in this paper in a separate text box above.

is known as "Alfardah" in which the amount of water flowing from the stream or spring irrigates the agricultural land day or night. In the case of the small water source – fountain – or the small spring, it is one day and one night. Alfardah is divided into 32 feet, and the foot is divided into 12 Bananah (finger).

The full day is divided into four quarters or eight-eighths. This means that a quarter of the day equals to 8 feet of water, and the night is divided into 24 places/positions according to the stars mark calculation. Each level of the known star place/position is equivalent to 8 feet of water. The night is divided into 4 quarters with each quarter equals to eight feet of water, and thus the total night equals to 32 feet, which is the Alfardah. Each spring has a specific area of agricultural land that is irrigated in a constant water cycle that ranges between 10-15 days.



Figure 7 While in Conversation with some farmers of Ghayl Bawazir, Hadhramout Gov.

In small streams, the water is collected at night and distributed only during the day, and Alfardah equals to 32 feet too (Baquhaizel et. al., 1996).

The water is distributed among the beneficiaries by what is known as the Muqadam Al-Me'ian and his assistants, who possess a full knowledge of the star system, according to which water is distributed.

There is a slight difference in the water shares distribution in Al-Dais area, which is about 80 km from the Gail Bawazir area. This difference is concentrated that Alfardah is only 24 Karats, and the Karat equals to half an hour of watering (One Karat = a foot and a one-third of a foot, meaning that every 3 Karat equals to four feet, which is equal to one-eighth Alfardah).

2) Wadi Dawa'an:

The customs and traditions of Alghyoul water shares distribution and the maintenance of their facilities are similar in many of the Yemeni eastern regions (the eastern plateau), especially in the governorates of Shabwah and Hadhramaut, which are also very similar to the customs and traditions of the spate irrigation region (Baquhaizel et. al., 1996).

In Wadi Dawa'an, there is a great similarity with the irrigation system common in Wadi Bihan of Shabwah Governorate and other Ghyoul area in the valley. There is exists a committee of 5-7 people who are chosen by the beneficiaries in Al-Saqia. The committee is headed by an experienced and trustworthy person known as Alkhail, who has assistants some of whom are also known as Ra'aedh¹⁵ Al-Saqia (RA). The mission of RA is to maintain the canal or the Al-Saqia. He monitors the canal constantly with the help of the Alkhail or beneficiaries if the devastation is great. Another one is known as the Ra'aedh Alnakheel (the date palm), whose mission is to monitor the sub-channels and determine the entitlements of each beneficiary in the irrigation of his land in addition to monitoring these channels and their safety.

In order to meet the costs of irrigation and maintenance of the canals, a number of palm trees, a plot of land, or both are allocated from the beneficiaries' property for the maintenance of Al-Saqiah. Alkhail is the one who oversees the distribution of water rations and the resolution of disputes between the beneficiaries.

The tasks of Alkhail in wadi Hadhramaut:

The benefecieries (association) choose someone who is knowledgeable and well experienced in agriculture as supervisor for irrigation system known as "Alkhail" (the horse) or the (irrigation supervisor), with the following tasks:

- Supervising operations.
- Mobilizing workers for the maintenance process.
- Identifying and collecting maintenance costs.

¹⁵ The word Ra'aedh came from the Al-Mara'dhah, which is a stick of about 50 cm long. It is thrown at the entrance to the canal, so if the stick passes in the middle of the canal, this means that the water is still a share of this land. If one end of the stick collides with the sides of the canal, this means that the water exceeds the need of this field and thus the water is diverted to the next field.

- Keeping the record of agricultural lands.
- Resolving disputes between beneficiaries.

There exists also a committee, which helps Alkhail to collect maintenance costs (known as Alferkah and Alsawk)¹⁶ and carry out his tasks at times of his weakness and unavailability, as well as cashier and account.

Maintenance of Irrigation Channels:

The maintenance operations are carried out twice a year before and at the end of the farming season. The type of maintenance and its costs are determined by the Mukadam Alme'ian (Al-Ghail Irrigation Supervisor) who is chosen by the beneficiaries. His duties are not different from those of others like him in other regions/areas. His term is not fixed but renewable if he shows satisfactory performance. Otherwise, he may be replaced by another person.

He is the one who mobilizes workers for maintenance, collects maintenance costs, and distributes water shares. He also prepares and submits a report to the beneficiaries or association, specifying the type of damage and its location. The association sends specialists to make the necessary study and estimate the fund needed for the operation. Usually, the maintenance costs are in-kind through the contribution of beneficiaries in the manual work required. Some of the beneficiaries pay their contribution in cash which is used to buy some maintenance supplies. Providing food for maintenance workers is covered by the maintenance costs paid in cash. Anyone who violates or fails to pay his contributions is deprived of water or financially fined in addition to writing a pledge not to repeat violation.

The association has several committees, including the maintenance committee, which supervises the work of Al Mukadam, who receives a monthly salary from the association.

The main revenues of the association come from the members' contributions (1000 riyals/share), and from the sale of water (400-500 riyals/hour) in addition to 5% of the crop yield from each beneficiary in exchange for maintenance of the channels.

3) Water Rights in Wadi Hajar:

Irrigation in this valley depends on the water running throughout the year, which is more than the need of the valley land for being planted only with palm trees. The water is distributed by lot among the beneficiaries who contribute to the maintenance operations of the channels and openings for each channel or opening separately. This process is managed by the irrigation supervisor (Mushref Alrai or Mukadam Alsaqiah) who is chosen by all beneficiaries annually, changed, and/or re-elected. He gets, in return for his work fees, extra lots of water shares in addition to his usual share according to the area size of his land. The land, in general, is not owned by those who work on it, and almost all farmers work on a land-sharing system, in exchange for one-third to one-half of the crop yield.

Duties of the Irrigation supervisor (Al Mukadam):

- Distributing water shares.
- Supervising Maintenance.
- Mobilizing workers for maintenance operation. Workers usually are the beneficiaries themselves.
- Maintaining a record of land pieces, area size, owners' names, and other data.

There exists an agricultural committee (AC) that is composed of experienced persons (3-5 persons) in the area. The AC is elected in the same way of electing the Al Mukadam. The main duties of AC are centered on solving disputes, supervising agricultural work, following up canal maintenance work, as well as following up issues with the local authority, and determining the type of farming in the white areas¹⁷ (which are biannually cultivated).

¹⁶ The "Alferkah" meaning the part, or that each person pays his share; while Alsawk is derived from the Arabic term "Alsaqiey" meaning "to water or to irrigate", and not related to the Arabic term "alsuq" or "the market place".

¹⁷ "White lands" are currently being cultivated now, and this is what distinguishes it from the rest of the lands that are not cultivated or left fallow.

(iv) Water rights in Shabwah Governorate:

1) Water rights in Wadi Bayhan:

The practices followed in the Bayhan Valley in the distribution of water shares and the maintenance of water structures evolved over time until they have become a common habit and custom in the region. It regulates the sharing of water quotas and the maintenance of facilities in the area. These norms are constantly evolving with the accumulation of experiences seeking the realization of justice and ensuring the beneficiaries' rights. In order to deliver the flow of water to the beneficiaries, they participate in the construction and restoration of the canal and the distribution of water shares. The beneficiaries contribute to the construction or maintenance of canals according to the size of the land targeted for each individual and its proximity to or distance from the canal. This contribution is also determined by whether the land is higher or lower than the level of water flow in the waterfall.

The land higher than Al-Saqia is called "Almentah" and the owner of this land pays the largest sums of money as compared to those of the lower land. The owner of large land pays more than the owner of a small land.

Usually, the owners of the lands allow the water passage of the canal in their lands to the neighboring lands without costs. When another party deprives one of the lands from stream water irrigation through intended destruction or preventing the passage of the water, that intervening party compensates the affected person with all the costs of the land based on the value of the adjacent to it or according to what the assessment of specialists in this regard.

This valley is characterized by being narrow at the top and being more spacious at the bottom, which created different customs and traditions in distributing water that varies at the top and bottom areas of the valley.

- At the top of the valley, irrigation water is distributed by allowing all channels to take their share of the water without obstacles except one channel (Al-Qaranyaiin channel)¹⁸ because in one season it takes full irrigation at the beginning of the season. Thus, this channel is deprived of any other irrigation during the season and it is entitled to take its share only in the subsequent season.
- Each main channel has several sub-channels, and each beneficiary has an opening/a slot to his field. The irrigation process is done according to the custom "the first served first"¹⁹. Rarely, irrigation is carried out from a higher plot of land to the lower plot through a tilt passage called (Al-Sakhl)²⁰.
- Each channel has a committee consisting of 3-4 people who are chosen by the beneficiaries for their influence and honesty called (The Canal's Committee "CC"). The CC manages the channel (Alsaqiah) and its tasks are focused on:
 - Supervising the distribution of water to the fields through the inter-channel.
 - repairing damages in the channel.
 - Collecting the costs of repairs from the beneficiaries.
 - Resolving conflict if it occurs between farmers.
- Usually, when the water of the valley reaches the lower channels of the valley it is in large quantities, which makes the water in all the channels flow in it and irrigates all fields without exception.

An Overview of the Maintenance of irrigation facilities in Hadhramaut and Shabwah governorates:

The maintenance and rehabilitation of Al-Ghyoul water facilities in Hadhramaut and Shabwah valleys are similar as summarized in the following paragraphs.

Usually, Alkhail, accompanied by workers and masters, goes into the field to inspect the irrigation establishments (channels and barriers) after the season of torrent occurrence to determine the presence of damage(s). In the case of minor

¹⁸ Al-Qaranyaiin channel, which is at the beginning of the valley, and takes its full share of water at the beginning of the season, but it takes no more again, as it takes all the water at the beginning of the season. With the possibility that torrents will not come again, it is therefore deprived of it.

¹⁹ The traditional rule is that: "the highest then the higher", which is interchangeably used in other areas with the rule: "first comes first served".

²⁰ The "Al-Sakhl" or "Al-mansam" is a lower passage at the edge of the field, allowing the smooth flow of excess water.

damages, it is fixed immediately while for major ones, the location, type of maintenance, and costs required for damages are determined. Therefore, a search also starts for likely sources of finance and its follow up with potential funding agencies who may be volunteers, local state authorities, or international donors' organizations (follow-up is done by either Alkhail or the Association-AC).

Beneficiaries pay maintenance costs in cash, and workers and masters are hired. Each beneficiary, upon payment of his contributions, receives from the Alkhail a receipt proving that he has paid his contributions. Each person's contributions depend on how much land he cultivates. Anyone who violates or fails to pay what he owes is deprived of water and submitted to the local authority for required action. In the event of any complaining individuals against the water shares, the Alkhail, with the committee during the season, will handle the complaint and settle it.

The association has a bank account and its revenues are concentrated from selling clay for construction or farming. The value of the sold clay is distributed at 50% to the landowner, 30% to repair the channels, and 20% to the association. The association also owns a tube well, from which water is sold as a secondary revenue for the association and it assists farmers as well in supplementary irrigation. The association takes advantage of the expertise of technicians and specialists in the Office of Agriculture and Irrigation (OAI) and others in exchange for fees to be paid from the association's account. The Alkhail gets paid a fee of less than a quarter of a tenth of the crop's yield.

Because the area depends on spate irrigation that comes from outside the region, the committee assigns a person to help Alkhail (known as Almuhawel or the shifter) on whom Alkhail and beneficiaries depend in monitoring the flow of the torrent, its quantities and in determining the type of crop that should be irrigated from this torrent. If the quantity of the flood is limited then the priority is given to date palm.

4. DISCUSSION OF MAIN STUDY RESULTS

1) Distribution of Alghyoul water among beneficiaries:

Yemen suffers from water scarcity for hundreds of years, and people have relied on rainwater, springs, and torrents. In the plain lands and the valleys, they resort to digging surface wells (does not exceed 15-20 meters in depth), to extract from them by camels, donkeys, or people in some cases through a process known as Almasna, which was spread throughout Yemen. The residents also relied on storing rainwater from one season to another through constructing ponds (Berak, pl. of Berkah) and troughs/reservoirs (Kerfan pl. of Kareef).

As a result of the constant and permanent water scarcity, it was and still is the main cause of disputes and conflicts between individuals, tribes, and different clans to obtain a share sufficient water for them to meet their daily needs for domestic use, for animals, as well as for irrigation of some cultivated crops close to the water source.

Usually, these disputes used to end in bloody conflicts that last for some time, before resorting to anyone who can help resolve them, whether the Sheikh of the tribe or clan or through the courts and state agencies. Often, these problems were solved by drafting a reconciliation document signed by all parties, through which the water share is to be distributed according to the need and the new changes, whether in the number of the population or the inheritance.

In this respect, Glass (2010) mentioned that between 70-80 percent of all rural conflicts in Yemen are related to water. However, there are many natural and behavioral variables in the region and society, such as an increase in the rate of rain in some seasons, and consequently an increase in the quantities of flowing water, or deterioration of the infrastructure of Al-Ghail (the spring/Al-Ain) water collection and its channels and neglecting its maintenance, which drives some good people in the community or stakeholders to bear the cost of the restoration, maintenance and expansion of these facilities despite their modesty.

Thus, it is envisaged that the one who does this work will benefit from the water by increasing his share or quantities in return for what he spent on restoration. While others buy the lands that benefit from this water from poor or needy people or families and thus get their share(s) in this water if part of it is used for crop cultivation. The prevailing custom is that the waters of springs (Al-Ayoun) and Al-Ghyoul are the property of some families or clans inherited from generation after another. Accordingly, other families or other clans are not entitled to benefit from such water sources except by buying a share of it or imposing new reality by force. This, however, contradicts the provisions of Islamic law which prescribe that water is a common resource for the advantage of all people.

2) Legal efforts to Diminish Conflict over Water:

Chapter four of the law decree on the Agricultural Council and the Agricultural Court of Lahj Sultanate, number 1 for the year 1950 (Penalties) indicated the following provisions:

1. Whoever is proven to have caused interruption to the Al-Ghayl water and that unentitled land was irrigated from it, he must bear the amount equal to the yield of that land, a fine of one hundred rupees or one-month imprisonment. This is if the aggressor is an owner or a cultivator in that land. But, if the aggressor pays the harvest of all the irrigated land whether owned by him or by other people and that if the aggressor is poor and unable to pay this fine, then he is imprisoned for one to six months.
2. Whoever is proven to have hit an abutment of an Ubar or Share, and that because of it the water of the stream was removed to another Sharj, and that unentitled lands were irrigated from, the aggressor should pay an amount equal to the yield the land produces, with a fine of one hundred rupees and ten-days imprisonment or payment of one hundred and fifty rupees instead of imprisonment
3. If the Agricultural Council has ordered that the water is to flow into certain lands and that the water encountered a blockade, such a blockade must be removed due to allowing the passage of the water. And if the farmer-owner of the blockade objects, the state should apply power to execute the order.

Hehmeyer (2000) points out that an individual who ignores the irrigation system exposes the entire community to severe consequences, and that such a disruption of the system will be a cause of less effectiveness and a comprehensive loss of farmers, leading thus to the destruction of the system. In other words, farmers realized that the value of the harm to society outweighed the short-sighted benefit to the individual. The sense of collective responsibility is the fundamental secret behind the long-term survival of this system. He also indicates that the unique water law of Zabid Valley, which was associated with the name of Sheikh Ismail Al-Jabarti, was organized in response to violent disputes between the valley farmers over water at the end of the fourteenth century, which is in operation until now.

Hehmeyer (2000) attributes the deterioration of water management in rural communities to the migration of men from the countryside to the cities and neighboring countries, who left behind women, children, and the elderly to remain in the countryside. The fact that natural resource management is entrusted to men, their absence means the collapse of the traditional rural networks responsible for practical initiatives, and also maintenance operations have not been performed. The population growth and the increase of economic activity pushed the society towards neglecting the traditional guardianship to resource conservation, and instead towards the development of more selfish methods.

Similarly, Varisco (2000) points to the importance of documenting Yemeni irrigation and agricultural practices to form an indispensable database for the future of agricultural development, which is closely related to the environmental, economic, and social life of Yemen. He also states that most development projects have encouraged or tolerated excessive use of water without preserving it and that many lessons could be learned in managing water resources in a way that achieves sustainable development. Irrigation workers in the Al-Ahjar (Al-Mahwit) have great experience in the timing of irrigation and the amount of water used according to the quality of the soil, and it is not arbitrary but the result of societal experiences over decades.

Al-Muhab and al-Ani (2000) also indicate that the distribution of Al-Ayoun water in the Sawan zone - Sana'a is determined by filling the water reservoir (Al-Majil) to one of its' levels, according to the irrigated area owned by the shareholder, or according to the days each shareholder has (each shareholder is allotted a particular number of days). The water then is emptied before sunset every day. The priority of this water is for drinking, and the surplus is directed to irrigation, according to the above, with priority granted for the fields below the Al-Majil.

Lessons learned:

The Yemeni citizen has been able to adapt to the environmental conditions in which he lives especially in terms of water scarcity. He harnessed such conditions and developed some common traditions and norms based on fair sharing among beneficiaries of Al-Ghyoul water for household and irrigation use. With the time passing by, and throughout the past few decades, the different pressing changes like fluctuation of water quantity, the land property transfer or the benefiting land ownership were considered in adjusting the prevailing norms and customs relating to water shares distribution and the maintenance of water structures in Al-Ghyoul areas.

These technologies saved a large amount of water that lead to expanding the land area under irrigation, the number of beneficiaries and the quantities of water distributed.

However, there are some other factors that have negatively affected the survival and development of these norms, among which is the emergence of influential people who impose their authority that have changed the way of dealing with water rights and the distribution of water shares. Many other factors played a certain role in the disappearance of these customs and traditions in the distribution of water shares and the maintenance and preservation of irrigation facilities, including: the increase in the population growth, the scarcity and fluctuation of rainwater, the increasing and indiscriminate drilling of underground tube-wells that lead to the depletion of underground water and its consequent drying up of streams and springs. The introduction of crops with high water requirements such as vegetables and fruits has also affected the distribution of water shares.

In addition to the expansion of Qat cultivation and its appropriation of a large share of the water. Moreover, the societal changes, especially the interference of the influential people, the corruption of local authorities and poverty, are major factors that have negatively affected the survival and development of such customs and traditions relating to water share distribution and maintenance of irrigation structures.

At the present time, the situation has been exacerbated by virtue of the protracted war in the country, the absence of the state administration, the spread of armed militias with their immoral values, the bullying behavior of the population against each other's, the high prices of food and fuel, the disappearance and high price of production inputs, and the depreciation of the currency, among other factors ruined all accepted values and morals in the society. All these causes have led to the following:

- Migration of rural settlers from the countryside and turning into fighters in the ranks of the various militias or workers in cities and neighboring countries.
- Negligence and deterioration of the maintenance of water structures.
- Degradation of agricultural lands, especially in the mountain terraces, and the desertification of lands in the coastal areas and the eastern plateau.
- Disappearance of many crops, and the dominance of Qat crop over cultivable land.
- Decline of agricultural land and deterioration of productivity.
- Prevalence of natural imbalance in Alghoul areas.
- Retreat of some agricultural-based crafts.
- Growing imbalance in the production of basic crops such as grains and thus food insecurity.
- Expanding segments of the poor and malnutrition.
- Unemployment is high
- Increasing demand for aid and food from abroad.

As a result of all these, the conflicts among the population will intensify, the level of poverty will expand, leading thus to the creation of environment suitable for the growth of terrorist movements conducive to the instability of the society and the region.

5. CONCLUSION

The prevailing norms in the community regulate the process of sharing water portions and maintaining their facilities as well as resolving disputes that occur between the different parties benefiting from water in this or that region. People have inherited these norms from generation to another with some developments and modifications from time to time in response to the pressing changes that occur in the society such as the ownership transfer of the land and water; the dividing of land and water among the inheritors, or due to the intervening natural factors such as water scarcity, the water affluence, and the water exhaustion for some time, and/or the changes in water course. The modern technologies have played a distinct role in distributing water shares and maintaining its facilities, such as using cement instead of clay, which needs continuous maintenance and repair, or introducing water pipelines for water conveyance instead of earth channels or natural passages.

6. RECOMMENDATIONS

It is necessary to collect and document indigenous norms and local traditions to utilize such knowledge in developing and endorsing relevant laws based on the common social aspects under the conditions of different regions and to adapt and improve the different development projects. It is also of importance to pay adequate attention to such norms and traditions as they initially stem from the accumulated vast experiences of the community with the problem of "water" as one of the main development obstacles and population survival factor for better future conservation and sustainable management.

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APPENDICES - A

Annex (1):

Definitions of Some Important Common Local Terms Used in this Study

1. Sharj (pl. shruj):

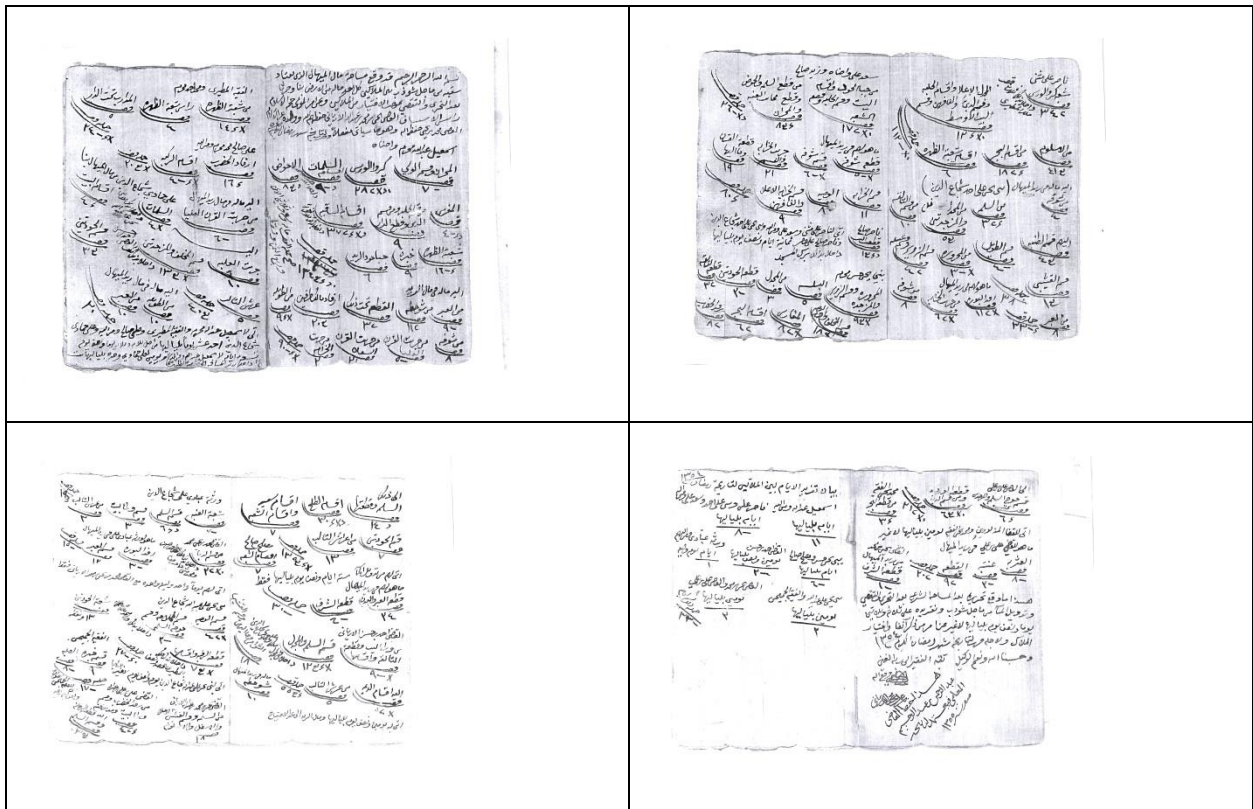
Sharj is agriculture captures slope wash from a relatively small catchment area to agricultural terrain, concentrating runoff usually onto a single field.

2. Aswam:

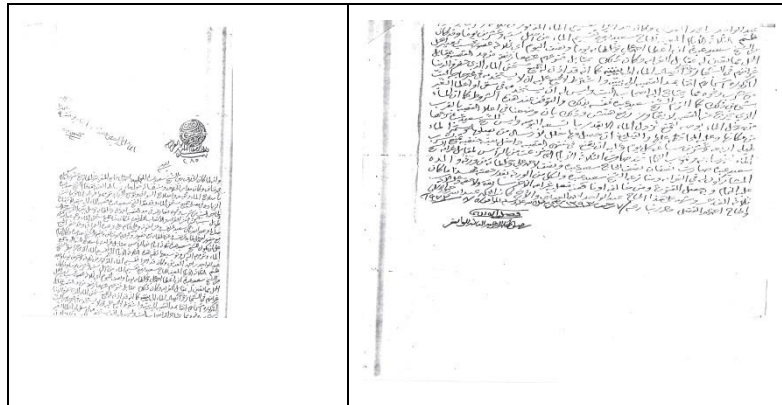
Is the plural of the word (Sawm) which is a border of the field from the front side.

Annex (2): Samples of the olden time ruling documents pertaining to Alghyoul water dispute resolutions in different Yemeni areas/regions

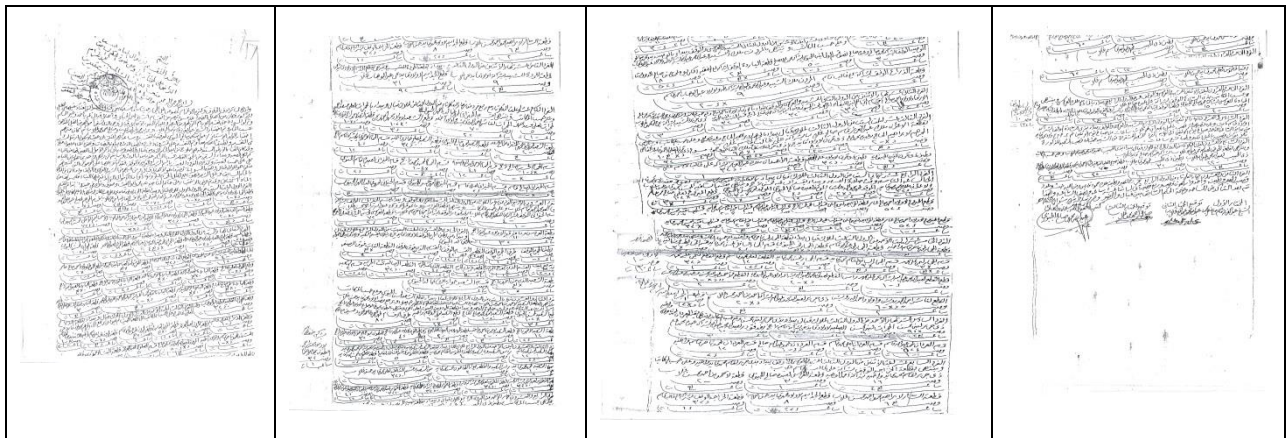
2.1 The ruling relating to the settlement of water conflict in Alqafir District, Bani Saif, Ibb Governorate



2.2 The ruling relating to the resolution of Alghyoul water conflict in Thua'abat area, Saber Mount, Taiz Governorate



2.3 The ruling relating to the settlement of Alghyoul water conflict in Bani Sa'ba, Alqafra, Ibb Governorate



Annex (3): Comparison of some important features in Al-Ghyoul irrigation areas of selected Yemeni Governorates covered by the study

#	Features/ Criteria	In Taiz Governorate	In Ibb Governorate	In Hadhramout Governorate	In Shabwah Governorate
1	Number of cases	3	4	3	1
2	Alghyoul locations	- Al-Akma, Thu'abat & Al-Barh	- Alsaddah & Alaudam, Al-Kafr (a,b)	- Wadi Hajr, Wadi Do'an & Gayl- Bawazir	- Wadi Baihan
3	Water use	- Drinking - Domestic use and - Irrigation (in Alakma if adequate)	- Irrigation - Domestic use	- Irrigation -- Domestic use	Irrigation
4	Number of Canals	- Numerous - Single in Thu'abat - Multiple in Al-Barh	- Multiple	Multiple canals/Barriers and openings	- Main channels - Sub-channels - Openings
5	Length of canals	4 kms in Thu'abat	undefined	- 5 kms	- Undefined
6	Nature of canals	- Earthen and/or Gypsum (Alqadhah)	Earthen and Cemented	- Earthen and/or Earthen-Cemented	- Earthen
7	Water share distribution for Irrigation/Access to water	- Highest land received water first (Field to field flow), in Summer season. - Upper-to-lower-stream rule in Albarh - Rule of "urgency of needs for irrigation" through consent of chosen experienced farmers (in winter season) - In Thu'abat, all landowners inherited the right to irrigate	- Upper land to the next after or below it, according to the size of land. - IS determines priority fields based on need. His opinion is respected by all (in Alodam) - In Al-Kafer according to previous ruling	- In wadi Hajr, Water is distributed by lot among the BNFs (The Upper stream landowners & tenants). - In Wadi Do'an, - "the highest-and-the-higher" rule. - Based on the strength of the flow, and similar to the case of Wadi Baihan- Shabwah - If flood quantity is limited, priority is given to date palm. - Based on the rule: "upper-to-lower-stream" - In Ghail Bawazir, - Sometimes based on the condition of the crop priority of irrigation is granted - The association supervises the process of water distribution	- First comes first served" - Rarely, irrigation is carried out from a higher plot of land to a lower plot through a tilt passage called (Al-Sakhl)
8	Performing Maintenances of irrigation structures	Yes (Except in Thu'abat).	Yes	Yes	Yes
9	Maintenance cost	In Alakma: Estimated by IS In Thu'abat: Rare due to durable construction materials (Gypsum Qadhah). In Albarh: Assigned by the Sheikh for repairing Aswam (boards of canals) and his Almasrub who supervise irrigation from run-off flood water but not from Al-Ghyail	Collective work by Beneficiaries in case of the canal's damage. Work may last for one to several days usually at end of autumn. The regular maintenance is done by IS and AIS.	In Wadi Do'an: - BNFs pay maintenance costs the productivities of number of date palms, or piece of land cultivated with other crops, or both. In Ghail Bawazir: - Beneficiaries pay either in kind (labor) or in cash. - Every BNF pays to the association 5% of crop yield in exchange for maintenance of the channels. - Every member of the association pay 1000 YR/water share.	Shared by BNFs
10	Measures against violators	- Fines or depriving of water	- Fines or depriving of water	In Wadi Hajr, Depriving of water shares, & Submitting him to local authorities for required action. In Ghail Bawazir: Depriving of water share, financially fined, & Writing a pledge not to repeat violation.	- Depriving of water - Submitting to local authorities for required action.

Annex (4) Comparison of features relating to Irrigation Supervisors (ISs) and their Assistants (AISs) of Al-Ghyoul irrigation in Selected Yemeni Governorates

#	Features/ Criteria	In Taiz Governorate	In Ibb Governorate	In Hadhramout Governorate	In Shabwah Governorate
1	Title of irrigation supervisor (IS)	Almudawel or Almasrub	Almudawel	- Mushref Alrai/ Mukadam Alsaqiah (Wadi Hajr) - Alkhail, irrigation committee 5-7 persons (Do'an) - Mukadam Alme'ian (Ghail Bawazir)	Canal's Committee CC (3-4 people for their influence and honesty)
2	Method of assigning IS	- Elected by BNFs (Alakmah and Thua'abat) - In Albarh: IS the owner of most land at the southern canal of the valley, and/or otherwise selected in a meeting by BNFs	- Selected by BNFs (usually from the village of the last irrigated field) in Alsadah; - In Alaudain, selected IS is approved by the Sheikh of the area, in Al-Kafer selected by BNFs	<u>In Wadi Hajr & Ghail Bawazir:</u> - Elected by all BNFs annually. - He may be changed or re-elected. <u>In Wadi Do'an:</u> - Selected in an assembly of about 100 members, from among 5-7 chosen as administrative body of the association	The CC members are Chosen by beneficiaries
3	Main tasks of IS	- Distributing water shares. - Settling disputes. - Meeting BNFs - Deciding who should irrigate first. - Estimating the cost of maintenance. - Coercing BNFs to pay the cost of maintenance. - Determining the type of crop and land area to be planted based on water quantity. - Mobilizing BNFs and workers during large scale maintenance.	- Distributing water shares - Resolving disputes - Cleaning irrigation channels with the help of AIS - Monitoring of offenders & preventing breaking rules. - Determining type and cost of maintenance of required. - Collecting cost of maintenance.	<u>Wadi Hajr:</u> - Distributing water shares. - Supervising Maintenance - Mobilizing workers for maintenance operation. - Maintaining a record of land, its area, owners, & other data. <u>Wadi Do'an:</u> - Supervising operations. - Mobilizing workers for maintenance - Determining and collecting maintenance costs. - Keeping record lands. - Resolving disputes - Supervising workers and masters in repairing minor damages after flood season. - Following up sources of funding for the repair of major damages <u>Ghail Bawazir:</u> Same as in other different regions/ areas besides: - Mobilizing workers for maintenance, - Collecting maintenance costs - Distributing water shares - Preparing and submitting a report to the association specifying the type of damage and its location.	The main tasks of the CC are: - Supervising water distribution to the fields through the inter-channel. - Repairing damages in the channel. - Collecting the costs of repairs from the beneficiaries. - Resolving conflict if it occurs between farmers.
4	Existence of assistants to the irrigation supervisor (AIS)	Yes (except in Thua'abat)	Yes (Sometimes selected in same meeting with IS in Alodain)	Yes: - comprising 3-5 experienced persons in Wadi Hajr. - Called Alrubbah Committee "AC" in Wadi Do'an	Yes
5	Title of AIS	- Al-Motabae'a (in Alakma). - Al-Makdami Alshuraj (in Albarh). - NA for Thua'abat	<u>In Alsadah:</u> - 3 – 5 AISs called Al-Kadeem, based on number of BNFs, area vastness & divisions <u>In Alodain:</u>	<u>In Wadi Hajr:</u> Agricultural Committee (AC). <u>In Wadi Do'an:</u> - AC <u>In Ghail Bawazir:</u> Specialized Committees of the association assisted by the IS	Irrigation committee
			- Al-Muwaze'a" or "Alkadeem		
6	Tasks of AISs	<u>In Alakma:</u> - Collect cost of maintenance. - Determining the extent of damage in channels. - Serving as a link between IS (Almudawel) and BNFs. <u>In Albarh:</u> - Assist the IS in his tasks whether from Al-Ghayil or the torrent/ flood	- Implementing assignments/ directions of Al-Modawel. - Inspecting the channel - Performing daily simple maintenance and cleaning. - Collecting the costs of maintenance from BNFs. - Acting as a link between BNFs and IS in most cases.	<u>In Wadi Hajr:</u> - Solving disputes - Supervising agricultural work - Following up canal maintenance work - Following up issues with the local authority - Determining the type of farming in the white areas. <u>In Wadi Do'an:</u> - AC helps "Alkhail" in collecting maintenance costs (known as Alferkah and Alsawk) and in carrying out tasks of IS at weakness and unavailability - Following up fund for repairing major damages Helping in resolving disputes and handling complaints. <u>In Ghail Bawazir:</u> - The maintenance committees formed helps Almkadam in supervising his work - Hired Irrigation Specialist helps in conducting a study on damages in channels and estimating the cost of repair.	- Distribution of water - Solving disputes - collecting the cost of maintenance
7	Duration of elected IS/AIS	<u>In Alakma:</u> Lifetime and may inherit task to his sons. <u>In Thua'abat:</u> Long-period, if performance satisfactory. <u>In Albarh:</u> Continues duties unless resigns or disrupts his tasks.	<u>In Alsadah:</u> 2-5 years (could be re-elected) or replaced by another person, <u>In Alodain:</u> IS elected for 5 years, after which another IS elected or the same person could continue if competent in performing his job.	<u>In Wadi Hajr:</u> IS elected every year. He can be changed or re-elected. <u>In Wadi Do'an and Ghail Bawazir:</u> Re-elected or changed in every general assembly of the association	NA
8	Origin of Person-in-Charge of water distribution	<u>In Alakma & Albarh:</u> From same family (Inherited fathers to sons) <u>In Thua'abat:</u> Appointed by BNFs.	<u>In Alsadah:</u> Alaqel (village head) <u>In Alaudain:</u> The Sheikh & Assistant of Alaubar is selected by BNFs.	<u>In Wadi Hajr:</u> From among BNFs in the area. <u>In Wadi Do'an and Ghail Bawazir:</u> From among the association members	From the association
9	Payment for IS and AIS	No payment	<u>In Alsadah:</u> Both are paid by BNFs service fees, a part of the crop produce (a quarter of a tenth of Maize and Barley yield; and an eighth of the tenth in Wheat and Sorghum for Qat crop, 10 – 20 bundles, or 3 – 4 thousand Yemeni Riyals (YR). All fees/rates are paid once a year. <u>In Alodain:</u> In the winter season, IS is paid by each BNF cash amounts ranging from 200 - 1,000 riyals, according to the size of land area. In summer, he is not paid as no effort required from him, and water normally abundant.	<u>In Wadi Hajr:</u> IS is paid extra lots of water shares as a service fee in addition to his normal share based on his land. <u>In Wadi Do'an:</u> AC gets productivity of number of date palms or the yield of piece of land or both <u>In Ghail Bawazir:</u> - Almkadam receives a monthly salary from the association	NA