

# **SMALL-SCALE IRRIGATION SYSTEMS IN MOROCCO: PRESENT STATUS AND SOME RESEARCH ISSUES**

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## **BACKGROUND**

Irrigation in Morocco is secular. The Romans colonized and exploited irrigated lands in many areas of the North Atlantic portion of Morocco, but the few archeological studies of the ancient Roman systems are incomplete and uncertain (Moulay R'chid 1982). In the 7th century, the Arab conquerors brought a new irrigation technology and laws based on the Koran. Many cities were established and desert areas irrigated. During the last part of the 15th century, the Moslems were chased out of Andalusia by the Christians and settled in various parts of Morocco and influenced the local irrigation systems. Influence may also have resulted from the presence of Portuguese and Spanish settlements along the coasts. Ayad (n.d.) notes that around Azemmour, on the coast of the Atlantic, the development of irrigation was enhanced following the increase of commercial exchange with the Europeans in the second part of the 19th century and particularly after the Madrid Agreement (1880), and later on after the Algeiras Treaty (1906). From 1912-56, Morocco was a French and Spanish Protectorate and the colonists left their own marks on the Moroccan irrigation systems. After independence, an important program of large-scale irrigation development, usually called "the dams policy," was undertaken.

## **PRESENT STATUS OF IRRIGATION SYSTEMS IN MOROCCO**

Two types of irrigation systems are frequently distinguished in Morocco: small- and medium-scale systems (SMSIS), which range in size from 50 hectares (ha) to about 3,000 ha, and large-scale systems (LSIS), which range from about 3,000 ha to several hundred thousand hectares. SMSIS may be traditional or modern systems; however, they are always farmer-managed. LSIS are modern systems, at least in their upstream portions, usually with storage reservoirs, and the main structures are always managed by the Offices Regionaux de Mise en Valeur Agricole (ORMVA), which is a government agency. There are presently nine ORMVA (ANAFID 1979). Although action has been taken to encourage farmer involvement in those systems, so far it has been limited (El Hallani 1979).

SMSIS represent a large potential (Tables 1 and 2). To understand fully the current status of SMSIS in Morocco, three aspects need to be studied: 1) the formation of water laws, 2) the irrigation policies followed by the Protectorate authorities and the Moroccan Government after independence in 1956, and 3) the irrigation organizations and their evolution.

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Table 1. Potential irrigated areas (in 1000 ha) in Morocco.

	LSIS (ORMVA)	SMSIS		Subtotal	Total
		ORMVA	DPA*		
Perennial waters	790	115	305	420	1250
Seasonal waters	-	80	90	170	170
Flood waters	-	65	100	165	165
<b>Total</b>	<b>790</b>	<b>260</b>	<b>495</b>	<b>755</b>	<b>1545</b>

\*Provincial Directorate of Agriculture; source: Ait Kadi 1986.

Table 2. Presently irrigated areas (in 1000 ha) in Morocco.

	LSIS (ORMVA)	SMSIS		Subtotal	Total
		ORMVA	DPA*		
Perennial waters	415	180	220	400	815
Seasonal waters	-	175	90	265	265
Flood waters	-	65	100	165	165
<b>Total</b>	<b>415</b>	<b>420</b>	<b>410</b>	<b>830</b>	<b>1245</b>

\*Provincial Directorate of Agriculture; source: Ait Kadi 1986.

The present Moroccan water laws are the result of the successive historical contributions of customs, Islamic laws, and modern laws. These three components still co-exist because no single component could supplant the others (Bouderbala et al. 1984). Customary regulations varying from one area to another are still extensive in the majority of SMSIS. Customs are a "real water code, although not formal" (El Alaoui 1979:41). The Islamic law (*Chraa*), "can be of a moral reference but never had practical applications" (Bouderbala et al. 1984) because it is too general. The Malekite Islamic rite in Morocco like the Chafei rite considers that when an individual settles in a land and brings water to it, he owns both the water and the irrigated land together with the "dead land" in which the water flows (Attar 1984).

According to Islamic laws, however, there are limits on the uses one can make of his own private water rights. The French, considering water a public good, declared all water resources in Morocco part of the public domain (laws of 1914 and 1919) with one exception: the water rights acquired before the law was decreed remained in force. However, as these water rights were never completely surveyed, it is difficult to say which rights were acquired prior to 1914. The colonial laws of 1914, complemented by those of 1919, were intended to allow the colonialists to corner and control all of the water

resources. In that respect, the French were more successful than they had been in Algeria and Tunisia (Bouderbala et al. 1984). After independence, the French modern laws were completed (sic) and amended as required for irrigation development. There are presently 65 main laws, of which 38 are post-1956. These laws were gathered and analyzed by Attar (1984) and Bouderbala et al. (1984). A good analysis of the Moroccan water laws can also be found in El Alaoui (1979).

To reach its aim of "creating large production units, irrigated if possible, to produce for the metropolitan state" (Kerbout 1983:5), the colonial powers used various methods to control both lands and water, such as despoliation of lands and turning away of waters to the colonists and their collaborators (ibid). According to Popp (1984), three periods can be distinguished in the colonial policy towards irrigation: 1) from 1912 to the mid-1930s the colonial states (France and Spain) were still busy with the "pacification" of the country, and the hydraulic structures built during this period were mainly for hydropower production and municipal water; 2) from the mid-1930s to the mid-1940s some small irrigation projects were developed; and 3) from the mid-1940s to 1956. During that period, the official and private colonial lands accounted for about one million hectares, and the French government started constructing large-scale irrigation systems to satisfy the growing needs of the colonists (the majority of irrigated lands were owned by non-Moroccans except in the Beni Amir and Boulaouane irrigation projects; ibid.:35).

Morocco as an independent state continued constructing LSIS, first at a slow pace and then, in the late-1960s, gradually increasing their implementation until LSIS development represented as much as two-thirds of the total public investments in agriculture (during the 1978-1980 triennial plan). In contrast, the public investments in SMSIS were almost insignificant. It seems that government development of SMSIS resulted from compassion and generosity toward farmers (Bouderbala et al. 1984). The actions undertaken in existing SMSIS were usually scattered, incomplete, and sometimes incoherent (see, for example, SCET MAROC 1977, and Zaghoul 1981), and were limited to construction of the headwork intakes, lining of some main canals, and installation of some flow measuring devices. Few actions were undertaken in terms of developing water user organizations and encouraging farmer involvement. The new SMSIS built since independence were usually planned with the LSIS methodology in mind and no actions were taken to insure their adequate management. Some successful actions in SMSIS within ORMVA's boundaries have been reported (El Hallani 1979, Madani 1983, Outabiht 1981).

Water allocation and distribution in SMSIS is presently undertaken by two main types of farmer organizations: a traditional type organization, and the Associations Syndicales Agricoles Privilegiées (ASAP), a legacy of the French Protectorate.

Almost all of the SMSIS located in areas where man has occupied the land intensively for a long time, as along the Atlas Mountains limits or in the pre-Saharan oases, are farmer-managed. Traditional farmer organizations, although not formally recognized and regulated, have precise and effective internal regulations transmitted from generation to generation. These organizations take care of all the management problems (including conflict management); planning, allocation, and distribution of irrigation water; and maintenance, control, and repair of the irrigation network.

The main structure of the water organization is the *jmaa*, an assembly of either irrigators, land owners within a given community's limits, owners of water rights, or members of the community concerned. The assembly may elect in a somewhat democratic way its representatives or simply nominate a council from among the oldest or more capable members. The general assembly may take place once a year and may be followed by a ceremony where people dance and sing. Watermasters are also chosen, together with their aides who can be chosen by the watermaster himself. These may have extensive powers ranging from the control of the water schedule to conflict management. They may have, for instance, the power to designate the irrigators who need to participate in maintenance works and fine those who refuse to do so. They may also declare a general mobilization (*touiza*) whenever repairs on the irrigation network require a large amount of labor. In some traditionally-managed SMSIS, watermasters do not exist because every member of the community knows his rights and duties (Bouderbala et al. 1984). The organization, the procedures, and the regulations vary greatly from one area to another because of differing natural, social, economic, and historical conditions. The decline of traditional farmer organizations is accelerating because the adequate environment for their activity is disappearing at a rapid pace (Bourras n.d., Kerbout 1983).

The Jmaa has lost much of its freedom to become the instrument of the administrative authorities and is now confined to the role of a transmission network for the administration (Bourras n.d.). Most traditional farmer organizations are, however, still performing well enough (SCET MAROC 1977).

Where land occupation was relatively recent and the density of the population was low, land was generally occupied by foreign settlers during the French Protectorate. Consequently the ASAP system for water management is the most common type of water users' organization on ex-colonial lands. The ASAP were decreed in 1924, at a time when the French Government wanted to give extensive powers for land reclamation to farmer organizations and the ASAP objectives included these activities. Intended primarily to satisfy the growing needs of French farmers, ASAP developed to include about half of the settlers in Morocco (Bouderbala et al. 1984). Today, all of the colonial lands that were not directly purchased by Moroccan farmers have been either distributed to Moroccans as part of agrarian reform, or are still exploited by government companies. The ASAP within these lands still formally exist but few are functioning. New laws are being written to replace those associations which are no longer adapted to the present situation.

## ADVANTAGES OF SMALL- AND MEDIUM-SCALE IRRIGATION PROJECTS

Besides their importance in terms of area served, SMSIS projects, usually farmer-managed, present many other interesting features (Anouallah 1981, Pereira 1981, Zaghoul 1981).

1. These projects are "closer" to the farmers and thus improving them results in a more rapid increase in agricultural output than large and new irrigation projects.

2. The investment costs in small existing projects are lower than in large new projects for an equivalent increase in value added. This assertion needs to be verified.
3. The investments in SMSIS are gradual, resulting in high and rapid returns when compared to large projects where it may take decades before a storage dam and conveyance system are completed and fully used.
4. A better equilibrium between various areas of the country is reached when investments are put in small irrigation projects.

The above points, together with the financial problems facing many Third World countries are increasingly pushing governments to take action to improve small farmer-managed irrigation projects. Morocco is following the same trend but, at the same time, government officials together with technicians and researchers in Morocco are finding out that they lack both experience and knowledge in this area and that small farmer-managed schemes are more difficult to study and rehabilitate than new and large projects.

#### PROBLEMS FACING THE IMPROVEMENT OF SMALL FARMER-MANAGED IRRIGATION PROJECTS

Many government agencies are facing problems relating to the improvement of farmer-managed irrigation systems in Morocco. These problems may be classified into five categories: 1) a lack of data concerning these systems; 2) problems related to the remoteness of these irrigation systems; 3) difficulties in solving land ownership problems because of their old and intensive occupation by farmers; 4) secular water rights are common in these systems; and 5) a series of unanswered questions related to administrative, legal, and financial policy issues.

*Lack of data.* The lack of data is frequent if not general in SMSIS. Although there is considerable progress in technology, the expense and time required for data gathering and analyses are problematic. Concerning the quantity and quality of water resources, for example, it is still difficult to install and manage a large number of gauging stations on remote streams and springs. Water table monitoring is also difficult for similar reasons. Water resources data gathering cannot be confined to the derivation point of a particular SMSIS but should include the entire watershed, aquifer system, and existing water rights both upstream and downstream of the derivation point. A fierce competition for water is taking place around large cities such as Fes, Meknes, and Oujda, and high quality data will be important in solving this problem.

*Remoteness.* Although Morocco has a good railway and road system and is open to both the Mediterranean Sea and the Atlantic Ocean, remoteness of SMSIS is another constraint. Remoteness can be measured in terms of distance to markets and to agriculture industries; if an intensive cropping system is to develop on SMSIS, market availability is a requirement. Remoteness can also be measured in terms of relative distance to sources of agricultural inputs, to extension personnel, and to the technical

environment in general. In some SMSIS, it has been found that modern pumping is almost impossible because it may take months to purchase spare parts or to repair a pump.

*Land ownership statutes.* Another problem is the complexity of land ownership statutes in SMSIS and in Morocco in general because not all lands are privately owned. Collective, *Guich*, *Public Habous*, and State land ownership statutes can be encountered. Collective lands are collectively owned by tribal groups under the guardianship of the Ministry of the Interior, while the use of these lands is individually left to the members of the tribal groups. Procedures for partition and use of these lands vary from one tribe to another. Tribal groups used to make a new partition of the land every year, taking into account deaths and new rightful owners (through marriage, for instance) but there is a trend toward the disappearance of these practices by a de facto privatizing. *Guich* lands are similar to collective lands in that their use is given to tribes. Two major differences, however, are that the tribes are given use of the land as compensation for their ancient participation in the army (prior to 1912), and that the lands are actually owned by the government. *Public Habous* lands are donated by pious individuals to religious foundations and are cultivated under various conditions. Like collective and *Guich* lands, they are inalienable. State lands are owned by the government and cultivated by government companies.

The large variety of land ownership statutes and the often precarious way in which the lands are cultivated, prevent intensive cropping and investment. Furthermore, land registry does not encompass a large proportion of the lands because cadastral surveys are limited in some areas of the country. Also, the fact that a high proportion of the farms are very small (less than a few hectares) and may be divided into many scattered lots of various sizes and geometric shapes makes intensive farming difficult.<sup>1</sup> As a result of successive inheritance, the farming lots may become so small that partition is stopped and the undivided lot is consequently cultivated in common. Another major concern is the fact that in some areas, land, water, and tree ownerships may be separated resulting in as many as three owners for the same lot.

*Secular water rights.* The existence of water rights is another important problem. These rights are old and often unsurveyed, and their evaluation and continuous survey and updating are difficult, time consuming, and costly, and, if not correctly conducted, may result in social unrest. The evaluation of water rights is particularly difficult because of: a) the lack of standard measuring devices on traditional irrigation systems, b) the fact that the notion of water rights may be directly linked to the physical structures of the irrigation systems (capacity of a derivation point or a canal, design of a water partition device); and any change in the physical system may result in a change in the water rights, and c) traditional or religious beliefs (e.g., a government agency was prevented from modernizing a flow partition device on a spring because the villagers strongly believed that any modification of the structures would result in the drying of the spring). Water rights are in many cases independent from the land (i.e., "single") resulting in a large inequity in land and water ownerships. Some private water rights are so small or geographically scattered that they cannot be beneficially used unless sold or let out.

*Policy issues.* The above problems result in a series of questions related to the appropriate policy to use when dealing with SMSIS, the correct legal framework and particular organization required for that policy to succeed, and the method needed to mobilize both financial resources and farmers to reach the goals. The answers are difficult because of the complexity of the problems and the variety of environmental, technical, social, and political implications of any decision. SMSIS are a result of a historical process sometimes slow, sometimes violent. Any hasty intervention, however small, will destroy a state of equilibrium with unpredictable consequences. This is why government agencies are so reluctant to interfere with SMSIS, although they recognize the urgency of such interference. A key role is consequently left for research.

### **SOME IDEAS CONCERNING RESEARCH ISSUES**

The few studies on farmer-managed irrigation systems in Morocco were conducted by sociologists, historians, geographers, and scientists in the human sciences. Consequently, the technical aspects of irrigation were not studied in much detail.

A SMSIS is a technical, social, economic, political, and historical entity. Consequently, its study should be conducted as a multi-disciplinary team effort. Because SMSIS differ, it is useless to identify causal factors unless the observations are made in a large number of systems. The single most important research issue is the study of the irrigation system itself. One of the main objectives of research is to establish a typification of SMSIS. This typification should be problem focused, not descriptive (Bouderbala et al. 1984); that is, it should try to answer specific questions that face those who want to intervene in the systems. Such questions might include: What particular difficulties are linked to land ownership statutes? Is it possible to consolidate water rights and lands? How efficient is the present system? If the irrigation network is to be modernized, could the old layout of the system be modified without major difficulties? The study is consequently not conducted for the sake of the study itself but with the problems to be solved in mind. Such an approach would facilitate the comparison of different systems and the analysis of the data gathered. The study of any system should include at least five aspects:

1. General information concerning the location, the climate, the soils, the crops, land ownership statutes and distribution, and water resources quality and quantity to define the setting of the irrigation system.
2. Irrigation network layout, capacity, structures (that is, the technology used), and on farm water management. Besides the water efficiency of the system, the relationships between (and the reasons for) the layout, the slope of the canals, the location of the intake structures, and the ethnic and natural environment.
3. Irrigation system management; that is, the organization for water management; the methods of irrigation water planning and distribution (and how well these methods respond to both the crop water needs and to equitable water distribution, particularly during periods when water is scarce); and the organization of system maintenance, particularly because maintenance works is often the price paid for water.<sup>2</sup>

4. Water rights,<sup>3</sup> that is, who has access to water and how much can he take? These are difficult questions because the answers may depend on particular circumstances such as the hydrology of the particular year or season, or the way water rights are quantified and the way measurements are made.<sup>4</sup>

5. A methodology for research in SMSIS is still difficult to suggest, at least for the Moroccan systems. It may take a few years of intensive study of many SMSIS before such a methodology can be developed.

## CONCLUSION

For public intervention in farmer-managed irrigation systems to succeed, a clear policy is needed. The improvement of the irrigation system itself is but a small part (and the last stage) of public intervention. Prior to that, farmers should be involved and organized, a clear legal framework should be instituted, production structures and cropping systems should be improved, water resources quantified and if possible augmented, and adequate administrative structures should be created. Research in this area is still badly lacking while it is the basis of any policy to be undertaken.

## NOTES

<sup>1</sup>Although it has been observed that the most intensively farmed land holdings are those located in oasis type areas where the fields are among the smallest of the country.

<sup>2</sup>In some irrigation systems in Morocco, water rights are lost in case of non-participation in maintenance works.

<sup>3</sup>Some researchers in Morocco prefer the concept "right to water" to the notion of "water right" (Hammoudi 1982).

<sup>4</sup>Time is certainly the most common means of measurement, but modern watches and clocks are relatively recent. Solar clocks are still used in many traditional irrigation systems in Morocco.

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