

CHAPTER ONE

SOCIAL CONFLICT IN WATER RESOURCE MANAGEMENT AND ITS ENVIRONMENTAL IMPACTS IN SOUTH-EASTERN TUNISIA

PAOLA MINOIA AND FRANCESCA GUGLIELMI

Introduction

The water scarcity issue is highly relevant in Tunisia, as well as in the whole Mediterranean region. The causes exist due to the natural physical scarcity of water that is typical in arid environments, together with the presence of anthropogenic pressures, such as overexploitation of aquifers, the contamination of fresh and groundwater resources, increasing water demand by the agricultural, domestic, tourist and industrial sectors, and difficult institutional regulatory settings and law enforcement related to water management. The agricultural sector is the greatest water consumer, amounting to 80% of the total consumption of the Southern Mediterranean countries (Chrik, Ghorbel and Zouari, 2005). Paradoxically, the highest consumption rates occur when the seasonal scarcity is worse: in summer, the water demand presented by the agricultural and tourist sectors dramatically increases. The situation is particularly sensitive in coastal areas, where tourist resorts are mainly concentrated. Intensive water use produces marine ingression in the aquifers, thus worsening the quality of water used for drinking, irrigation and ecosystem functionality.

The linkage between environmental and social degradation is particularly evident in poor and marginal areas. Poor communities increase their vulnerability if they depend on a depleted source. Therefore, the need to protect a natural resource has to be coupled with the need to sustain the local sources of income, e.g. by supporting the acquisition of technical options to rationalise the water demand or by providing alternative solutions to those relying on the endangered resource. A cooperative approach between communities and institutions is a fundamental

prerequisite for a sustainable development of the target areas. In all cases, decisions have to be made through processes involving stakeholder participation. In contrast, the application of top-down decisions and partial or specific sectoral solutions can constitute a cause for social and institutional conflicts.

Local governance mechanisms play a key role in the integrated management of water resources as well as in human development, by enhancing negotiation dynamics with all relevant players, acceptance of decisions made, and support towards the groups that might be at risk because of the efforts concentrated on the preservation of the natural resource. During the past decade, some Mediterranean countries introduced new regulations (e.g. Morocco, 1995; Tunisia, 1999) introduced new regulations on water management, including provisions for decentralisation of decision-making. However, the local authorities' capacity to involve local stakeholders hasn't always been effective, as in the case of the overexploited Djeffara aquifer of Northern Gabès in Tunisia.

The aim of this paper is to assess how water management policies have been applied in Tunisia, particularly by analysing a case of water stress in the south- eastern region of the country, showing that institutional decisions targeting water conservation issues, when not integrating social and governance aspects, can promote conflict with important target groups.

Water resource management in Tunisia

In Tunisia, during the decade 1991-2000, a national strategy of water resource mobilization was set up in order to satisfy the growing water demand from the agricultural, domestic, industrial, and tourist sectors. The proposed solutions were to increase the exploitation ratio of the overall resources to 95% by the year 2010 (Benabdallah 2003) and to increase the utilisation of non-conventional resources, in particular from treated sewage waters, that grew from 37 Mm³ in 1988 to 200 Mm³ in 2000, from the domestic sources and, to a minor extent, from artificial groundwater discharges and desalination plants (Ministère de l'Agriculture/ DGRE 2003). This strategy included new engineered infrastructures, but also demonstrated a progressive integration of demand management policies, aimed at moderating water allocation per hectare in agriculture, reduce losses, protect the quality of water resources and obtain greater volume for other growing sectors. These decisions were in line with international policies addressing water issues at the global level, such as those

introduced by the Dublin and Johannesburg Conferences, respectively in 1992 and 2002 (GWP 2000; Scanlon, Cassar and Nemes 2004). Tunisia has since approached the principles of Integrated Water Resource Management (IWRM). A primary principle is related to the *integrated* and *demand-side* approach to water management, meaning that institutional, technical, economic, environmental and social aspects have to be integrated in order to rationalise water consumption and ameliorate the balance between limited water quantities and the increasing human demand. Another aspect of the IWRM principles refers to the need to ensure a level of *governance* sufficiently close to local communities, in order to allow for their meaningful participation (Wallace *et al.* 2003).



Fig. 1-1: Location of Gabès Governorate

As for the first principle mentioned, the public policies undertaken in Tunisia follow, in practice, a “weak approach”, focussed on reducing the losses and providing incentives to consumers for virtuous behaviour by means of pricing, subsidies, management tools and sensitization activities; while a “stronger approach”, that would also address the inefficiencies in water allocations and distribution among the sectors, and would apply monitoring, control and sanctions interventions for non-compliant behaviours, is not sufficiently applied (Romagny et al 2004; Chrik, Ghorbel and Zouari 2005).

In line with the local governance principle, the Governorates and the regional *Commissariat Régional au Développement Agricole* (CRDA) of Tunisia have started to decentralize some tasks to local associations of water users. In 1999 (Law n° 99-43) the pre-existing groups related to farmers activities (*Associations d'Intérêt Collectif* - AIC) were renamed as *Groupements de Développement Agricole* (GDA) and assumed more responsibility in steering the members towards better agricultural practices, for soil, water and environmental protection, particularly with respect to pollution, irrigation and overexploitation control. However, not all GDA carry out these tasks because of internal weaknesses, like those identified in the case study of the Gabès Governorate.

Water deficits in Gabès and the institutional responses

The water resources utilized in the Gabès Governorate (Fig. 1-1) are mainly from deep aquifers, followed by phreatic aquifers. The volume of available and consumed water resources in Gabès are summarized in Table 1-1.

Four main aquifers supply the Gabès Governorate: Djefara of Gabès (serving North Gabès, South Gabès, El Hamma Chenchou and Oglet Mertaba); Continental Intercalaire; Turonien Matmata; and Crétacé de Sidi Mansour. The total volume of available groundwater is 156.6 mm³ and the volume utilized is 123 mm³, allocated to the following sectors (Abidi and Rahali 2004):

- Agriculture: 90.1 mm³/yr (73% of total use);
- Tourism and domestic use: 28.9 mm³/yr (24%);
- Industry: 4.1 mm³/yr (3%).

The main part of the exploited water resources comes from the Djefara Aquifer, with a volume of 115.80 Mm³/yr and a utilised amount of 99.9 mm³/yr; the other aquifers show less important volumes of available and consumed water resources. A rapid increase in consumption rates has been recorded since 1998 (Abidi and Rahali 2004).

The intensive exploitation has caused various kinds of environmental impacts on the inshore Dj Jeffara aquifer. In particular, there has been a decrease in the piezometric level, a deterioration of the water quality due to salinity and serious marine intrusion. In particular, the Dj Jeffara of Gabès North is a coastal and phreatic aquifer, supported by sands of the Miocene which consist of two surfaces separated by a semi permeable sandy-clay layer of about 40 meters thickness (Abidi, 1999). Because of this relatively thin layer, the area is naturally at risk of marine intrusion. Other pressures are caused by local farmers, who dig wells to irrigate their fields, thus increasing the dynamics of sea water intrusion and decreasing the piezometric level of the aquifer.

These environmental damages induced the governorate to react by imposing measures to prevent further degradation. Having assessed the relationship between the intensive exploitation of the inshore aquifer and irrigation uses, the response was the implementation of restrictive rules of water uses, based on the protection principles enunciated in the Tunisian *Code des Eaux* of 1975 (Chkir et al., 2005).

The first delimitation constituted a “protection zone”, defined in 1985 (decree n° 85-1105) but appeared too limited (Fig. 1-2), and therefore in 1987 (decree n° 87-480) was extended to the area of “interdiction” defined by the *oued* Akarit in the north-east of Gabès Governorate, Teboulbou-El M’dou, south-east of Gabès city, and including part of Eastern and Western Gabès, Gabès Medina, Ghannouch, Metouia and a section of El Hamma (Fig. 1-2). According to Tunisian regulations, an “interdiction area” is defined by the *Arrondissement Ressource en Eau* of the CRDA of Gabès Governorate, responsible for aquifer monitoring, whenever the following conditions are present: 1) overexploitation of the aquifer; 2) decrease of the piezometric level of the aquifer; 3) water salinity increase because of marine intrusion; and 4) localization in a coastal zone. In the interdiction area, farmers are forced to use fixed volumes of water and need permission from the *Arrondissement Ressource en Eau* of the CRDA of Gabès.

Table 1-1: Water resources in Gabès Governorate

Source: Data from Office du Développement du Sud 2004

	Available resources mm ³ /yr	Consumed resources mm ³ /yr
Groundwater	180.87	146.37
Phreatic Aquifer (<50 m)	24.27	23.37
Deep Aquifer (>50 m)	156.6	123
Surface water	44	6.50
Treated sewage water	5.69	1.20

Conflict analysis in the Oued Akarit-El Bsissi plains

Some aspects of the social conflicts originating from the restrictive rules and their environmental impact can be better understood by focusing on a specific zone of the interdiction area, the agricultural plain of Akarit-El Bsissi. It is a coastal plain located in the delegation of Metouia, bordered to the north by the *oued* El Akarit, to the east by the Mediterranean Sea, to the south by the *oued* El Melah and to the west by the national road connecting Gabès to Sfax (Fig. 1-3).

This is a marginal area with agricultural fields but only scattered settlements, as the farmers mainly come from other areas of the Metouia or Ghannouch delegations. In summer, the crops cover 830.5 hectares while in winter these cover 904.5 hectares. Other cash crops for local and regional markets, especially tobacco, occupy 194 hectares during the entire year (CRDA Gabès 2003). Small family companies make up the basic economy for the local communities, who have increased their vulnerability after the institution of the interdiction area.

The installation of common wells allowed by the CRDA in other zones of the interdiction area, to be managed by local GDA, could not apply in El Bsissi area, where the agricultural land is not intensively exploited but rather presents scattered cultivated plots. The distances between the parcels are too wide to allow for their grouping and connection by pipes from a common well. Therefore, the solution was only to dig several private wells. Theoretically, even in this case, their use is limited by fixed volumes authorized for the irrigation of their perimeters.

However, the reality is that there is a lack of control. The high number of private wells in this area poses great difficulties to the CRDA officers to effectively monitor the water consumption rates and consequently respect the interdiction law.

Although justified by the need for environmental protection of the resource, the interdiction was not accepted by the rural populations that perceived the allowed amounts as being scarce compared to their expectations and felt deprived of “their own water resource”. By the interdiction law of 1987, they suffered due to the limitation of water volume compared to the extension of their perimeters. Still today, twenty years after the decision, some farmers do not understand why they have to pay to obtain a limited volume of water for their agricultural activities when they could directly extract the needed water through a simple well located on their parcel (Chkir et al., 2005).

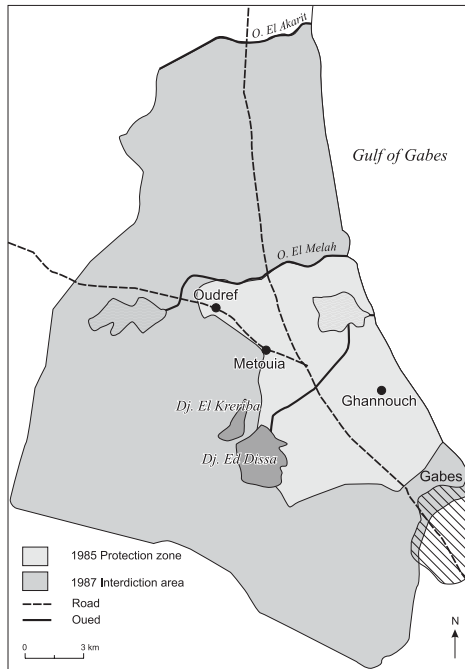


Fig. 1-2: Protection and Interdiction areas

Interviews of local farmers carried out in February and March 2006 revealed that before the delimitation of the area, the public institutions did not involve the affected communities by using awareness campaigns or negotiation activities. Nor have these parties benefited from any compensation measures for the limited volume of water to be utilised in their agricultural production. It is thus evident that the interdiction has established a conflict between the regional authorities of Gabès Governorate and the CRDA, on one side, and the farmers on the other. The way the interdiction law has been imposed, by a top-down instead of a participatory and negotiation process, has created a critical relationship between the public authorities and the local users, and as a consequence, has increased the number of illegal wells, posing serious constraints to the achievement of the very goals of the interdiction.

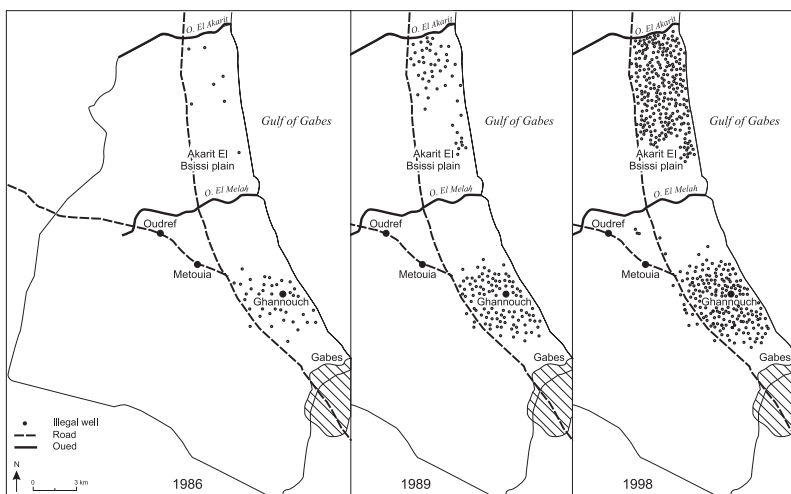


Fig. 1-3: Expansion of illegal wells in the Akarit-El Bssi and Ghannouch plains

The limited supervision and the low depth of the aquifer of Gabès North (less than 50 meters) have induced the farmers to increase the wells, without submitting notification or permission requests to the CRDA. The discovery of these violations only brings administrative sanctions, which are not experienced as effective disincentives for the illicit farmers. However, the relations between the regional institutions and the local water users have become tense, with social, economic and environmental implications. In fact, the farmers were left alone with the new constraints to the local productivity, and as a reaction found a solution in digging illegal wells. Therefore, the overexploitation of Gabès North aquifer – particularly in the area of the *oued* Akarit-El Bssi - continues, with the consequences of a further decrease in the piezometric level of the groundwater and marine intrusion in the inshore aquifer.

A survey compiled by the *Arrondissement Ressources en Eau* (CRDA Gabès 2003) shows the proliferation trend of illegal wells which have been discovered by the public authorities, including the following:

- 1986: 45 illegal wells, 7 in El Bssi and 38 in Ghannouch;
- 1989: 150 illegal wells, 51 in the *oued* El Melah-El Bssi-*oued* Akarit and 99 scattered between Ghannouch and Metouia;
- 1996: 285 illegal wells, 197 in El Bssi and 88 in Ghannouch;
- 1998: 354 illegal wells: 264 in El Bssi (105 artesian, 107 engine driven, and 47 abandoned) and 190 in Ghannouch.

Figure 3 shows the intense proliferation of illegal wells, mainly concentrated in the area of the *oued* Akarit-El Bsissi, and to a minor extent, in Ghannouch. Their depths have progressively increased, generally going beyond 50 meters, to reach the layers at 70-80 m and even at 130 m, thus crossing the phreatic aquifer to reach the deeper one. The increase of engine-equipped wells has evident impacts, especially in terms of diminution of the artesian flow, that is passed from 10-25 l/s to 4 l/s, with average values of 0.5 and 1 l/s. As a result, the diffusion of mechanised pumping has reduced the use of artesian wells (CRDA Gabès, 2003).

In the 1970s and 1980s, the piezometric level of the inshore aquifer of Gabès North was lying on isopieze between 20 and 25 meters. In 1998, as a consequence of the increased number of illegal wells, the piezometric level dropped by 10 meters, which was the threshold value to avoid sea intrusion (CRDA Gabès, 2003).

The need to solve this situation, as the legal measures have proven to be insufficiently effective, has recently motivated the CRDA to create a new GDA in the *oued* Akarit-El Bsissi. Some information and awareness raising meetings were conducted by the CRDA, the *Arrondissements en Ressources en Eau* and *Génie Rural*, in order to get the partnership of local farmers and their representatives from the Regional Farmers Union and from the delegations of Ghannouch and Metouia. The GDA cannot directly manage irrigation from common wells, but is supposed to provide support to farmers, through economic subsidies by the governorate and through technical advice, particularly on the application of water saving techniques for irrigation. From their side, the farmers pay for the water withdrawals and ordinary maintenance and are transparent and legally compliant in terms of the number of wells. The GDA is responsible for awareness-raising and agricultural extension activities. This is clearly contributing to a slower well proliferation pattern than the one that had occurred during the previous decade (personal communication by the head of the *Arrondissements en Ressources en Eau* of Gabès, 1st March 2006). Nevertheless, further efforts are needed, e.g. to strengthen the educational activities offered by the CRDA and the GDA, as the proposed ones are not fully incisive or understood by the farmers. From their perspective, the interdiction decision has jeopardized their economic activities, and some of them see the GDA institution as a further imposition by the regional authorities, and not a farmers' representative institution. These are the main constraints upon the effective role of the GDA to act as a bridge between the regional institutions and the local farmers, who are not fully

aware of the need to protect the water resources and to ensure their sustainable use (Chkir, Ghorbel and Zouari 2005).

The situation that has arisen can be described as an institutional and intersectoral conflict (Minoia and Camuffo 2006). The institutional conflict regards in this case the relations between the local authorities and the civil society. The institutions are putting constraints upon the already poor economies and cultural habits of local farmers, as they do not have the means to utilise water saving techniques. Farmers suffer from the interdiction decision, because it brings a change in their lives and working patterns. The interdiction decision, though based on environmental considerations, is judged as being a cause of social problems.

Intersectoral conflicts appear when some water users perceive that their use is endangered by extractions done for other purposes. While this type of conflict has not been explored in the El Bsissi area, it is more and more apparent in other parts of the interdiction area, where tourist and industrial sectors are developing. Although agriculture is the major consumer of water, in the southern part of the area near the town of Gabès, tourism and industry also use the Djeffara waters (besides treated waters). However, the restriction does not apply to them because their withdrawal seems not to cause the overexploitation of the aquifer. The interdiction helps to emphasize the economical and social differences existing between the productive sectors, as tourism and industry are richer sectors than small and medium sized farming. Tourism and industry are still relatively small, but are rapidly expanding sectors, obtaining public support and facilitation by government, whereas the farmers feel that the water tariff increases, based on consumption rates, together with the interdiction, constitute a penalization of the agricultural sector. The competition among sectors is felt by the agricultural producers as being caused by a national policy that gives support to other economic activities, despite their environmental impact.

Concluding remarks

Through the case of Akarit El Bsissi, this paper has presented a particular situation of conflict, originating from an “interdiction” of irrigation practices from around a depleted aquifer. The reaction is expressed by the affected farmers through non-compliant behaviour, rather than open conflict. Although the quantitative limitations of water abstractions imposed on the farmers are justified by urgent conservation needs, the decision-making process reveals different shortcomings of the

policy institutions. Some adjustments for the future have to include the following strategies:

1) The establishment by institutions of effective cooperation with the stakeholders through awareness raising programmes about the environmental impact of their irrigation patterns;

2) The development and proposal of a negotiation process with farmers, to decide on modalities for the application of the interdiction rule, in order to permit adaptation by the vulnerable groups to take place, and to compensate the affected farmers for their social and economic losses;

3) The enforcement by inspectors of their monitoring system of water withdrawal, and with sanctions against farmers responsible for illegal boreholes.

Although it is clear that there is a willingness to avoid open conflicts that would worsen the situation, a coherent approach with respect to the interdiction rule has to be kept, to promote clarity in the legal environment and to facilitate compliant behaviour.

This is clearly a case that calls for effective *local governance* tools and for a complex approach that takes into consideration environmental protection needs, as well as the social and economic development of the area and its communities. If there is a lack of public participation in water resource management and the environmental policies fail and remain ineffective, then sustainable development will not be achieved (FEEM 2006). Good governance of water relies on the compliance of people from the political institutions, and on the capacity of these institutions to manage social problems and to gain the general consensus through agreements and compromise (Agricultural Research Institute, 2006).

A first step for the area of the *oued* Akarit-El Bsissi would be to convince the members of the *GDA* that the decision of interdiction will not constrain the socio-economic development of the region (Chkir et al., 2005). On the other side, the civil society has to become aware of the environmental impact of their actions, the relationship that local actions have to global ones, and the impact that present activities will have on the future (Tamas, 2002).

In conclusion, there is much to do to create a collaborative relationship with the *Groupement de Développement Agricole* of El Bsissi and with the *Commissariat Régional au Développement Agricole* of Gabès. So far, constraints have been in the paternalistic attitude of both scientists and policy-makers towards the public stakeholders, who were considered as an audience to be informed and made aware, rather than a group from which information could be gathered and to fully involve during the whole decision-making process. The challenge will be in

enhancing the capacities of the GDA to become a facilitator, able to effectively overcome the traditional mistrust existing between the government and the public, and make use of scientific outputs in order to reach shared policies.

The participatory approach and involvement of the most relevant stakeholders in decision-making regarding the best uses of local resources, is highly needed to reach a concrete development of the agricultural sector and to protect water resources.

Acknowledgement

The authors wish to thank Dr. Najiba Chkir of the Laboratoire de Radio-Analyses pour l'Environnement, ENIS, and M. Brahim Abidi of the CRDA Gabès, for their scientific cooperation; Maria Vuori and Jouni Suominen, University of Helsinki, for drawing the maps. They also acknowledge the financial support of the EC through the “Nostrum-DSS” Co-ordination Action and of the Italian Ministry of University and Research through the FIRB project “Logos-Med”.

References

- Abidi, B. (1999). “Gestion des ressources en eau d’une zone d’interdiction. Cas des nappes souterraines de la région O. Akarit – El Bsissi (Gabès Nord), *Journée des Ressources en Eau*, INAT 3 juin 1999, Ministère de l’Agriculture, Direction Générale des Ressources en Eau, Tunis.
- Abidi B. and Rahali M. (2004). “Arrondissement de Gabès”, in Direction Générale des Ressources en Eau (by), *Annuaire de l’exploitation des nappes profondes*, pp. 333-345
- Agricultural Research Institute (2006): “Comparative assessment of decision-making processes, regulations and laws in Mediterranean Countries”, *Nostrum-DSS* (http://www.feem-web.it/nostrum/doc/d6-2_rev.pdf)
- Benabdallah, S. (2003): “La réutilisation des eaux usées traitées en Tunisie”, Bonn
([http://www.diegdi.de/.../0/fa66ed1ab3b8efd6c1256ce100431e37/\\$FILE/reutilisation%20eaux%20Tunisie%20Benabdallah.pdf](http://www.diegdi.de/.../0/fa66ed1ab3b8efd6c1256ce100431e37/$FILE/reutilisation%20eaux%20Tunisie%20Benabdallah.pdf))
- Chkir Ben Jemâa N., Ghorbel Zouari S., Zouari K. (2005): “Statistical information at country level. Assessment of water management practises, use and needs. Tunisia”, *Nostrum-DSS National Report, Part I* (http://www.feem-web.it/nostrum/intranet/cd/docs/tun_1.pdf)

- Chkir Ben Jemâa N., Ghorbel Zouari S., Zouari K. (2005). "Tunisia. Groundwater management of a protected area: Jeffara aquifer-Southern Tunisia", *Nostrum-DSS, National Report, Part II*
- Chkir Ben Jemâa N., Ghorbel Zouari S., Zouari K. (2005): "Report on water uses in agriculture in the Mediterranean countries", *Nostrum-DSS* (http://www.feem-web.it/nostrum/doc/d2-1_rev.pdf)
- CRDA Gabès (2003). *Gestion participative des nappes phréatiques. Cas du périmètre irrigué sur puits de surface: région d'El Bsis-si-oued Akarit (Gouvernorat de Gabès). Rapport d'Evaluation*, Ministère de l'Agriculture, de l'Environnement et des Ressources Hydrauliques, Gabès
- FEEM-Fondazione Eni Enrico Mattei (2006): "Thematic report on Dss and stakeholders' participation", *Nostrum-DSS*. (<http://www.feem-web.it/nostrum/doc/d6-7.pdf>)
- Gaaloul N. and Zouari K. (2004): *Harnessing salty water to enhance sustainable livelihoods of the rural poor in Tunisia*, International Center for Biosaline Agriculture, Dubai
- Global Water Partnership Technical Advisory Committee (GWP-TAC) (2000): "Integrated Water Resources Management", TAC Background Papers n°4, Stockholm. (<http://www.gwpforum.org/servlet/PSP>)
- Ministère de l'Agriculture (1998): *EAU 21-Stratégie du secteur de l'eau en Tunisie à long terme 2030*
- Ministère de l'Agriculture, Direction Générale des Ressources en Eau (2003): *Etude des nappes aquifères de Sfax - lot n° 8 - Définition des besoins hydriques pour eau potable, d'irrigation et d'industrie, Sfax*
- Minoia P. and Camuffo M. (2006): "Thematic report on social aspects of conflicting water uses", *Nostrum-DSS* (<http://www.feem-web.it/nostrum/doc/d6-6.pdf>)
- Office du Développement du Sud (2004). *Le Gouvernorat de Gabès en chiffres*, Gabès, Ministère du Développement et de la Coopération International
- Romagny, B., Guillaume, H., Ben Ouezdou, H., Palluault, S. (2004). Ressources en eau, usages et concurrences dans la Jeffara tunisienne, *Série Usages, appropriation, gestion des écosystèmes. Documents de recherche n°1*. Laboratoire Population-Environnement-Développement Unité Mixte de Recherche IRD-Université de Provence 151, 38 p. (http://www.up.univ-mrs.fr/wiupenv/labo/d_lpe/publications/docs-recherche/lped-usages2.pdf)
- Scanlon J., Cassar A. and Nemes N. (2004): "Water as a Human Right?", *IUCN Environmental Policy and Law Paper n°51*

- Tamas, P. (2003): “Water Resource Scarcity and Conflict: Review of Applicable Indicators and Systems of Reference”, *UNESCO-IHP*, Paris (<http://unesdoc.unesco.org/images/0013/001333/133307e.pdf>)
- Wallace J. S., Acreman, M. C. et al. (2003) “The sharing of water between society and ecosystems: from conflict to catchment based co-management.” *Philosophical Transactions: Biological Sciences* 358 (1440), pp. 2011-2026.