



# Groundwater Governance in Tunisia

## A Policy White Paper

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## Acronyms

AIC	Associations of Collective Interest ( <i>Associations d'Intérêt Collectif</i> )
CRDA	Regional Agency for Agricultural Development ( <i>Commissariat Régional au Développement Agricole</i> )
CTV	Local Extension Services (Cellule Territoriale de Vulgarisation)
DG BGTH	General Directorate of Dams and Major Hydraulic Works (Direction Générale des Barrages et Grands Travaux Hydrauliques)
DGRE	General Directorate of Water Resources (Direction Générale des Ressources en Eau)
DGGREE	General Directorate of Rural Development and Water Exploitation (Direction Générale du Génie Rural et de l'Exploitation des Eaux)
GDA	Group of Agricultural Development (Groupement de Développement Agricole)
STEG	National Electricity Company (Société Tunisie d'Electricité et du Gaz)

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## Foreword

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This Policy White Paper is part of a project on "Groundwater Governance in the Arab World" funded by USAID which includes a review of groundwater management and policy options in the world, with a focus on the Middle East and North Africa (MENA) region, as well as case studies in Tunisia (Haouaria region), Jordan (Azraq groundwater basin) and Lebanon (Central Beqaa). Each country case study has been the object of two scientific reports: a study of the groundwater policy background and history; and a report on field investigations in each basin carried out to document current dynamics and problems of groundwater-based agriculture. Further to these studies, *Dialogues* have been conducted with and between local stakeholders and policy-makers in each location. Problems, principles and management options have been discussed and confronted at length, and opinions and suggestions have been shared. This White Paper is meant to tease out important points from all these research output in order to provide policy ideas and orientations in a summary form. Analyses and recommendations stem from the ideas advanced by stakeholders during the workshops held, but also from field work and from the evidence synthesized from experience at the world level by this project. The control and regulation of groundwater abstraction is perhaps the most vexing challenge of water management worldwide, with very few encouraging or 'success stories'. Mindful of the political complexities of groundwater regulation, this White Paper is an attempt to contribute to groundwater policy thinking in Tunisia.

## 1 Introduction

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Surface and groundwater resources in Tunisia are almost completely appropriated. This appropriation has allowed the country to develop its rural areas through irrigation, and to supply drinking water to its expanding urban areas and industries. Groundwater in Tunisia is a strategic resource, covering 75 percent of all water uses in the country and 80 percent in irrigated agriculture (Elloumi 2016).

The traditional approach of Tunisia's groundwater resources policy has fallen short of ensuring the sustainability of the country's resources and developing a long-term successful management approach. The search for a balance between economic growth, rural development, resource use and sustainability is complex and compels the government to develop a new approach capable of addressing all these aspects within the potential and limits of the natural environment, in an acceptable and mutually beneficial manner.

Against this backdrop, the main reason for developing this Policy White Paper stems from the realisation that it is necessary to support the collective effort the country is experiencing at the moment, thinking and assessing the current state of groundwater management policy in Tunisia in order to infuse new ideas and inspire the new water law under discussion. The aim of this policy paper is to lay out a series of ideas and steps providing useful criteria for public discussion about the current state and future of groundwater resources and its management, outlining how certain arrangements and measures to manage groundwater in Tunisia can be improved.

The Policy White Paper is structured as following: first, the main components and structures surrounding the management and regulatory structure of groundwater in Tunisia are laid out, emphasizing the issue of well regulation and community user participation in groundwater management, analyzing the current situation, its limitations and problems. We then emphasize the different dimensions of groundwater reform in Tunisia, putting forward some specific recommendations complementing the on-going process of revision of the Water Law.

Some of the main policy messages of the Policy White Paper are:

- Improve data collection and data sharing among users, and the overall modelling capacity of strategic aquifers;
- Improve stakeholder mobilization in view of the need to pursue the decentralisation policy in water resources management;
- Recognize that sharing roles and responsibilities is an option that can improve efficiency and sustainability;
- Commit and spend financial resources for user participation;
- Collectively define clear rules for sharing groundwater and apply them;
- Consider the details of the process of well regulation, clarifying the criteria for both old and new wells based on the situation on the ground.

## 2 Background on groundwater governance in Tunisia

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### 2.1 Groundwater resources and use

Tunisia's hydrogeological setting can be simplified into three main systems (Elloumi 2016): 1) in the north aquifers are found in sandstone deposits and sometimes alluvial and calcareous. Groundwater abstraction in these areas combines shallow hand-dug wells with a wide shaft (3 to 5 meters) with boreholes down to 200 meters (Gaubí 2008); 2) in Central Tunisia, groundwater is found in multi-layered aquifer formations reaching up to 600 meters in thickness, and is abstracted mostly via deep boreholes. In the south of the country, deep groundwater is found in large aquifer reserves (e.g. the Jeffara aquifer in Gabes) and two large fossil aquifer systems in the Sahara region; 3) in the south are found 56 percent of all deep groundwater reserves in Tunisia. Most shallow groundwater resources (there are more than 210 shallow aquifers where groundwater is found at a maximum depth of 50 meters) are found in the north (50 percent) and the center of the country (34 percent of shallow groundwater resources) (Figure 1).

Shallow (unconfined) groundwater is the most prevalent type of water used for irrigation in Tunisia (supplying 48 percent of water needs for agriculture followed by deep groundwater supplying 25 percent and surface water supplying 21 percent) (Hamdane 2014).<sup>1</sup> In Tunisia, the number of wells doubled in 20 years reaching 120,000 in 2000 (Faysse et al. 2011). Other more recent estimates such as FAO (2009) indicate that there are over 137,700 shallow wells in Tunisia of which around 95,000 are equipped with pumps and 5,111 deep wells (data from 2005). As with other countries in the MENA region (and elsewhere), these numbers are probably underestimated.

With regard to the use of groundwater, two types of management systems can be differentiated in Tunisia: 1) private-individual with free access to the resource, which in the last few years has multiplied and become more atomized (shallow dug wells and deeper boreholes); 2) collective groundwater management, either through the state or GDAs (*Groupements de Développement Agricoles*) for irrigation and/or drinking water supply. Collective management may include different types of arrangements between users, and various degrees of involvement of the state. Geographically, groundwater management in Tunisia exists through four main types of groundwater abstraction and use (Closas and Molle 2016):

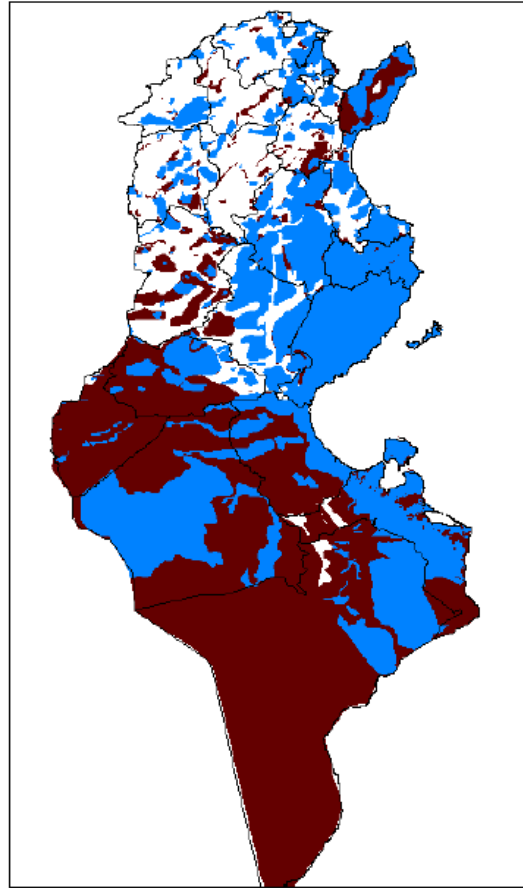
- 1) Individual private abstraction, in the north and east of the country and mostly from shallow aquifers;
- 2) In Public irrigation schemes, organized in GDAs with different degrees of autonomy, and representing 57 percent of the total irrigated area in the country;
- 3) In the south, groundwater is mostly used in oases and managed through GDAs;
- 4) Conjunctive use (surface and groundwater), covering around 15 to 20 percent of all privately irrigated land in Tunisia and also existing in the Public irrigated schemes (through private wells).

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<sup>1</sup> As will be discussed later, the Water Law defines shallow aquifers as water bearing rock formations found at 50 meters below the surface or less.



Figure 1. Shallow and deep aquifers in Tunisia (Source: Besbes 2012 in Hamdane 2014).



## 2.2 Tunisia's water management legal framework

Tunisia's main legal instrument for water management is the Water Code promulgated in 1975,<sup>2</sup> currently under revision. Based on Islamic law principles, customary law, and previous legal reforms from the Protectorate, the 1975 Code introduced a series of institutional principles. As will be discussed in the following sections, the practice and development of these principles have been limited in Tunisia.

- *The public ownership of water.* The Water Code set out that all water resources (surface and underground) were part of the public domain belonging to the state and that there can be no private water ownership. As stated in Article 3 "the public hydraulic domain is inalienable". Following this, some traditional individual property rights were converted into use rights.
- *The leading role of the Administration* in planning, mobilizing, monitoring, and controlling water use (quantitatively and qualitatively): abstraction, use, development plans, safeguard and prohibition areas, discharges, etc.
- *The principle of maximizing water use*, with dispositions in the Water Code aiming to promote water conservation and efficiency, avoiding waste and resource degradation.

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<sup>2</sup> This is Act 75-16 of 31 of March 1975 amended by Act 87-35 of July 6<sup>th</sup>, 1987, supplemented by Law 88-94 of August 2<sup>nd</sup>, 1988, as amended by Act 2001-116 of 26<sup>th</sup> of November 2001 and by Decree 2001-2606 of November 9<sup>th</sup>, 2001.

- *The protection of the environment linked to water*, prohibiting any action that may cause direct or indirect pollution of water bodies and by providing conservation measures and the protection of water quality. Similarly, the reuse of treated wastewater for agricultural purposes is encouraged.
- *The principle of direct participation* of the private sector in the management of non-conventional water resources is envisaged, though restrictively (treatment of wastewater and desalination).
- *The possibility of self-management* of water resources as part of an association of users is permitted.

## 2.3 Actors and water management policies in Tunisia

### 2.3.1 Main state actors in water management (surface and groundwater)

Since 1975, the Ministry of Agriculture is in charge of water management, assisted by two bodies, the National Water Council and the Commission of the Public Water Domain. Within the Ministry of Agriculture, several technical departments are involved in the management of water resources.<sup>3</sup> The most important are:

- The General Directorate of Water Resources (*Direction Générale des Ressources en Eau*, DGRE) is responsible for the general supervision of water resources (surface and groundwater) and their management, granting authorizations for water use and abstraction, the monitoring of resources through observation points (water quality measuring stations, rainfall, piezometric levels). The General Directorate also prepares cases concerning the delimitation of safeguard and prohibition areas and their submission to the Commission of the Public Water Domain. The Bureau for Hydro-geological Studies and Census of Water Uses is under this directorate.
- The General Directorate of Dams and Major Hydraulic Works (*Direction Générale des Barrages et Grands Travaux Hydrauliques*, DG BGTH) undertakes the study, design and operation of dams and small storage infrastructure.
- The General Directorate of Rural Engineering and Water Exploitation (*Direction Générale du Génie Rural et de l'Exploitation des Eaux*, DGGREE) oversees the development of publicly irrigated areas the supply of drinking water in rural areas, the promotion of water savings and the associative management of water resources (user associations).

In each governorate, the Regional Commission for Agricultural Development (*Commissariat Régional au Développement Agricole*, CRDA) is the decentralized body representing the Ministry of Agriculture. It has financial autonomy and is responsible for the implementation of policies from the Ministry in each governorate. The combination of a lack of dialogue and consultation between stakeholders and the Ministry with weak human and budgetary resources allocated to the CRDA causes increasing difficulties in accurately inventorying and monitoring water resources in a lax legal context. Following the 2011 revolution, the prevailing absence of rule enforcement was accentuated, resulting into undeclared deepening of existing wells, unreported drilling of wells, and an absence of monitoring, allowing abstraction in excess of authorized amounts to continue unnoticed, or unaddressed.

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<sup>3</sup> If the largest component of the public water domain is undertaken by the Ministry of Agriculture, it should be noted that the Ministry in charge of the Environment through the National Agency for the Protection of the Environment and the Office of National Sanitation also share competencies to control water pollution.

### **2.3.2 Evolution of (ground)water policies in Tunisia<sup>4</sup>**

Water policy occupies a prominent place in Tunisia's social and economic development given the centrality of this resource not only for agriculture but also increasingly over the decades for tourism, urban supply, and industry. Since the 1960s, the evolution of Tunisia's hydraulic policies has followed the shifting role of the state towards structural adjustment policies which led to the establishment of a policy with more emphasis on demand management than resource mobilisation. This complemented a very much 'infrastructure-focused' approach relying on heavy infrastructure with a softer approach with smaller infrastructure development. Groundwater helped facilitate this shift, providing much needed resources in the Centre and Southern parts of Tunisia.

During the first decade of Tunisia's development post-independence (1960s), the state continued the politics of surface water resource mobilization initiated during the protectorate period in order to supply water to the urban centres of the north of the country and especially the capital. Additionally, the government also laid out the plans for the development of irrigation in the Lower Medjerda Valley. In the south and centre of the country groundwater abstraction was developed in order to supply drinking water for the major cities and the irrigation of some publicly-controlled areas given the poor situation of these areas at the end of the French colonisation.

During these decades the role of irrigation became increasingly important. After the 1980s, successive water management policies aimed to consolidate the economic development of rural areas through the mobilization of water resources, the development of irrigation projects, and the expansion of surface water transfers. This led to a network of infrastructure and pipes connecting various river basins and supplying water from production areas with an officially declared surplus to consuming areas with a 'deficit'. This network is dominated by a north-south and an east-west water transfers, from the rural areas of the interior to the coast. This transfer of resources however partly draws water from agriculture-dependent areas to more economically productive centres, thus increasing the reliance on groundwater for irrigation and amplifying the negative effects of over-abstraction in certain areas. Easy access to drilling rigs and technology since the early 1990s also contributed to the proliferation of illegal wells.

Through this strategy, the mobilization of groundwater has also become more important, both through private ventures in shallow and deep aquifers and through public investment in deep aquifers. This increasing reliance on groundwater and its mobilization supplies all types of uses, from irrigation to drinking water supply, industry, and tourism. With the liberalisation of economic activities after the 1980s, more groundwater abstraction concessions in deep aquifers were granted to private ventures and illegal wells also proliferated. This created a supply-driven system of water management focused on the constant mobilization on new sources and neglecting certain aspects of groundwater resource management such as the control and monitoring of aquifers.

### **2.3.3 Irrigation water pricing in public irrigated areas and its effect on groundwater**

Since the implementation of Tunisia's structural adjustment programme in August 1986, water pricing for irrigation in the publicly controlled areas (around 57 percent of the total irrigated area in Tunisia) was put forward as the measure that would improve the efficiency and allocation of water in a context of resource scarcity. In reality however, according to Elloumi (2016), through the gradual increase in average water tariffs the policy aimed at the recovery of the variable

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<sup>4</sup> Section drawing largely on Elloumi 2016.

operation and maintenance costs of irrigation infrastructure in the short term and, in the longer term, the recovery of fixed costs for the investment in irrigation infrastructure (Elloumi 2016).

Within this context, water saving policy in Tunisia consists of two components. The first one is the improvement of infrastructure efficiency and the reduction of losses in publicly-controlled irrigated areas (e.g. 23,000 hectares in the south under a project on oasis irrigation improvement). The second component relates to improving irrigation water use at the land plot level. The implementation of the policy was well received by farmers as it allowed them to modernise farm equipment, reduce farm labour costs, and improve water use efficiency and increase yields. The policy however was not accompanied by a control of the area irrigated and of water abstraction volumes, and eventually had a reverse effect on groundwater resources. Farmers used the water savings generated to increase their irrigated land surface, therefore increasing water consumption (Bachta and Elloumi 2005).

The increase in water tariffs amounted to 400 percent between 1990 and 2003 and was used to recover a portion of the increasing operation and maintenance costs of the water supply infrastructure for irrigation. The recovery rate increased for this period from 57 percent to 90 percent. The policy of continuous tariff increase was however not accepted easily and user reluctance to pay the tariffs is important. Other users shifted to groundwater wherever this resource was available. Some accompanying and ease-up measures were introduced to diffuse this reluctance such as the introduction of preferential tariffs for certain types of crops with low added values (forage and grain crops), with a reduction of 50 percent in tariffs, the liberalisation of prices for irrigated crops and subsidies to farmers for drip irrigation.

## **2.4 Tunisia's groundwater management tools**

Following Tunisia's Water Law, the state is endowed with a series of instruments to use to manage and regulate groundwater. Technology is used to increase water supply or improve water use and efficiency at the farm level (through the installation of drip irrigation, or supplementary infrastructure. The state can make use of positive incentives (commonly known as 'carrots') and sanctions (commonly known as 'sticks') to regulate the number of wells (new ones and old ones) and the abstraction of groundwater. Well permits and authorizations are the main tool used in Tunisia.<sup>5</sup> As a positive incentive, subsidies linked to the official registration of wells are in place (between 7 and 60 percent of investment). Sanctions are also in place for farmers pumping from deep wells without an authorization.

The state can also declare safeguard areas to protect groundwater resources. Safeguard areas are established according to the existing Water Law when the conditions of groundwater exploitation are likely to endanger the quantitative and qualitative conservation of water. In this case any abstraction is subject to prior authorization within the designated area. There are currently 20 safeguard areas in 12 governorates in Tunisia (30 in total including prohibition and protection areas since 1953) (Elloumi 2016). Prohibition areas can also be declared when the conservation or quality of groundwater are in danger given the degree of exploitation.

The state can also engage in public campaigns to increase awareness amongst users and the general public and train users to better use groundwater saving techniques. These tools can be equally used at the central level as at the local level (GDAs). However, as this White Paper will show in the subsequent sections, the implementation, enforcement and success of these regulatory and management tools varies between theory and practice.

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<sup>5</sup> This will be assessed in the following section.

Table 1. Instruments for groundwater management in Tunisia (Source: Elloumi 2016)

Type of instrument	Regulatory instrument	Tools used in Tunisia
<b>Technology</b>	Increase water supply	Dams Water transfers Aquifer recharge (with flood water or treated wastewater) Desalination Reuse of treated wastewater
	Improve water use at the land plot level	Improve water use in publicly irrigated areas (infrastructure maintenance and replacement) Improve irrigation techniques at the land plot level Crop productivity
<b>Incentive/Sanction</b>	Control of wells	Authorizations for wells deeper than 50 meters
	Control of abstractions	Safeguard and Prohibition areas Control electricity supply for wells
	Economic instruments	Water fees for irrigation in public irrigated areas Subsidies for drip irrigation
<b>Awareness/Capacity development</b>	Education	Knowledge diffusion and follow-up of farmers
	Collective action	Decentralised and community-managed groundwater systems (GDAs)

## 2.5 Well regulation

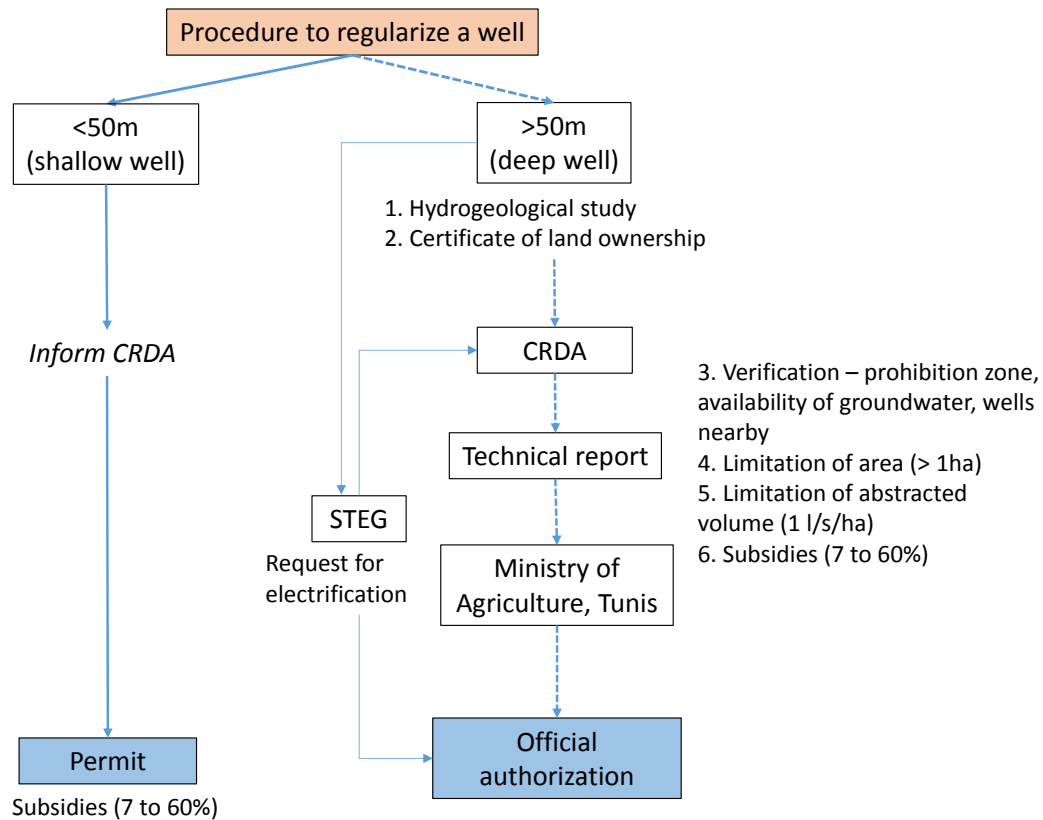
### 2.5.1 Groundwater permits and registration

Groundwater in Tunisia has been regulated until now by the 1975 Water Law and its various modifications (1987, 1988, 1994, and 2001). The current draft version of the new Water Law under discussion at the moment stems from the National strategy for the Preservation of Groundwater, which identified the reform of the existing Water Law as a necessary step towards the adaptation of the legal framework to the present situation regarding water and groundwater resources.

The various versions of the Water Law have established user rights and a public water domain (Closas and Molle 2016). Until now, abstraction of groundwater in Tunisia occurs in two situations: abstraction from shallow wells (<50 meters) and abstraction from deep wells (>50 meters).<sup>6</sup> For shallow wells a simple permit is required, issued by the CRDA after being informed, while for deep wells a formal authorization issued by the CRDA after a procedure of registration is required by law (Figure 2). The distinction between shallow and deep wells is somewhat arbitrary, bearing little connection with geophysical boundaries and reflecting a time when wells were mostly dug manually. Since the shallow open-shaft wells used in agriculture in the 1970s presented limitations as they could not easily be dug deeper than 50 meters, this is the reason why the Water Law limited its scope and definitions to such a depth.

<sup>6</sup> The revision of the Water Law will eliminate this distinction. This is further elaborated in Section 3.3.

Figure 2. Current well registration process in Tunisia (Source: based on Ghazouani and Mekki 2016)



Under the present system, the registration of deep wells (deeper than 50 meters) follows the request by individuals with a hydrological study and the land property title. CRDAs are responsible for issuing a report on the proposed drilling, checking whether the intended use conflicts with existing or projected needs, if it is situated in safeguard areas, and if the discharge requested should be reduced (Closas and Molle 2016). After this verification process, the authorization is then submitted to the National Electricity Company (STEG) who provides the necessary electric power for the required well specificities. The authorized electric tension to be provided is calculated by the company according to the pump characteristics and the water needed for the field (according to its area). With regards to abstraction and consumption, the number of boreholes is not limited per user, only the abstracted volume.

In Tunisia, well drilling has been subsidized until now as a means to improve livelihoods in the countryside (if the farmer drills a well without finding water he may even get some compensation from the state). Subsidies are given for well drilling but also for investments such as pumps, storage basins, and piped networks (25 percent of the cost). Subsidies are also granted for drip irrigation and for gasoline or electricity used for pumping. The authorization specifies the quantity than can be abstracted (which is expressed in l/s continuous flow - *débit fictif continu*) and the type of crops is only asked for reference (Closas and Molle 2016).

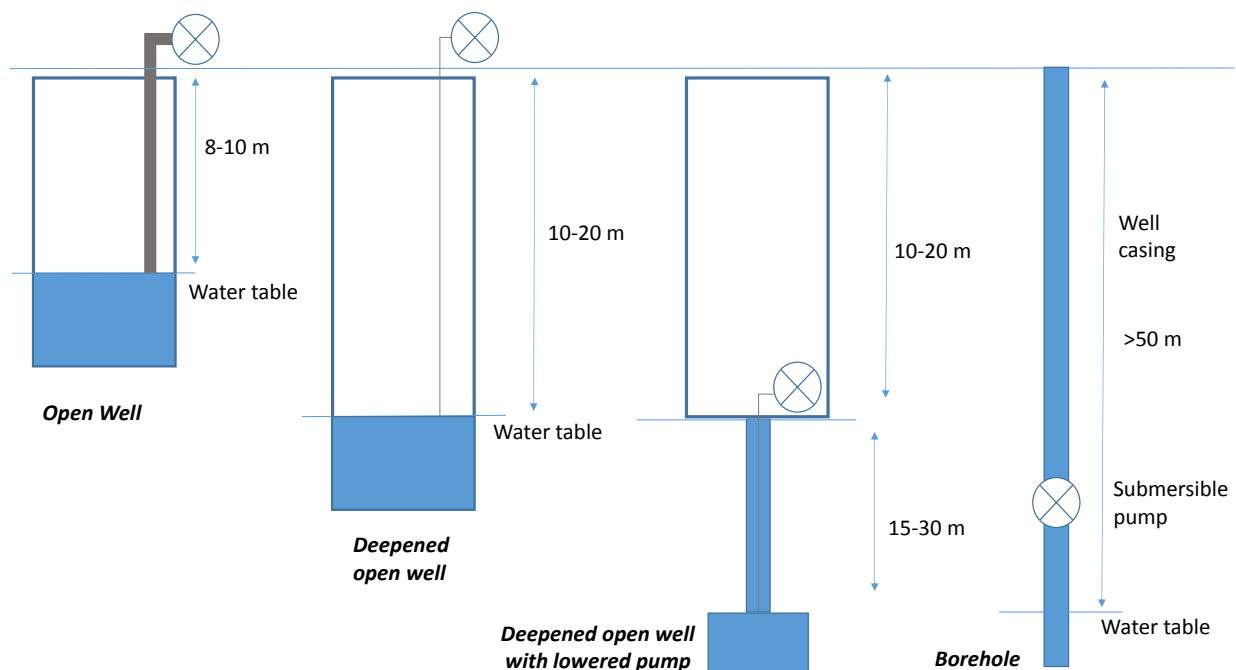
Once the authorization is granted, the CRDA is expected to check every year if the clauses of the contract are respected, while the farmer would also need to renew the license periodically. Farmers with deep wells have to pay a water fee. Despite its very low cost (0.002 DT/m<sup>3</sup>) and the fact that it has not been updated since it was established in the 1980s, few beneficiaries

accessing deep groundwater (part of the public water domain) pay the fee required by law (Elloumi 2016). Income generated for the state for these fees represents between 5 and 10 percent of the total amount supposedly owed to the state. For shallow and deep wells, farmers can benefit from investment subsidies and the level depends on the type of investment under the investment law. The beneficiary has to request such procedure to the Agency for the Promotion of Agricultural Investments (APIA). The request allows the CRDA to monitor the wells and abstraction levels (Elloumi 2016).

### 2.5.2 The reality on the ground of shallow and deep wells

Over the years, technology advances have allowed farmers to deepen their hand-dug and open-shaft wells below the allowed depths. Through various ingenious designs, farmers have been able to tap below the authorized 50 meter depth without having to request an authorization (Figure 3). The poor enforcement of Ministry regulations and control on the ground acts as an incentive, as farmers are rarely controlled and wells seldom sealed. The reality of deepened shallow wells requires closer attention by the government. Wells deepened below 50 meters through tubewells are frequently abstracting groundwater not from the superficial phreatic aquifer but from deeper confined aquifers that are considered as strategic by the administration. In addition such wells contribute to creating/adding connections between several layers, making it more complex to understand what the status of the resource is. In the absence of water meters, well owners do not feel obliged to respect pumping volumes as requested in their well authorization. At the same time, poor monitoring and lack of resources limit the control of volumes by the administration (Elloumi 2016).

Figure 3. Modalities of well deepening in the Cap Bon (Source: Ghazouani and Mekki 2016)



The situation observed in Sidi Bouzid by Elloumi (2016) is also described by Ghazouani and Mekki in Haouaria (2016). In Sidi Bouzid, the amount of groundwater abstracted by farmers exceeds the volume authorized by the Ministry and specified in the permits issued. Equally, the deepening of shallow wells into deep wells (below 50 meters) has been practiced since the 1980s. However, the Ministry of Agriculture bases its groundwater assessments and calculations



of water balance on the volumes officially declared by users in the permits. In the cases with multi-layered aquifer systems such as in Haouaria in the Cap Bon or in Sidi Bouzid, the deepening of wells beyond 50 meters is not accounted for by the Ministry as farmers do it illegally and without requesting an authorization. Thus, all groundwater abstraction data is of little use and misleading as it does not reflect reality.

This double situation of over-pumping beyond authorized limits and illegal deepening into deep aquifer layers makes the monitoring of real abstracted volumes difficult and puts into question the values presented by the Ministry as official abstracted volumes (Elloumi 2016). As a revealing anecdote, the announcement by the Ministry in 2011 that all wells in Kairouan, including illegal ones, would qualify for being connected to the grid was followed by 12,000 requests to the public electricity company (Molle and Closas 2017), against an estimate of between 8,000 and 9,000 wells for the whole plain... This gives an indication of the level of illegal wells in an area highly dependent on groundwater for agriculture and where illegal practices of well deepening have been carried out for years (Elloumi 2016). Based on this, it is clear that the Ministry's estimates of deep wells in Tunisia (5,111 according to data from 2005) are clearly inaccurate. And so is the estimated amount of water withdrawn from them.

Table 2. Level of transformation of shallow wells into deep wells in the Governorate of Sidi Bouzid (Source: MEDD-GIZ 2013)

Nappe	Nbre Total de Puits équipés	Estimation du Taux de puits forés	Nbre de Puits forés
	DGRE (NPh) 2010	Estimat° 2010	Estimat° 2010
Sidi Bouzid	2949	90%	2654
Hajeb_Jelma	2270	40%	908
Horchane-braga	1900	40%	760
Regueb	1400	60%	840
O.Hajel	742	40%	297
Meknassy	981	40%	392
Sabkhat Naouel	281	20%	56
<b>Total</b>	<b>10523</b>		<b>5908</b>

## 2.6 User participation in groundwater management

### 2.6.1 Promoting groundwater user associations as a unit for management

Tunisia's centralized water management structure was modified in 1987 when a new approach towards groundwater governance was established. This approach aimed at progressively disengaging the state from local community management and implementing new reforms in order to increase the role of users and the decentralization of agricultural development (Jouili et al. 2013; Sghaier 2010). The structural adjustment program of the 1980s in Tunisia led to a relative withdrawal of the state, creating the opportunity for the decentralisation of services and the promotion of user-based management through a more active participation of local user groups for purposes such as water resource planning and management. Regional Commissions for Agricultural Development (CRDAs) were created as decentralized Ministry offices alongside Associations of Collective Interest (AICs) responsible for some public irrigated schemes and capable of collecting revenues and subsidies and sale water to its users (Sghaier 2010; Marlet and Mnajja 2017).



Over the following decades, the decentralisation of services through AICs evolved into Groups of Agricultural Development (GDA in the French acronym), their latest nomenclature until now, with an increasing intended financial disengagement from the Ministry. This is done even if most users still perceive GDAs as an extension of the state and not as an autonomous organisation (Marlet and Mnajja 2017). GDAs, created since 2004 by the state, establish specific internal management rules and procedures, activity plans and financial projections, and are capable of channelling subsidies from the Ministry to users (Mekki and Ghazouani 2012). Currently, the GDAs are divided between those managing collective irrigation schemes (either small-scale or a secondary-canal section in a larger public scheme) and those managing rural drinking water supply, with some managing both. There are over 2,800 GDAs, with 1,253 for irrigation managing around 195,000 hectares of public irrigated land (Hamdane 2014).

The GDAs can have wide powers on groundwater management and regulation. At the Governorate level, the Advisory Committee on Professional Groups in Agriculture and Fisheries is in charge of their supervision. The GDAs are not-for-profit associations, and have civil liability and financial autonomy. They are responsible for the exploitation and operation of irrigation systems and water supply systems delegated by the state. According to the present structure, and following the state's decentralisation policy, the administration's role and relation with these groups remains that of: 1) planning; 2) coordination (allocation of funds, arbitration); 3) supervision and control, as well as capacity building and training on water management (technical, financial, managerial).

The generalization of this model of user associations across Tunisia showed however that the associative management of public irrigated areas requires certain prerequisites such as awareness raising and technical capacity building, and training of staff in the various administrative, technical, and managerial tasks required for the proper functioning of the association. Also, associations need financial resources for the operation and maintenance of their infrastructure and the development of technical and regulatory activities. These associations still require substantial formal support from public agencies. Low participation levels amongst association members affect their legitimacy and also finances as many users are late or do not pay their fees.

### **2.6.2 GDA management problems**

The main weaknesses in the current GDA system lie in the interventionism and interference of local politics in administrative and managerial activities of the GDAs, as well as the lack of internal financial and administrative capacities to service and maintain their infrastructure (Ghazouani et al. 2012). Poor maintenance is often linked to the association's limited financial resources due to poor fee collection rates from members. As a result, GDAs have limited capacity to pay for external services (repairs, rebuilding) but also because service providers might not be available onsite, especially in remote rural areas with small suppliers. The technical and financial situation of the GDAs varies and their performance in terms of providing a reasonable quality of service is mixed (Marlet and Mnajja 2016). Of all GDAs in Tunisia, 20 percent are considered to be providing a good service, 51 percent are average, 17 percent are considered low, and 12 percent have discontinued operation for various technical and social reasons (Mekki and Ghazouani 2012).

Water planning within the Ministry is hierarchical and continues to be dominated by a top-down approach following a cyclical decadal management strategy with a national and overarching resource mobilisation and management vision (Elloumi 2016). Such vision constitutes the justification for the type of management practiced by the Ministry and decentralised through the CRDAs to the regions. The very organisation of the CRDAs as decentralised ministerial

representations replicating all Ministry services facilitates the transmission of such top-down approach, consolidating the hierarchical relations between administrative units at the regional and local level and the General Directorates at the central level. This structure does not leave much room for manoeuvre for decisions to be made regionally or locally or to influence resource management policy. In such context, other stakeholders such as local civil society organisations do not have a say in the choice of water management policy in their region (ibid.).

Moreover, the financial resources of the CRDAs are insufficient to enable them to provide technical or operational support to the GDAs. This also applies to other CRDA functions such as agricultural development and agricultural extension services. This is due to the fact that, in large part, the capacities of the local extension services of the Ministry of Agriculture (*Cellule Territoriale de Vulgarisation*, CTV in its French acronym) are largely obsolete (Marlet and Mnajja 2016).

Adding to the limitations of GDAs, the previous negative experience in Tunisia of its agriculture cooperatives and their dissolution remains in the social and rural psyche as it was fraught with political conflicts and tensions, with a series of events tarnishing the role of cooperatives in agriculture in rural areas.<sup>7</sup>

Demand management policies that followed the decentralisation of service provision by the Ministry of Agriculture also had a negative impact on groundwater management and over-abstraction. The adoption of technical improvements and water saving techniques at the land plot level, including subsidies for drip irrigation has led to a sharp increase in demand for these products. Some farmers will claim additional subsidies from the state with false invoices in order to benefit from up to 60 percent of the installation costs. This resulted in a high level of technology installation and mechanization of irrigation. Even though the penetration of water saving technology was estimated to reduce water demand in agriculture by 20 to 30 percent, groundwater abstraction increased as farmers often invested additional resources in expanding irrigation as a response to the improvement in water efficiency and profitability (Bachta and Elloumi 2005; Elloumi 2016). The granting of these subsidies by the state is not limited by the irrigated area, so it is logical that farmers expand their cultivated area, whether within their farm or by renting land, within the publicly irrigated area or outside.

## 2.7 Land management

In Tunisia as in most countries, groundwater access and abstraction are also linked to land property and land access. The groundwater revolution that began in the 1970s went in parallel with a process of land reform. After the country's independence in 1956, the state nationalized large areas of land previously colonized by French farmers in 1964 (Geroudet 2004). Run as cooperatives until 1971, land came to be allocated privately via decree and farmers obtained in some cases property titles. In many cases however, land division was not done officially and families organized the division (inheritance) and allocation of plots informally (ibid.).

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<sup>7</sup> In the early 1990s when the state sold the last cooperatives to private investors, instances of corruption appeared such as the case reported in Chouigi where the CEO of the investment company assured that the reallocation of land was done with the approval of all parts. The last president of the same cooperative claimed however that the allocation was done through political pressure with prison threats by officials. The dissolution of the cooperative, following the pretext of bankruptcy, was to allow the notables of Tunis to control the land. Community members accuse of mismanagement the administrative team who was put in charge before its dissolution while others blame the judicial liquidator appointed (Source: <http://nawaat.org/portail/2015/11/09/la-ferme-de-chouigui-mise-en-valeur-de-la-terre-et-appauvrissement-des-agriculteurs/>; <http://nawaat.org/portail/2015/11/09/la-ferme-de-chouigui-mise-en-valeur-de-la-terre-et-appauvrissement-des-agriculteurs/>)

The possibility to get bank loans is generally dependent on land property and the lack of formal or official land titles prevents certain users (usually small farmers) from obtaining additional capital to improve their wells (e.g. deepen them or purchase new and more powerful pumps) (Fautras 2016). Land inheritance has continuously created land partition and conflicts between heirs. This is a further cause for the drilling and digging of new wells while land attribution is pending between heirs and the land in question (with a well) is being fought over administratively (Massuel et al. 2017). The lack of consolidation of land (in many cases for small farmers) also affects groundwater access. The spread of land plots and the distance between them complicate irrigation. The small size of land plots also limits economies of scale and revenues (Fautras 2016). The regularization of a land property title or a sale contract also requires payment, sometimes not affordable for small landowners. Thus, the problems with land property, undivided lands and allocation persist in Tunisia, despite the efforts from the government to establish a permanent regime of private property through the cadastre (ibid.).

Land access inequality also limits the access to state subsidies from small farmers and groundwater users. They struggle to access the market for agricultural inputs such as seeds, pesticides, and other phytosanitary products as observed in Haouaria by Ghazouani and Mekki (2016). As a result, farmers can easily accumulate debts (from the bank or also from the company selling agricultural inputs). The non-payment of these debts is a further driver of exclusion of these small farmers (ibid.).

### 3 Assessing groundwater governance options in the face of current dynamics

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#### 3.1 Dimensions of groundwater reform in Tunisia

Based on the present analysis, we can put forward a schematic view of the different dimensions of groundwater management that need to be considered in order to achieve groundwater sustainability in Tunisia (Figure 4). The following sub-sections will explore these dimensions in further detail. At the end of each sub-section, a table summarises a series of components that are expected to be part of the revised Water Law in Tunisia followed by a series of recommendations aimed at complementing such reform.

Figure 4. Dimensions of groundwater sustainability in Tunisia



## 3.2 Making decentralization work

### 3.2.1 Ministerial structure and the politics of water

The patronage nature of the political system in Tunisia before the 2011 Revolution included abuse of power and the use of public resources for personal interests surrounding the deposed President Ben Ali (Al-Alaween et al. 2016; OECD 2013; Rijkers et al. 2014). This has affected the relationship between citizens and politicians and has prevented democracy and public debate from properly functioning in Tunisia in the past. This created, until the 2011 Revolution, an exclusive culture of decision-making with no consultation or participation, across different administrations and sectors with different water needs (e.g. between agriculture with the country's lion share and other uses seeking to increase their share).

Such predominance of the Ministry of Agriculture is institutionalized by the Water Law as it gives it full responsibility for water resource management, a unique case in the MENA region. Since the creation of an inter-ministerial National Water Council (Decree No. 2010-407 of 9<sup>th</sup> March 2010), the Ministry of Agriculture maintains its privileged position as it continues to concentrate and supervise all services and departments having a role in water mobilization, management, irrigation, urban water supply (Tunisia's public water utility) and rural development (Elloumi 2016). Equally, the policy that emphasizes the role of local stakeholders through decentralisation and subsidiarity has not really changed the power structures between the different users and the state, which remains dominated by the central government. At the same time, local stakeholders and users have developed different strategies to avoid or circumvent official procedures to access groundwater (e.g. authorization for well deepening, limiting groundwater volumes abstracted) (Elloumi 2016).

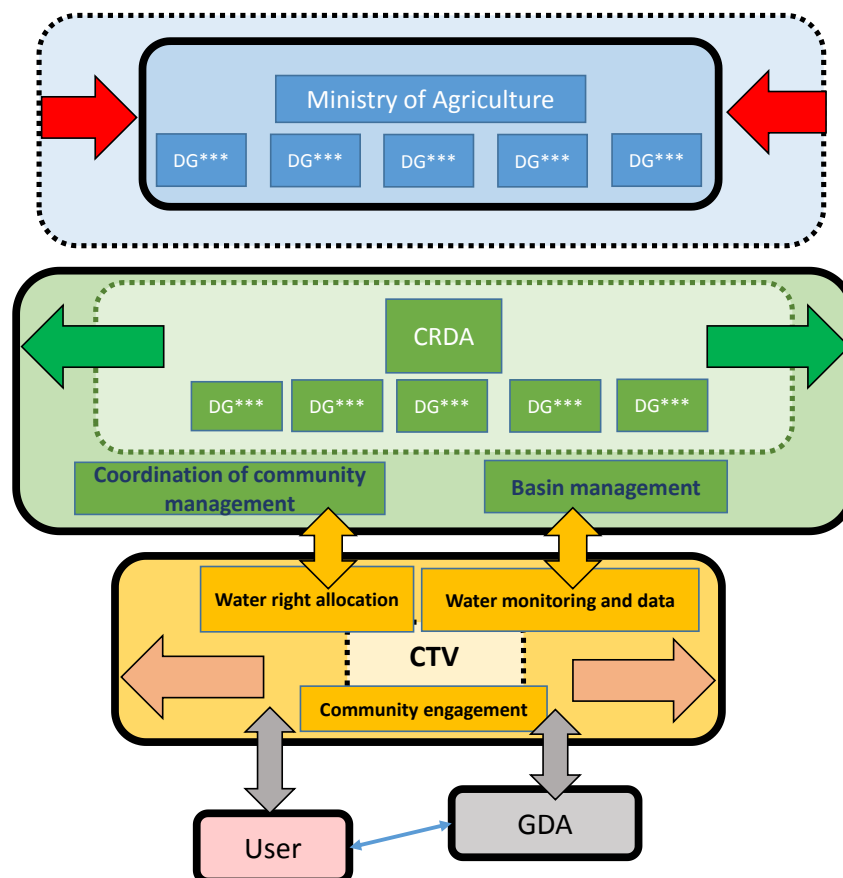
Since the 2011 Revolution, users' behaviour has changed and reflects a more explicit rejection of policies and state measures which, previously, would have remained un-questioned. Two dynamics regarding water management policy remain: 1) that of central policy-making circles that in particular see the mobilization of water resources from the hinterland towards coastal areas as a necessity for the economic development of Tunisia; and 2) that of the advocates of a more participatory and open management and governance system inclusive of different stakeholders (Elloumi 2016). The former supports the continuation of the supply-driven hydraulic mission in the country, making use of new technologies (desalination, wastewater reuse, aquifer recharge) to maintain or expand the existing levels of water consumption and use. The latter considers the use of a panoply of different management instruments, the different possibilities provided by water saving measures, and stakeholder participation and decentralised management as part of a sustainable resource management strategy (ibid.).

When it is approved, the new Water Law will need to be matched with the reform of water services within the Ministry of Agriculture (Figure 5). At the moment, there seems to be a contradiction between what the law says and what the Ministry does, as Tunisia's water policy predicates decentralisation but management and service provision is centralised and there are not enough devolved services at the local level (CTVs). As Figure 5 indicates, the responsibilities and roles of the various levels of government need to be revised. Given their proximity to users and their capacity to provide technical support and training, CTVs can become the decentralized entry point of the Ministry at the local level, with reinforced capacities and functions. CTV would have to be empowered with a larger mandate with additional funds. The CRDAs can provide support and technical secondment. The proposition here is that at the central level, the Ministry of Agriculture keeps its main functions of articulation and implementation of a water management strategy through its different directorates. However, at the local level, the prerogatives, resources, and tasks of CTVs could be expanded. Groundwater data and

monitoring and the supervision of water rights could be decentralised and shared between the CRDA and the CTVs.

Since the Revolution of January 2011, a change in relationships between the different water policy actors emerged. Environmental associations and NGOs have been able to introduce in the public debate ideas such as the right to a sustainable and healthy environment for future generations. These questions have led to a lobby movement which helped enshrine the concept of the protection of water as a right in the country's new constitution in 2014. The application of the premise into policy remains to be seen (Elloumi 2016). Even though the debate between and with stakeholders has been expanded, it remains limited to the different views within the Ministry and interest groups representing the state. In such a context, water politics in Tunisia have remained under the control of the same group of stakeholders as before the revolution (Elloumi 2016).

Figure 5. A simplified new structure for the Ministry of Agriculture (Source: authors)



This situation is explained in part by the long professional career of most Ministry officials at the head of the various ministerial departments since the early years of independence until today. This helps perpetuate the country's age-old hydraulic mission, creating a single narrative of water management and transmitting this vision within the Ministry (Elloumi 2016). The various national water strategies in Tunisia (*Eau 2020*, *Eau 2030*, and *Eau 2050*) were not issued through a process of participation and were rarely based on an encompassing and inclusive debate across decision-making spheres. They are mainly a centralized view by a group of experts or consultancy firms chosen by the government to sanction the choices already made by the decision-makers (Elloumi 2016).

The responsibility for water management and policy by local groups, however, has its limitations. Decentralisation and transfer of management from central to local forms of management is a long process. Hastiness to abide by international principles (IWRM for example which includes decentralization and stakeholder participation as part of its principles) can undermine the process if appropriate funds and time are not committed. Rules need to be developed, collectively by end-users and beneficiaries, not imposed from higher levels of governments. The process of decentralisation requires resources, patience, and a long process of negotiation and preparation to ensure the long-term management of the resource. These lessons need to resonate with Tunisia's engagement with stakeholders and water management participatory approaches before it is too late and the process has started without enough legitimacy, appropriate planning and engagement from participants.

Since 2000, Tunisia has been receiving international funds to support the implementation of the country's water sector programme (e.g. PISEAU I from 2001 to 2007 and PISEAU II from 2009 to 2015). The internationally funded project PISEAU II (World Bank, African Development Bank, and French Development Agency) aimed to continue the investments from the previous programme, promoting more efficient management and operation in public irrigation schemes, improve access to drinking water in rural areas, and assist stakeholders in making better decision related to integrated water resources management (World Bank 2015). Amongst its various objectives, PISEAU II specifically focused on irrigation management and modernization as well as groundwater management. The internal assessment of PISEAU II by the World Bank regarding the decentralisation of government services has noted that the knowledge base for the institutional reform which was to be brought by the project was 'insufficiently robust' and with "virtually no understanding of skill gaps at government staff and farmer leaders levels, hardly any notion of incentives, and very little on the political economy of rural areas" (World Bank 2015: 11).

#### ***Expected reforms in the new Water Law<sup>8</sup>***

- Preparation of integrated management plans and water use at various levels (national, regional, local).
- Water resource planning at different scales is to be done in collaboration with all stakeholders in the water sector.

#### ***Recommendations of this White Paper***

- Develop mutual trust and awareness between users and the administration by:
  - Increasing awareness of the reality and situation of groundwater resources and over-abstraction ('we are all in this together') through official media campaigns to target audiences, newspaper articles,
  - Establish campaigns for information and transparency of data and access by the administration (for users, researchers, donors),
- Propose cost-sharing arrangements for groundwater management between the state, GDAs, and CRDAs with regard to:
  - Groundwater abstraction monitoring that the state should perform (commitments to pay for shared monitoring costs with piezometers),
  - Groundwater management and planning at the local level,

<sup>8</sup> This section of the table introduces some of the concepts and ideas found in the draft Water Law currently under discussion.

- Empower the decentralised levels of the ministry and increase their autonomy and tasks.
- Further financial support should be made available for the recruitment of new staff in CRDAs and CTVs, along with the increase in technical support and training for staff and users. *No proper management can be based on scarce public funding or shifting costs onto users* (Molle and Closas 2017).

### 3.2.2 The functioning of GDAs

As the OECD (2014) points out in a review of Tunisia's water policy, the adoption of a chapter on local authorities in the Constitution (articles 128-139) reinforced the decentralisation process of responsibilities among the different levels of government. However, as seen in the previous point, the implementation of a decentralised groundwater management system will require a revision of the tasks traditionally assigned to the Tunisian administration and regular stakeholders, as well as the development of new competencies and capacities, and access to more resources. Legislation will have to clarify roles and establish limits and regulations for new structures. GDAs' capacities for water management will have to be increased and professionalized, strengthening their technical and administrative skills (e.g. hiring technical directors, young graduates) with budget support for their salaries (OECD 2014).

Even though decentralisation is a principle of Tunisia's water management policy, it should not mean excessive disengagement of the state from the provision of public services. The collectivization of local groundwater management in Tunisia needs to be supported within the country's move towards more decentralisation. The furthering of decentralisation could also allow the creation of cooperatives in Tunisia and improve the legal and economic status of agricultural trade unions in order to support small farmers. GDAs need to be reinforced to prove that community-based groundwater management is possible and sustainable not only financially but also socially. The formula considered in the new Water Law is a change of legal status for GDAs, from associations of private law to associations under the aegis of public law. Such change will also represent a change in name, from GDA to GH (*Groupeement Hydraulique*). With this move it would therefore seem that the state is providing more regulation and potentially more legal security while incorporating them as public entities. It remains to be seen whether this means more or less devolution of powers for users and GDAs.

The delegation of groundwater management to the GDAs has not been accompanied by the re-appropriation of the resource by its users, as the resource remains state property. As the internal evaluation of the PISEAU II project from the World Bank pointed out, there is distrust among the rural population of the GDAs leadership who are nominally elected but not considered as representative of the communities (World Bank 2015). The consultation of beneficiaries did not yield the expected results, as they tended to focus "on the rationale and advantages of the project, rather than seeking a better understanding of the population's concerns and priorities" (World Bank 2015: 12).

At the same time, several GDAs sharing one aquifer are in competition with each other as well as with other types of users. There are no structures that work linking the different GDAs in one aquifer system together, making joint monitoring and rule-making difficult given the absence of coordination (Elloumi 2016).

The amendment of the Water Code in 1987 allowed the development of a variety of Associations of Collective Interest (AIC) that evolved into GDAs in 2004. Despite such provision of associations, these GDAs are not represented at the national level as part of the National Water



Council. It would be therefore appropriate if user representation also existed in national advisory bodies, an aspect considered by the new Water Law being drafted.

It seems also relevant to point out that Tunisia, through the GDAs, is already applying a form of co-management of groundwater wells in public irrigated areas. However, such co-management only involves groundwater management and wells, not the resource or aquifer per se. There are no abstraction volumes agreed upon between GDAs sharing one given aquifer and established to preserve and jointly manage groundwater resources. This further step is extremely difficult to achieve. Spain has established a system whereby the declaration of over-exploitation of an aquifer immediately triggers the organisation of a groundwater user association covering the entire aquifer and a special emergency groundwater abstraction and management plan for all uses (Closas et al. 2017). This measure could be explored in Tunisia, potentially linked to the concept of aquifer contracts (see below).

Amongst the wide array of GDAs in Tunisia one stands out, portrayed as a success story by the Ministry of Agriculture: the GDA of Bsissi in South Tunisia (Frija et al. 2013, 2016; Leghrissi 2012; Hamdane 2015; Montginoul et al. 2017). The relative success of Bsissi's community groundwater management has been achieved through the combination of several factors: 1) the Ministry made pressure and declared the area as a groundwater prohibition area and increased prosecutions against offenders; 2) increased awareness by farmers exploiting the same aquifer of the depletion of groundwater resources and the potential impact on their farms and crops; 3) strong leadership in the area and a common social background; 4) the acceptance by farmers to self-limit groundwater abstraction in the whole area controlled by the GDA; 5) the establishment of penalties for over-abstraction and the closing of new wells; 6) the role of the CRDA as external guarantor of the process; 7) the limited number of abstractors (Closas and Molle 2016). These contextual elements indicate that the experience of the GDA in Bsissi cannot be easily replicated across the country.

#### ***Expected reforms in the new Water Law***

- In the absence of local initiative, the local management plans in areas where particular problems have been identified can be included in the Regional Integrated Water Resources Management Master Plan. The local management plans will incorporate:
  - The objectives of water quality and quantity to be achieved,
  - Allocate water available between different uses,
  - Identify and protect sensible aquatic environments,
  - Coordinate management actions and maintenance works.

#### ***Recommendations of this White Paper***

- The state needs to support coordination between GDAs using a same aquifer, providing additional complementary services and support.
- Enhance the role of GDAs in water policy and planning by giving them representation at the national policy level.
- Following the Bsissi example:
  - Support the engagement of the Ministry of Agriculture in the declaration and management of prohibition areas through the involvement of GDAs,
  - In prohibition areas, make the formation of a groundwater union compulsory, associating GDAs and individual users.



- Study and propose a breakdown of the aquifer in smaller manageable units, with sufficient modelling capacity to take hydrologic interactions between these units into account
- Scope and management prerogatives of GDAs and aquifer-based user unions should be expanded and local management plans for groundwater systems should be put in place. These plans should:
  - Include an inventory of existing wells, securing help from remote sensing specialists (and funding from cooperation agencies)
  - Clarify water needs for all users including the environment: this demands enhanced modelling capacity to define the safe yield of the aquifer,
  - Consider the environmental services supported by the groundwater system,
  - Document monitoring and reporting requirements needed from users (feasible),
  - Periodically review these prerogatives to incorporate new knowledge and data on groundwater abstraction.

### **3.2.3 Private user participation**

During the local dialogue organised by IWMI, INRGREF, and LISODE in Haouaria in February 2016, transparency and continuous information exchange were mentioned as key to attaining stakeholder participation and engagement. The need to make sure that there are no legal hurdles to potential collective action mechanisms was also highlighted (according to the participants, the absence of collective action until now could mean that it is not allowed). It was suggested that the CTV Unit of the Ministry of Agriculture could examine this point alongside the Directorate in charge of legislation at the CRDA and make sure there are no hurdles to the association of private users.

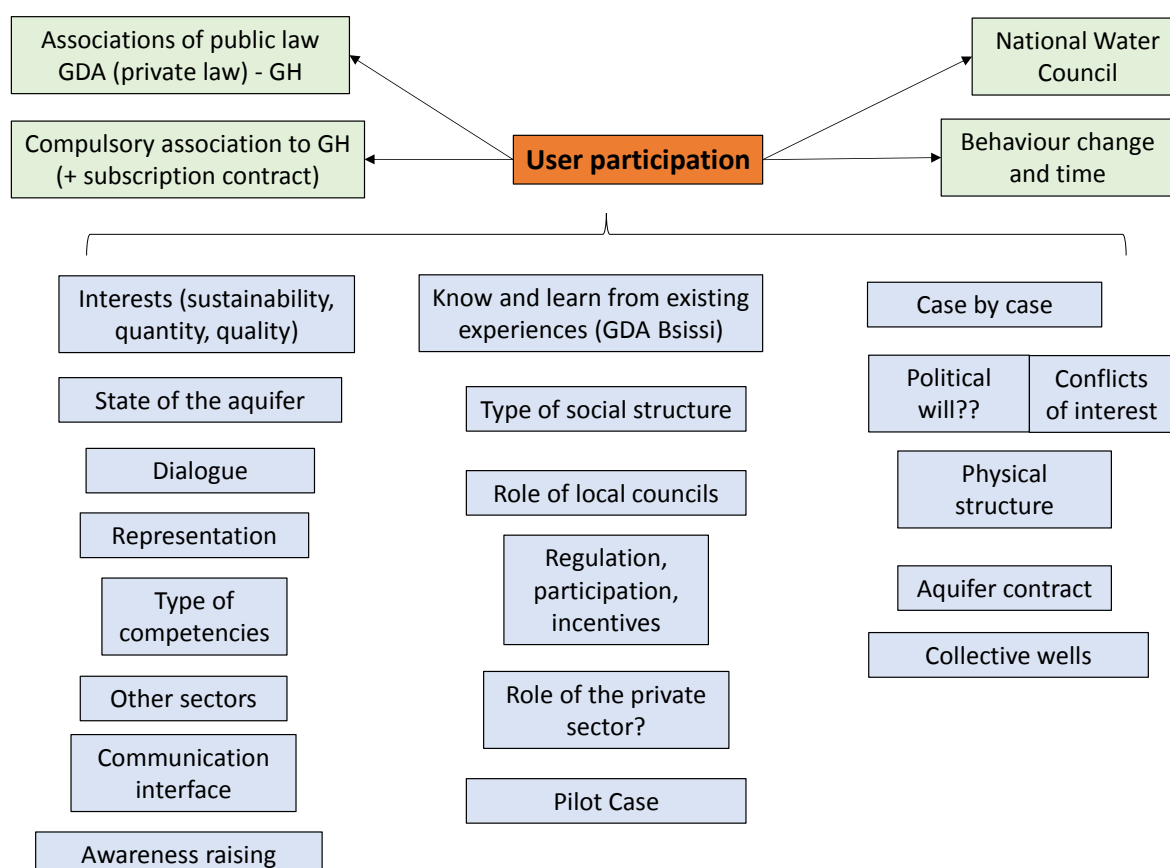
At the national level and as part of the new Water Law, Tunisia is contemplating the establishment of 'aquifer contracts'. In order to support this process, the experience from Morocco is relevant. Morocco has only managed to sign one aquifer contract so far. Although the aquifer contract signed in the Souss is a bold attempt at regulating groundwater over-abstraction, its implementation has been undermined by a general *laissez-faire* attitude, the failure of the government to deliver on the supply augmentation projects, and the event of a few good hydrologic years that displaced the prevailing sense of urgency (Molle and Closas 2017; Closas and Villholth 2016).

If Tunisia wants to pursue this type of arrangements, it needs to enhance its groundwater management decentralisation structure and the direct involvement all users of the aquifer is required. During the workshop it was proposed that the CTV organises an information day on collective action and representation. It remains to be seen how this will be adjusted with the new Water Law and the new legal status of GDAs. The lack of information and transparency about the new Water Law represents a limitation regarding the preparation and anticipation of these potential changes.

The final workshop held in Tunis in April 2017 yielded some additional thoughts and considerations regarding the elements needed to ensure the participation of users in groundwater management. Most of the elements found in Figure 6 have been introduced in the two previous sections. The compulsory association of private users under a *Groupeement Hydraulique* (a new nomenclature for the GDA under the draft Law) is an innovation with regards to the previous legal system but it is only limited to the public irrigation areas. We observe however that within the administration the paternalistic view regarding these public

irrigation areas is still present. Many policies and plans are developed with these areas in mind, leaving outside the scope and consideration of the state the privately irrigated areas (which constitute around half of the irrigated area in the country). Additionally, as the experience in Haouaria has shown, it is in many cases the small user (who has more to lose) who is likely to participate in the dialogue between public authorities and users. Larger users on the contrary are very difficult to mobilize (since they stand to gain from free-riding) and a specific campaign targeting them should be developed.

Figure 6. Feedback from stakeholders on components to improve user participation in Tunisia



Note: the grouping in columns represented here was the result of the organisation of contents by workshop participants.

<p><b>Expected reforms in the new Water Law</b></p> <ul style="list-style-type: none"> <li>Strengthen the participation of different actors.</li> </ul>
<p><b>Recommendations of this White Paper</b></p> <ul style="list-style-type: none"> <li>Facilitate and/or impose the creation of associations of private groundwater users: <ul style="list-style-type: none"> <li>To follow-up well registration and management of groundwater, working with the CRDA,</li> <li>Regular exchange of information and data,</li> <li>Coordination between CRDA and associations,</li> <li>Make the technical services of the CRDA available to user associations.</li> </ul> </li> <li>Recognize the legal status of associations of private groundwater users, (if necessary,</li> </ul>

registered under a different legal status separate from public associations).

- Pilot experiments to demonstrate the viability of these associations of private groundwater users.
- CRDA and CTV organize information days to define the modalities and benefit of collective action, designed around a common problem: 'groundwater over-abstraction'.
- Support through incentives the organization of associations of private groundwater users (potentially through subsidies or other financial incentives such as tax deductions).
- Support and monitor of these associations by the state (through the various decentralized services of the Ministry of Agriculture).

### ***3.2.4 The experience of aquifer dialogues: methodology and user participation principles***

The stakeholder dialogue organized in Haouaria, Cap Bon, by IWMI, INRGREF, and LISODE in February 2016 aimed at putting in the same room local stakeholders and users and government officials during a series of workshops. The methodology developed to structure and organize stakeholder participation for this project focused on co-learning. The work was based on an initial problem-definition and problem-solving approach, bringing both the needs and contributions of all participants to value their different points of view and experiences (LISODE 2016). The approach is based on shared stakeholder experiences, jointly examined to identify what works and what does not and improve horizontal and vertical knowledge sharing. The role of a facilitator as an intermediary to channel the contributions and organize the debate and discussion was considered important, together with adequate methodological tools for developing consensus and the emergence of a shared vision between the participants (media supports, role-model games) (ibid.).

The process of dialogue and participation was based on the following principles (ibid.):

1. **Participation is free.** Stakeholders are free to attend workshops or not and there is no 'subordination' to the project organizers; attendance only depends on the willingness of the participant.
2. **Project and workshop objectives are transparent and are communicated to the participants.** Uncertainties are also shared and communicated from the onset of the workshop as well as the outputs.
3. **The intervention of project partners is limited to facilitation,** helping stakeholders who participate to build their own common objectives and come up with shared solutions. Facilitation is seen as a catalyser of these dynamics and accompanies the discussion.
4. **Facilitation is neutral regarding contents and outputs** and no particular solution is put forward during the process. The only task of the facilitators and project partners is to mobilize local stakeholders and, according to the needs, provide relevant and occasional expertise.
5. **The process aims to reinforce the voices of the 'weak',** those stakeholders usually excluded from negotiations on groundwater management and regulation, or those associated but who could not express themselves freely.
6. **Stakeholder representation is not perfect,** and the process cannot expect to have a perfect statistical representation of the diversity of all stakeholders but a diversity of point of views and interests.

7. **Allow a first workshop between stakeholders without government representatives.** The lack of dialogue and communication between local users and stakeholders with the government necessitated a first workshop in order to structure the messages to be shared with the officials.
8. **Debate between the government and users has to be balanced and equal,** facilitating the full understanding of positions and points of view. A full day is dedicated to the exchange between local users and officials in order to facilitate the understanding of the voices from the field by the administration, their diagnosis and challenges regarding groundwater use and management. At the same time, the administration is also asked to express its opinion and debate with users on an equal level.
9. **Participatory processes are non-linear and adapted to each context.** Participation in each case study is built on a step-by-step basis. The methodology remains iterative and open to context specificities, unexpected changes, and reactions from the participants.

Two main issues emerged from the dialogue: 1) the issue of information which, according to the participants, seems insufficient, especially on regulation and knowledge of groundwater resource; and 2) the question of the state's strategy for the area, particularly on the preservation of water resources, which remains unclear for now, according to them. Additionally, the participation process needs to lead to specific objectives, or at least to be clear about the expectations and achievements of the process from the start. Participation for the sake of participation can be tiresome and users can lose interest if they obtain nothing in the end.

#### ***Recommendations of this White Paper***

- Involve local stakeholders as early as possible, as partners, with transparency and mutual commitment (this includes large and small groundwater consumers, local industries). The definition of goals of the participatory process needs to incorporate stakeholder inputs in order to gain legitimacy.
- The participation process needs to be open about the goals, expectations, and expected results.
- Encourage the creation of legitimate local committees that will act as regular interlocutors.
- Bring researchers closer to users and decision-makers to provide reliable accounts of the different dimensions of groundwater: technical, socio-economic, political and organizational.
- Systematically share information as soon as it is available (top-down and bottom-up).
- Always take into account local realities (case-by-case).
- Incorporate win-win logic with stakeholders.
- Have regular exchanges between stakeholders and on-the-ground monitoring of the process.
- Establish evaluation indicators on the participation process validated by stakeholders.
- Make use of experts in participatory approaches to help design the process.

### 3.3 The regulation of wells and groundwater abstraction

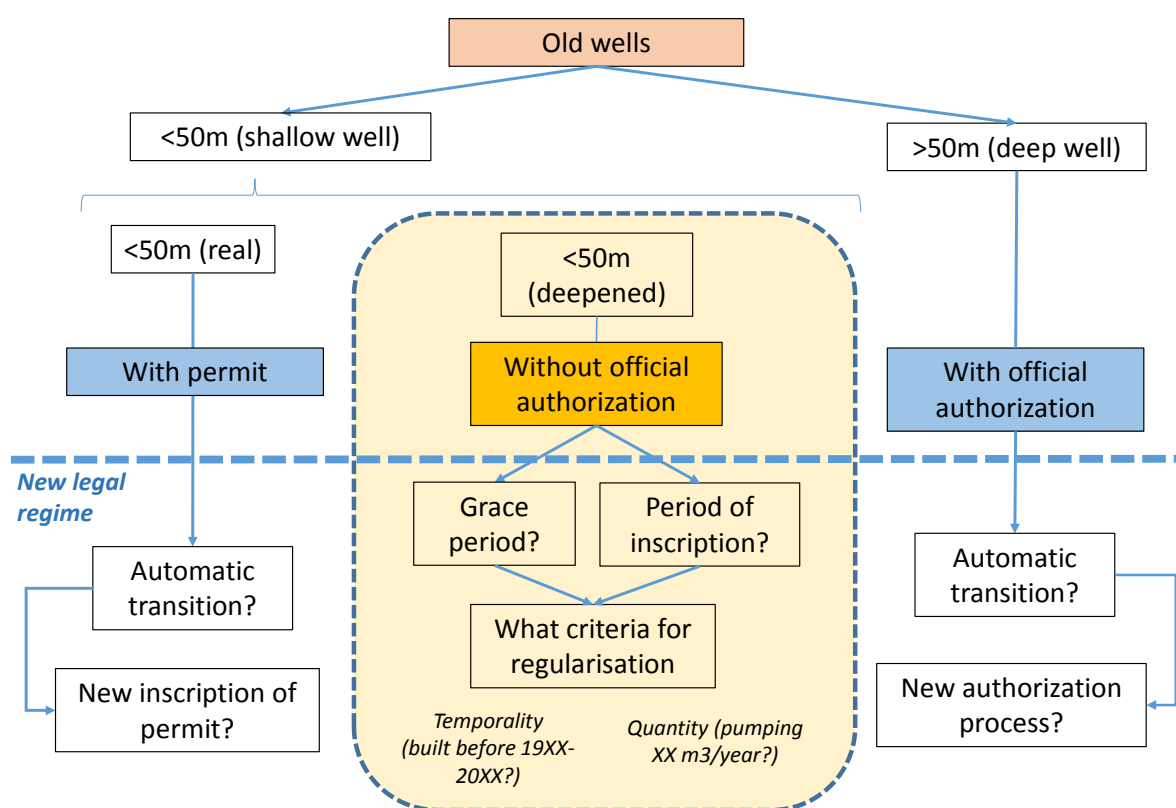
#### 3.3.1 Well registration

As described in Section 2, the assessment of groundwater over-abstraction in Tunisia made by the Ministry of Agriculture is affected by the distinction made by the law between shallow and deep groundwater. National data and different examples from the field (e.g. Kairouan, Haouaria) show that in reality the situation of over-exploitation as described by official data is significantly underestimated. This stems from the fact that the over-abstraction of what is considered shallow sources is not monitored properly and many 'shallow wells' have been deepened and now tap the lower aquifer that is theoretically considered as strategic and protected. Wells are being drilled and dug without government control and are not accounted for in the official records.

The project to reform Tunisia's water Law would establish an authorization for any well independent of its depth, thus removing the legal separation between shallow and deep groundwater subject to different regulatory rules. Well drilling companies would have to be registered with the Ministry. The situation on the ground and the differences between existing (i.e. old) shallow wells, deepened wells with and without permits, and deep wells presents therefore a logistical and regulatory conundrum (Figure 7) in light of these expected legislative changes. The regulatory question that arises is how are old wells supposed to adapt to the new regulation? And also, how is the new regulation supposed to accommodate the various types of situations on the ground? The transition towards new groundwater regulation regimes and new groundwater rights is never easy and fraught with logistical, administrative, regulatory and financial hurdles (Molle and Closas 2017). The case of Spain (Closas et al. 2017) and Jordan (Al-Naber and Molle 2017) are paradigmatic when it comes to the various difficulties and delays faced in very lengthy processes. This cannot be obviated and needs to be taken into account by the authorities attempting to implement the new Water Law.

Additionally, in Tunisia, land and groundwater management are intrinsically linked. The insecurity of land ownership found in the country is a contributing factor of the poor application of the law regarding well permits as farmers do not want to bear the risks to apply for a formal permit and hence not being able to demonstrate the ownership of the land they farm.

Figure 7. Conceptualizing the regulation of old wells in Tunisia (Source: authors)



The first issue concerning the regulation of wells is how to differentiate between old and new wells. The temptation is high for farmers to declare new wells as 'old' if they are to be legalized/'regularized'. How are both these types of well going to be incorporated, what will be the criteria and the type of transition process to undertake? Additionally, the new Water Law will have to cope with the existing situation on the ground concerning the lack of authorization of many shallow wells having been deepened, a situation which, at the moment, eludes ministry officials.

Here, two different potential approaches could be envisaged:

**1. Decide that the registration of wells is necessary.** In that case, the process should clarify to what wells does this apply to? Shallow, deep wells, or both? Do old wells (drilled before the new law comes into effect) are also included? For that, a set of criteria will have to be established, potentially in relation to their temporality (when was the well dug/drilled?) or a volumetric criteria regarding how much water were these wells pumping before the new law. An incentive for users to register could be in the form of a declaration by the Ministry of Agriculture for an 'amnesty' for all old wells unregistered and open a special period of regularization in order to start anew with the new Water Law. Incentives need to be embedded in the process in order to make users and permit owners join the process. This can only be avoided by acknowledging the situation and matching enough resources (human and financial) to the task at hand.

Regarding the new wells, the provisions included in the new Water Law seem to indicate that it will not be easy for users to register new wells (Figure 8), especially in the 'prohibition areas' where this is already formally impossible. According to the draft of the new Water Law, the process is expected to include authorized drilling companies only, geological samples, an environmental impact study, the use of meter, and the payment of groundwater abstraction

fees. As will be discussed further later, even though these tools are all sound measures to manage groundwater on paper (e.g. meters and groundwater fees), they all have intrinsic practical, logistical, and managerial limitations.

However, caveats and limitations surrounding this process abound. It will be impossible for Tunisia to regularize all illegal wells on the basis of the law itself. Not because it is written it will be applied. The government needs to set up positive incentives (carrots) running in parallel with other regulatory measures. It is unrealistic to expect that a tougher law on paper will solve the issue of illegal wells. The electrification of wells by the STEG, made dependent upon having an official permit or authorization is a good start, not exempt from problems though (corruption of officials subject to bribes to release well authorizations 'under the table', as it has been observed in Sidi Bouzid) (Faure 2016).

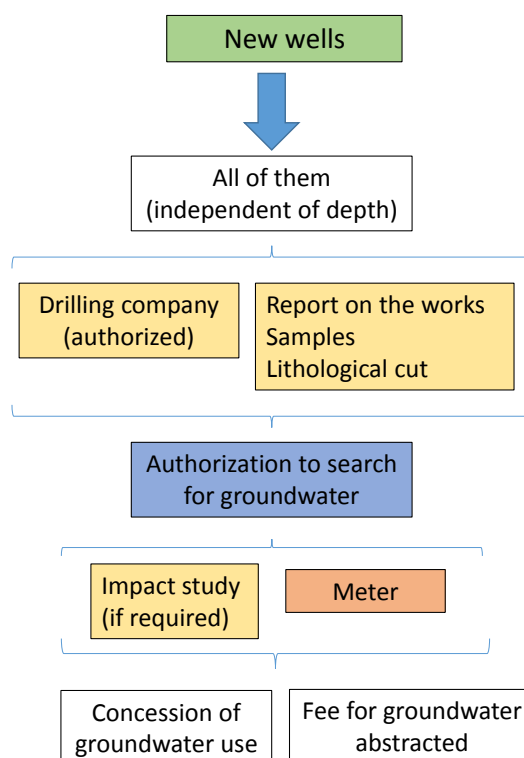
Further reflection on the use of indirect measures to regulate groundwater wells could include a stronger oversight from the STEG on the use of low-voltage electricity from households for wells, a phenomenon observed in the Kairouan Plain. Farmers have used household connections to power electric pumps, causing at times the disruption of electricity supply.

The bottom line for this process is that, in any case the registration of wells needs to be made the easiest possible. As it is, the proposed procedure is 'heavy' on the requirement side (like in Morocco) and only propose 'stick measures' (registration fee, metering and pricing), with no benefit for groundwater whatsoever. The review of experience by Molle and Closas (2017) provides ample evidence that such a regularization process will be doomed to failure. Farmers will not come forward to register, and deadlines will have to be extended multiple times.

**2. It would be unrealistic for Tunisia to register and control all its wells.** Even though this is what is considered in the new Water Law, given the expected logistical difficulties for the Ministry of Agriculture and the Bureau of Hydro-geological studies and Census of well permits, an inventory of wells through direct surveys would provide a more informed picture of the current situation. This would most likely avoid the unrealistic task of registering all wells. However, the cost of such an inventory needs to be considered in a country with probably over 150,000 wells and no more than half registered (the FAO in 2009 stated that according to official figures Tunisia had 137,700 shallow wells). It is also unrealistic to rely solely on the regulation of wells in order to articulate the state's groundwater management policies given the logistical limitations and the existing dynamics on the ground with unregistered wells.

To summarize, encouraging owners of existing wells to register is a very difficult task. Some users may have inherited the well and consider it as family property; they will not see any good reason to follow a long and administratively arduous process to register the well. Additionally, farmers are generally fearful of taxation or future volumetric monitoring/pricing and if in addition this process is burdensome and/or costly there should be no expectation that wells will be registered by users. In all cases, experience shows that wells will not be registered only 'because the law says so' and without additional 'carrots', possibly associated with 'sticks'.

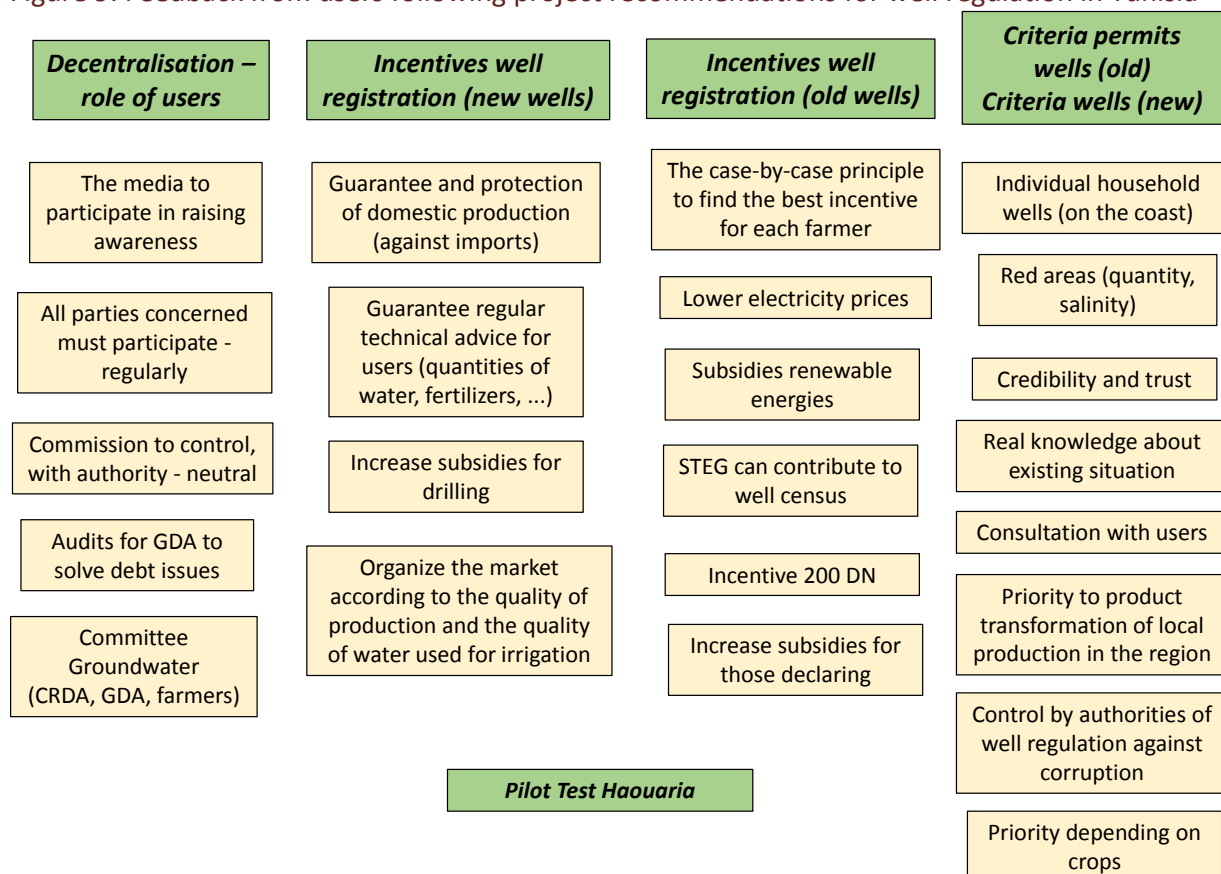
Figure 8. The new system of well registration in Tunisia as drafted in the new Water Law (Source: authors)



As a complement to these issues, we are including the recommendations and talking points discussed by a focus group of private users from Haouaria during the final workshop held in Tunisia in April 2017. The discussion arose as a reaction to some of the recommendations included in this Policy Paper. The interventions during the meeting touched upon the types of criteria for permits for old and new wells, the need for and type of incentives, and the role of users in the decentralization of groundwater management. Some of the recommendations are incorporated in this document. Clamping down on well registration corruption, and establish further subsidies (e.g. renewable energy) to incentivize the registration of wells were options considered by the participants.



Figure 9. Feedback from users following project recommendations for well regulation in Tunisia



### **Expected reforms in the new Water Law**

- Any drilling operation or digging of well regardless of the depth will require a prior authorization.
- Drilling companies cannot operate without a prior permit from the Ministry.

### **Recommendations of this White Paper**

- Planning and management of groundwater needs to understand the reality on the ground of shallow and deepened wells.
- Explain to permit and authorization holders (and the broader community) the specific management objectives and arrangements for their water resource and the rules that apply to them as users of that resource.
- Establish simple rules for well registration and define an incentive structure for users, potentially linked to agriculture production (as an indirect mechanism to monitor) and not directly linked to groundwater abstraction/pumping (which can be easily tampered).
- In a groundwater protection or prohibition area, consider the establishment of limits, including groundwater use caps and extraction limits that apply to the area/system.
- Recognize the need to invest in the enforcement of rules for well regulation as well as penalties.
- Ease the registration of new wells through a simple process and incentives.
- Under the new Water Law, consider the different criteria that need to be applied to

regularize wells:

- Consider an 'amnesty' of old wells without permit in order to control them, opening a unique and limited period of regularization of all 'old wells' not declared. Any well not registered during this period will be subject to sanctions and these sanctions will have to be applied. Resources will have to be allocated by the Ministry to follow up this process.
- If the registration of all wells is considered unrealistic, an inventory of wells to understand better the situation on the ground needs to be commissioned (see Data & Knowledge section).
- Facilitate the provision of land ownership certificates by updating the land census and clarifying contentious cases and conflicts.

### **3.3.2 Rule enforcement and groundwater protection**

#### **3.3.2.1 The water police**

Following the Ministry of Agriculture's decentralised structure, the CRDA is responsible for enforcing the law. This includes the 'water police' according to the new Water Law. However, the staff of the CRDA does not have a culture of monitoring groundwater conditions on the ground and enforcing regulation. They are not given the means to do such controls and do not feel they are backed or pushed by any political will to constrain groundwater use (Elloumi 2016).

The mandate of the water police needs to be reviewed and has to be ample enough to act as a positive incentive, not seen simply as a negative enforcement rule (a stick) to fear. Such service of rule enforcement could be tied up to the various services provided by the decentralised offices of the Ministry at the local level and the Extension Services (CTV). Additionally, the connotation of the word 'police' is negative and not conducive to trust within the farmer community. Since the revolution in 2011, the government has had a weaker presence in rural areas and the lack of rule enforcement has become more prevalent. Penalties are not dissuasive and the support from local authorities to control, monitor, and sanction rule infringement is weak.

The use of a water police needs to be put in context and lessons from other countries should be used to evaluate the real potential of a force like this one. Dissuasion with regards to infringing the law needs to be met with real capacity to locate the infraction and punish the perpetrator. The precedents for a water police in countries like Spain and Morocco are not very promising, as many countries face budget and staff limitations. In Morocco, Jordan, or Lebanon such water police operates with agents from the police or even the army when the law needs to be enforced. However, a presence of police on the ground may arouse animosity in rural communities. The enforcement and punishment by agents, usually recruited within the same area, is problematic since these same agents often have family and social links in these communities. The limited potential and effectiveness of such police need to be recognized.

The limitations of a water police could reinforce the view of users about the lack of reach and real powers of the state when it comes to enforcing new laws and regulations regarding groundwater management. In this case, the temptation for the state is to harden sanctions on paper; but there is a risk to lose credibility if no real enforcement capacity is demonstrated.

For groundwater protection areas, the state is allowed to make any change in existing abstraction structures, and it can limit abstraction volumes or even stop it. Currently, 9 prohibition areas in 6 governorates are in place. The number of areas should be reviewed (and potentially include new areas). The aspects of their management better established, relying on

the potential of participatory groundwater management for this type of cases. Moreover, provisions found in the Water Code for these areas are often not respected and no new water protection area has been declared in Tunisia since 2010.

### 3.3.2.2 The use of meters for groundwater control

The use of meters can be developed to improve the understanding of groundwater abstraction (as a management tool) but also as an enforcement tool devised to control and monitor groundwater resources and limit abstraction when needed. This however requires investment and follow-up. The push for water meters reflected in the new draft of the Water Law needs to be met again with incentives. It is unreasonable to expect that farmers will install water meters gladly and cooperatively. In Jordan the use of water meters has experienced many limitations there, despite a much smaller number of wells (around 3-4000 in the highlands) (Al Naber and Molle 2017).

Until now, Tunisia has been wise not to attempt to meter all its wells and it would be a mistake if under the new law such process was initiated (the draft water law contemplates this as well as the National Strategy for the Protection of Groundwater). Groundwater use is monitored and metered within the publicly irrigated areas (through the GDAs). Outside these areas, groundwater abstraction from private wells escapes control and the volume abstracted is controlled theoretically (based on declared volume) and done ex ante when the user applies for an authorization (when it happens). Meters are usually not easily accepted by users as they are suspicious of future control, volumetric quotas, pricing and sanctions. As seen in Jordan, meters can be easily bypassed, tampered with or damaged and preventing this requires a strict and close control of the state of the meters (of which there are no examples in the MENA region).

Meters can also be used to price groundwater volumetrically. This is also contemplated in the new draft Water Law. This approach also has limits linked to the use of meters mentioned above. Few countries charge agricultural groundwater users but when they do the fee is either not collected at all (e.g. Lebanon) or minimal (e.g. Morocco: 0.002 US\$/m<sup>3</sup>, eventually paid by very few users; see Molle, 2017). Since pumping is usually private and individual, there is no service that the state can charge for (except some relatively minor charges for resource management or environmental considerations, as sometimes found in Europe).

International experience has it that when meters start to indicate volumes that result in damageable costs or penalties, they invariably tend to be tampered with, by-passed or are found 'out of order'. Meter reading has also globally extensively been found to be prone to bribing and to invite corruption. Jordan, a country that has attempted such a measure, groundwater fees have been found to have minimal financial impact (Venot and Molle 2008; Demillecamps 2010), in part because well owners have consistently negotiated comfortable free blocks and resisted hikes in tariffs (Molle et al. 2017). There is no justification for the state to charge for groundwater at a level which would elicit conservation behaviors, and this applies worldwide at least in the agricultural sector. One exception is the very high block tariff recently imposed by Jordan on *illegal* wells (Al Naber and Molle 2017), precisely *because* they are illegal, and the results of this measure still remain to be evaluated.

#### ***Expected reforms in the new Water Law***

- Creation of a Water Police made of officers from the Ministry of Agriculture with the powers and resources to perform their duty.
- With access to all works and infrastructure using water resources or with an impact on

these resources.

- Empowered to take measures accordingly if rules are not respected.
- Reinforcement of sanctions for illegal wells in a safeguard or prohibition area (between 5,000 and 10,000 DT and between 3 and 6 months of prison) and destruction of the well (paid by the offender). Drillers working on an illegal well will also be sanctioned (10,000 DT) and their drilling equipment confiscated.

#### ***Recommendations of this White Paper***

- Assess the effectiveness of the existing sanctions regime and its application.
- Revise the declaration of areas of safeguard and prohibition and establish a regime of special monitoring, with the organisation of committees with representatives of the state and users to follow-up the situation (with access to data).
- Consider expanding the declaration of areas of safeguard and prohibition to other areas in need in Tunisia (as established in the National Strategy of Protection of Groundwater).
- The mandate of the 'water police', its enforcement and powers need to be sanctioned and legitimized not only by the Ministry of Agriculture but also validated and agreed by the community of users to increase trust and acceptance.
- Reconsider the necessity to install meters in wells to control groundwater abstraction: this is a measure that will likely fail. Consider instead alternative and indirect ways to monitor groundwater abstraction and agricultural expansion (see Data & knowledge section).
- Give up the idea of pricing groundwater in a context where the charges that could be politically acceptable would probably 1) not cover the collection costs, 2) discourage people from legalizing old wells and declaring new ones.

### **3.4 Data and knowledge**

Better hydrogeological and water use data to understand and manage groundwater resources is needed in Tunisia, as well as proper oversight and effective binding measures that encourage transparency and user adherence to the water law. Data is also necessary in order to determine the specific boundaries of hydrological units (e.g. aquifers) that could be designated as coming under one unified management plan. Data availability can also be useful for the purpose of transparency in order to increase awareness and trust between the government and users.

Tunisia has already considered addressing some of these aspects as described in the country's National Strategy for the Protection of Groundwater, developing 60 new piezometers and installing new monitoring stations with remote data collection in 174 other piezometers (World Bank 2015). Objectives, however, need to be realistic as their achievement is often subject to delays and problems as observed by the World Bank in its internal evaluation of the PISEAU II (ibid.). PISEAU II included the prospection with exploratory wells and observation wells, a comprehensive groundwater monitoring system, aquifer modeling, inventory of water points in major exploited aquifers, and the support to communities to manage overexploited aquifers. The internal assessment of PISEAU II by the World Bank in 2015 stated that the completion of some of these objectives was rated *Modest* at best (ibid.). The creation of exploratory wells was far from its set goal, with only 54 percent of target achieved, while only 19 percent of the target for observatory wells was achieved. The assessment also stated that the groundwater monitoring system, the inventory of wells and the participatory management in three aquifers all failed to be put in place (ibid.).

Presently, the lack of accurate data and knowledge on the current situation of groundwater resources in Tunisia undermines the capacity of the Ministry of Agriculture and users to properly

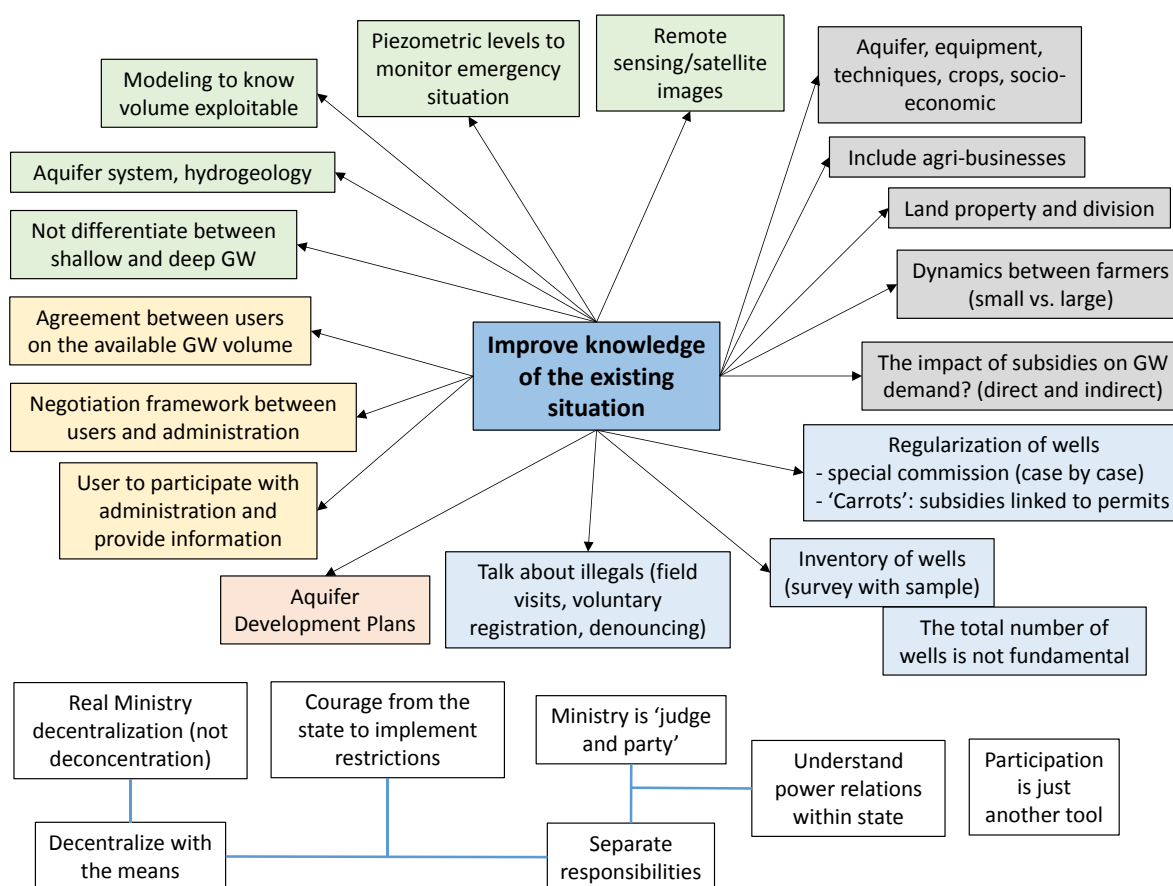
understand the level of 'emergency' vis-à-vis groundwater depletion in some areas and undermines management capabilities. This is a priority for Tunisia since, as discussed before, data is out-of-date and does not reflect the reality on the ground regarding wells (deep and shallow), providing an inaccurate picture of the real situation of groundwater overexploitation in Tunisia. The official statistics and data base of the Ministry of Agriculture needs to be updated as the number of deep wells, in particular, is completely underestimated, linked to the fact that the phenomenon of 'shallow well deepening' is not accounted for officially. This is a reality observed on the field in many locations in Tunisia, Merguellil, Sidi Bouzid, and Cap Bon to cite a few cases referenced already. The knowledge of groundwater use practices on the ground can also be limited by the fact that there are powerful and large farmers with incentives not to publicly disclose exact abstraction volumes (World Bank 2015).

The consequence of this lack of data and poor understanding of such reality is that the official estimates used by the Ministry of Agriculture to draw its management plans and monitor the evolution of groundwater levels in the country's aquifers are largely erroneous. Any technical study, forecast and modeling done by the Ministry based on official data will be therefore inaccurate. This also affects the determination of both aquifer safe yields and the levels of groundwater over-abstraction issued by the Ministry for local aquifers in Tunisia and at the national level.

As observed above, the control and monitoring of all wells in the country, be it through meters or well regulation, is not a realistic option. Tunisia should consider the use of indirect measures to monitor and control groundwater abstraction for agriculture. A less invasive method to gather information and data on groundwater use than the use of meters is the indirect control of groundwater-irrigated areas with remote sensing and satellite imagery (e.g. Jordan) (Molle et al. 2017). This system has minimal intrusion although results need to be calibrated and validated on the ground. This measure however also requires training and available staff at the ministry to process and analyze the images, and agents on the field to enforce the law. The use of this technology is not to be used as a proxy to identify wells but to follow up agricultural water use and cultivation expansion (especially in the arid areas of the country). The use of this technology has of course a cost that should be estimated by the Ministry of Agriculture.

During the final workshop of the project held in Tunis on the 5<sup>th</sup> of April 2017, a group of participants reflected on the options to improve the existing knowledge of the situation on the ground regarding groundwater resources and management. Figure 8 schematizes the discussion and the main salient points. The figure is divided in sections (represented by different colors) referring to different areas (loosely thematic). Starting from the center and anti-clockwise: 1) improved knowledge of the resource (in green); 2) improved user participation (yellow); 3) improved aquifer management (light orange); 4) dealing with well registration (light blue); 5) knowledge of uses and users (light grey). Aside and at the bottom of the figure we find specific aspects related to the Ministry of Agriculture, including the recommendation of developing separate responsibilities for regulation and enforcement (as the ministry has both the mandate to support and protect farmers' interests as well as the protection of water resources).

Figure 10. Feedback from stakeholders with options to improve knowledge on the existing situation regarding groundwater knowledge



### ***Expected reforms in the new Water Law***

- Develop integrated water resources management, introducing the concept of sustainability and management according to hydrological units;

### ***Recommendations of this White Paper***

- Improve knowledge and research regarding the status of groundwater resources in Tunisia as the hydrogeological data used by the Ministry are largely obsolete and do not reflect the reality of groundwater use and over-abstraction in Tunisia.
- Review the number and location of new boreholes required to ensure adequate baseline level of monitoring across the country.
- Undertake a survey to understand the extent of the phenomenon of well deepening; The number and location of existing deep wells not included in the public register needs to be updated.
- Update the data on wells and understand the reality of ground-level complexities and adaptation measures by farmers.
- Identify the cost of operating (monitoring), maintaining and renewing the network over the planning period, taking into account a planning horizon.

- The Ministry of Agriculture will identify a backlog program of works to upgrade and refine the monitoring network (piezometers and observation wells) to ensure it provides adequate coverage and is in reasonable working condition.
- Further develop the use of remote sensing and satellite imagery to control and monitor agriculture water use and expansion.
- The Ministry of Agriculture should work with its decentralised services and user groups in order to establish management units per aquifers or sub-units of aquifers. These aquifer management units should be aligned with the boundaries of the groundwater systems. These boundaries should:
  - Cover all parts of a groundwater system that share common characteristics and/or are interconnected.
  - Be set at an operational and administrative scale appropriate for efficient management;
  - Identify specific management needs and groundwater variations for each of the zones.
  - Where necessary, identify the need for transitional arrangements to avoid sudden changes in management arrangements for groundwater users and processes for implementing future rules.
  - Develop local groundwater management plans for each unit in consultation with stakeholders and groundwater users. One option would be by establishing Aquifer Development Plans (contemplated in the previous Water Law).



## 4 Conclusion

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Tunisia is at a crossroads when it comes to groundwater management and regulation. Presently, decision makers and politicians are negotiating a new draft for a revised Water Law. In order to support such process, this Policy White Paper has put forward a few ideas and recommendations to be considered in order to make the transition towards the new regime of groundwater management more feasible. Additionally, the expected reforms have to be met with realistic considerations and measures that will reflect the complexities of Tunisia's groundwater management and governance system.

One of the first required steps for Tunisia to achieve a sustainable use and management of its groundwater resources is better hydrogeological and water use data. The lack of accurate data on groundwater undermines the capacity of the Ministry of Agriculture to properly understand the level of 'emergency' vis-à-vis groundwater depletion. Data is out-of-date and does not reflect the reality on the ground regarding wells, especially related to the thousands of deepened shallowed wells not registered, providing an inaccurate picture of the real situation of groundwater overexploitation. The consequence of this lack of data and poor understanding of such reality is that the official estimates used by the Ministry of Agriculture to draw its management plans and monitor the evolution of groundwater levels in the country's aquifers are completely erroneous. Any technical report or modeling based on official data will be inaccurate.

In parallel, Tunisia needs to address the situation vis-à-vis its wells. Tunisia has to acknowledge that encouraging owners of existing wells to register is a very difficult task. Tunisia has also to understand that a legal and administrative imbroglio will appear when the new Water Law comes into effect regarding the old wells (registered and not registered, deepened) and the new wells. Farmers are not interested and will not follow a process that is burdensome and/or costly and if this is the case there should be no expectation that wells will be registered by users. In all cases, experience shows that wells will not be registered only 'because the law says so' and without additional 'carrots', possibly associated with 'sticks'.

The need to enforce regulation in Tunisia has to be met with a real commitment on the ground. The temptation for the state is always to harden sanctions but this may turn them non credible if there is no real capacity for enforcement. Dissuasion with regards to infringing the law needs to be met with real capacity to locate the infraction and punish the perpetrator. Unless there is a *strong and credible* threat ('stick') used, regulatory process will not achieve its intended objectives.

The control of groundwater via direct measures has also its problems. For private wells the volume of groundwater abstraction is controlled theoretically by the Ministry of Agriculture (based on voluntarily declared volume) and done *ex ante* when the user applies for an authorization (when it happens). Farmers are in general fearful of taxation or volumetric monitoring/pricing and, without exception, meters are usually not easily accepted by users as they are suspicious and do not want the additional risk to suffer control and possible sanctions. As seen in Jordan, meters can be easily bypassed or damaged.

The decentralisation of water service delivery for irrigation has also its problems. The main weaknesses in the current system of GDAs are linked to a lack of internal financial and administrative capacities of the GDAs for servicing and maintaining their infrastructure. Moreover, the financial resources of the CRDAs are insufficient to enable them to provide support the GDAs or the management of the publicly managed irrigated areas. More funds and support are needed for Tunisia's GDAs and CRDAs. Additionally, the experience put forward by



this project of aquifer dialogues was seen as a positive first step towards increasing user participation in groundwater management. Experiences like these need to be further replicated, involving local stakeholders as early as possible, as partners, with transparency and mutual commitment and encouraging the creation of legitimate local committees that will act as regular interlocutors with the government.

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