

The North West Sahara Aquifer System: the complex management of a strategic transboundary resource

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ABSTRACT

The North Western Sahara Aquifer System (NWSAS) is a very large aquifer system extending on a 1 million Km² surface, under the national territories of Algeria, Libya and Tunisia. Due to the lack of fresh surface water availability in these desert and semi-arid regions, its importance is today strategic for the above mentioned countries economic and social development. As a consequence of it, in the last decades, its exploitation has increased exponentially, causing serious hydrogeological problems and worries for the future. Supported by the scientific community, many national and international organizations, the Observatoire du Sahara Sud (OSS) above all, have recently raised the debate on the compatibility between the Algeria, Tunisia and Libya withdraws and the very little groundwater resource renewal rate. The apparent, but difficult, upcoming solution is a shared management of the whole aquifer system by the three involved countries. In this context, some results of a hydrogeological study carried on the tunisian NWSAS region are presented, focused on the actual exploitation state of the art definition and to estimate the different withdrawal scenarios consequences at medium-long period on the aquifer system at local and regional scale.

Key words: NWSAS, Tunisia, arid regions, artesianism, overexploitation.

1. INTRODUCTION

The most important water resource in the whole desert and semi-desert area of North Western Sahara is given by the North Western Sahara Aquifer System (NWSAS), a very large hydrogeological complex shared between three States: Algeria, Libya and Tunisia. The NWAS, from the geological point of view, is made by sedimentary formations the oldest of them date back to the Carboniferous-Permian period and it includes two main aquifers with different hydrogeological features, the Complexe Terminal (CT) and the Continentale Intercalaire (CI) (Fig.1).

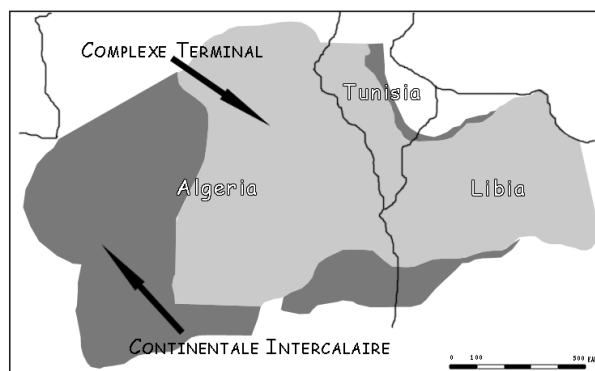


Fig.1 – NWSAS boundaries

Even though the NWSAS groundwater have been often considered as "fossil" to mean a meteoric water recharge absence, recent studies (Ould Baba, 2005) found that in some regions there is a direct alimentation by rainfall for a total recharge of about 10⁹ m³/y; nevertheless, the NWSAS hydrogeological features produce some very low filtration velocities justifying the average

groundwater age of about 35.000-40.000 years. All these topics show the typically nature of a non renewable resource.

2. THE NWSAS EXPLOITATION

A recent census provided by the Observatoire du Sahara Sud (OSS) international organization in 2001 showed that about 8.800 withdrawal points affect the NWSAS with predominance in the agricultural sector: 3500 are fed by the Continental Intercalaire and 5300 by the Complexe Terminal (OSS, 2003).

From a geographical point of view, 6500 are in Algeria for about 42,1 m³/s, 1200 in Tunisia for 17,2 m³/s and 1100 in Libya for 10,8 m³/s (Fig.2).

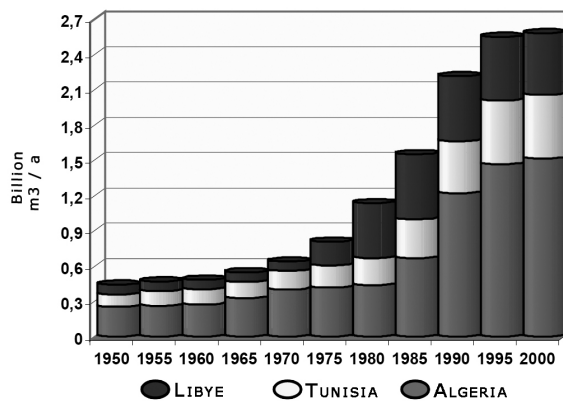


Fig.2 – NWSAS withdrawal evolution trend

The total withdraw from the NWSAS have been estimated in about 70,1 m³/s, corresponding to 2,2 10⁹ m³/y, with a worrying increasing trend.

These values easily give a clear idea about the hydrogeological imbalance affecting the NWSAS with a consumption more than double with regard to the recharge: even if the total groundwater availability, estimated in about 30*10¹² m³ doesn't seem to be an obstacle to a massive exploitation for the human activities, many problems could raise due to the withdrawals spatial concentration in small areas and to the future planning of new and huge well fields and adduction works by Libya and Algeria. In fact, while this aquifer has remained substantially stable up to the 80's, in the last fifteen years, its strategic role has led to a very fast increase in its water consumption especially for major agricultural projects in the arid and semi arid areas in these Countries. As a consequence, some of its main hydrogeological features are quickly altering and many problems are rising, like aquifer pressure loss, water salinization, natural oases disappearance (OSS, 2003; Besbes et al., 2004; Zammouri et al., 2007; Sappa et al., 2008).

3. THE CASE STUDY

We have met this critical situation in the frame of the Hydraulic Commission works, set up by the Italian-Tunisian Cooperation in the aim of driving on the Project of rehabilitation and creation of date palms in Rjim Maatoug, in South Tunisia (Agoun et al., 2007).

The Rjim Maatoug artificial date palms oasis spread out on about 2500 ha on the arid region of the Tunisian Chotts; they are irrigated by 22 artesian wells exploiting the NWSAS, with artesian discharges changed in the years from the initial values of about 100-150 l/s in 90's to the actual 50-60 l/s. Data collected in some recent field campaign (Agoun et al., 2007; Sappa et al., 2008) show a worrying artesianism lowering trend related to the exploitation increasing in the whole Chotts region. In comparison with the initial predictions (DGRE, 1997), the drawdown is about 10 years early with an actual trend of more than 1 m/y (Fig. 3).

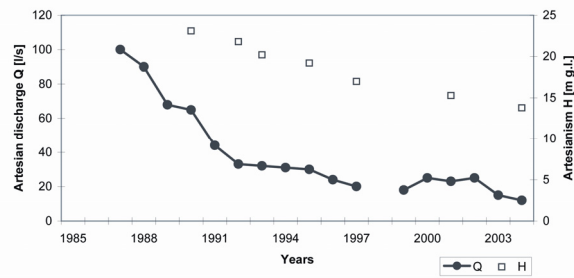


Fig.3 – NWSAS artesianism drawdown at Rjim Maatoug oasis

The numerical simulations made at regional and local scale lead to fix the definitive artesianism disappearance at 2020 horizon while at 2040 the piezometric level would reach the Chott's static level, causing a possible aquifer salinization phenomena trigger. Moreover, the actual aquifer hydrostatic pressure values are not adequate any more to grant the waterworks functioning, requiring the probable usage of electromechanical pumps, with serious consequences on the whole oasis production and the economic and social budget due to the obvious rise of the groundwater prices.

4. CONCLUSIONS

The experience made in Tunisian context allowed to define a worrying sketch about the local consequences of the lack of NWSAS exploitation shared management politics: the drawdown trend acceleration monitored at some oasis in the Tunisian Chott's region can't be only related to the local withdrawals at regional scale, but must be considered as a warning of a widespread situation about the NWSAS hydrogeological deficit. The studies results showed as the only management strategies carried out at national scale are not sufficient to grant the water resource availability for the future generations. International legislations, consumption data monitoring and cooperation among the involved countries, together with people awakening, seem to be the only effective ways to prevent some possible system collapse.

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