DOI 10.7343/as-2023-696

ACQUE SOTTERRANEE
Italian Journal of Groundwater
journal homepage: https://www.acquesotterranee.net/

2022-AS45-696: 05 - 06

EDITORIAL MESSAGE

Special Issue: Hydrogeology in Algeria - 2nd section

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Groundwater depletion is the natural consequence of withdrawing water from an aquifer at a higher rate than recharge. If groundwater abstraction exceeds groundwater recharge for extensive areas and long time, overexploitation or persistent groundwater depletion can occur (Gleeson et al., 2010). Globally, the depletion rate increased over the world between 1900 and 2008 from about 500 to ~4000 km^3 yr^{-1} (Konikow, 2011). Depletion affects North Africa, the Middle East, South and Central Asia and it is caused by human activities and mismanagement, but also by climate change and related stresses (Albrecht et al., 2017).

The average rate of aquifer exploitation in the Northern of Algeria was estimated at 80% in 2002 (Boufetta and Ouadja, 2020). Several studies of severe overexploitation as in Mitidja plain, Soummam Valley, Sebaou valley, Tafna basin, Seybouse, etc notified that the measured piezometric level decreased between 10 and 30 m, more than 50 m in other critical areas with several wells going dry (Kessasra et al., 2017). Due to hydrocarbon deposits and Saharan agricultural extension, implying demographic growth, the withdrawal worsens depletion and water quality impairment in the South (Bendida et al., 2021). Indeed, the most strategic areas as Ouargla, Hassi Messaoud, Hassi Rmel, Adrar, etc. are characterized by an accelerated development and an increased local and regional exploitation rates from Terminal Complex and Continental Intercalar aquifers.

Lower aquifer recharge, groundwater depletion and pollution (for example due to non-treated urban and industrial wastewater and unsustainable agricultural activities) are considered the main aspects of groundwater crisis in Algeria. Increased anthropization of the alluvial valleys in the most exploited aquifers affects the groundwater fluxes in both recharge and outflow (Yebdri et al., 2021). Missing effective groundwater management is also one of the most relevant cause for groundwater depletion in Algeria. Almost, it still includes a chronic lack in groundwater knowledge and data which multiplied obstacles in the way to identify groundwater pumping data, evaluate the diverse uses, needs and demands and, to implement an adequate strategy for protection of the most active aquifers. Unregistered wells provide more uncertainty and wrong estimation of groundwater pumping. Added to this, there is a lack of awareness about the benefits of managing the groundwater resource using numerical groundwater flow models. Models are not largely used in decision-making or analysis of the groundwater system in the country, except some technical projects focused only on restricted areas, research projects and publications without a real impact on the decision-making.

Furthermore, depletion is exacerbated by the decrease in the natural recharge with an expected water shortage. This reduction, caused by irregularities in rainfall and longer dry seasons, means that groundwater are not properly renewed (Djemai et al., 2017).

Similarly another threaten to groundwater is the accelerate anthropization. In fact, wellhead protection areas around groundwater catchment fields are not being applied. Otherwise, the concentration of the population along coastal strips may cause a significant pressure on water resources. The seawater intrusion caused by excessive exploitation and decreasing piezometric levels brings water quality impairment. In the end, this prevents the use of groundwater.

Note that questions related to transboundary shared aquifers are rarely addressed. Algeria and Tunisia are grappling with the consequences of using this shared resource for development of the Medjerda watershed. Regarding the North Western Sahara Aquifer System (Algeria, Libya and Tunisia), the Parties established a Consultation Mechanism in 2003 *"to coordinate, promote and facilitate the rational management of the water resources"*, but no formal agreement.

The availability and sustainability of groundwater resources is fairly related to which adequate strategy to adopt for it preservation. While desalination is considered in Algeria officially as a *"panacea option"* to reduce the current pressure on groundwater suffering from overexploitation, it is crucial to implement the *"groundwater preservation and aquifer rehabilitation plan"*. As a long-term program, it should include i) a supplementary effort to improve survey and analysis for more concise field data, whereas most observation networks are damaged, some are not appropriate for the current issues, and large territories remain unexplored, ii) boosting numerical modeling development to improve decision making and future tendencies which may lead to formulate appropriate management scenarios.

Which vision will the authorities develop for the sustainable use of groundwater? Which role may hydrogeologists and researchers play in the guidance and consulting when making the decision? The second section of the Special Issue Hydrogeology in Algeria published in this issue of the Acque Sotterranee - Italian Journal of Groundwater provides, by means of six new papers, insights in order to support the implementation of the new strategy for preservation of the groundwater in Algeria.

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In particular, Hani et al. (2023) developed a three-dimensional model using the MODFLOW and MT3DMS codes to predict seawater intrusion in the in the lower Seybouse coastal aquifer system. The application of these model indicates that the groundwater withdrawals result in a continuous decrease of the water level and in an increase of chloride concentration. The hydrogeochemical evolution and mineralization of groundwater in a semi-arid shallow aquifer was investigated by Tafrount et al. (2023) in the Barika area in northeast Algeria. They found dissolution of evaporated minerals, precipitation of carbonates, evapotranspiration, and ion exchange reactions act as the primary processes of mineralization. Dib et al. (2023) performed multivariate statistical analysis of the alluvial aquifer of Tadjenanet-Chelghoum Laid (Eastern Algeria). They show that the aquifer is recharged by precipitation at the plains border, where groundwater gets its original mineralization from the carbonate formations, and becomes more mineralized in chlorides, sodium and sulphates concentrations in contact with the salt-bearing terrigenous formations of the Mio-Plio-Quaternary sequence. Integrated geochemical and isotopic approaches for the investigation of thermo-mineral water was used by Lekrine et al. (2023). Their research aims at evaluating the hydrogeochemical evolution and the assessment for drinking and irrigation use of the spring water from the alluvial aquifer and major karst aquifer systems in Tebessa (northeastern of Algeria). Khedidja et al. (2023) assessed the groundwater vulnerability to pollution using DRASTIC and the SI methods of the alluvial aquifer in Tadjenanet- Chelghoum laid (East Algeria). The Authors found the vulnerability and contamination risk maps created for this study constitute valuable tools for environmental planning and can be used for predictive management of groundwater resources. Still an engineering geology study is presented by Khellaf et al. (2023) on a feasibility study for the southern extension of Mila town (northeast of Algeria) for urbanization purposes using a combined geotechnical and hydrogeophysical approach.

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