



Rehabilitation and extension of a khettara for a sustainable use of underground water resources

a. pilia (1), v. spanu (2), c. concollato (3), e. calzolai (4), and a.m. valenilla (5)

(1) Ecotherm Site Assessment, S.R.L., via Vaccareccia 43/d, Pomezia, Roma, (2) Dipartimento di Scienze della Terra, Università degli Studi di Cagliari, Via Trentino 51, I-09127 Cagliari, Italy, (3) S.I.A.-Studio Ingegneria e Architettura, via D.Turazza, 48/d, 35122 Padova, Italy, (4) Facoltà di Ingegneria, Università degli Studi di Firenze, Via S. Marta, 3 - 50139 Firenze (FI), Italy, (5) CRS4 (Center for Advanced Studies, Research and Development in Sardinia), Loc. Piscinamanna, I-09010 Pula (CA), Italy

As one of the major effects of soil degradation resulting from anthropogenic factors and influenced by climate variations, desertification represents a significant environmental issue in arid and semi-arid areas. Owing to a lack of resources to tackle the problem, the consequences of desertification drastically affect the population of developing countries.

One of the areas affected by this problem is the desert area of Hassi Labiad, near to Merzouga, in the South- East of Morocco, close to the border with Algeria, where the Erg Chebbi desert begins.

From a geological point of view the studied zone extends across coarse sand dunes from Quaternary (Erg Chebbi Desert), which lies on a basement constituted by clay schist with sandstone intercalations and mauve- grayish sandstone from Lower Viséen (Carboniferous). Basement outcrops are identified in the area.

In this area, the hydrological supply has been guaranteed for thousands of years by an ancient irrigation system, used in these area since about 1000 BC, the so called khettara.

This system, from its creation by the Persians, has been diffused across the whole arabic culture; it's based on the picking up of water through underground draining channels from shallow aquifers with an altitude above sea level, which are higher than the irrigation areas to which water is brought.

This system worked until a few years ago when, due to touristic development in the area, many groundwater pumping wells were created; the overpumping caused the decrease of groundwater level. Therefore, there was no more intersection between the khettara channel and the aquifer; and it became necessary to find a new intersection point by prolongating the ketthara principal channel.

This project has been promoted and directed by the UNDP, the local ONG AHT Hassi Labiad in collaboration with Bambini nel Deserto NGO, and Osservatorio Mediterraneo Onlus. Basically, it consisted of a hydrogeological study in order to check the feasibility of the extension and the optimal peculiarities for the new channelling, for a sustainable use of underground water resources.

The methodology consisted principally of topographic and water level measurements through wells and piezometers. Most of these measurements were made in water wells that already exist, due to the existence of the old khettara, while in the areas where enough density of measurement points is not found, new piezometers have been realised.

Moreover, an analysis of rain gauge data and a valuation of the quantity of the underground water taken from the system have been carried out, in order to make a first hydrogeological balance.

From the achieved results with the hydrogeological study an extension of the khettara of 230 m with a E-W direction has been made, that allowed to reintercept the alluvial ground water and to create a drainage system able to pick up the underground water in a sustainable way, also during the driest period of the year.

Work carried out with a Bambini nel Deserto project, with the financial support of UNDP, the local ONG AHT Hassi Labiad in collaboration with Osservatorio Mediterraneo Onlus.