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Mapping of suitable zones for manual drilling as a possible solution to increase access to drinking water in Africa through integration of systematized GIS data and local knowledge

Fabio Fussi (1), Roberta Alvino (), Massimo Caruba (), Luca Galimberti (), Ignacio Marzan (2), David Tarrason y Cerda' (3), and Daniela Sabatini ()

(1) University of Milano Bicocca, Remote Sensing of Environmental Dynamics Laboratory, Department of Environmental and Earth Science, Milano, Italy (fabio.fussi@usa.net), (2) ICTJA-CSIC, Barcelona, Spain, (3) CREAF, Cerdanyola del Vallès 08193, Spai

In several African countries water supply is still largely a huge problem. In order to achieve MDG for water supply, UNICEF is promoting manual drilling in Africa.
Manual drilling refers to those techniques of drilling boreholes for groundwater exploitation using human or animal power (not mechanized equipment). These techniques are well known in countries with large alluvial deposits (India, Nepal, Bangladesh, etc). They are cheaper than mechanized boreholes, easy to implement as the equipment is locally done, able to provide clean water if correctly applied.

But manual drilling is feasible only where suitable hydrogeological conditions are met:
- the shallow geological layers are not too hard (soft sediments or rocks having limited resistance) and have good permeability;
- the depth where it is possible to find exploitable water is limited (in this study we assumed no deeper than 25 m).
For this reason mapping of suitable zone for manual drilling has been the first step in UNICEF program already completed in 15 countries. this paper explains the general methodology for the identification of suitable zones at country level
The methodology is based in the integration of different information (maps, reports, database) already existing in each country, together with interview of local technicians with direct experience in various regions and limited direct field data collection.

General suitability for manual drilling (although adapted to specific condition in each country) is based on the combination of three main parameters: the geological suitability, the suitability according to water depth and the morphological suitability:
- Geological suitability is related to the hardness and permeability of the shallow layers of rock formations. It has been obtained through a GIS procedure of simplification and reclassification of geological maps, estimating hardness and permeability of main rock and overlaying weathered layer on the basis of stratigraphic borehole logs, presence of hand dug well and perception of local geologists;
- Suitability according to water depth is related to the depth where exploitable water strikes can be found. it has been estimated through analysis of the spa tial distribution of water level obtained by national inventories of water points and direct experience of drillers;
- Geomorphological suitability refers to the existence of a surface morphology that facilitates the accumulation of unconsolidated materials. It has been obtained from SRTM digital elevation model, estimating slope and topographic position index

The general suitability has been obtained through the combination of geological and water depth suitability using 2-dimensional tables for the whole country. Morphological suitability has been finally integrated for a more detailed analysis in those areas with hilly topography.

The final results provide an important support for the definition of those areas where promotion of manual drilling is a suitable strategy and the choice of specific techniques to apply. Furthermore this study has put in evidence the high value of keeping well organized geographic database for the implementation of correct development strategy in Africa, and in the mean time has given an example of integration of systematized data and traditional knowledge