XXXVIII IAH Congress

Groundwater Quality Sustainability
Krakow, 12–17 September 2010

Extended Abstracts

Editors:
Andrzej Zuber
Jarosław Kania
Ewa Kmiecik

University of Silesia Press 2010

abstract id: **205**

topic: **3**
Aquifer management

3.1
Regional groundwater systems

title: **Using spatial profile of recharge potential for the definition of primary recharge area on Chou-Shui Alluvial Fan**

author(s): **Yu-Wen Chen**
National Chiao Tung University, Taiwan, bsjacky@gmail.com

Jui-Pin Tsai
National Chiao Tung University, Taiwan, skysky2cie@gmail.com

Liang-Cheng Chang
National Chiao Tung University, Taiwan, lcchang31938@gmail.com

keywords: primary recharge area, distributing factor, Chou-Shui Alluvial Fan, recharge potential

The surface hydrology in Taiwan varies immensely in the time and space domains. The impact of global climate change may cause the situation to become severe. Using only surface reservoirs cannot provide a reliable water supply because rainfall influences reservoir water supplies. Thus, groundwater resources become more vital. The protection and sustainable management of groundwater resources are imperative issues to consider. For groundwater protection and management, defining the high recharge areas of a groundwater basin is essential, making it possible to monitor and manage human activities. To define a high recharge area is a challenging issue because of complicated surface and geological conditions. Nevertheless, to avoid confusion and facilitate communication with the public, the methodology for determining a high recharge area must be simple and easy to demonstrate.

In response to previous discussions, this study proposes a methodology by combining a factor scoring method and a geographic information system (GIS) to define the high recharging areas of a groundwater basin systematically. The factor scoring method computes the recharge-potential score for a basin. The GIS system facilitates the spatial analysis of selected factors and demonstrates the results. Thus, recharge-potential scores form the basis for defining a high recharge area. The summation of the weighted factors score yields the recharge-potential scores. The factors are selected based on influence on groundwater recharging. Seven factors were selected for computing the recharge potential of the Chou-Shui Alluvial Fan including land use, surface soil, river density, average annual rainfall, correlation between rainfall and groundwater storage, variation of storage for unit aquifer area and hydraulic conductivity.

The computation of recharge-potential scores consists of two major steps. Each factor score is computed from its original data format. The data format for each factor in its original state is di erent and is collected from a groundwater database, remote sensing data, and GIS coverage. All factor scores range from 0 to 100 and a high score implies a high recharge potential. The scores are spatially distributed and represented as cell-based coverage with 1 km2 cells size. The original data format for “land use” and “surface soil” is GIS coverage with polygons and features. For these two factors, a factor score was assigned to each feature based on its influence on groundwater recharging. The cell-based coverage of the two scores was obtained by applying GIS spatial analysis techniques of regrouping and overlaying. The other factors’ original format is points distributed in space with a continuous data value. These factors require an interpolation scheme to interpolate the point-wise data into cell-based coverage. The scores were assigned based on its influence on groundwater recharging.

Second, the recharge-potential (RP) scores were computed by summing the weighted seven factor scores. Therefore, the factor weighting must be defined before computing the RP scores. The causal analysis among the factors suggested by Shaban (2006) was implemented to determine the factor weighting. The causal analysis defined the mutual interaction among the factors and a causal network for the seven factors was developed. The factor weighting was computed based on the causal network. To demonstrate the feasibility for a practical application of this method, the propose method was applied to determine the high recharge areas of the Chou-Shui Alluvial Fan, one of the most important basins in Taiwan. A groundwater recharge-potential score coverage was obtained and the score revealed that the RP score decreases from the proximal area to the distal area. Therefore, based on this study, the primary high recharge area for Chou-Shui Alluvial Fan is located at the proximal area. This result was compared with previous field investigations and shows good agreement, indicating the proposed methodology is applicable to a complicated high recharge area definition problem.

International Association of Hydrogeologists

AGH University of Science and Technology

2-vol. set + CD
ISSN 0208-6336
ISBN 978-83-226-1979-0