Ecohydrology, phreatophytes and groundwater dependent ecosystems

[1]O. BATELAAN and [2]J.P.M. WITTE

[1]Vrije Universiteit Brussel, Dept. Hydrology and Hydraulic Engineering, Belgium, e-mail: batelaan@vub.ac.be, also at: K.U.Leuven, Dept. Geography-Geology
[2] Kiwa Water Research, PO Box 1072, 3430 BB Nieuwegein, The Netherlands, e-mail: Flip.Witte@kiwa.nl

ABSTRACT

Ecohydrology has been discovered, and embraced, as a new scientific discipline throughout the world. Several authors have stressed its importance to the progress of hydrology and ecology. However, there appears to be a wide range of ideas on which topics ecohydrology should include. We describe the history of ecohydrology and distinguish the different ecohydrologic schools. One of the roots of ecohydrology is based on the dependence of certain plants on groundwater, as was already recognized by Henry Philibert Gaspard Darcy. Oscar Edward Meinzer introduced the term 'phreatophyte' (Meinzer, 1923). He defined it as a plant that habitually obtains its water supply from the zone of saturation, either directly or through the capillary fringe. In the first half of the 20th century plants hydrologists regularly used plants as indicators in groundwater investigations, especially in the semi-arid regions of the U.S.A. Here the relation between vegetation and groundwater availability is obvious. After the first half of the 20th century hydrogeologists seemed to lose their interest in the use of phreatophytes in groundwater studies, but ecologists continued the study of their habitat requirements (Londo, 1988; Ellenberg, 1991). Recently the interest in phreatophytes in general was revived, following the interest in groundwater dependent ecosystems.

In this paper, the ecohydrological schools are reviewed as well as the role of phreatophytes in ecohydrology and in assessment of groundwater dependent ecosystems. Case studies are used to demonstrate the benefits, limitations and complications of using phreatophytes in hydrological studies. Groundwater and particle tracking models, hydrochemistry and remote sensing are used to understand the distribution of plants and the composition of vegetation. These all contribute in understanding biodiversity and the functioning of groundwater dependent wetlands. In addition, phreatophytes may be helpful when designing groundwater models. In stable conditions, they reflect average long term hydrologic conditions, which can be assessed quite easily. It is argued that the well balanced use of 'soft' phreatophytic information can be complementary to 'hard' groundwater data and analysis techniques. This will result in a better understanding of groundwater dependent ecosystems.

Keywords: Ecohydrology, phreatophytes, groundwater dependent ecosystems