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Phreatophytes and Groundwater

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The dependence of certain plants on groundwater was already recognized by Henry Philibert Gaspard Darcy who mentioned in his famous 'Les Fontaines Publiques de la Ville de Dijon' (Darcy, 1856) that plants and topography are important for locating springs and that evaporation and transpiration by plants had dried up certain springs. Oscar Edward Meinzer, sometimes called the 'father of groundwater', 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. Meinzer wrote in 1927 a complete book on plants as indicators of groundwater. In the first half of the 20th century plants were regularly used as indicators in groundwater investigations by hydrologists, especially in the semi-arid regions of the U.S.A., where the relation between vegetation and groundwater availability is very obvious. After the first half of the 20th century hydrogeologists lost their interest in the use of phreatophytes in groundwater studies, however ecologists continued the study of their habitat requirements (Londo, 1988; Ellenberg, 1991). More recent the interest in phreatophytes in general and by hydrologists especially revived again, following the rise and interest in the new field of ecohydrology. Groundwater models are used to understand the distribution of plants and the composition of vegetation in a wide range of circumstances. They help to understand biodiversity and the functioning of wetlands. On the other hand, phreatophytes may be helpful when designing groundwater models. In stable conditions, they reflect average long term hydrologic conditions, which can be assessed quite easily. Estimated groundwater levels and delineation of seepage zones based on phreatophytes are used for calibrating groundwater models.

In this paper review is given of the eco- and hydrological characteristics of phreatophytes. Case studies are used to show the benefit of use of phreatophytes in hydrological studies, as well as the limitations and complications. It is argued that a well balanced use of 'soft' phreatophytic information can be complementary to 'hard' groundwater data and help to reveal new ecohydrological relations.