

# Non-Human Water Supply or Evapotranspiration : the Parameter from Hell

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## Abstract

Any assessment of water supply needs requires a thorough evaluation of the four parameters of the hydrologic cycle. Traditionally, these parameters include a single input (precipitation) and three outputs (evapotranspiration, surface runoff and groundwater recharge). The volume of water occurring as precipitation, surface runoff, and groundwater recharge can be measured directly. Evapotranspiration is not. It has been determined in the New Jersey Pine Barrens by one of two indirect methods. It has been estimated in an annual water budget as the difference between precipitation on the one hand and the sum of surface runoff and groundwater recharge on the other. It can also be estimated using an energy budget as a proxy for water volume.

A major difficulty with determining evapotranspiration is that it is two different processes controlled by different factors. Evaporation is a physical process controlled by a vast array of meteorological variables where surface water vaporizes into the atmosphere. But transpiration is largely a botanical process controlled by plant physiology and soil moisture characteristics where groundwater is drawn through the plants and transferred into the atmosphere. The instrumentation set up needed to measure transpiration can be daunting.

The U.S. Geological Survey has complete several studies on Pine Barrens Hydrology (E.C. Rhodehamel, 1970; A.W. Harbaugh & Tilley, C.L., 1984; E.Modica, 1996, 1998)-all precursors to the current Kirkwood-Cohansey Aquifer Study. Each recognized the role of evapotranspiration as a hydrologic output but made assumptions about wetland soils and groundwater wetland discharge that require closer scrutiny. These studies assumed that all groundwater discharge ultimately makes its way into streams rather than transpiring through wetland vegetation into the atmosphere. The 1998 Modica study recognized that wetland soils were largely muck but did not deal with the effect of the change in soils type from upland gravelly sands to lowland mucks as a factor in refracting groundwater flow upward toward the wetland plant root zone rather than toward streams.

Wetland transpiration is not an insignificant output. The volume of water consumed by wetland vegetation has been studied in the Pine Barrens (J.T. Ballard, 1979) and also in other parts of the world. Transpiration constitutes a fourth output in the hydrologic cycle of Pine Barrens wetlands. Past studies were concerned about the impact of well withdrawals on river ecology but largely ignore the impact on adjacent wetlands. Consequently, direct transpiration measurement of Pine Barrens wetland vegetation is needed to evaluate the significance of this fourth output.