



The 2007 Darcy Lecture in London
Convened by the Hydrogeological Group of the Geological Society
Tuesday 3rd July, Harrey Massey Lecture Theatre, UCL

The 2007 Darcy Distinguished Lecturer is Dr. James Butler, University of Kansas and Kansas Geological Survey. Jim Butler earned a B.S. in geology from the College of William and Mary, and an M.S. and Ph.D. in applied hydrogeology from Stanford University. His research interests include the development of field methods for site characterization and the assessment of hydrologic processes in stream-aquifer systems. Jim has served as an associate editor for *Water Resources Research* and the *Journal of Hydrology*, and is currently serving on the editorial boards of *Ground Water* and the *Hydrogeology Journal*.

Programme

- 2.15 Registration, at Harrey Massey Lecture Theatre foyer
- 3.00 Introduction, William Burgess, Hydrogeological Group, Geological Society
- 3.10 **Jonathan Smith**, Environment Agency / University of Sheffield
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‘The hyporheic zone: pollutant attenuation zone or ecologically critical habitat?’

The hyporheic zone (HZ) is located at the interface between groundwater and surface waters. It exhibits dynamic chemical and temperature gradients and is often conceptualised as a dynamic ecotone at the interface of aquifer and river systems. New environmental legislation, such as the EU Water Framework Directive, requires regulatory organisations to take a more holistic approach to environmental management, including integrated management of surface water groundwater bodies. Understanding processes at the interface of these environmental compartments, which have traditionally been managed separately, has become a high priority.

The HZ has the potential to enhance certain pollutant degradation and retardation processes. The HZ is also a unique and little studied hypogean habitat. The geochemical conditions conducive to natural attenuation of certain priority pollutants, such as nitrate and halogenated ethenes (chemically reducing conditions) are the opposite of those that typically enhance the biodiversity and ecological status of river systems (aerobic conditions). The HZ can provide either ecological service, but rarely both.

Assessors need to consider which ecological services are most valuable in a given catchment or river reach. In urban and other contaminated areas the benefits provided by reductive natural attenuation processes in hyporheic sediments may be large. In other ‘pristine’ catchments the benefits provided by a diverse and healthy hyporheic invertebrate community might support fisheries and other higher faunal communities, while the benefits of reductive microbial processes may be minimal. As river restoration proceeds the relative benefit accrued by each ecological service may change, and river managers may need to consider this in long-term environmental restoration plans.

This paper will review the environmental objectives of recent legislation with respect to the groundwater – surface water interface. It will consider policy issues regarding the ecological benefits required of the HZ, and will describe potential environmental management strategies for the HZ. Current risk assessment and management protocols in the UK and elsewhere

rarely consider processes occurring within the HZ, or its role as a pathway or receptor within a source-pathway-receptor risk analysis.

3.35 **Roger Wotton**, UCL Biology, r.wotton@ucl.ac.uk
'Ecosystem engineering in Chalk streams'

Chalk streams flow from aquifers and are characterised by modulated flows and high quality source water. Rooted plants that grow in the streams alter flow patterns and the deposition of sediments, so they are regarded as "ecosystem engineers". Animals in chalk streams are also engineers, transforming the particle size of organic matter. The production of aggregates by animals changes the availability of nutrients and this, together with the engineering by plants, has an important effect on the functioning of chalk stream ecosystems.

4.00 2007 Darcy Lecture: **Dr. James Butler**
'What the Heck Is a Phreatophyte? A Field Investigation of Ecohydrologic Processes in Stream-Aquifer Systems'

The lecture presents an overview of a multidisciplinary investigation of water use by phreatophytes - plants that utilize ground water - in semi-arid riparian zones. Ground water consumption by non-native phreatophytes is an issue of considerable concern in the western United States, as well as elsewhere. The lecture describes the various components of the water budget in stream-aquifer systems, with an emphasis on the contribution of riparian zone phreatophytes. The presentation highlights the ecohydrologic information embedded in water level data from shallow wells, and demonstrates its value for studies of riparian zones stressed by invasive phreatophytes and other factors.

5.00 Closing remarks