Summer Death in a Banksia Woodland: Is Groundwater Important?

Dr Philip Groom

The Gnangara Groundwater Mound is one of two large, shallow unconfined aquifers on Western Australia's Swan Coastal Plain currently under abstraction as part of the public metropolitan water supply. Groundwater abstraction for public water supply results in lowering of the water tables, which may have a detrimental impact on these ecosystems dependent on shallow groundwater. The potential impact of groundwater drawdown on groundwater-dependent vegetation ranges from gradual changes in plant community structure, to sudden and extensive vegetation deaths.

One of the most significant impacts of abstraction operations on native *Banksia* vegetation was observed in summer 1985 within the vicinity of the Wanneroo wellfield, where up to 80% of all *Banksia* trees died. Tree mortality was attributed to a rapid drawdown of the water table as a result of an increase in summer abstraction. This prompted the Water Authority of Western Australia to recognize the need to study the potential effects of groundwater abstraction of groundwater-dependent woodlands in response to drawdown caused by abstraction. As part of their monitoring program, vegetation monitoring was conducted within close proximity to a groundwater abstraction bore (Pinjar bore P50) one year prior to it becoming operational. Three years later (in February 1991), extensive overstorey death of the native vegetation surrounding P50 and other Pinjar bores was observed, following several days of high summer temperatures. The site was subsequently revisited and the understorey floristic composition, abundance and vigour of overstorey species resurveyed, and compared with data collected from a site not currently influenced by abstraction.

A lowering of groundwater level by 2.2 m at P50 between the summers of 1990 and 1991, resulting from the cumulative effects of abstraction and below average annual rainfall (low groundwater recharge), coincided with a loss of up to 80% of adults of the *Banksia* overstorey species. Over the similar time period no additional *Banksia* deaths were recorded in areas not influenced by groundwater abstraction. For understorey species, medium (1-<2 m root depth) and deep rooted (>2 m root depth) shrub species had the greatest reduction in total number of adult plants, compared with shallow-rooted (<1 m root depth) shrub species. *Banksia* tree species and deep-rooted shrub species would have undergone severe water stress in response to this sudden lowering of groundwater levels. Shallow-rooted species were not reliant on groundwater for their water requirements, and were therefore more drought tolerant than deeper rooted species. Water stress may have been the primary cause of vegetation death in close proximity to the P50 bore, although more deaths would have occurred in response to extreme summer temperatures (>45°C) recorded during February 1991, than by water stress alone.

Reducing the impacts of drawdown on the native vegetation surrounding groundwater production bores and wellfields is an important task for managers of groundwater resources, the understanding of which is vital for the maintenance of groundwater levels within limits necessary to support ecological water requirements. Other studies have shown that *Banksia* tree species occurring at groundwater depths <6 m are able to tolerate no more than a yearly average drawdown of 0.2 m. It is expected that at such depths (which are similar to those at P50), *Banksia* tree species have access to groundwater resources virtually all year round. However this would not be the case for all deep-rooted shrub species. Reducing summer groundwater abstraction following successive years of poor rainfall may reduce the risk of extensive death of deep-rooted shrub and *Banksia* species occurring due to water stress, and therefore temperature-related deaths.

The work described in the talk was analysed whilst Dr Groom was employed from a Land and Water Resources Research and Development Corporation grant received by Dr Ray Froend (Centre for Ecosystem Management, Edith Cowan University), in partnership with the Western Australia Water and Rivers Commission, and Water Corporation. Access to the vegetation monitoring data was provided by Mattiske Consulting Pty Ltd and the Water and Rivers Commission.

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Kings Park Board Administration Lecture Theatre, Fraser Ave., Kings Park

Taxonomy and classifications.

An enquiry into the principles and prejudices governing the naming of things.

Dr Revets will discuss the nature of taxonomy, and classifications in general, from a variety of perspectives. The intellectual development of the scientist, the historical development of the science of taxonomy and some of the developments of science and philosophy of science are brought together to elucidate the nature of the principles governing classifications. The conclusion of the analysis is uncomfortable: the foundations are weak and narrow, and fail to provide the stability needed.

Dr Revets studied Zoology at Vrije Universiteit Brussels, graduating magna cun laude in 1982, on a memoir entitled "Incongruencies in the system analysis of ecosystems." He then obtained the degree of Doctor in Science at the same University in 1989, summa cum laude on the dissertation "The Buliminacea (Foraminiferida); Morphology, Systematics, and Evolution." Since then, Dr Revets has held a number of positions including Research Assistant at the University of Basel, in Switzerland (1991-1992), an ARC Postdoctoral Fellowship at The University of Western Australia (1992-1995), and a NERC-ODP Research Fellowship, at the Natural History Museum, London. (1996-1997). Dr Revets currently holds an ARC QEII Fellowship at The University of Western Australia (1997-2002), and is an accomplished speaker, having presented research papers at 11 international conferences. He also has been a member of a variety of learned societies such as the Cushman Foundation for Foraminiferal Research and the British Micropalaeontological Society, and is the current Convenor of the Systematics Discussion Group, at UWA. In addition Dr Revets is on the editorial board of Palaeontologia Electronica and reviews manuscripts for journals such as the Journal of Foraminiferal Research, Micropaleontology, and Revue de Micropaleontologie. Dr Revets also has published widely with 23 papers mainly on foraminiferal systematics and morphology, and one systematic monograph. He has interests in Protists in general, and Amoebae and Foraminifera in more detail, as well as Philosophy of Science and foundations of Mathematics, Classification and Taxonomy.

I. Abbott

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