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New UCT research dips into water management issues

Three graduands at the University of Cape Town will receive their doctoral degrees this month for their research into water management. In their respective theses they compare water use by indigenous trees with that of alien species; consider how low-flow events affect rivers; and examine the use of algae as water quality indicators in KwaZulu-Natal rivers.

Alien trees use water more efficiently

In Botany, Mark Baudert Gush's thesis, *Water-use, growth and water-use efficiency of Indigenous tree species in a range of forest and woodland systems in South Africa*, found that growth and transpiration rates in indigenous tree species are consistently lower than that for introduced tree species.

Gush established that ratios of growth to water-use observed in indigenous tree species indicate that these have lower efficiencies of use, when compared with genetically-improved introduced tree species. These results are attributed to the slow growth relative to the amount of water used by indigenous trees. He concluded that lower water-use of indigenous tree species is an advantage when considering planting trees in water-constrained catchments with forestry potential.

Gush has a BSc in Forestry from the University of Stellenbosch, and Honours and MSc degrees in Hydrology from the University of Natal. He is a senior scientist at the Council for Scientific and Industrial Research in Stellenbosch and heads up the Hydrosociences Research Group. He leads a number of projects investigating the water use of commercial fruit tree orchards and indigenous tree species. His thesis was supervised by Dr Ed February of the Department of Botany.

Measuring how low a river can flow

In Zoology, Rebecca Elizabeth Tharme's thesis, *Ecologically relevant low flows for riverine benthic macroinvertebrates: characterization and application*, examined the amount of water needed at different times of year for the sustained ecological

functioning of rivers. She found that most research has focused on the role of floods in river maintenance, so she on low-flow events and their effects on instream fauna.

Her thesis describes the experimental diversion of different amounts of water from several natural perennial streams during the dry season. She investigated the short-term effects of natural and unnaturally low flows on water chemistry, quantified losses in the availability and quality of physical habitat, and describes the responses of invertebrates living on the stream bed. She identified thresholds of change in physical conditions that affected different members of the invertebrate community, singled out hydrological indices of most ecological meaning, and thus characterised what is meant by "ecologically relevant" low flows.

Tharme graduated with a BSc from the University of Natal, Pietermaritzburg, followed by a BSc (Hons) with distinction in Zoology from UCT. For the past eight years, she has worked in developing countries in water resource management, firstly with the International Water Management Institute, based in Sri Lanka, and now as a Senior Freshwater Scientist with The Nature Conservancy's Global Freshwater Program. Her PhD thesis was supervised by Associate Professor Jenny Day of the Department of Zoology.

Assessing effects of sewage and industrial drainage

In Botany, Colin George Mostert Archibald's thesis, *The use of contemporary and historic diatom assemblages in the derivation of reference state communities for rivers in KwaZulu-Natal, South Africa*, investigates assemblages of a ubiquitous group of microscopic algae, the diatoms, as indicators of water quality and ecological conditions in the rivers of KwaZulu-Natal.

Many historic and recent collections were investigated and compared to produce reference state communities, using the supposition that undisturbed headwaters of rivers would engender diatom assemblages of high ecological status. Specific diatom assemblages indicative of these reference state communities were contrasted with diatom assemblages impacted by waste from acid mine drainage, sugar waste, sewage and industry waste.

Archibald found that the headwaters of selected rivers in KwaZulu-Natal fulfil the criteria for diatom reference conditions, and that the metrics associated with these diatom communities can be taken as benchmarks at the high end of a water quality condition gradient.

Archibald has a BSc from Rhodes University and an MSc from the University of Natal. Following a career in contract research, he has completed a PhD on the freshwater diatoms of KwaZulu-Natal in semi-retirement, as the culmination of a lifetime's interest and commitment to the well-being of our key freshwater resources. He was supervised by Professor John Bolton of the Department of Botany.

Please note: Information in this release is based on the supervisor's citation for the PhD thesis. UCT advises journalists to obtain a copy of the thesis and/or interview the PhD graduate to verify and expand on this information.

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