Policy and science needs for the protection of ecological values of groundwater




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Ecological values of groundwater

- The Australian national water reforms require environmental provision in water plans; where plans include groundwater, the environmental values of groundwater must be considered
- The science and policy to guide planners in making environmental provision for groundwater is at an early stage in Australia in comparison with consideration of environmental flows in surface water
- NWC biennial assessment 2009: the identification and assessment of the water needs of groundwater dependent ecosystems need to be brought into the planning and allocation process, just as for surface water ecosystems

Mud mound springs in the Eulo group, south-western Queensland

National Principles for Provision of Water to Ecosystems 1996

- Ecological values defined: natural ecological processes occurring within water dependent ecosystems and the biodiversity of these systems

- Environmental water requirements and environmental water provisions

- Provision of water for ecosystems should be on the basis of the ‘best scientific information’ available

- Environmental water provisions should be responsive to monitoring and adaptive management

- All relevant environmental, social and economic stakeholders will be involved in water allocation planning and decision-making on environmental water provisions

ARMCANZ/ANZECC (1996) *National Principles for the Provision of Water for Ecosystems*. Sustainable Land and Water Resources Management Committee Subcommittee on Water Resources. Occasional Paper SWR No 3.

Principles for developing and using ‘best available science’

- Create and support a cooperative process that enables interdisciplinary teams to produce shared knowledge
- Articulate a clear management or policy question and translate it into research questions and supporting hypotheses
- Define the knowledge needs
- Create a hierarchy of ‘best’ information (published and unpublished literature, expert opinion, local knowledge)
- Develop study designs and analyses that are appropriate to the hypotheses being tested
- Cleary state assumptions, define terms, and identify uncertainties and risks
- Build in revisions
- Keep a record of the decision-making process
- Communicate research methods, supporting rationale, results and management applications

Ryder D.S., Tomlinson M., Gawne B. & Likens G.E. (2010) Defining and using best available science: A policy conundrum for the management of aquatic ecosystems. *Marine and Freshwater Research*, 61, 821-828.

Ecological value in groundwater: the GDE concept

- Ecological value in surface water: macroinvertebrate diversity, fish spawning in response to flow, biofilm productivity
- Ecological value in groundwater: Groundwater dependent ecosystems
- Some recognition of GDEs in Australian water plans (e.g. GAB springs)

Assumptions and limitations of the GDE concept

- Does the concept of the GDE capture the ecological values of groundwater? Masking of spatial and temporal variability of groundwater use and the connectivities between GDE types
- There are a fixed number of GDE types (5-6):

  - baseflow, “wetlands”, vegetation, subterranean, marine and estuarine
- Allows subjective prioritisation of some GDE types
- The task of providing environmental water in groundwater planning involves identifying GDEs and developing an ecological response function (usually groundwater level)
- Science base is building, but there are still significant knowledge gaps
- What about ecological processes and ecosystem services?

Plans nominally recognise environmental values of groundwater, but lack a comprehensive assessment of these values, and therefore fail to protect them

Beyond the GDE

- The GDE concept will still have a place in environmental water management… but we can improve on it
- Consider ecological values first
- Recognise ecohydrological gradients and connectivities
- Align GDE typology with existing ecosystem classification
- Acknowledge that an ecological response function is unlikely to be identified for every GDE/environmental value; shift from “environmental flow” thinking
- Environmental water requirements are a regime with multiple, interacting components. Variability in components, e.g. groundwater level fluctuations, is likely to be ecologically relevant
- Start thinking about ecosystem services of groundwater!

No groundwater plans consider the water needs of ecosystem services

Principles for improved provision for the ecological values of groundwater in water plans

- Consistency in terminology
- Identification of environmental assets: biodiversity and function
- Use of conceptual models of ecosystem function
- Hypothesis-testing approach to knowledge gaps; informs monitoring strategy
- Criteria for condition assessment
- Independent peer review of assessments and flow recommendations

Paroster peelensis, a stygobitic dystiscid from the Peel Valley Alluvium, NSW

In summary

- GDE concept is useful, but we need to make use of ‘best available science
- Make environmental provision more systematic: ecological objectives in plans form the basis of research questions; hypotheses address research questions and guide the monitoring program
- Resources and capacity-building for monitoring
- Independent peer review of assessments and environmental water recommendations
- Collaborative, documented process
- Integration of water quality and water quantity management
- Linking with ecological ‘health’

Environmental provision for groundwater needs to be more systematic

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Thank you for your attention

The Central Condamine alluvium, a subsurface GDE