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# *Groundwater-dependent ecosystems: GDEs – just another acronym or do we really need to know?*

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*Transcript edited and summarised by Dr Peter Mitchell, Biolinks Alliance*

I'm a geologist by trade and then got into groundwater, with a PhD on degradation of springs. We didn't call them groundwater-dependent ecosystems then, but these springs had always been there as a natural part of the landscape. We've never really understood groundwater because we can't see it but we have an idea of ecosystems.

Policy around ground water is governed by "climate". In the 70s and 80s, water tables were rising, and the whole world was going to get flooded with dryland salinity; groundwater was a "threat". Then we had a drought and groundwater levels fell about 6-9 metres and we started seeing acid sulphate soils within rivers. We worried ecological impact of groundwater. Then we had a flood and everything was okay! Although the incredible wet years only replenished groundwater levels by about 30 or 40%.

**What are groundwater-dependent ecosystems?**

There's no set definition of groundwater - every state has a different definition of groundwater. So we went with the definition that a GDE is where any part of the lifecycle of anything relies on groundwater.

In 2004 the National Water Initiative started putting money towards GDEs in response to the drought and we built the GDE Atlas. This two year mapping project brought all the information we knew together. The Atlas gets regularly updated by state working committees. Victoria even has Ministerial guidelines on how and when to manage GDEs. All from something that didn't exist 20 years ago.

In the past, GDE policy was driven by the big springs in the Great Artesian Basin. But GDEs aren't always big springs and they don't always have really obvious critters. Cave and aquifer GDEs have little critters that live in the ground - the stygofauna. They're complex ecosytems, and in Tasmania they include the largest kind of yabby. Loggerhead turtle comes in touch with groundwater for a small part of their lifecycle. The groundwater keeps

the moisture of the beach sand high and this keeps the cavity of the egg chamber open. Groundwater extraction can dry out the dunes so egg chambers collapse.

In an ecological sense, GDEs are ecotones between groundwater and surface water - a bit like estuaries. Groundwater comes to the surface even in dry times and persists through time. For those reasons, GDEs are rich in life and are highly valued ecosystems.

But, from a policy point of view, one department manages groundwater and a different department manages the surface water. And that's really problematic.

**Risks to groundwater dependent ecosystems**

One risk to groundwater-dependent ecosystems is groundwater extraction. But there is also a connection between urbanisation and GDEs - changes in surface water management and urbanisation cause changes in the amount and quality of runoff, and these affect GDEs.

The Millennium drought was the perfect storm. We compared the flow along the Loddon River with rainfall and levels in a groundwater bores beside the river. During wet times, groundwater flows into the river for long periods of time. But, with climate change and groundwater pumping, the groundwater levels fall below the river and there is no groundwater flowing into the river. If you change the surface water flow and lower the groundwater in swamps, you can have a massive acid sulphate soil kill. One very large swamp was annihilated after they put a big drain around it. In this case, the surface water managers and groundwater managers weren't talking, with consequences for the environment.

But it's not always the obvious threats that are really important. In an area with growling grass frogs near Melbourne, chitrid fungus was persisting in groundwater discharge zones because groundwater is warmer and more saline than surface water. In a big development in the headwaters of the creek, the excess runoff was to be dumped into the creek. But that was going to make the creek cooler and less saline, and even less habitable for the growling grass frog. So our understanding of these things is complicated.

In another urban landscape, water levels in a drain lined with melaleucas and containing galaxia fish, the water level was dropping. And this was not groundwater pumping, it was urbanisation. Modelling of groundwater flows showed that another big industrial estate was severely reducing the recharge. Again, its not groundwater pumping but land use change – urbanisation - that's affected these ecosystems.

**The cultural connection**

We think we know a lot, and then realise that people have been thinking about GDEs for a very long time. There was an understanding among Aboriginal groups of the importance of stream refuges. The local mobs had rules and appreciation of groundwater – they already had a lot of knowledge around groundwater. When groundwater in the different aquifers is mapped in northern Australia, they take on the cultural values and link the Dreamtime

story into that modern style map. They treat the knowledge equally. Combining the two together is a really lovely way to discuss the importance of groundwater and ecosystems.

**Managing GDEs**

Why don't we call rivers "water-dependent ecosystems"? We just call them rivers. So why do we have this thing called GDEs? It's all really just water management.

In the past, GDEs were easy to manage because they weren't "there" in the landscape. We now have a GDE atlas and a national website. Now, when someone builds a new development - a road or a mine - and they're doing an Environmental Impact Statement, they have to check the maps and say if there is a GDE in the area. And then they have to prove that the map's wrong or go through the process of mitigation around that ecosystem.