Saving streams of the south-west forests

The streams of the south-west forests harbour a whole host of aquatic species and provide many environmental benefits. Yet these rivers are under threat from a drying climate. An eight-year study examined just what shape these waterways are in, and paved the way for their future protection.

by Melita Pennifold

People often hold a fascination for rivers and streams. These natural features offer somewhere to recreate, to seek solitude and to admire nature's beauty. They promote biodiversity, offer a whole array of environmental benefits, and aid agriculture, tourism and forestry. The rivers and streams of Western Australia's south-west forests are especially important, offering refuges for plants and animals in our dry state, particularly during the drier summer months. Further, forest streams usually have better water quality than streams in cleared areas, as the surrounding vegetation plays a vital role in preventing the rise of saline groundwater.

Yet these forest waterways and their inhabitants may be at risk from human-related pressures such as agriculture, tourism, forestry, water storage and recreation. Some of these activities may create disturbances in the catchment which change the hydrology and sediment processes. This in turn can affect conditions within a stream and therefore the animals that live in them.

To add to this pressure, over the past couple of decades the south-west has been experiencing a drier climate, which increases competition for water resources. Since the mid-1970s there has been a significant decrease in annual rainfall—about 10 to 15 per cent—and an associated, even larger drop in stream flow—up to 40 per cent. In some cases, streams which used to flow year round are now dry for several months. This has further increased concern over what may become of the rivers and streams in the south-west forests and their aquatic inhabitants.

Previous page
Main Blackwood River.
Photo – Alicia Dyson
Insets from left to right A diving beetle (*Necterosoma penicillatus*), mayfly (*Tasmanocoenis tillyardi*) and stonefly (*Newmanoperla exigua*).
Photos – DPaW Science Division

Above DPaW technical officer Kirsty Quinlan collecting samples.

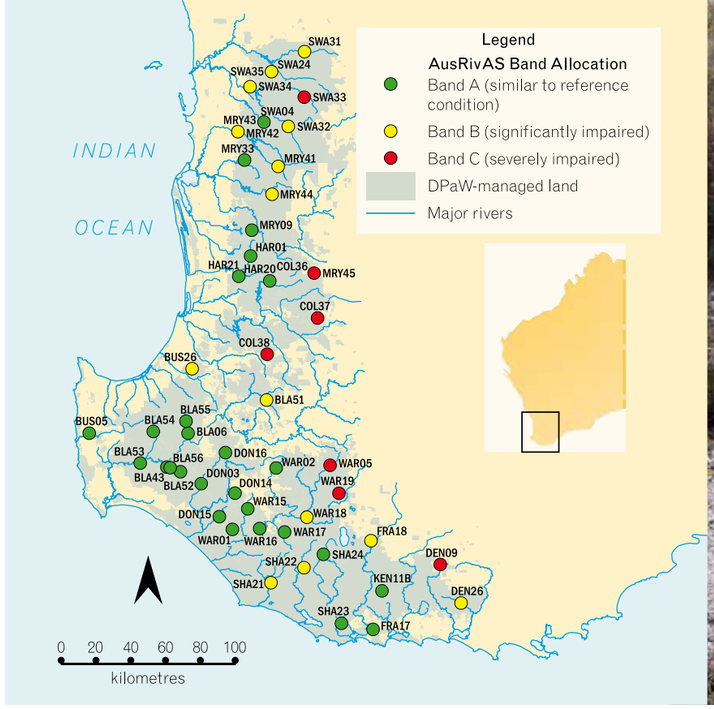
Below left Lefroy Brook.
Photos – Melita Pennifold/DPaW

The project

In 2005, the South-West Forest Stream Biodiversity Monitoring project was initiated to determine the health of aquatic invertebrate communities in forest streams. The ecological condition of the rivers and streams was assessed using the Australian River Assessment Scheme. The scheme focused on aquatic macroinvertebrates—creatures that can be seen with the naked eye— and includes all aquatic insects, worms, snails and crustaceans. Some of these animals spend only part of their life cycle in the water and have terrestrial adult stages—for example dragonflies, midges and mosquitoes—while others rely on the stream for their entire life cycle.

Macroinvertebrates are often used for biomonitoring in rivers as they are common, widespread and provide a good measure of a river's health. These animals respond to water conditions over a period of time, and a single period of adverse water quality during their life cycle may result in death and the absence of a species from a site. Some macroinvertebrates cannot tolerate polluted or disturbed streams while others thrive in degraded conditions. Therefore, the condition of a river or stream greatly affects the macroinvertebrate community.

Macroinvertebrates were sampled annually in spring at 51 sites located over a wide geographic area in the south-west of WA, including streams in catchments subject to a range of management activities such as timber harvesting, prescribed burns and maintenance of roads and tracks. Generally, sites were downstream of, rather than within, areas subject to timber harvesting and prescribed burns. This is because the aim was to monitor the broader effectiveness of forest management rather than local impacts. Sampling was conducted from 2005 to 2011 and spanned a wide variety of seasonal stream-flow conditions, including several very dry years. Findings were then compared to data obtained from minimally disturbed reference streams and assigned to 'bands' that reflect different ranges of biological condition, ranging from 'richer than reference' to 'extremely impaired', that is containing very few of the expected families.



Above Monitoring resulted in waterways being assigned Australian River Assessment Scheme (AusRivAS) bands, which reflected their state of health.

Above right Nile Creek during a dry winter in 2010.
Photo – Melita Pennifold/DPaW

Dry findings

This is the first study to monitor stream aquatic fauna over a long time period in such an expansive area of the south-west. The aquatic fauna in the streams was very diverse, with more than 295 species recorded from 116 families. Insects such as water beetles, dragonflies, caddisflies and midges were the most common and widespread fauna collected. The number of species collected for any particular site varied each year and was usually lower after a dry winter. Low rainfall over the study period resulted in some streams drying more frequently or having a shorter hydroperiod (the length of time water is retained). This reduces the chance of survival for some species, as they may not have time to breed. In 2010, a particularly dry year, a third of the sites were dry and in the following year the number of species recorded for most sites was reduced. In 2011, only three sites received an ecological band rating similar to reference condition. If the incidence of dry years continues to increase, streams will become more seasonal and there may be a change in fauna from river-type fauna, which like flowing water, to wetland-type fauna.

When averaged over the eight years, 27 sites were classed as 'similar to reference', 16 were 'significantly impaired' and eight were 'severely impaired'. No sites were classed as 'richer than reference' or 'extremely impaired'. While almost half of the sites appeared to be impaired, the level of impairment was not directly related to forest management activities. In most cases impairment could be attributed to low rainfall, naturally high salinity or acidity, or some other kind of local disturbance. Timber harvesting and prescribed burning generally had small and transient effects on stream biodiversity. Most of these impaired sites were in the northern jarrah forest north of Dwellingup or in the drier eastern forests.

Bushfires which occurred at two sampling sites did reduce the diversity and abundance of the stream fauna, but the fauna at these streams recovered after several years. However, the intensity of the bushfire seemed to determine how long recovery took—the more intense the fire, the longer the recovery. How dry the streambed is when a fire occurs may also determine how much the stream fauna is affected by the fire and how quickly it recovers.

Where to now?

This study shows that many streams and freshwater communities are under greater stress and risk of decline from a drying climate rather than current forest management activities. This places greater importance on managing catchments and groundwater to ensure the streams keep flowing. It is important to determine areas where aquatic communities are similar (bioregions) and areas where rare and endemic species occur. These data can then be used to assess if aquatic fauna are protected through the current conservation reserves. It is also important to identify and protect those habitats, streams and regions that can act as long-term refuges from drying to ensure future survival of aquatic communities.

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