

# Effects of bushfire on stream ecology

By Tom Nelson and Ann Milligan

*Bushfires, such as those that burnt catchments in southern Australia in January, cause major changes to terrestrial and freshwater ecosystems, but they offer not-to-be-missed opportunities to learn more about stream ecology.*

Bushfire disturbances are complex and alter stream ecosystem dynamics in many ways. Several effects could be observed only two months after fires had burnt-out large percentages of the natural bush catchments of rivers and streams such as the Cotter in ACT, the Ovens in Victoria and Pipers Creek in NSW (a tributary of the Snowy River). Monitoring has been quickly set up, as new growth sprouts across the catchment.

Few effects of bushfire act directly on the stream ecology at the time of the fire. A number of detrimental effects occur following rain after the event.

In regular monitoring visits since the fires in ACT, Tom Nelson, of the CRC for Freshwater Ecology and the University of Canberra, has found sediment blanketing



*A small tributary of the Cotter River, smothered by a shoulder-high bank of sand following an intense localised thunderstorm.*

*Photo: F Tingle*

the streambed of the Cotter River in places where there was an irregular rock and gravel bed before. Soil has been destabilised on the hillslopes by intense heat and the loss of plant roots during the fires, and thunderstorms since have washed it into the river. Other sediment has banked up nearby, poised to wash in if there is more heavy rain. Sediment clogs up the crevices and niches in the gravel and cobbles of a natural riverbed, destroying this habitat for a range of small creatures.

One obvious and unfortunate after-effect of the fires is fish death. According to newspaper reports<sup>1</sup>, tonnes of mud and ash had washed into the Ovens and Buckland Rivers in north-eastern Victoria by early or mid-March, threatening fish. Murray cod and golden perch were reported<sup>2</sup> dead at sites in the Murrumbidgee River in ACT in the weeks after the fires. The cause of fish death in these circumstances is usually lack of oxygen in the water. As bacteria in the stream-beds work to break down the influx of organic materials and ash, so the oxygen in the water gets used up and the fish suffocate. As further evidence of poor water quality, freshwater crayfish were seen walking out of the Buckland and Murrumbidgee Rivers.

After the fires, organic matter washed or fell into the streams in the form of ash, charred leaves and burnt overhanging woody debris. Where flow was naturally blocked by snags in the stream, charcoal and ash scums developed, floating two to three centimetres thick. Fine black ash accumulated in bulk deposits, in pools and other slow-moving areas. The ash has added to



*Black sediment was common in the Cotter River after the severe fires the month before. Photo: F Dyer*

sediment and filled-in the fine structure of the streambed. Our researchers are studying whether this insoluble carbon can be a food source for the visible stream organisms.

The bushfires in ACT and Kosciuszko National Park have burned right to the edges of streams such as the Cotter River, the Perisher Creek and the Thredbo River. With no leaves on the riverbank trees and shrubs, and only patches of overhanging grasses, the streams are open to the sunlight through much of the day. Water temperatures are likely to be higher as a result.

The extra light and higher temperatures, and the inputs of organic nutrients since the fires, are likely to alter the algal food resources in the water. Algae are at the base of the food chain and are a food source for macroinvertebrates (water insects and crustaceans). But grazing insects and larvae appear not to graze some of the algae that grow in well-lit conditions. Therefore changes in the algae may lead to different populations of macroinvertebrates. As these organisms are food for larger creatures such as fish, turtles and birds, the whole local food chain may be affected.

Although bushfires have marked impacts on freshwater ecosystems, streams usually return to pre-fire conditions within five to twenty years, depending on the severity of the fires. Meanwhile, for freshwater ecologists, the challenge is to better understand the links between post-fire inputs washed into the water, the freshwater food webs and the in-stream plant and animal assemblages.



*The fires in the Cotter River catchment burnt the vegetation right to the water's edge, exposing the water to sunlight all day long.*

*Photo: R Ogden*

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<sup>1</sup> *The Weekly Times*, 5 March 2003, 19 March 2003

<sup>2</sup> *Canberra Times*, 15 March 2003



*Pipers Creek, Kosciuszko National Park, pump station weir which was edged by dense alpine scrub before the January fires. Photo: C Lemann*