Effects of land-use on the response of stream macroinvertebrate communities to drought, fire and flood disturbance in the Lower Cotter Catchment.

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ABSTRACT

Land-use can have a significant influence on macroinvertebrate communities following natural disturbance events such as drought, fire and flood. The long-term response of macroinvertebrate communities to multiple disturbance types in nature is relatively unknown, because of our focus towards individual disturbance events. Of the studies conducted it is thought that the recovery by macroinvertebrate communities may be either longer or incomplete when catchments have been previously degraded by the effects of land-use disturbance or another disturbance event. In 2003, bushfires burnt through approximately 70% of land within the Australian Capital Territory (ACT), including areas within the Lower Cotter Catchment (LCC). Following the fires, in September 2010 and again in March 2011, flooding severely altered the physical characteristics of streams within the LCC. During the years of 1925-2006 many lower areas of the catchment were subject to commercial forestry practices such as the construction of access roads, and the seeding and logging of *Pinus radiata*. Although commercial forestry practices ceased in 2006 many lower areas of the catchment remain affected by the effects of the pine plantations and *Pinus radiata* are still a common feature within lower areas of the catchment. In addition to these disturbance events, during the years of 1999-2009 the LCC was also subject to severe drought conditions, which made many streams with the LCC susceptible to drying. This catchment having experienced multiple disturbances of drought, fire, flood and land-use provided an opportunity to study the effects of these disturbances on macroinvertebrate communities.

This study examines a long-term data set, collected by the Institute for Applied Ecology (IAE) Freshwater Ecology Laboratory (University of Canberra) between the years of 1994-2013, which takes into account these disturbance events. The objectives of this study were: 1.) to determine how stream macroinvertebrate communities responded to drought, fire and flood disturbance within the LCC and, 2.) to determine whether former forestry land-use affected how stream macroinvertebrate communities responded to drought, fire and flood disturbance within the LCC.

This study found that changes in stream flow caused by drought and flood had an overriding influence on macroinvertebrate community composition within the LCC. However, macroinvertebrate communities may be more resistant to drought than flood
because shifts in macroinvertebrate communities only occurred once stream flow ceased. Response by macroinvertebrate communities to fire in the LCC appeared to be taxa specific and was difficult to detect using multivariate analysis. Taxa which are sensitive to reduced water quality and scouring (e.g. Baetidae, Leptophlebiidae and Gripopterygidae) were absent in 2003, yet returned within two years of fire taking place. This indicates that macroinvertebrate communities are generally resilient to fire and will recover within two years after fire, but are less resistant to fire and that many sensitive taxa will either be absent or decline in abundance in the first year of fire taking place. Land-use disturbance had little, if any, effect on macroinvertebrate community composition within the LCC and land-use did not appear to affect how macroinvertebrate communities responded to drought, fire and flood within the LCC. However, this may have been caused by the spatial distribution of forestry land-use and native vegetation within the catchment, in combination with the long-term disturbance history of forestry land-use operating within the catchment.

This study provides evidence that further work is needed to examine the effects of multiple disturbances on macroinvertebrate communities. While single disturbances provide valuable insight into how macroinvertebrate communities may respond, there is a growing need for further exploration of multiple disturbance events to further our knowledge of how macroinvertebrate communities respond to disturbances.
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