

The effects of forest disturbance and recovery on water in Mediterranean eucalypt forests of southwestern Australia

Ning Liu

*CSIRO Environment, Canberra, Australia
Email: ning.liu@csiro.au*

Abstract: Impacts of wildfire on Mediterranean forests have been globally reported under climate change. The frequency and severity of fire have been more frequent since 2000 in the southwest of Western Australia (SWWA), a region with around 50,000 km² of natural regrowth eucalyptus forests. Wildfires could dramatically shift the forest's ecosystem functions, particularly as climate modelling suggests a drying trend. Therefore, this study comprehensively analyzed the impacts of a wildfire (The Northcliffe wildfire, on 28 January 2015) on vegetation structure and the forest recovery impacts on the water processes in a fully forested catchment (Weld River - Ordnance Rd Crossing, WR). The WR catchment was covered by 45% of eucalypt tall forest and 38% of eucalypt open forest and was 100% burnt during this fire.

Our results show that the severity of wildfire generally results in significant changes to vegetation structure and water processes, which may have long-lasting impacts on ecosystem functioning. By comparing with nearby undisturbed forests, we found that the coverage of photosynthetic vegetation and normalized difference vegetation index (NDVI) declined from 75% to 50% and from 0.8 to 0.6, respectively, after the fire, and it took about two years for the vegetation to recover. The open forest recovered about one year faster than the tall forest, while severely burnt forests generally took longer to recover than low to moderately burnt forests.

The wildfire disturbance resulted in up to a 40% decline in evapotranspiration of those forests, but it recovered quite quickly (about one year) due to the resprouting. The runoff coefficient of the WR catchment increased by 0.05 and 0.15 in the first and second year after the fire, respectively, due to the decrease in evapotranspiration; however, the streamflow returned to the pre-fire condition in the third/fourth year. Overall, our results suggest that the severity of wildfire can have significant impacts on vegetation and water processes, but these impacts may diminish within five years due to the rapid recovery of eucalypt forests.

Keywords: *Wildfire, drought, forest disturbance, forest recovery, streamflow*