EGU21-7023
https://doi.org/10.5194/egusphere-egu21-7023
EGU General Assembly 2021

Stand dynamics and species composition control long-term post-fire trends in evapotranspiration and streamflow from South-eastern Australia's Temperate Eucalyptus forests

Assaf Inbar[1], Richard Benyon[1], Patrick Lane[1], Shyanika Lakmali[1], Shane Haydon[2], and Gary Sheridan[1]
[1]The University of Melbourne, Faculty of Science, School of Ecosystems and Forest Sciences, Parkville, Australia (assaf.inbar@unimelb.edu.au)
[2]Melbourne Water Corporation, 990 La Trobe St, Melbourne, VIC 3008, Australia

Most of the water that ends up in Melbourne's water supply catchments originates from wet Eucalyptus forests that are dominated by Eucalyptus regnans, the tallest known angiosperm on earth. Studies had shown that catchments that are dominated by these forests can experience a significant long-term (>100 years) reduction in streamflow after a stand-replacing fire, which was attributed to higher water-use of the dense overstory regrowth. However, despite several lines of evidence, the direction, extent and duration of post-fire hydrological behaviour vary significantly between catchments and between fire events. Here we propose that this variability is caused by initial stocking density and species composition after the fire, and the climatic conditions that prevail during forest regeneration that affect tree growth and mortality rates. In order to test the hypothesis, we formulated an ecohydrological model that simulates hydrology, growth and forest dynamics of E. regnans and Acacia dealbata, which are known to compete for resources during the initial stages of vegetation recovery. The new model shows high skill in predicting long-term streamflow when compared to observations using multiple sources of data. Simulation analysis shows that the direction, extent and duration of post-fire hydrological behaviour are sensitive to initial stocking density and to the relative abundance of species that regenerate after the fire, which influence the rate of self-thinning during stand development. Furthermore, simulation results show that the observed long-term reduction in streamflow is less likely to occur when the forest would have been less dense before the fire, which theoretically could only occur when a high proportion of the short-lived A. Dealbata regenerated after the previous fire. This highlights the importance of including mechanisms that control the effect of species composition on forest dynamics when modelling the effect of possible future climatic scenarios on water yield.