FIRE IN THE LANDSCAPE

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INTRODUCTION

This three year research project has focused on three key issues for land management agencies – reducing the risk of catastrophic wildfires in forests through the use of prescribed burning while delivering high quality water and maintaining ecosystem carbon balances. Carbon storage and delivery of water are clearly recognised as economically important ecosystem services and both are significant areas of research for Australian forests.

Most of the water supplied to major cities is sourced from high-rainfall forested catchments. Fire directly and indirectly affects water yield and, after an initial increase, may be reduced by up to 50% of pre-fire levels for several decades.

Similarly, it has been estimated that each of the recent landscape-scale fires in 2003 and 2006-7 in southern Australia released an amount of CO_2 equivalent to nearly 50% of the net annual emissions for 2006.

It is imperative that we understand the impact of fire management practices on these two important ecosystem services.

EDUCATION

The research projects currently support six PhD students. Research has also been incorporated into undergraduate and postgraduate courses by both participating universities.

MAJOR PROJECT OUTPUTS

PROJECT 1 – Environmental impacts of prescribed and wildfire – emissions management
Researchers: Liubov Volkova and Chris Weston, University of Melbourne

1. Volkova L, Weston C (2013) Redistribution and emission of forest carbon by planned burning in *Eucalyptus obliqua* (L. Herit.) forest of south-eastern Australia. *Forest Ecology and Management* **304**, 383-390.
2. Volkova L, Weston C. Impact of fuel reduction burning on carbon balance in *Eucalyptus* forests of south-eastern Australia, Mega Fire Reality Conference, Tallahassee, USA, November 2011.
3. Volkova L, Weston C (2012) Environmental impacts of prescribed and wildfire – emissions management. **Bushfire CRC Fire Note Issue 96**.

PROJECT 2 – Greenhouse gas emission from fire and their environmental effects
Researchers: Malcolm Possell and Tina Bell, University of Sydney

4. Possell M, Bell TL (2013) The influence of fuel moisture content on the combustion of *Eucalyptus* foliage. *International Journal of Wildland Fire* (in press).
5. Bell TL, Stephens SL, Moritz MA (2013) Short-term physiological effects of smoke on wine grapevine leaves. *International Journal of Wildland Fire* (in press).
6. Possell M, Bell TL (2012) The influence of whole plant water availability on combustion of *Eucalyptus* foliage. Proceedings of the AFAC/Bushfire CRC 2012 Conference Science Day, RP Thornton, ed. Bushfire CRC, Victoria.
7. Possell M, Bell TL (2013) Smoke composition and the flammability of forests and grasslands. **Bushfire CRC Fire Note Issue 110**.

PROJECT 3 – Fires and hydrology of south-eastern Australian mixed-species forests
Researcher: Tarryn Turnbull, University of Sydney

8. Buckley TN, Turnbull TL, Adams MA (2012a) Simple models for stomatal conductance derived from a process model: cross-validation against sap flux data. *Plant, Cell and Environment* **35**, 1647-1662.
9. Buckley TN, Turnbull TL, Pfautsch S, Gharun M, Adams MA (2012b) Differences in water use between mature and post-fire regrowth stands of subalpine *Eucalyptus delegatensis* R. Baker. *Forest Ecology and Management* **270**, 1-10.
10. Gharun M, Turnbull TL, Adams MA (2013a) Validation of canopy transpiration in a mixed-species foothill eucalypt forest using a soil–plant–atmosphere model. *Journal of Hydrology* **492**, 219-227.
11. Gharun M, Turnbull TL, Adams MA (2013b) Stand water use status in relation to fire in a mixed species eucalypt forest. *Forest Ecology and Management* **304**, 162-170.
12. Turnbull TL, Barlow AM, Buckley TN, Gharun M, Adams MA. Canopy re-establishment and leaf physiology of resprouting eucalypts explain increases in vegetation water use after wildfire. IAHS ICCE Conference, Wildfire and Water Quality, Banff, Canada, June 2012.

PROJECT 4 – Quantifying risk of water quality impacts from burned areas
Researchers: Petter Nyman, Gary Sheridan and Pat Lane, University of Melbourne

13. Nyman P, Sheridan GJ, Lane PNJ. Post-fire response models and their applications in hazard prediction and land management. *Progress in Physical Geography* (submitted for review).
14. Jones OD., Nyman P and Sheridan GJ. Modeling the effects of climate change on extreme erosion events in forests. Stochastic *Environmental Research and Risk Assessment* (submitted for review).
15. Nyman P, Sheridan GJ, Moody JA, Noske, PJ, Lane PNJ, Smith HG. Sediment availability on burnt hillslopes. *Journal of Geophysical Research* (submitted for review).
16. Nyman P, Sheridan GJ, Smith HG, Lane PNJ. Modelling the effects of surface storage, macropore flow and water repellency on infiltration after wildfire. *Journal of Hydrology* (submitted for review).
17. Jones OD, Nyman P, Sheridan GJ (2011) A stochastic coverage model for erosion events caused by the intersection of burnt forest and convective thunderstorms. Proceedings of the 19th International Congress on Modelling and Simulation, Perth, December 2011.
18. Nyman P, Sheridan, GJ, Jones, OD, Lane PNJ (2011) Erosion and risk to water resources in the context of fire and rainfall regimes. Proceedings of the AFAC/Bushfire CRC 2011 Conference Science Day, RP Thornton, ed. Bushfire CRC, Victoria.
19. Cawson J, Sheridan GJ, Smith HG and Lane PNJ (2011) The effect of prescribed fire severity and burn patchiness on runoff and erosion. Proceedings of the AFAC/Bushfire CRC 2011 Conference Science Day, RP Thornton, ed. Bushfire CRC, Victoria.
20. Lane PNJ, Sheridan GJ, Noske PJ, Sherwin CB, Costenaro J, Nyman P, Smith HG (2011) Fire effects on forest hydrology: lessons from a multi-scale catchment experiment in SE Australia, Workshop Proceedings XXV IUGG General Assembly, Melbourne, July 2011.
21. Sheridan GJ. Fires, storms, and water supplies: modelling the post-fire window of hydrologic risk. IAHS ICCE Conference on Wildfire and Water Quality, Banff, Canada, June 2012.
22. Nyman P (2012) Erosion risk to water resources in fire and rainfall regimes. **Bushfire CRC Fire Note Issue 90**.

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