

Fire in the Landscape

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Overview

Four research areas:

- 1. Carbon above ground - Atmospheric carbon emissions
- 2. Carbon below ground - Soil carbon formation
- 3. Water quality
- 4. Water quantity

1. Carbon above ground

**“Greenhouse gas emissions
from fire and their
environmental effects”**

University of Sydney

Tina Bell

Research aims

- To develop our knowledge on the impacts of planned and unplanned fire on the forest carbon pool (where does the carbon go) - GHG emissions and the carbon balance of forests
- To determine how GHG emissions affect growth of native forests and surrounding agriculture
- To provide guidelines for how best to manage prescribed fires to minimise ecological and economic impacts

Research update

Recent work:

- Identification of GHG emissions from three widespread *Eucalyptus* species and a number of grasses under defined combustion conditions and fuel moisture content

Next important steps:

- Identification of GHG emissions from different forest fuel types (bark, litter, green leaves) under defined combustion conditions
- Development of an emissions model incorporating fuel moisture content and fuel type

2. Carbon below ground

“The impact of fuel reduction burning on forest carbon storage”

Chris Weston & Luba Volkova, University of Melbourne



Research Questions?

- What are the impacts of prescribed fire on the C balance in soil, litter and vegetation in forests? How does this change over time since fire?
- How does organic matter in the surface and upper soil layers change after prescribed burning?
- How are rates of carbon turnover affected by prescribed fire?
- How can we predict the likely net CO₂ release from a planned fire? What is the C “cost “ of planned fire?

Research update

Recent work:

- Identification of carbon pools (soil, litter and vegetation) before and after prescribed burning in mixed-species forests in Victoria and Tasmania
- Modeling of carbon losses from these forests

Next important steps:

- Looking at components that make up carbon pool
- Measurement of carbon emissions after burning

3. Water Quality

“Quantifying water quality risks following wildfire”

Gary Sheridan, Petter Nyman & Patrick Lane, University of Melbourne



Research Questions?

- What is the likelihood of extreme erosion events and debris flows following planned and unplanned fires?
- What is the relationship between burn severity and the probability of water quality impacts?
- Through planned fire, can we reduce the risk of adverse water quality outcomes associated with wildfire?
- Can we develop tools to predict the likelihood of extreme erosion before implementing a planned fire?

Research update

Recent work:

- Developed methods for measuring debris flows (occurrence, magnitude).
- Historical documentation of frequency and magnitude of extreme erosion events to determine water quality impacts.

Next important steps:

- Utilise aerial photographs and ground-truthing to predict likelihood of erosion events occurring.
- Improve relationships of water quality with burn severity and hill slope hydrology

4. Water Quantity

“Fires and hydrology of mixed-species forests in Victoria”

Tarryn Turnbull, University of Sydney

Background

- Water yield from forested catchments is tightly coupled to vegetation water-use
 - e.g. 5% change in vegetation water-use may result in 20% reduction in streamflow

Research Questions?

- What is the water use in re-sprouting mixed-species forests following planned and unplanned fire?
- Can we predict future tree water-use in regenerating mixed-species forests?
- Can we refine the existing model to predict water use in regenerating mixed species forests for a range of species, soils and topographical microclimates?

Research update

Recent work:

- Four sites instrumented to continuously log tree water use
- Monthly measurements of leaves to assess variation in water-use within the changing canopy and leaf type (since April 2010)

Next important steps:

- Field work to look at features affecting tree water-use
- Controlled experiments to look at water use with various leaf characteristics – refine the model

SUMMARY

Bringing it all together

- Common sites, students, data, stakeholders and outcomes
 - eg, greenhouse gas emissions from fuels from mixed-species forest in NE Victoria
- Preliminary work well underway
- Stakeholders engaged in ACT, NSW, Victoria
- Postgraduate students onboard

PHD STUDENT PROJECTS

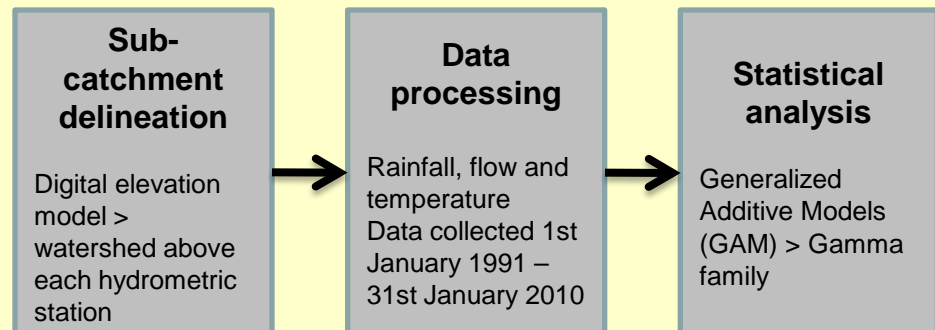
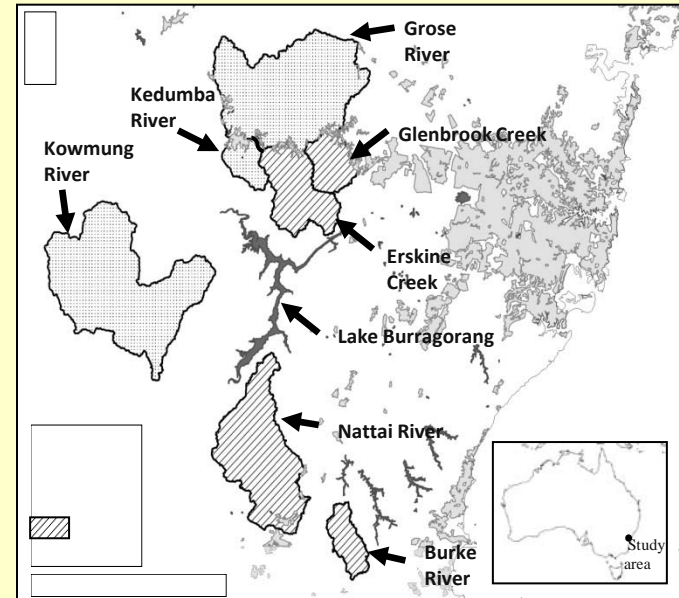
WILDFIRE IMPACTS ON HYDROLOGY WITHIN SYDNEY'S DRINKING WATER SUPPLY CATCHMENTS

Student: Jessica Heath

Commenced: March 2010

End User: NSW Parks and
Wildlife Service

Aim: To determine if summer
wildfires in 2001-2002
have had an impact on the
post-wildfire water yield



PHD STUDENT PROJECTS

EFFECT OF SMOKE FROM BUSHFIRES ON PLANT PHYSIOLOGY

- Student: Vicky Aerts
- Commenced: October 2010
- End User: Forests NSW
- Aim: To analyse the effect of smoke from prescribed burning and bushfires on agricultural and native plant physiology



PHD STUDENT PROJECTS

IS ALIEN PLANT INVASION A THREAT TO BURNING OF AUSTRALIAN FORESTS?

Student: Felipe Aires

Commenced: March 2011

End User: ACT Parks and
Conservation Service

Aim: To predict and test changes in
fuel accumulation and fire
behaviour in forests of eastern
Australia caused by invasion by
woody weeds



PHD STUDENT PROJECTS

DO WOODY LEGUMES USE FLAMMABILITY TO PROMOTE THEIR PERSISTENCE?

Student: Valerie Densmore

Commenced: March 2011

End User: Forests NSW

Aim: To investigate the interaction of
fire, soil nutrient status and
occurrence of woody legumes



PHD STUDENT PROJECTS

RECOVERY OF SOIL CARBON AND NITROGEN IN *EUCALYPTUS DELEGATENSIS* FOREST FOLLOWING WILDFIRE

Student: Hari Ram Shrestha

Commenced: late-2011

End User: ACT Parks and
Conservation Service

Aim: To understand processes
involved in recovery of soil
nitrogen and carbon after
landscape-scale wildfire



PHD STUDENT PROJECTS

QUANTIFYING WATER QUALITY RISKS FOLLOWING WILDFIRE

Student: Rene Van Der Sant

Commenced: mid 2011

Aim: To determine the sensitivity of
landscapes to extreme erosion
events

