POST-FIRE HYDROLOGICAL EVENTS AS NATURAL HAZARDS

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Background: Hydrological processes in burnt catchments can have adverse impacts on water quality, infrastructure and can pose a direct threat to communities and dwellings situated in within a critical 'impact zone'. Impacts can occur through large erosion events, destructive debris flows and/or flash floods (see examples below). The hazard is a measure of the frequency and magnitude with which impacts occur.

Post-fire erosion events are often localized and confined to steep upland areas, but the impact on water quality can be detected a long distance downstream.

Events can be very destructive when roads or other infrastructure intersect with stormy weather in burnt and steep catchments. Some catchments represent higher risk than others. Photo: Adrian Murphy

Communities can be directly exposed to flash floods and debris flows. Information on hazard improves preparedness and warning procedures in the case of approaching storms. Photo: Jodie Halliwell

Key questions: Which areas (or landscape units) represent the highest risk and should be prioritized in post-fire rehabilitation and emergency response procedures? What is the magnitude of the risk after a wildfire vs. prescribed fire? Under what rainfall conditions will catchment produce a dangerous response?

This overall *research objective* is to better understand and predict hazards given landscape-scale interactions between burn impacts and catchment properties. The *outcomes* will help inform land and fire agencies about the magnitude of risk in different parts of the landscape for a range of burn scenarios.

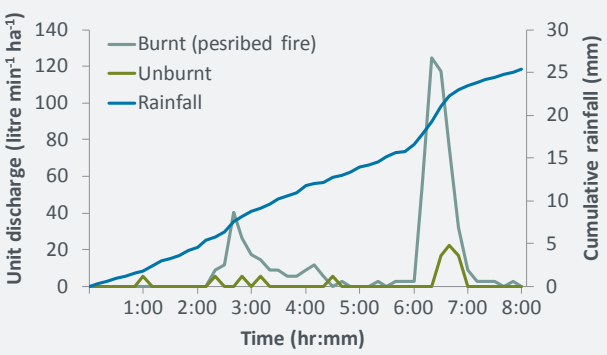
Research approach: Variability in post-fire responses is a function of i) hydrological transfer processes within a catchment and ii) rainfall variability between catchments. Measurements must therefore consider the different scales at which hazards operate. In this project we quantify fire-effects at a catchment (process) level and at a regional (response) level:

1. Catchment monitoring – a single response unit

AIM: To characterise landscape units in terms of the runoff and erosion properties which underlie the hazard

a)

b)



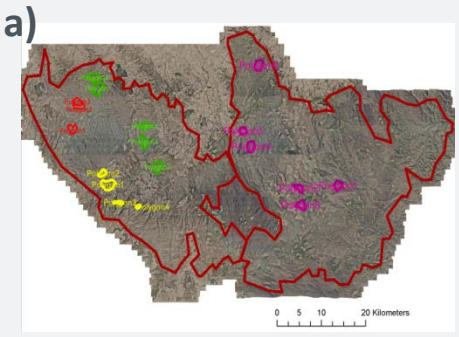
a) *Instrumented catchments capture interactions between landscape properties and fire severity as drivers of variability in post-fire response potential. Wildfire, prescribed fire and unburnt 'treatments' are monitored.*

b) *Runoff and erosion responses can be compared during the recovery period. Data contributes to model development and understanding of processes.*

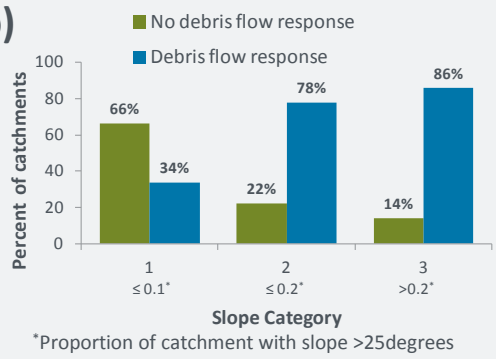
2. Regional based debris flow mapping – multiple response units

AIM: To measure the effect of landscape-fire-storm interactions on spatial variability in post-fire erosion responses

a)



b)



a) *Aerial imagery from the 2009 fires in Victoria is being used to map the location and magnitude of post-fire debris flow events. The probability of the events occurring can be quantified as a function of landscape properties, burn severity and rainfall.*

b) *Catchment slope as an example of a landscape factor which influence the occurrence of debris flow. Steep terrain = higher proportion of debris flow producing catchments.*

Future outputs: Process based research in single catchments provide parameters for quantifying the potential for a catchment to generate a response. This information can be coupled with landscape scale response measurements to develop prediction of what type of events may happen in the future and where they are most likely to occur. Linking site specific process research with landscape response require new models which take into account the fire-landscape-storm interactions. Once validated the model outputs can be used to map areas of high risk. This risk can be quantified in post-fire emergency response situations or over time as function of different fire regimes.

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