



QUANTIFYING WATER QUALITY RISKS FOLLOWING FIRE

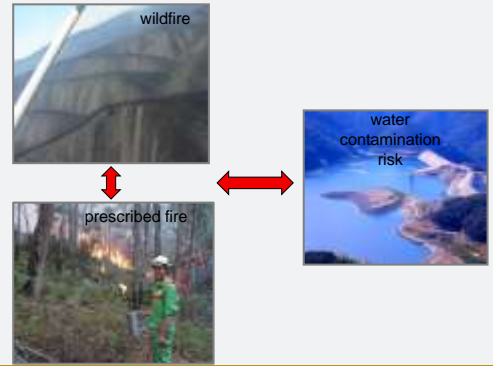
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United States Geological Survey, Golden, Colorado, USA.



CONTEXT




TODAY'S TALK



2011-2012 research activity;

1. Black Saturday Air Photo (AP) analysis
2. Instrumented research catchments
3. Germ-grain model development



WHY DO WE CARE ABOUT POST FIRE DEBRIS FLOWS?



Normal erosion event after fire



Post-fire debris flow






Will the video work??




www.tuaf.ch




POST-FIRE DEBRIS FLOWS



Where will they occur?

How big will they be?

How common are they?



1ST ATTEMPT BACK IN 2008.....



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IDENTIFYING FEATURES



Deep linear scour lines to bedrock



Large fans of deposited rock



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2ND ATTEMPT....



Airphoto mosaic
March 2009

Feb 2010

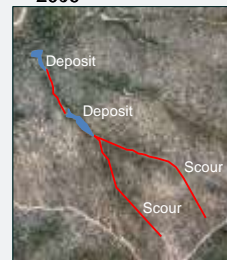
- ca. 400,000ha burnt, >80% forested
- Air photo mosaic 1 year apart

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AIRPHOTO IDENTIFICATION OF POST FIRE DEBRIS FLOWS



Stanley– March
2009



100 m

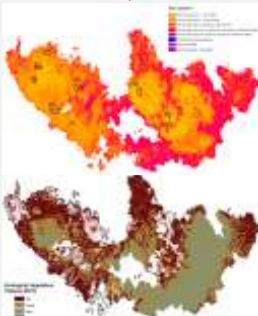
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HOW DO WE KNOW AIRPHOTO INTERPRETATION IS CORRECT?



Kilmore Murrindindi
Complex

Mudgegonga Beechworth
Complex



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FIELD MAPPING OF POST FIRE DEBRIS FLOWS

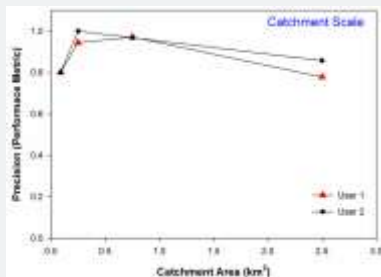


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PRECISION OF AIR PHOTO ANALYSIS



$$\text{Precision} = \frac{\text{True Positive}}{\text{True Positive} + \text{False Positive}}$$



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POST-FIRE DEBRIS FLOWS



Where will they occur?
How big will they be?
How common are they?

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TODAY'S TALK

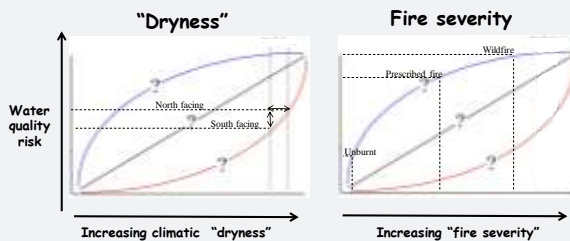


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INSTRUMENTED CATCHMENTS

Exploring risk factors



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INSTRUMENTED CATCHMENTS

Exploring the "window of risk"



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INSTRUMENTED CATCHMENTS



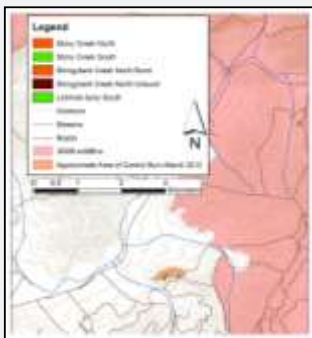
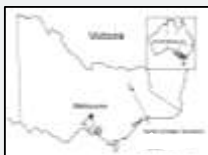
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INSTRUMENTED FIELD CATCHMENTS



Method

- 2 levels of "dryness"
- 3 levels of fire severity
- other variables constant
- in-situ field instrumentation
- runoff and erosion
- 3-6 years of measurement



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TREATMENTS/FACTORS



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Vegetation recovery



North facing (drier)

South facing (wetter)

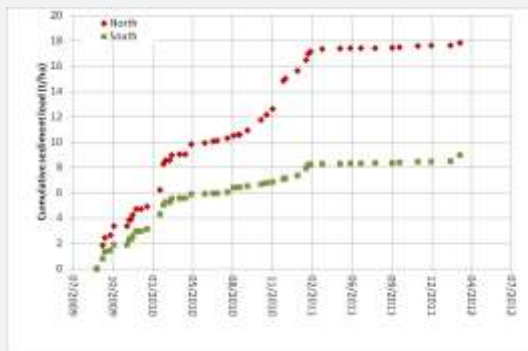


North 33 months (November 2011)

South 23 months (January 2011)

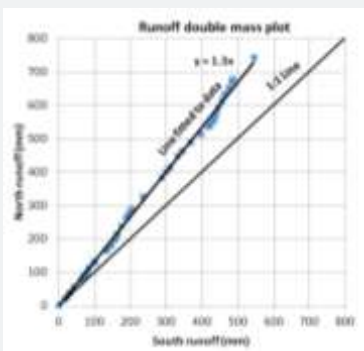
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EROSION DIFFERENCE NORTH V SOUTH



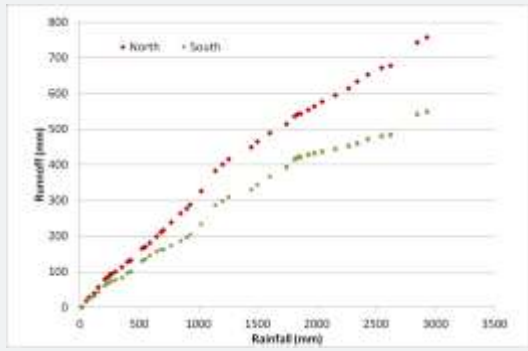
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RUNOFF DIFFERENCE NORTH V SOUTH

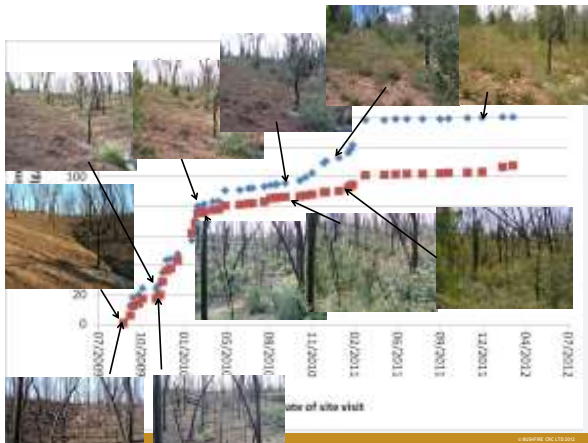


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RUNOFF DIFFERENCE NORTH V SOUTH



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PRESCRIBED FIRE CATCHMENTS

To be continued...



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MODELING POST FIRE DEBRIS FLOW RISK

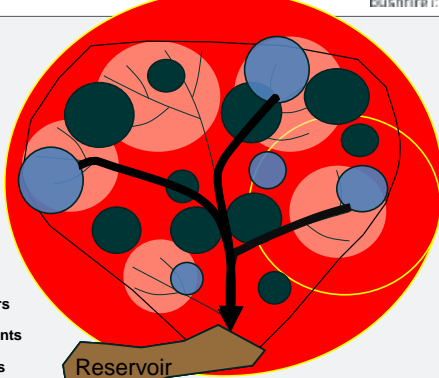


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"EPISODIC PATCHES OF ACTIVITY"



Year 8



- Headwaters
- Storm events
- Fire events

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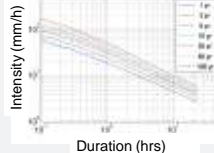
Rainfall



Frequency, Intensity, Storm Size

DATA

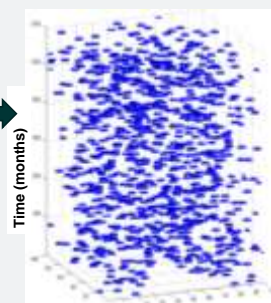
Intensity, frequency, duration



Radar Data



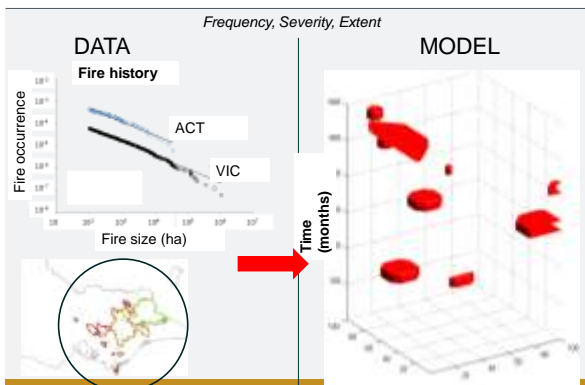
MODEL



Time (months)

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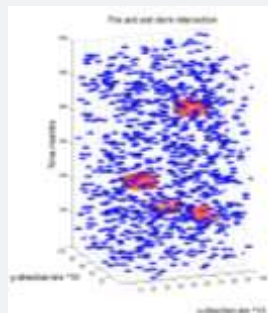
Fire



GERM-GRAIN MODEL...



DEBRIS FLOWS OCCUR WHERE HIGH INTENSITY FIRES AND STORMS INTERSECT WITH SUSCEPTIBLE CATCHMENTS



$$E[A] = \int \int (1 - e^{-\lambda_f(x)}) (1 - e^{-\lambda_s(y)})$$

In order to use this model, need to know...

1. Rainfall thresholds
2. The frequency of rainfall > thresholds
3. The frequency of fires
4. The size of storms and fires

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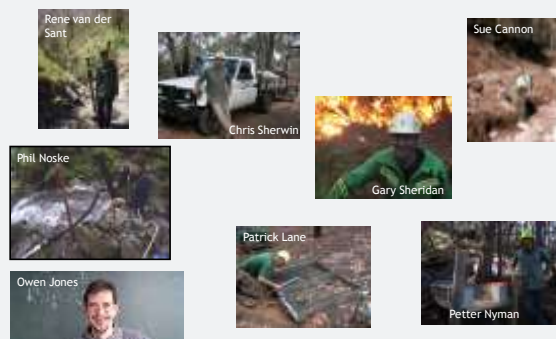
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THANKS



Email: sheridan@unimelb.edu.au

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END

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