Wildfires - when & where do they occur and how quickly do they grow?

An international approach

Matt Plucinski (& Jim Gould, Mike Wotton, Lachie McCaw)

4 October 2012

ECOSYSTEM SCIENCES / CLIMATE ADAPTATION FLAGSHIP
www.csiro.au

Natural Resources Canada | Ressources naturelles Canada
Canadian Forest Service | Service canadien des forêts

Department of Environment and Conservation
Our environment, our future

CSIRO
bushfire CRC

Outline

- Background
  - Black Saturday
  - Knowledge gaps
- Fire occurrence case study (SW Western Australia)
  - Aims
  - Influential factors
  - Preliminary results
  - Future work
- Fire growth
  - Factors contributing to acceleration
  - Practical applications
- Concluding remarks

Background

Black Saturday (7 February 2009)

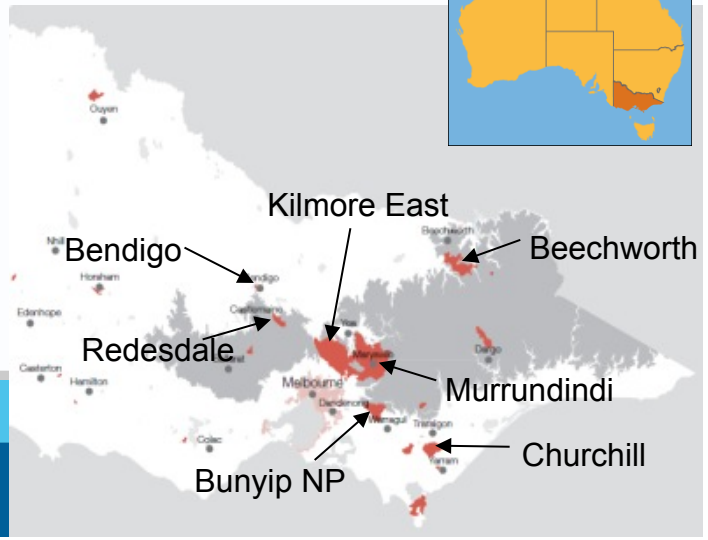
- Worst fires in Australia's history
  - 173 people died in 5 fires
  - > 2000 houses destroyed
  - Worst fire weather on record
- Royal commission
- Changes to all fire agencies across the nation
- Research projects
  - Including:

    Fire danger

    Fire occurrence

    Fire behaviour – spotting

    – **fire growth** / transition



Background

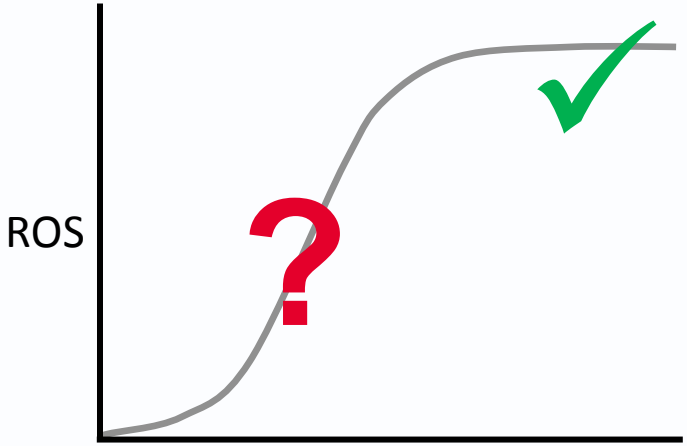
Gaps in our (Aussie) knowledge

Fire occurrence

- When and where are fire outbreaks likely to occur?
  - Is a given day likely to have any fires?
  - If so how many?
  - What parts of the landscape are most prone to ignitions?
- Significant amount international research, but not Australia
  - Regional problem – effect of local environmental conditions & culture

Fire growth

- How long does it take for a fire to develop?
  - To quasi-steady rate of spread
  - To a size that is beyond normal initial attack

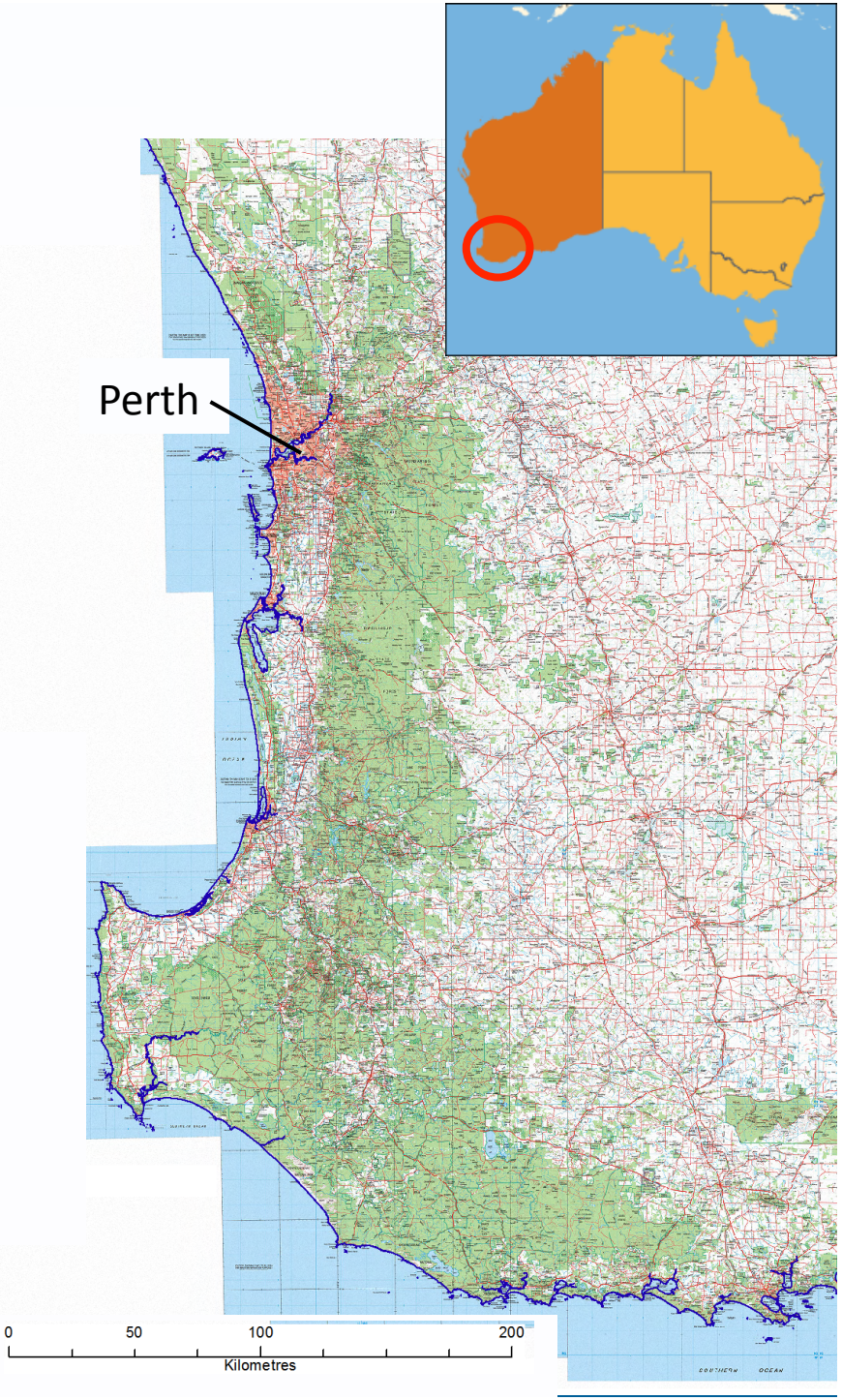


Fire Occurrence

Case Study: SW Western Australia

Aims

- Determine spatial & temporal factors
- Model probability of a fire day
- Develop spatial ignition risk models
- Investigate the application of fire occurrence model outputs for suppression planning and resourcing
- *Collaborate*



Fire Occurrence

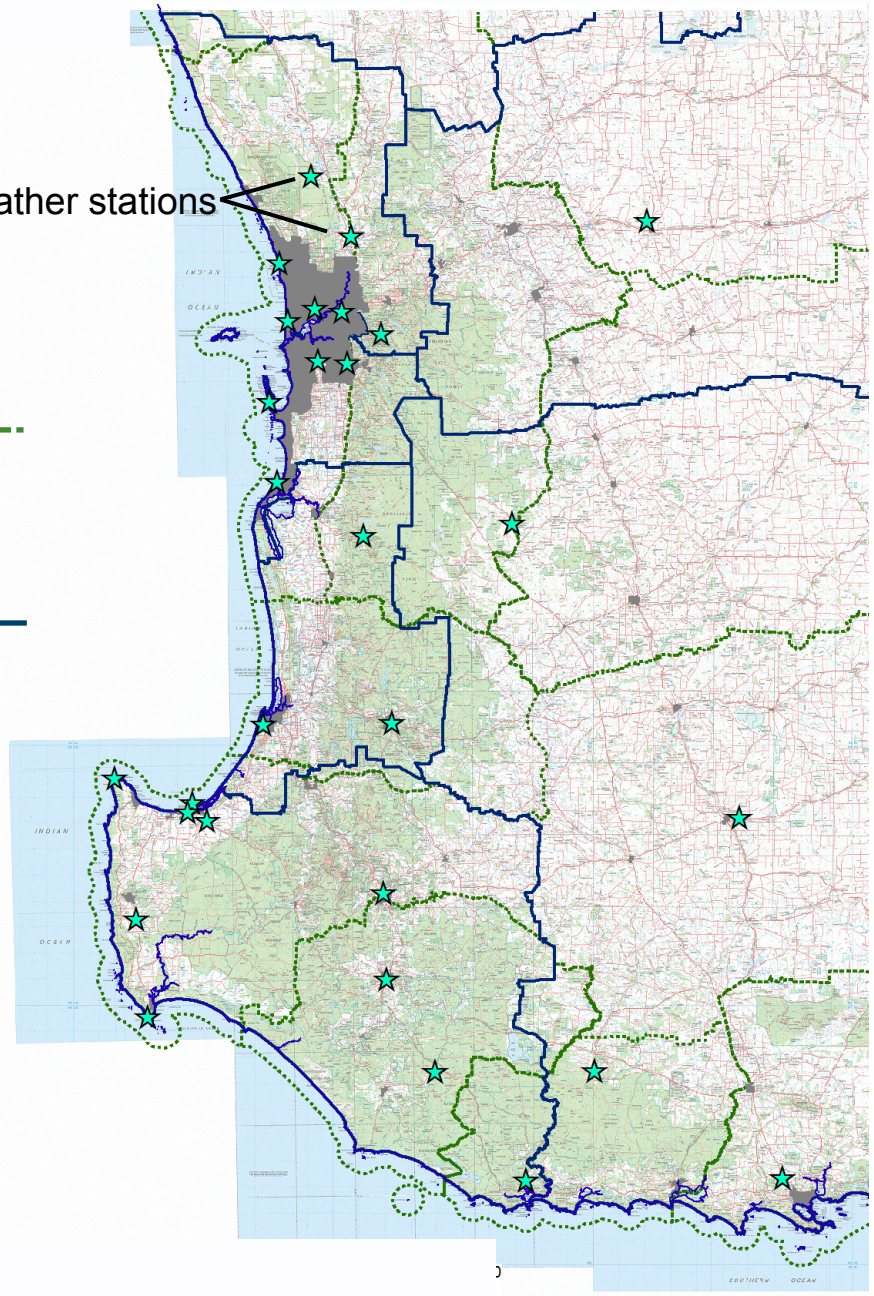
Case Study: SW Western Australia

- Environmental conditions
- Two fire suppression agencies

Department of Environment and Conservation
Our environment, our future

FESA
Fire & Emergency Services Authority of Western Australia

- Data availability

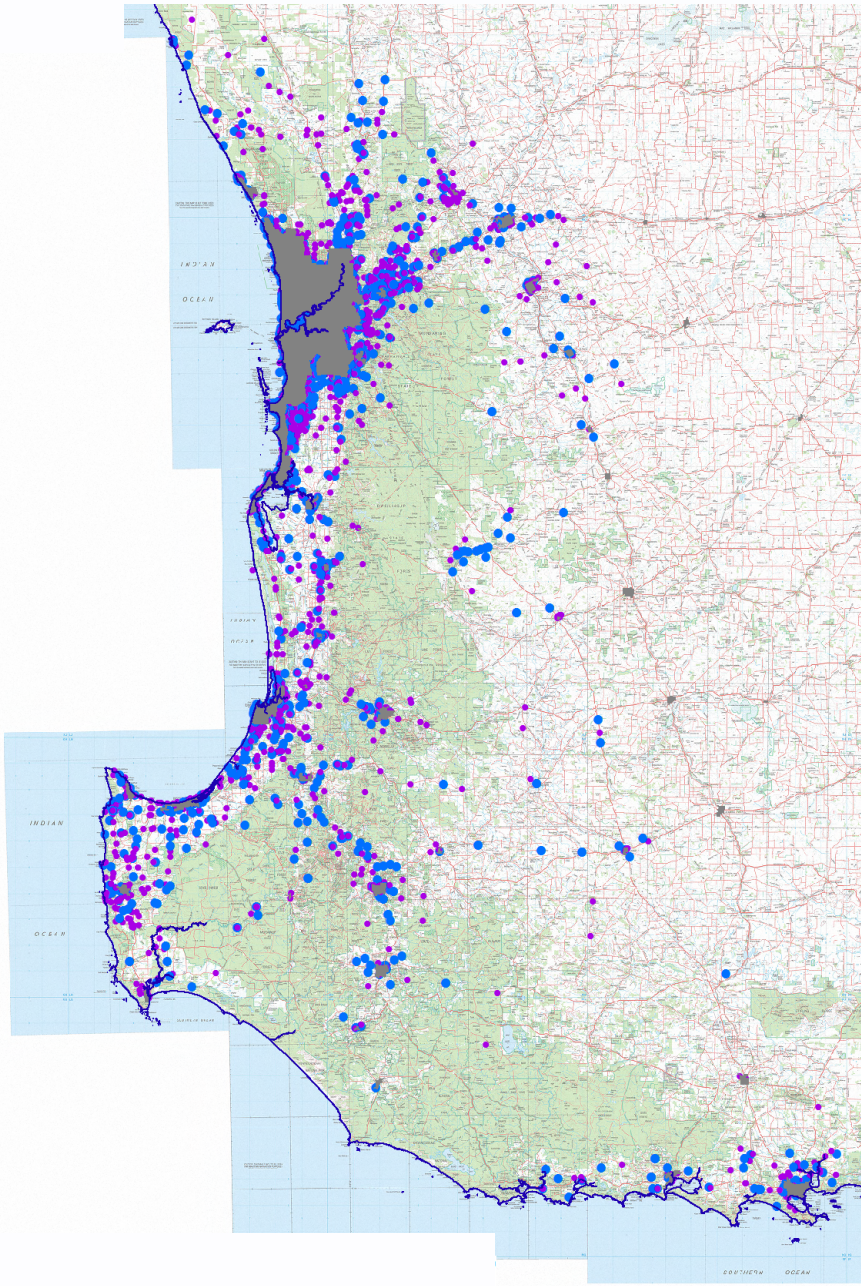


Fire Occurrence

Case Study: SW Western Australia

Spatial trends

• Lightning	6.5 %
• Deliberate (arson)	34.5 %
Accidental	23.9 %
Other	15.5 %
Unknown	19.5 %



Fire Occurrence

Case Study: SW Western Australia

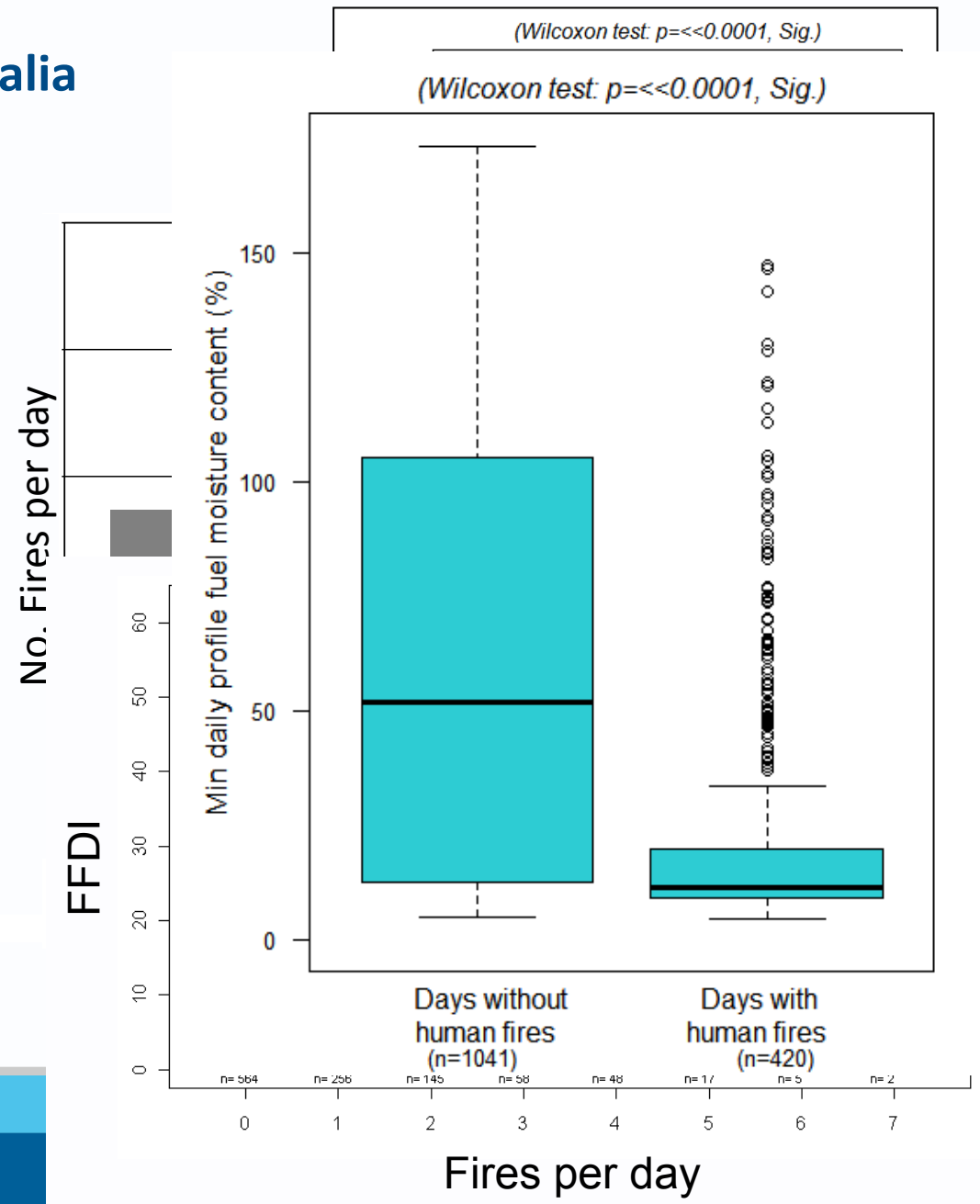
Temporal relationships

- Day of week
- Type of day

Weather relationships

- Forest fire danger index
- CFWI
- Fuel moisture content

All human caused bushfires
example from DEC Swan Coastal district

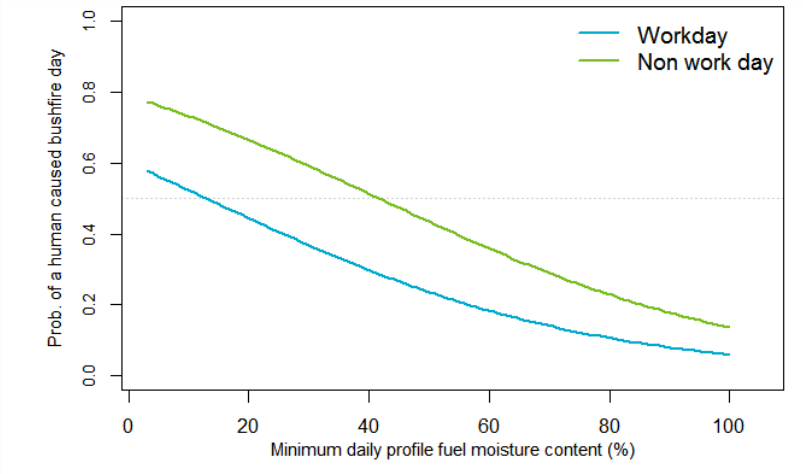


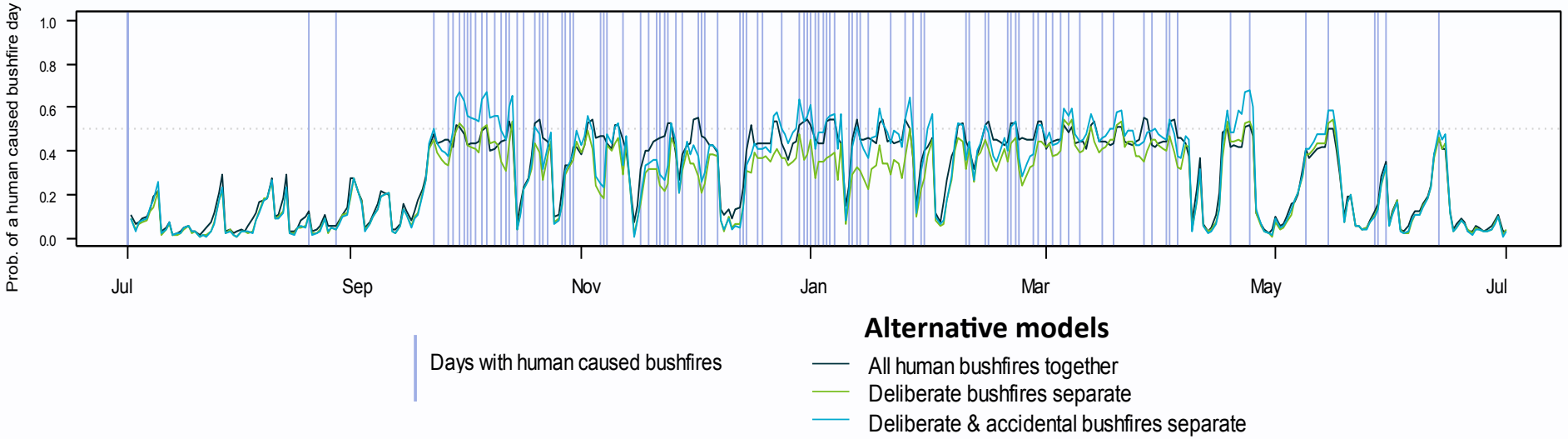
Fire Occurrence

Case Study: SW Western Australia

Modelling probability a human caused fire day

- Fuel moisture content (%)
- Work day (0,1)





Fire Occurrence

Case Study: SW Western Australia

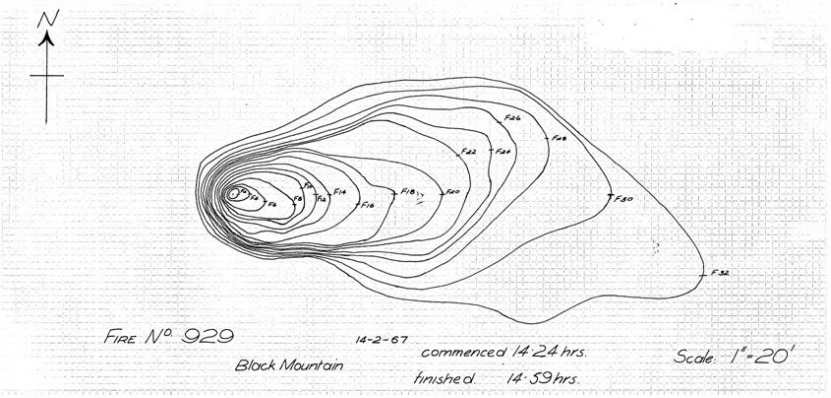
- Future work
  - Currently developing models for fire management regions
    - Probability of a fire day
    - Number of fires per day
  - Spatial patterns/ model

  - Analysis looking at both temporal and spatial variables

Fire growth

This project deals with:

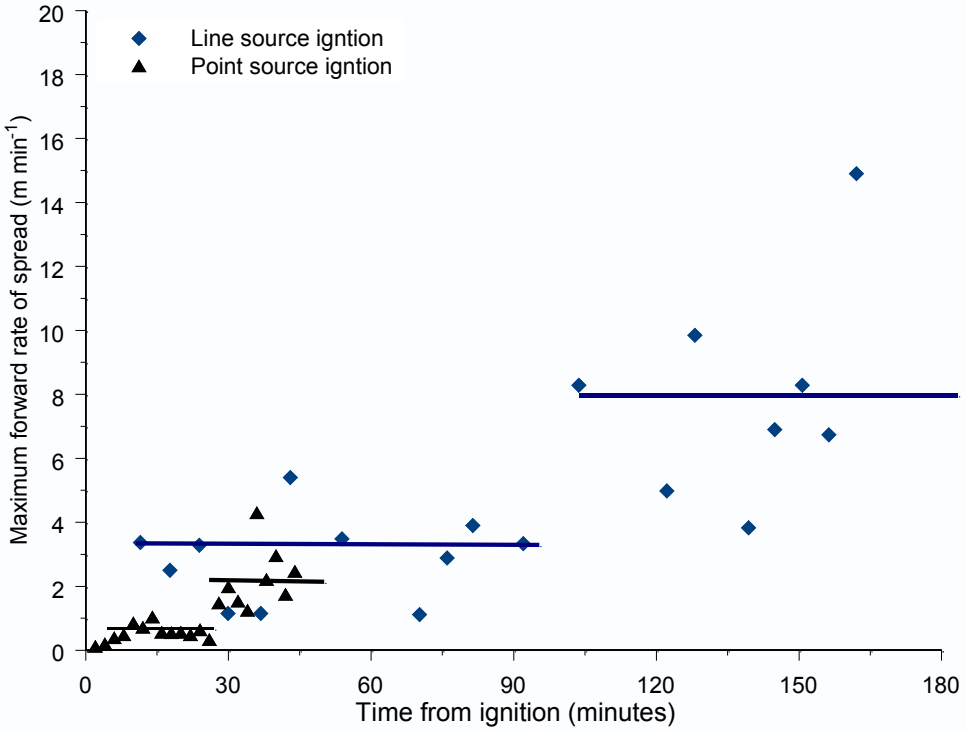
- *the rate of growth in area and perimeter within the first hour or so from point ignitions, and*
- *the change in rate of spread from time of ignition until an equilibrium spread rate has been achieved,*



Fire growth

Factors contributing to acceleration:

- fuel moisture
- fuel structure, characteristics, distribution
- wind speed and turbulence at the flaming zone
- slope
- burn out time
- scaling up of fires
- convection column – does or does not form
- ?????



Fire growth

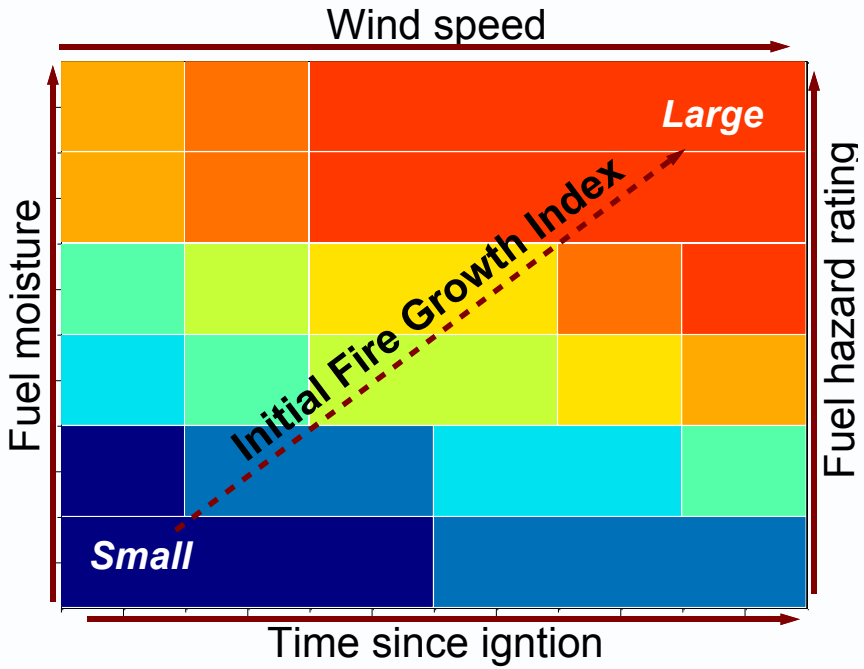
Practical Applications

Suppression planning & allocation

- provide better estimates of the different stages of fire development
- Models calculating first hour of fire growth (i.e., area, perimeter, length-breath ratios) for user-friendly DSS for optimising deployment of suppression resources

Prescribed burning

- Planning and determining ignition patterns
- manipulate fire behaviour using different ignition patterns



Conceptual diagram showing range of fire behaviour variables in developing a fire growth model or an Initial Fire Growth Index (IFGI) indicating the heightened potential fire size

Concluding remarks

Fire occurrence

- We have a different fire environment (cultural and environmental) to those looked at in previous fire occurrence studies
  - We want to understand it better
  - Using collaborative approach to kick-start project

Fire growth

- This work will fill a gap in our knowledge
- Value in revisiting old data

Thank you

Ecosystem Sciences

Bushfire Dynamics and Applications
Matt Plucinski
Research Scientist

t +61 2 6246 4242
e matt.plucinski@csiro.au
w www.csiro.au