PROGRAM A3.1 Evaluation of Aerial Suppression Techniques and Guidelines

Factors influencing the success of initial attack of bushfires in Australia using aircraft

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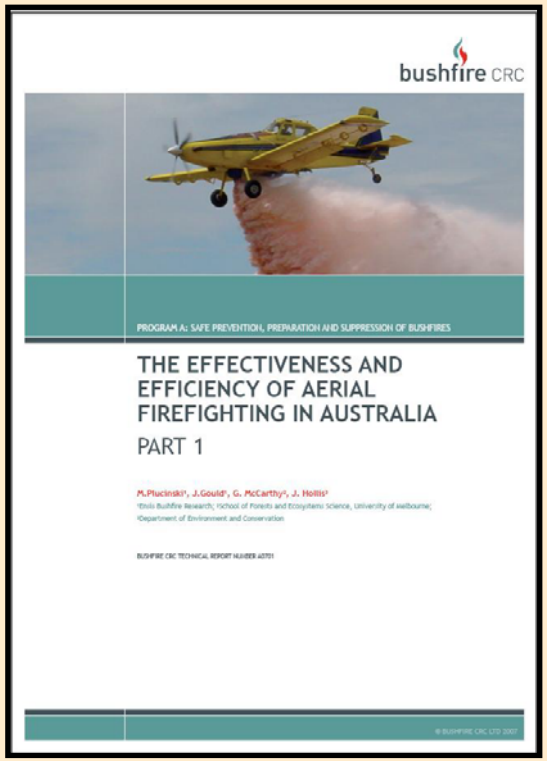
Background

- Aerial suppression is most effective and efficient during initial attack
- Preliminary model predicting the probability of fire containment published in 2007
  - Limited data set and range (*n=76*)
- Project has continued since then and now has a much greater data set (513 fires) and better data range



Available at:
www.bushfirecrc.com

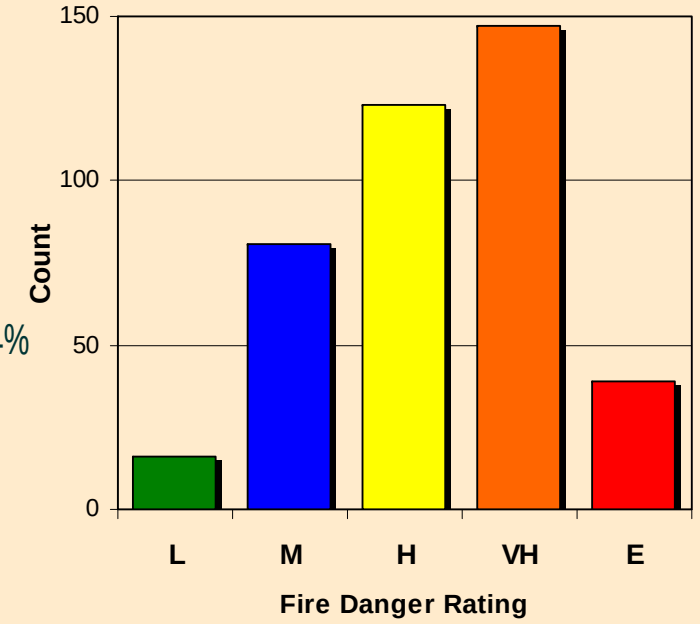
Methods

- Survey forms sent out to personnel involved in operations for fires that used aircraft during IA
  - weather, terrain, fuel, timing, fire area etc.
- Initial attack success
  - Containment in <8 hours
  - Binary data (success/ failure)
  - Modelled using logistic regression – probability of success
- Data divided into two vegetation groups
  - FFDI – forest, woodland, heath, scrub, plantations etc.
  - GFDI – grass dominated

Results - Forest FDI fuel types

406 Fires from Forest FDI fuel types covering a representative range of conditions

- Vegetation
  - 68% forest/ woodland
  - 6% pine plantations
  - 18% scrub
  - 8% heath
- FFDI: 1–107
  - Wind 0-67km/h/ Temp 12-43° / RH 5-94%
- Location
  - 12% within 1km of urban interface
  - 19% remote (no/ limited ground access)
  - 69% general rural locations



Results - Forest FDI fuel types

Significant factors for inclusion in a model:

- Time from detection to aircraft IA (hours)
- Wind speed (km/h)
- Near Surface Fuel Hazard Score
- Time from detection to ground IA (hours)
- Fire area at IA (ha)

  – *Details of model in proceedings*

Results - Forest FDI fuel types

- New model is similar in structure to the preliminary model

	Preliminary	New
Response timing	Aircraft	Air & ground
Weather	FFDI	Wind speed
Fuel (hazard score)	Overall	Near-surface
Fire size at initial attack	Area at IA	Area at IA

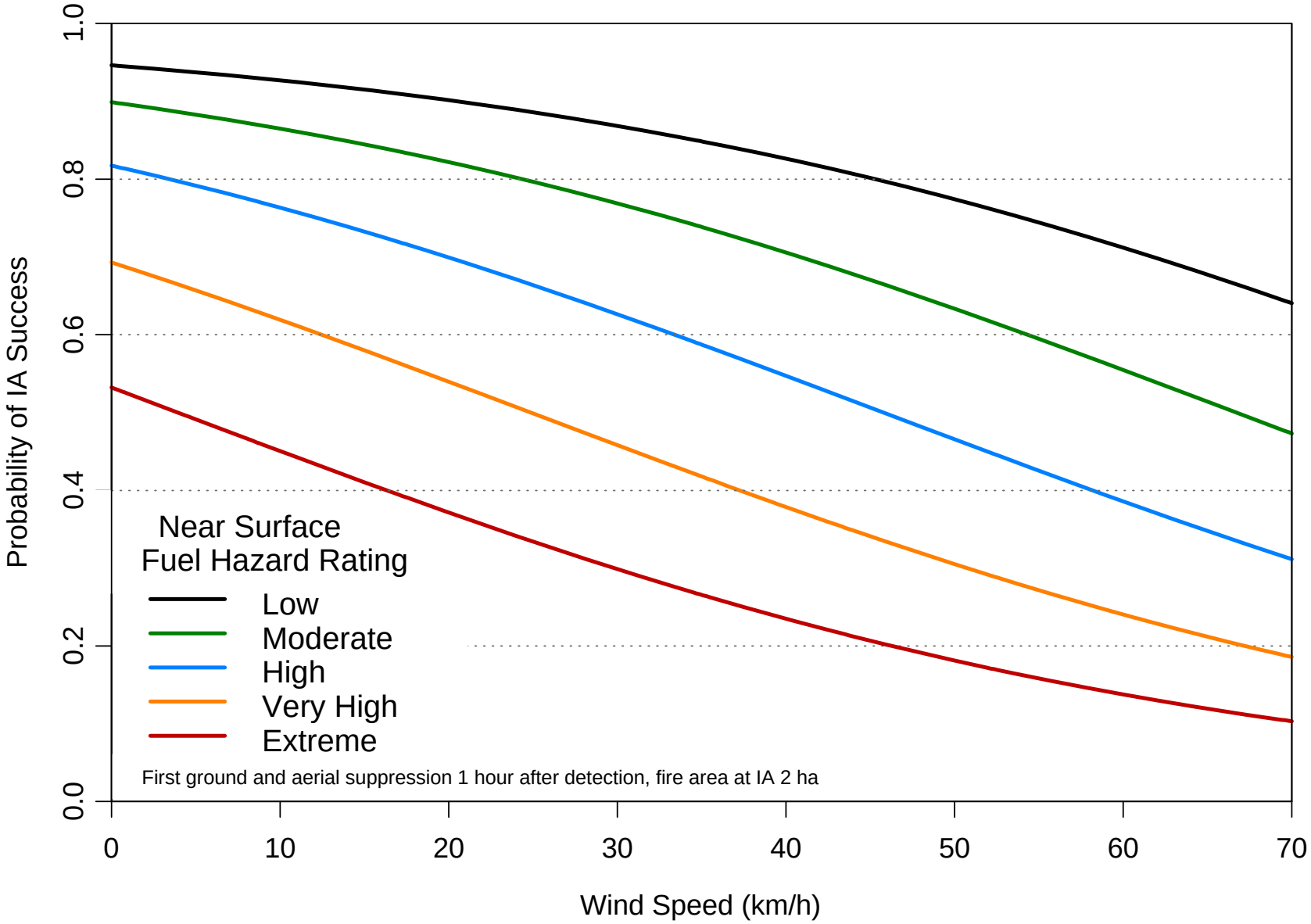
- Location class not significant (correlated with response time)
- Vegetation type not significant at this level

Near surface fuel – (definition)

- grasses, low shrubs and heath containing suspended components of leaves, bark and twigs
  - **Low** – sparse/ dispersed
  - **Moderate** – scattered suspended leaves, <20% dead
  - **High** – up to 40% cover, 20-50% dead
  - **Very High** – 40-60% cover, 20-50% dead
  - **Extreme** - >50% cover, >50% dead

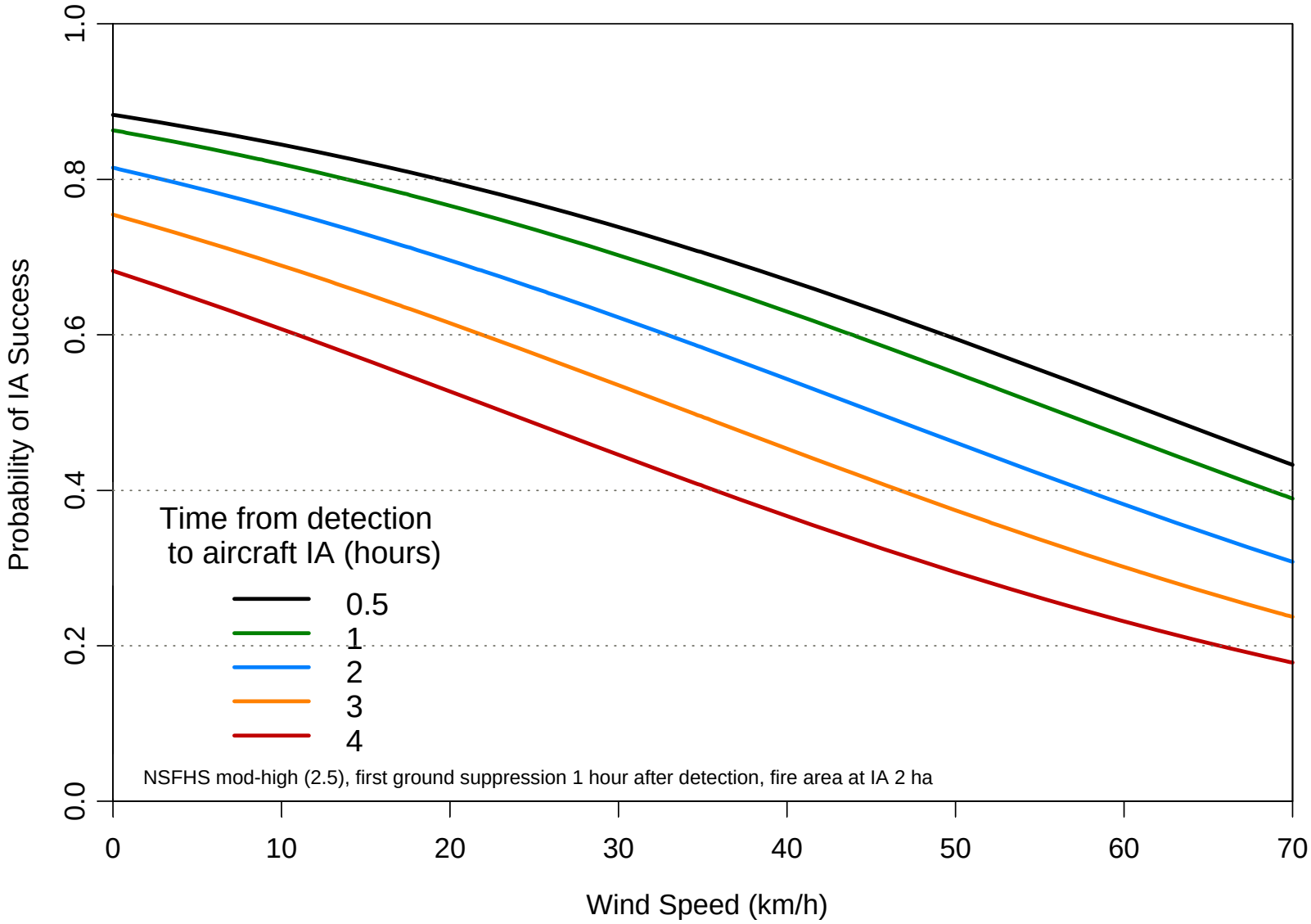
Results - Forest FDI fuel types

Probability of initial attack success with wind speed and near surface fuel hazard rating



Results - Forest FDI fuel types

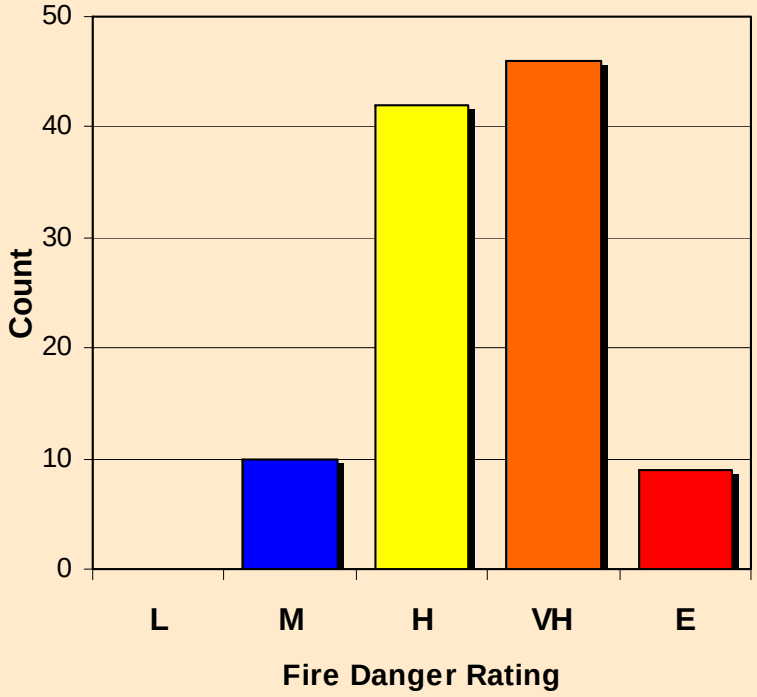
Probability of initial attack success with wind speed and time from detection to aircraft initial attack



Results - Grassland fires

107 Fires from grassland areas

- GFDI: 4–128 (wind 2.5-80km/h, Temp 18-43° , RH 7-65%)
- Curing (70-100%, mean 95%, median 100%)
- Location
  - 14% interface
  - 86% general/rural



Results - Grassland fires

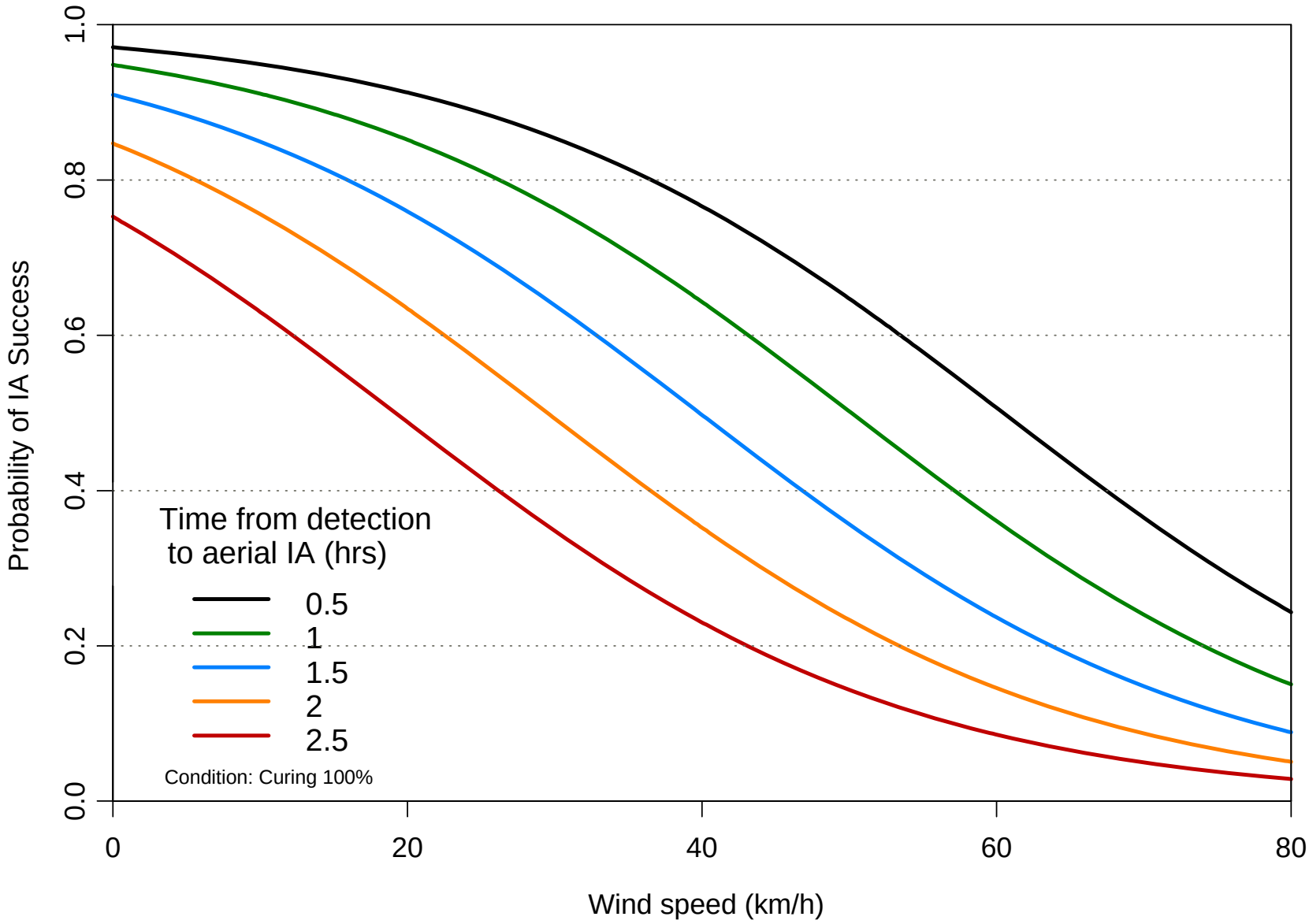
Significant factors included in the model:

- Time from detection to aircraft IA (hours)
- Wind speed (km/h)
- Curing (%)

  - Location class not significant (correlated with response time)
  - *Details of model in proceedings*

Results - Grassland fires

Probability of initial attack success with wind speed and time from detection to aircraft initial attck



Limitations - (method/ data set)

- Definition of initial attack success
  - Not suited to all locations/ land uses
  - Subject of future work
- Weight of attack
  - Not considered
  - Difficult to compare over different terrain/ vegetation/ weather etc
- Subjective assessments
  - e.g. Fuel hazard scores
- Missing data
  - e.g. Grazing/ pasture condition (grassland fires)

Role of operational data

- Unique dataset in Australia
- Similar datasets collected over longer periods can be used for
  - Ongoing assessment of suppression performance
  - Development of operational guides
  - Evaluation of medium and long term strategies
  - e.g.
    - Cumming (2005) used 30 years of data to investigate the impact of a changed management strategy on IA success
    - Arienti *et al.* (2006) investigated the effects of fire cause, timing fuel, accessibility and response on IA and detection failures
- Key data fields related to suppression effectiveness should be collected in fire history data bases

Conclusions

Initial attack success depends on:

- Weather
- Fuel
- Timing
- Initial fire area

- Collection and analysis of this type of data over a long period can be used for performance monitoring and evaluation of strategies

Acknowledgements

- This work relied upon the generous input of numerous operations personnel who provided us with data