PROGRAM A

LINKING FIELD OBSERVATIONS WITH REMOTE SENSING TO DETERMINE GRASSLAND FIRE HAZARD

Stuart Anderson
Ensis Forest Biosecurity and Protection, Scion, Christchurch, New Zealand

Elizabeth Botha
Ensis Forest Biosecurity and Protection, CSIRO, Canberra

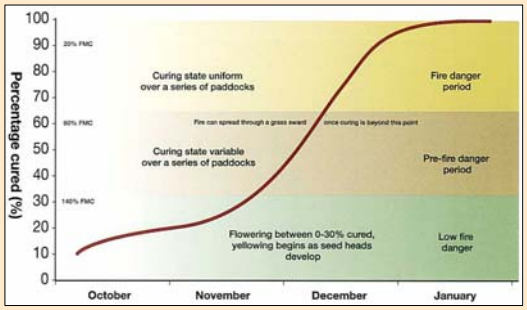
Program A : Linking field observations with remote sensing to determine grassland fire hazard

Outline

1. Grassland curing
2. Project overview
3. Research methods
4. Field data collection
5. Remote sensing

Grassland curing

- Degree of curing – the proportion of dead material in a grassland fuel complex (%)

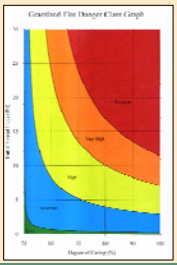


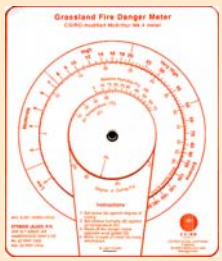
(Source: Garvey and Millie 2001)

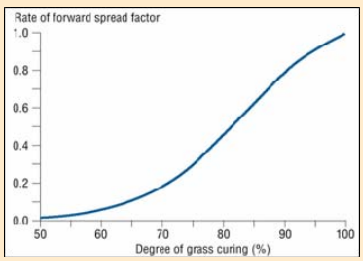
bushfire CRC
Program A : Linking field observations with remote sensing to determine grassland fire hazard

Why is curing important?

- Input into fire behaviour models and fire danger rating systems in Australia and New Zealand
- Grassfires significant in both countries
- Prescribed fire also very important
- Often poorly assessed





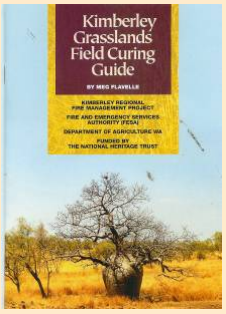


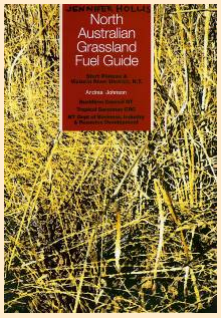
bushfire CRC

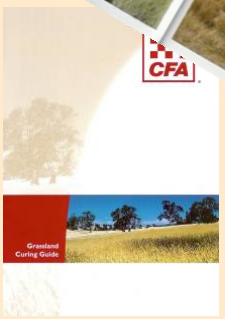
Current curing assessment

Visual

Poor correlation between visuals and actual curing

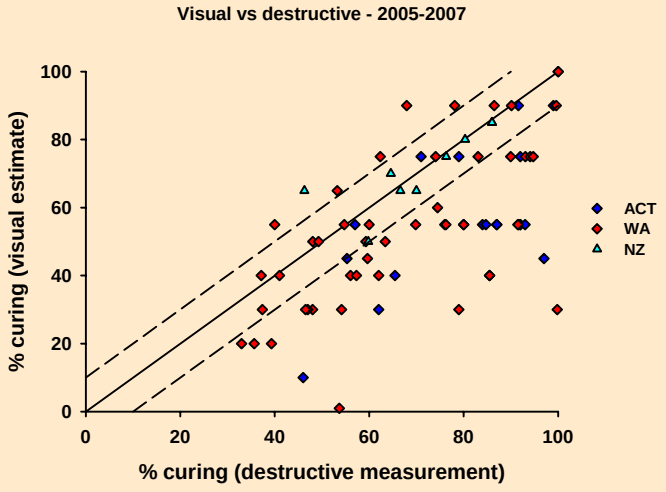






bushfire CRC

Curing assessment: Visual



bushfire CRC

Program A : Linking field observations with remote sensing to determine grassland fire hazard

Current curing assessment

Visual

- Poor correlation between visuals and actual curing

Destructive

- Time-consuming
- Difficult

Remote sensing

- Cloudiness
- Pixel size
- Non-uniform fuels
- Discontinuous cover/patchiness
- Outdated technology

bushfire CRC

Program A : Linking field observations with remote sensing to determine grassland fire hazard

© BUSHFIRE CRC LTD 2007

Aim:

This project will develop better methods to assess the current and predicted levels of curing in grasslands as an input into fire danger rating systems and fire behaviour models




bushfire CRC

Program A : Linking field observations with remote sensing to determine grassland fire hazard

Research approaches

1. Remote sensing
2. Curing modelling
3. Field sampling

bushfire CRC

Program A : Linking field observations with remote sensing to determine grassland fire hazard

© BUSHFIRE CRC LTD 2007

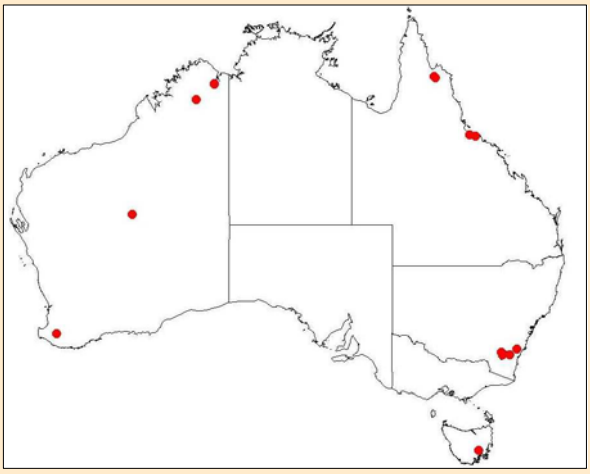
Field data collection

- Field data is ESSENTIAL
- Collected across grasslands of Australia and New Zealand
- A major task, but very important
- Destructive sampling most reliable – cost, effort, time
- Alternative approach – modified Levy Rod

bushfire CRC

Program A : Linking field observations with remote sensing to determine grassland fire hazard

Field Sites



bushfire CRC

Program A : Linking field observations with remote sensing to determine grassland fire hazard

© BUSHFIRE CRC LTD 2007

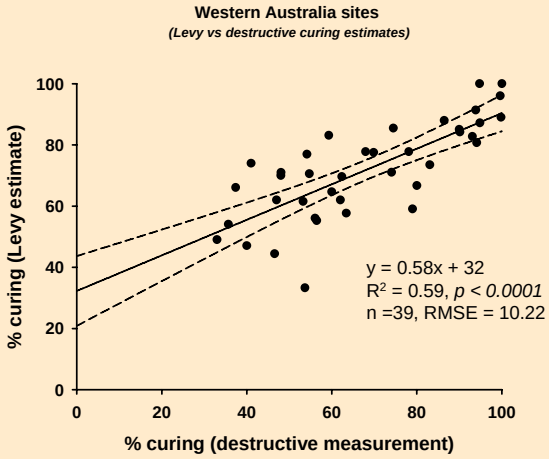
Data collection: Levy rod method

- Total number of live and dead grass touches against a thin steel rod
- Record at intervals along fixed transects
- Less subjectivity

bushfire CRC

Program A : Linking field observations with remote sensing to determine grassland fire hazard

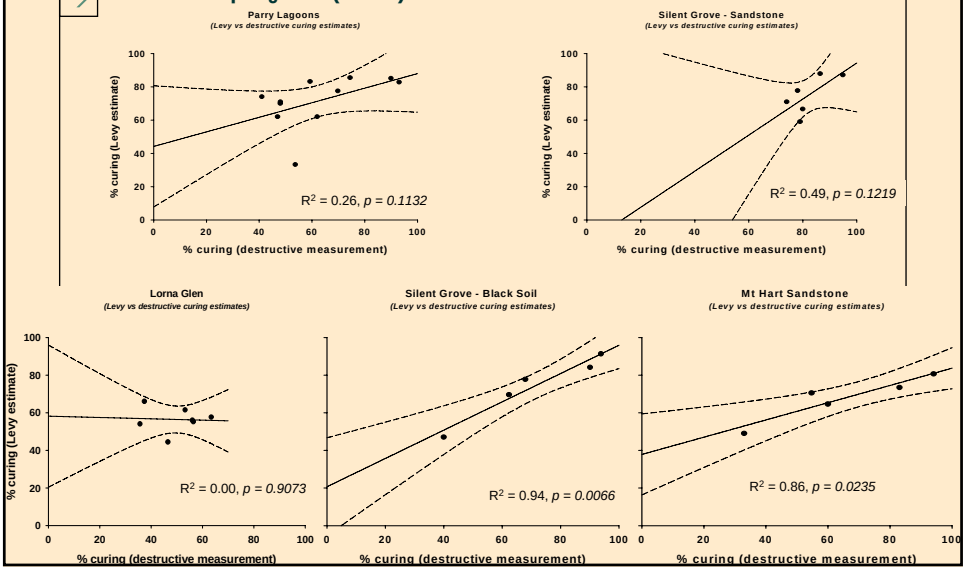
Field sampling: WA (06/07)



bushfire CRC

Program A : Linking field observations with remote sensing to determine grassland fire hazard

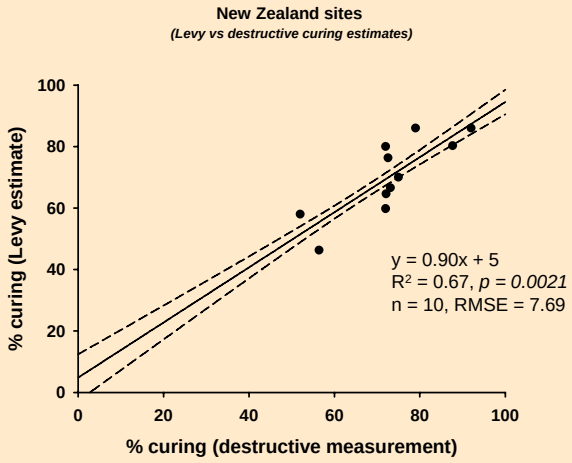
Field sampling: WA (06/07)



bushfire CRC

Program A : Linking field observations with remote sensing to determine grassland fire hazard

Field sampling: NZ (06/07)



bushfire CRC

Program A : Linking field observations with remote sensing to determine grassland fire hazard

© BUSHFIRE CRC LTD 2007

Field Data Collection

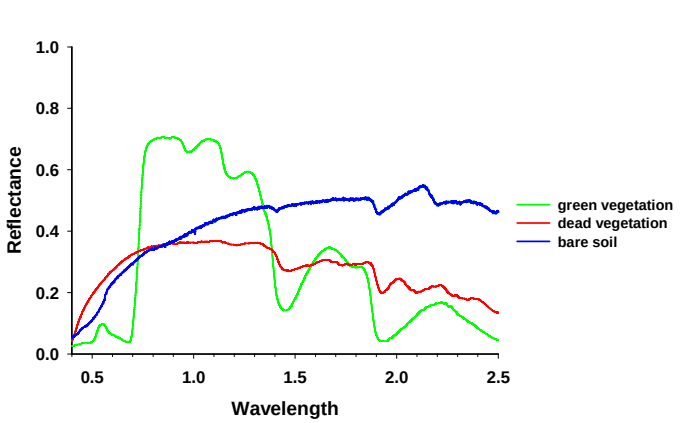
1. Levy Rod Assessments
2. Fuel Moisture Content
3. Destructive Sampling (selected sites)

Support from end-user agencies is appreciated

bushfire CRC

Program A : Linking field observations with remote sensing to determine grassland fire hazard

Remote Sensing: Background



Satellite data

bushfire CRC

Program A : Linking field observations with remote sensing to determine grassland fire hazard

© BUSHFIRE CRC LTD 2007

MODIS MOD09 image product

a) 7 spectral bands
b) 500x500m spatial-resolution
c) 8-day temporal resolution

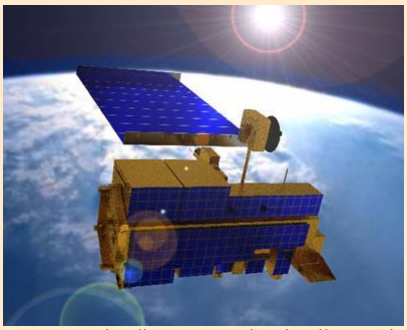


Image source: http://terra.nasa.gov/Brochure/Sect_4-7.html

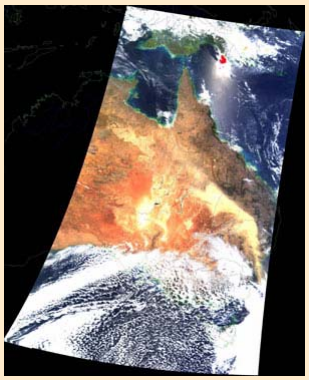
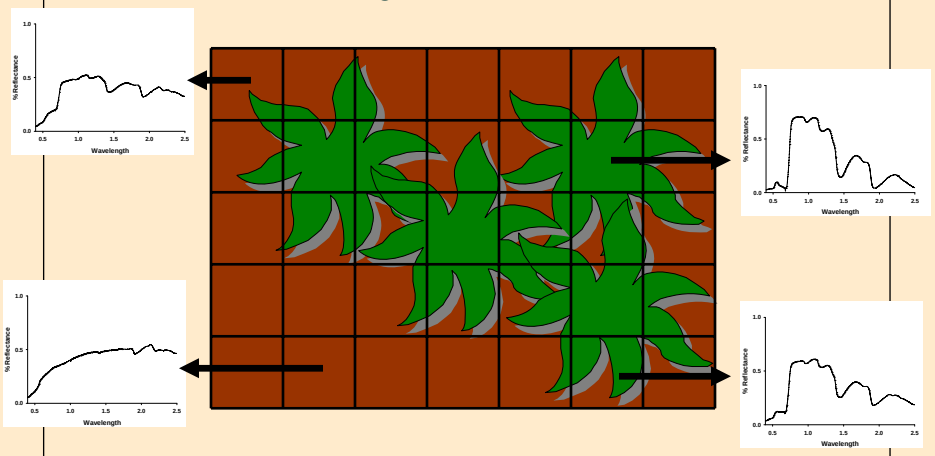


Image source: http://www.ga.gov.au

bushfire CRC

Program A : Linking field observations with remote sensing to determine grassland fire hazard

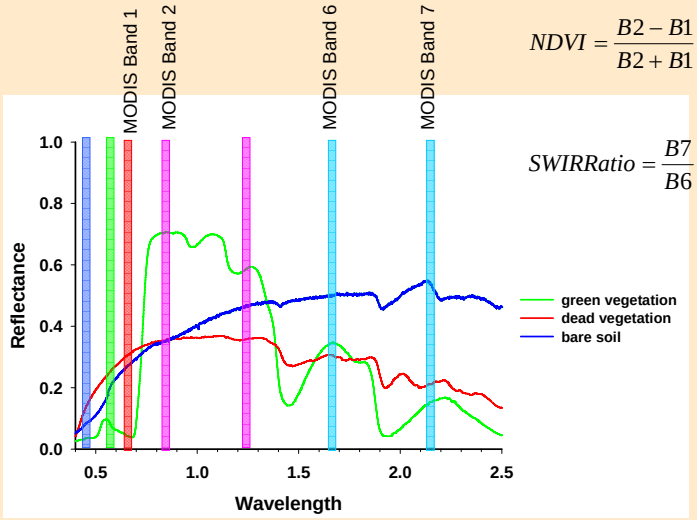
Remote Sensing: What the satellite sees



bushfire CRC

Remote Sensing

Program A : Linking field observations with remote sensing to determine grassland fire hazard



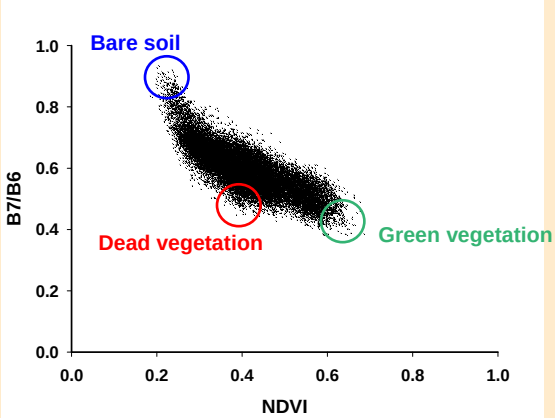
$$NDVI = \frac{B2 - B1}{B2 + B1}$$

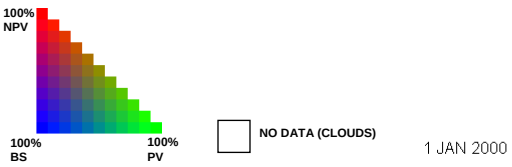
$$SWIRRatio = \frac{B7}{B6}$$

bushfire CRC

Program A : Linking field observations with remote sensing to determine grassland fire hazard

Spectral unmixing

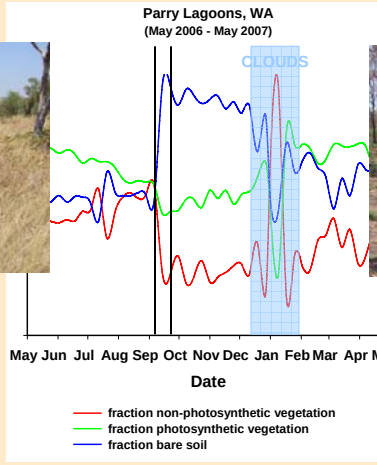




bushfire CRC

Program A : Linking field observations with remote sensing to determine grassland fire hazard

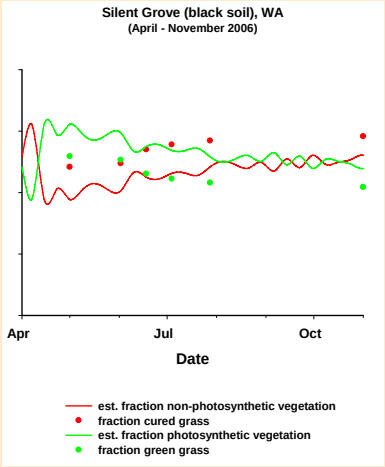
WA Spectral Unmixing

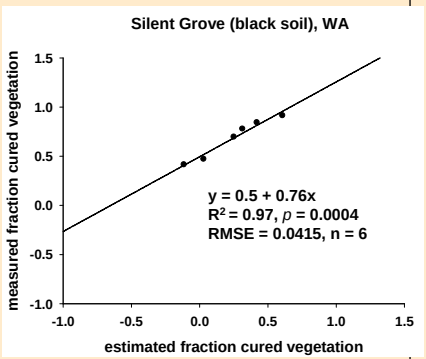


bushfire CRC

Program A : Linking field observations with remote sensing to determine grassland fire hazard

Results: WA (Kimberley)

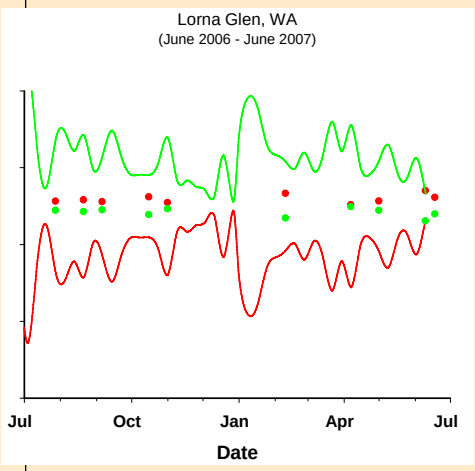


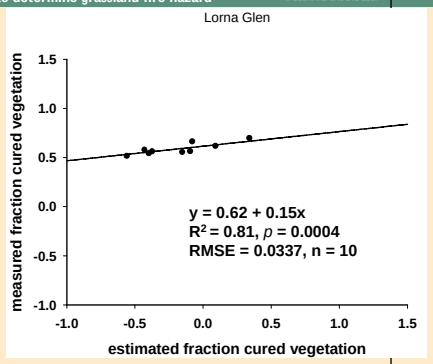


bushfire CRC

Program A : Linking field observations with remote sensing to determine grassland fire hazard

Results: WA (Goldfields)

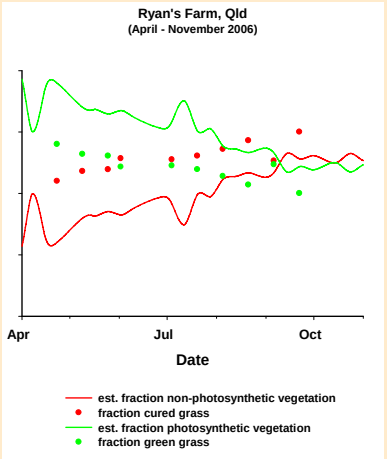


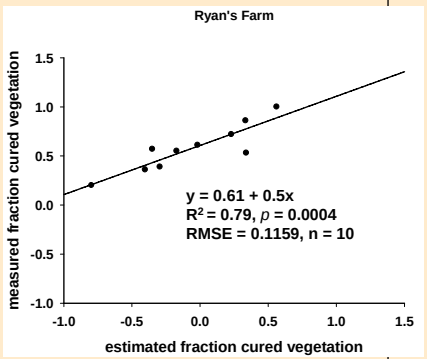


bushfire CRC

Program A : Linking field observations with remote sensing to determine grassland fire hazard

Results: Qld

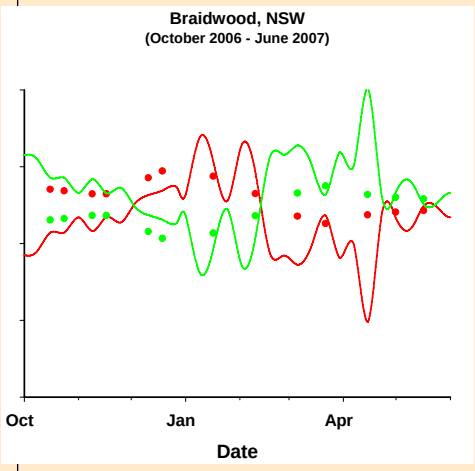


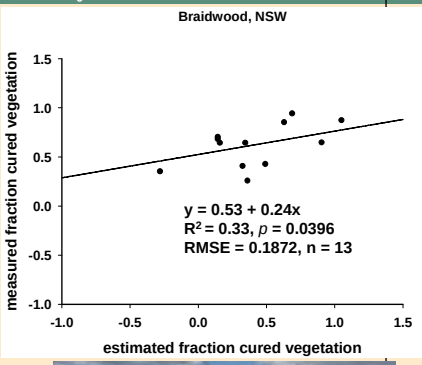


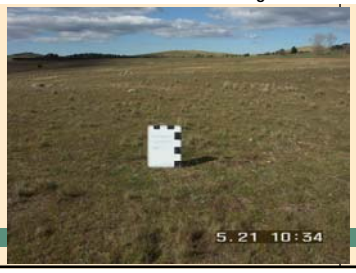
bushfire CRC

Program A : Linking field observations with remote sensing to determine grassland fire hazard

Results: ACT/NSW



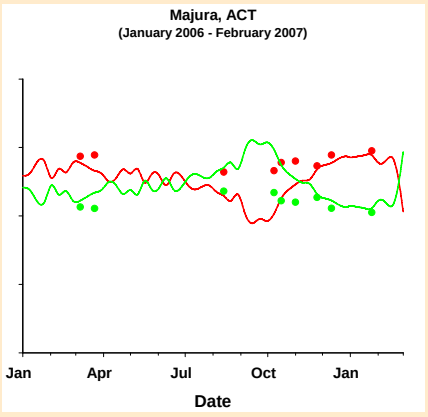


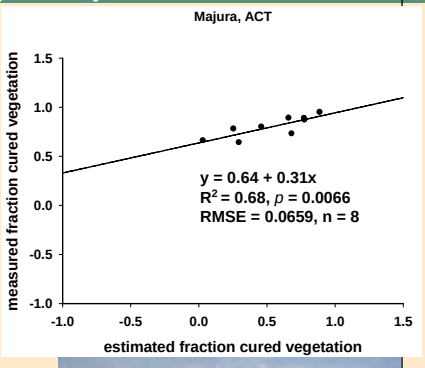


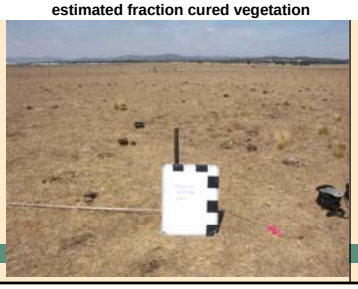
bushfire CRC

Program A : Linking field observations with remote sensing to determine grassland fire hazard

Results: ACT/NSW







bushfire CRC

Preliminary results

1. Spectral patterns of dead/live vegetation correlate with ground observations
2. No 1:1 relationship between unmixing results and ground data – model will have to be calibrated separately for each region
3. Best results in tropical savanna area where model was developed
4. Each region may require different end-members to optimize the spectral unmixing algorithm.
5. We need more ground observations to validate this method – especially of the grasslands in the southern part of Australia.

bushfire CRC

Program A : Linking field observations with remote sensing to determine grassland fire hazard
© BUSHFIRE CRC LTD 2007

Acknowledgements

Wendy Anderson (UNSW@ADFA)
Jennifer Hollis (DEC, WA)
Ruth Gibbs (Ensis/CSIRO)
Kelsy Gibos (formerly Ensis/Scion)
Juan Pablo Guerschman (CSIRO Land and Water)
Leigh Douglas (formerly Ensis/CSIRO)
Peter Ellis (Ensis/CSIRO)
Francis Hines and Adam Fountain (formerly UNSW@ADFA)
End-user agencies:

Australia: Dept of Environment & Conservation (WA), Qld Fire & Rescue Service, ACT Government, private landowners

New Zealand: Dept of Conservation, National Rural Fire Authority, NZ Forest Owners Assn, Local Government NZ, NZ Defence Force, private landowners