National Australian rangelands monitoring activities

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The rangelands are those areas where the rainfall is too low or unreliable and the soils too poor to support regular cropping. They cover about 80% of Australia and include savannas, woodlands, shrublands, grasslands and wetlands. (Bastin et al 2008) (ACRIS)
In terms of area used for livestock export production, Australia is by far the largest.
Ground Cover
Monitoring Ground Cover

Sydney, 23 Sept 2009
Monitoring Ground Cover

- Ground Cover: the vegetation (living and dead), biological crusts and stone that is in contact with the soil surface (Stewart et al, 2009).
Monitoring Ground Cover

- Ground Cover: the vegetation (living and dead), biological crusts and stone that is in contact with the soil surface (Stewart et al, 2009).

- Fractional Cover: fractions (of an area or the pixel) of photosynthetic vegetation (PV) and non-photosynthetic vegetation (NPV, including standing dry vegetation and litter) and the remaining fraction of bare soil (PV and NPV include all canopy layers).
Monitoring Ground Cover

- In-situ Data
Monitoring Ground Cover

- ~1200 field observations!
- Peak 2011-2013 (DAFF funded sites)
- Good scatter around Australia
- Most observations apr-oct.

Figure 2: Summary of field observations of vegetation fractional cover. Part (a) shows the spatial distribution of field observations. Dot colours show observed fractional cover values in RGB as indicated in the legend (triangle). In sites with multiple observations the most recent is shown; (b) number of field observations per year; and (c) distribution during the year.
Monitoring Ground Cover

- ~1200 field observations!
- Peak 2011-2013 (DAFF funded sites)
- Good scatter around Australia
- Most observations apr-oct.
- Good scatter in PV/NPV/BS space
  - Representative of Australian conditions

Figure 3: Characterisation of field measurements of vegetation fractional cover: (a) ternary diagram showing the distribution of PV, NPV and BS fractions across the field observations. Dot colours show observed fractional cover values in RGB as indicated in the legend (triangle). Histograms showing the distribution of (b) PV, (c) NPV and (d) BS. In each histogram, the mean, median and standard deviation (std) of the three fractions are shown.
Monitoring Ground Cover

- Spectral unmixing approach to estimate fractional cover (PV, NPV and BS) using:
  - MODIS: 500m, 8-day composites, 2000-current
  - Landsat: 30m, scene based (with seasonal composites), ~1987 to current
- Accuracy is best for PV (RMSE 0.11-0.13)

Guerschman et al 2015
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Guerschman et al 2009, Guerschman et al 2015
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Guerschman et al 2009, Guerschman et al 2015

Photosynthetic vegetation (the green stuff)
Non photosynthetic vegetation (the dry stuff)
Soil

National Australian rangelands monitoring activities | Juan Guerschman
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March 2015

Guerschman et al 2009, Guerschman et al 2015
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Guerschman et al 2009, Guerschman et al 2015
Trends in Australian vegetation cover

Mean vegetation cover across Australia:

• Effect of drought mid 2000’s
• Despite green cover 2011 as high as 2000, dry veg cover not as high
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Trends in Australian vegetation cover

Mean vegetation cover across Australia:

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• Despite green cover 2011 as high as 2000, dry veg cover not as high

• Longer term fAPAR data (Donohue et al 2009) shows several years high PV (late 1990s) which may have “built up” high NPV cover
Monitoring Ground Cover

PHOTOSYNTHETIC VEGETATION (the green stuff)

NON PHOTOSYNTHETIC VEGETATION (the dry stuff)

SOIL

PV

NPV

Bare

FEB 2000
C-Store
A remote-sensing and observation-driven carbon assessment system
Carbon store (biomass) modelling

Observation collation

Validation, calibration and assimilation

Dynamic carbon store estimates with error surfaces

Remote-sensing and data driven

National

Monthly

Simple

250m resolution

Error quantification
C-Store model structure

Loosely based on LPJ (Sitch et al 2003) with advice from VAST (Barrett 2002)

Remotely sensed GPP from DIFFUSE (Donohue 2014)

Run separately for grass and tree
Results

*Uncalibrated model results

Graphs show mean and 95% CI
Results

*Uncalibrated model results

Graphs show mean and 95% CI
Results

*Uncalibrated model results

Graphs show mean and 95% CI

Howard Springs flux tower site, near Darwin (NT)
**Results**

**Above-ground (fine) litter mass**

Howard Springs A-G litter

Fire Model 1 random fire events

Fire Model 2 remotely sensed fire events

Known fire event

RS fire event
Summary

- Rangelands an important land use type in Australia

- Several years of research on remote sensing for **ground cover estimation**
  - Products mature (extensively calibrated, accuracy assessed and known)
  - Available at:
    - coarse spatial, high temporal resolution (2000-current)
    - High spatial, medium temporal resolution (1987-current) Landsat
    - Very coarse (5km) global – (non-validated)
  - Provide a real biophysical property, measurable in the field
  - Estimates TOTAL vegetation cover (green and dry)

- Biomass, carbon estimates available from modeling
  - Continental, 250m, monthly
  - Research in progress: Calibration, data assimilation
Thank you