MAPPING BUSHFIRE HAZARD AND IMPACT

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MANAGEMENT NEED

A good understanding of fire risk across the landscape is critical in preparing and responding to bushfire events and managing fire regimes, and this will be enhanced by remote sensing data. However, the vast array of spatial data sources available is not being used very effectively in fire management.

GOAL

This project uses cutting edge technology and imagery to produce spatial information on **fire hazard and impacts** needed by planners, land managers and emergency services to effectively manage fire at landscape scales

FIRE HAZARD MAPPING AND MONITORING

Related work presented by *Garlapati et al.* and *Chen et al.*

Automated classification of mobile laser scanning observations

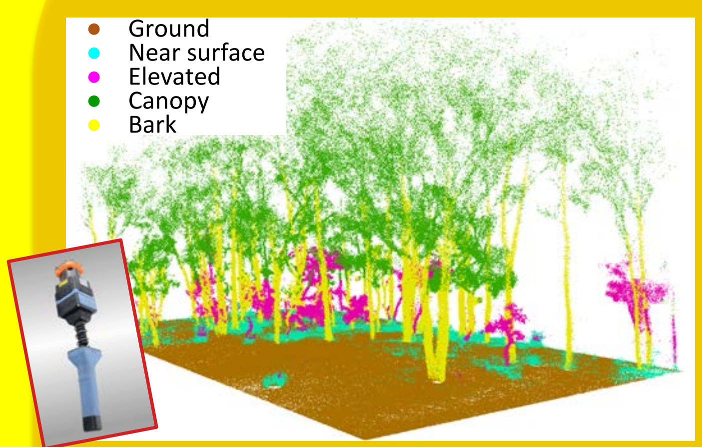


Table 1. Classification matrix

LiDAR classification	Field observed			
	Tree	Elevated	Not observed	Total
Tree	49	1	2	52
Elevated	0	12	1	13
Undetected	1	2	0	3
Total	50	15	3	68

Fig. 1. Classification of point cloud generated with the Zebedee handheld laser scanner (inset) into different fuel components.

The classification algorithm is able to **automatically recognise 98% of the trees** in the study site and **80% of the elevated vegetation** components with an **error of commission of 20%** (Table 1).

….. to automatically derive information on forest structure and biomass

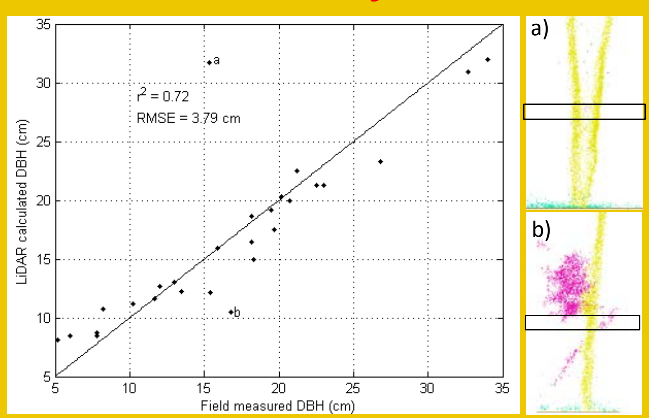


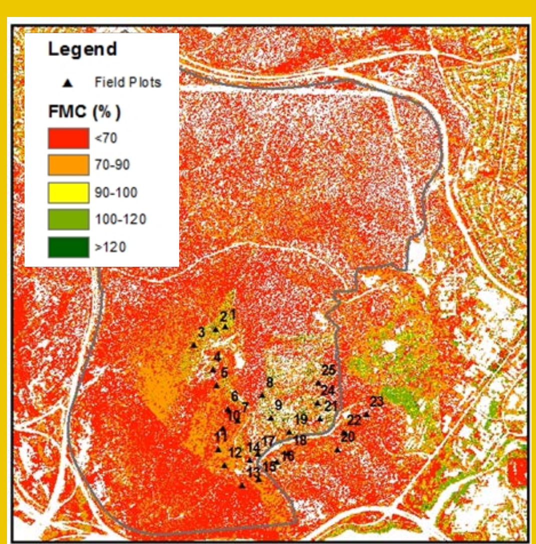
Table 2. Plot level values of fractional cover and height for the different vegetation layers as calculated from the classified point cloud.

Structure	Near-surface	Elevated understorey	Tree canopy
Height	0.14	2.17	8.7
Cover	0.18	0.07	0.49

Fig. 2. Field measured versus LiDAR derived Diameter at Breast Height (DBH). There is a good agreement except in cases a) and b). Black rectangles indicate points at breast height.

(Marselis *et al* 2015)

Satellite-based Live Fuel Moisture Content (FMC)



We evaluated an algorithm proposed by Jurdao *et al.* (2013) in the ACT. The evaluation against field measurements of FMC sampled in the study sites (Fig. 3) is favourable **with errors in the FMC estimation of 23%**. We are applying the same algorithm to Landsat, MODIS (30-500 m resolution) at National scale to produce the **first FMC product for Australia**. These maps will be useful for fire managers to monitor spatial and temporal dynamics in FMC, thus providing insights into risk of unplanned fire and optimal scheduling of prescribed burning.

Fig. 3. Overstorey FMC estimation at the Black Mountain Nature Reserve using HYMAP hyperspectral data collected at the ACT and radiative transfer modelling.

In-situ sensors for grassland curing and FMC

These sensors have proved to be useful to monitor grassland curing and FMC in **remote areas** where regular visual assessment and sampling is not feasible.

Fig. 4. One of the 5 sensors located at the ACT. Latest readings here:

Related work presented by *Gale et al.*

Cosmic ray moisture sensor

Recent invention to **monitor soil and biomass moisture content over large areas in near real time** with potential for on-ground fire and flood risk early warning in remote areas.

Fig. 5. Namadgi COSMOZ Station. Latest readings here:

FIRE IMPACTS ON LANDSCAPE VALUES

High-resolution Fire Risk and Impact (HiFRI) framework

HiFRI provides best possible estimates on **forest fuel load and moisture content and fire impacts on landscape values** such as water resource generation and carbon storage by integrating satellite observations into an environmental model.

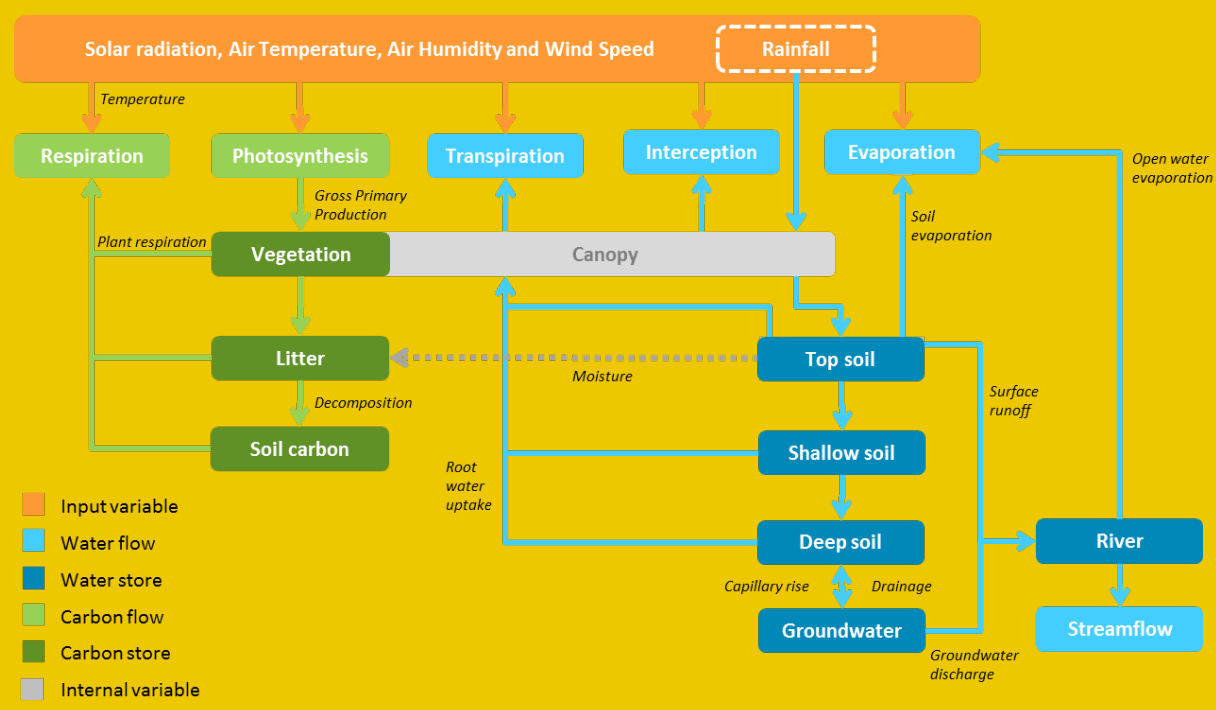


Fig. 6. Illustration of the spatial forest growth, water use and carbon uptake model (van Dijk *et al.* 2015)

A case study in the ACT covering the period 2000 to 2010 was undertaken to assess the feasibility of providing fuel, water and carbon estimates at an unprecedented high spatial **resolution of 25 m** and analyse the impacts of the 2003 Canberra region fires (Fig. 7). We integrated Landsat satellite imagery with terrain information from the TERN's (Terrestrial Ecosystem Research Network) Soil and Landscape Grid of Australia and TERN eMAST's 1km daily climate grids.

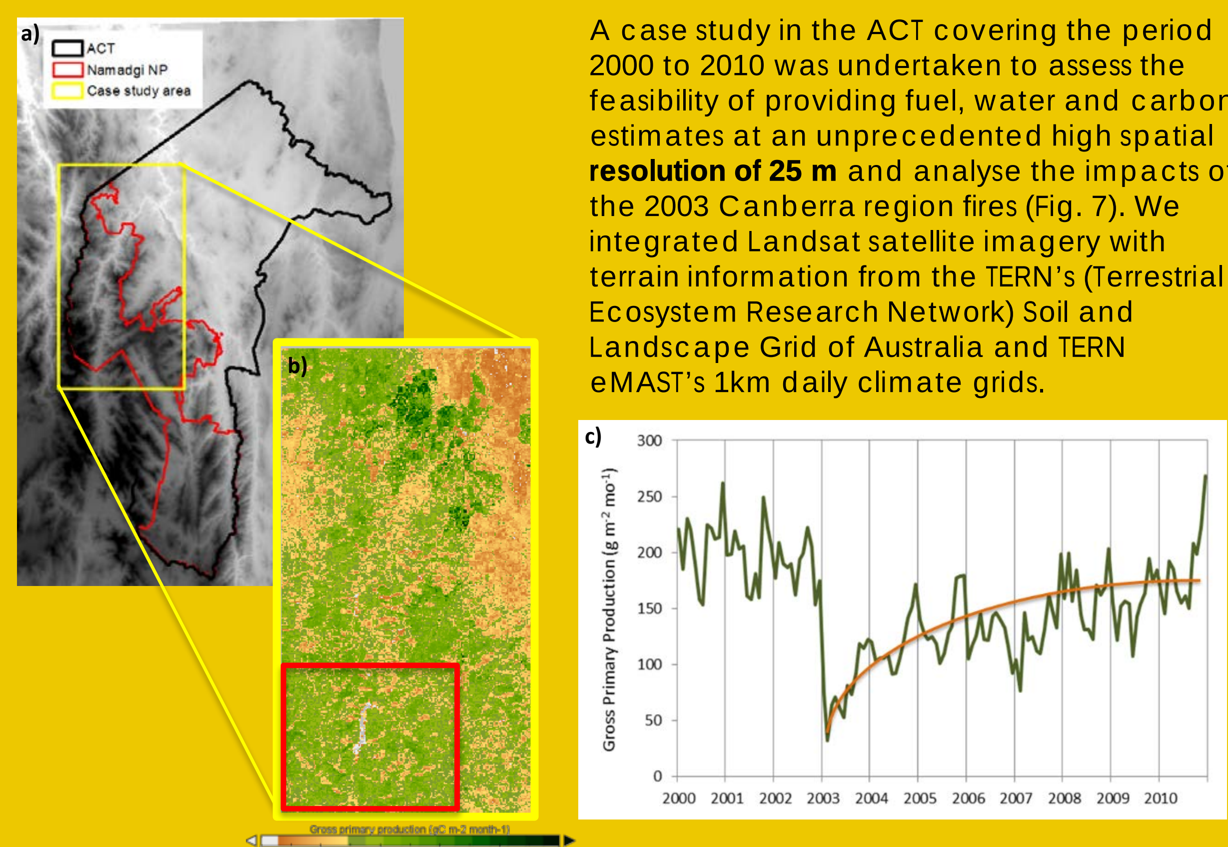


Fig. 7. a) Location of the case study area. b) Estimated vegetation carbon uptake (GPP, g C m^{-2} y^{-1}) for 2010. c) Area-average monthly carbon uptake (GPP, green line) for the area outlined by the red outline on b). The brown curve is added to illustrate the use of GPP estimates to enhance the fuel accumulation growth curve approach (Van Dijk *et al.* 2015).

END USER STATEMENT

This research has potential application to fire predictive services (operational spread modelling) and to the proposed new National Fire Danger Rating System through improvements to operational fuel mapping and fuel condition. It also has the potential to better ground truth soil moisture assessments developed by the CRC Landscape Moisture project, and the NEMP funded grassland curing project led by the Victorian CFA.

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