Fuel reduction burning (FRB) impacts catchment water supply predominately by removing the vegetation and modifying the amount of vegetation water use (i.e. evapotranspiration). Vegetation water use is directly proportional to the amount of leaf area. Changes in the leaf area estimated from the Leaf Area Index (LAI) can be used to assess fire affected areas (Boer et al. 2008).

Aim: With a special focus on the understory, we use LAI as a proxy to model spatial variability in the impact of FRB on catchment water balance.

**Leaf Area Index from Digital Photography**

LAI can be measured using digital cover photography (see Macfarlane et al. 2007). This method has widely been used and validated for the overstorey of eucalypt forests, but not for the understory. FRB mostly affects the understory and rapid techniques for measurement of such effect in the field are called for.

We validated digital photography with destructive sampling (Figure 2) before measuring the leaf area and biomass in 78 plots across south-east Australia: LAIover = LAI overstorey + LAI understory.

**Landsat and Ground-Based Measurements**

Surface reflectance in the red ($\lambda_{RED}$) and near-infrared ($\lambda_{NIR}$) bands were extracted from cloud-free Landsat 8 scenes to estimate Normalized Difference Vegetation Index (NDVI) for each plot:

$$\text{NDVI} = \frac{(\lambda_{NDVI} - \lambda_{NIR})}{(\lambda_{NDVI} + \lambda_{NIR})}$$

Left: Diameter of the overstorey and understory vegetation was measured in 78 plots (burnt and unburnt) and average water use ($Q$, litre ha$^{-1}$ day$^{-1}$) was inferred from the sapwood area (see Pfautsch et al. 2010; Mitchell et al. 2012). Plot size is compatible with stand structure of dry sclerophyll forest and Landsat pixel size (30 m). LAI varied in average 31% in the overstorey and 52% in the understory.

**Mapping Impact of FRB on Water**

We used a 280 ha FRB in the ACT as a case study to explore burn severity (USGS Differenced Normalized Burn Ratio, dNBR), changes in LAI (dLAI = LAIpre - LAIpost) and the impact on vegetation water use (dQ = Qpre - Qpost). Modeled LAI provided useful detail about the distribution of the impact of low intensity fire. Areas of smaller decrease in LAI associated with parts of the landscape with greater topographic wetness. Water that is not used by the vegetation as a result of its removal by FRB, contributes to the overall water stock (Table 2).

<table>
<thead>
<tr>
<th>Burn severity level</th>
<th>Maximum decrease in Q (mm year$^{-1}$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low to moderate severity</td>
<td>150</td>
</tr>
<tr>
<td>Moderate-high severity</td>
<td>230</td>
</tr>
<tr>
<td>High severity</td>
<td>400</td>
</tr>
</tbody>
</table>

In some parts up to 40% of the annual rainfall was ultimately affected by the FRB. However, this is an immediate impact. Vegetation regeneration processes combined with catchment’s predominant hydrological flows need to be considered to assess longer term impacts of FRB.

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**References**


