



# EXPERIENCES IN THE IN-FIELD UTILISATION OF FUELS3D

Non-peer reviewed research proceedings from the Bushfire and Natural Hazards CRC & AFAC conference

Perth, 5 – 8 September 2018

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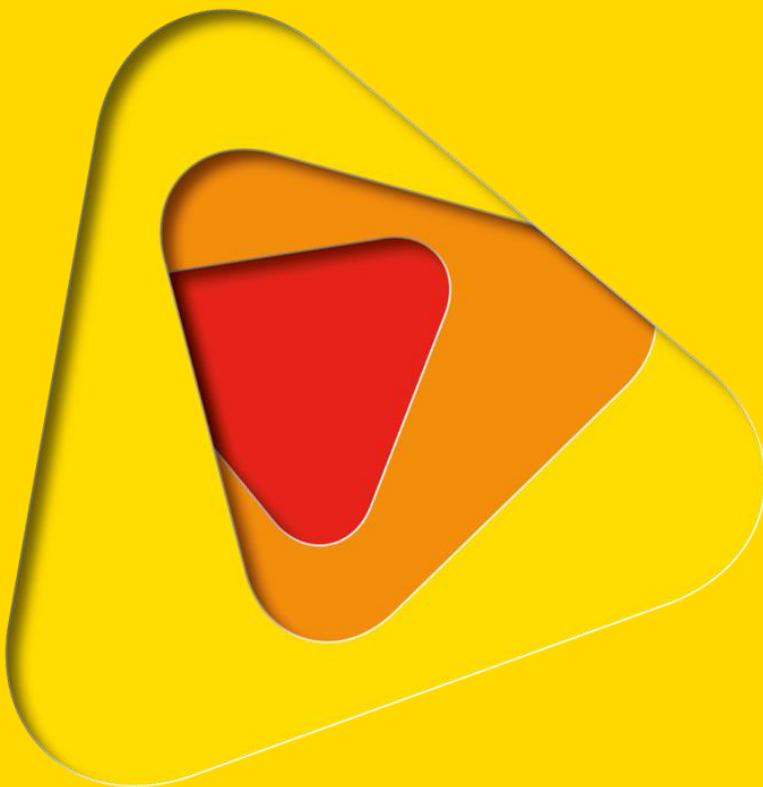
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Version	Release history	Date
1.0	Initial release of document	05/09/2018



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## ABSTRACT

### EXPERIENCES IN THE IN-FIELD UTILISATION OF FUELS3D

Fuels3D provides a rapid method to collect quantified information describing fuel hazard using a smartphone. The method requires users to collect a number of photos along a transect within a fuel hazard environment. The photos are processed using photogrammetric algorithms to provide a three-dimensional representation of the fuel, and subsequently estimates of fuel hazard metrics including fuel height, cover and fate (dead/alive). This paper reports on the initial large scale utilisation trial of the Fuels3D fuel hazard workflow. Project end-users from Victoria, South Australia and ACT were provided with a smartphone app (iOS or Android) that allowed photos to be easily collected following the Fuels3D method. End-users were instructed to collect samples within a variety of fuel types and hazards in order to test the potential and limitations of the app. These photos were transferred utilising the cloudstor research infrastructure to a processing PC, where estimates of fuel hazard metrics were derived and reported back to end-users. Initial results of this trial indicate that Fuels3D is capable of quantified estimates of fuel hazard metrics that are more precise than those achieved with visual fuel hazard assessments.

## INTRODUCTION

The Overall Fuel Hazard Assessment Guide (OFHAG) provides an excellent resource and reference for monitoring fuel hazard across south-east Australian landscapes<sup>1</sup>. In using this guide, the assessment of vegetation attributes such as cover, height and proportion live/dead, that are used to calculate hazard rating of a plot is achieved visually. Visual assessments such as these provide only qualitative information on some metrics and have been demonstrated within the literature to be subjective, meaning assessments are often not repeatable<sup>2,3</sup>.

The Fuels3D app (Figure 1) has been developed to provide a low cost, and repeatable method to collect fuel hazard information. Fuels3D utilizes images captured on a smartphone and computer vision algorithms to provide a 3D representation of the fuel structure. From the resultant point cloud, representation of structural metrics such as height and cover can be extracted for use in conjunction with the OFHAG in assessing the hazard present in a landscape.

The app has undergone rigorous testing to ensure the metrics derived from the 3D representation of the landscape are repeatable and accurate<sup>2,4</sup>. This abstract provides insight into the steps undertaken towards the first in industry trial of the app. This includes a description of fuels3D architecture and workflow, as well as, initial outcomes of the on-going trial.

## FUELS 3D WORKFLOW

Figure 1 provides a graphical illustration of the three stages of the Fuels3D workflow; the fuels3D app and data capture by the user, data transfer and point cloud processing and metric reporting. This section outlines these stages.



FIGURE 1. THE FUELS3D WORKFLOW

### THE FUELS3D APP

The fuels3D app has been developed in-house at RMIT University for use on both android and iOS devices. In consultation with various end-users and through an initial in-field trial the app has been developed to be easy to use. Key improvements since the in-field trial include; the development of an iOS version of the app, enhanced user experience through the inclusion of forward and back buttons and a photo guide to allow users to more easily capture images suitable for use in the fuels3D processing step (Figure 2).



FIGURE 2. THE ENHANCED IMAGE CAPTURE SCREEN DEPICTED WITHIN THE IOS VERSION OF THE FUELS3D APP

Guides for both image capture and image upload have been also developed. These guides include pictorial steps that allow the images captured using the new transect data capture approach. The transect approach, developed to allow a greater area to be rapidly captured, requires users to establish a transect using the fuels3D color coded markers (Seen in figure 3). The user then follows a path around these markers capturing images every 30 – 50 cm at three heights by raising and lowering the camera in a zig-zag motion, allowing depth and structural information can be collected. The red line seen in Figure 2 provides a guide as to how to compose each image in relation to the transect.

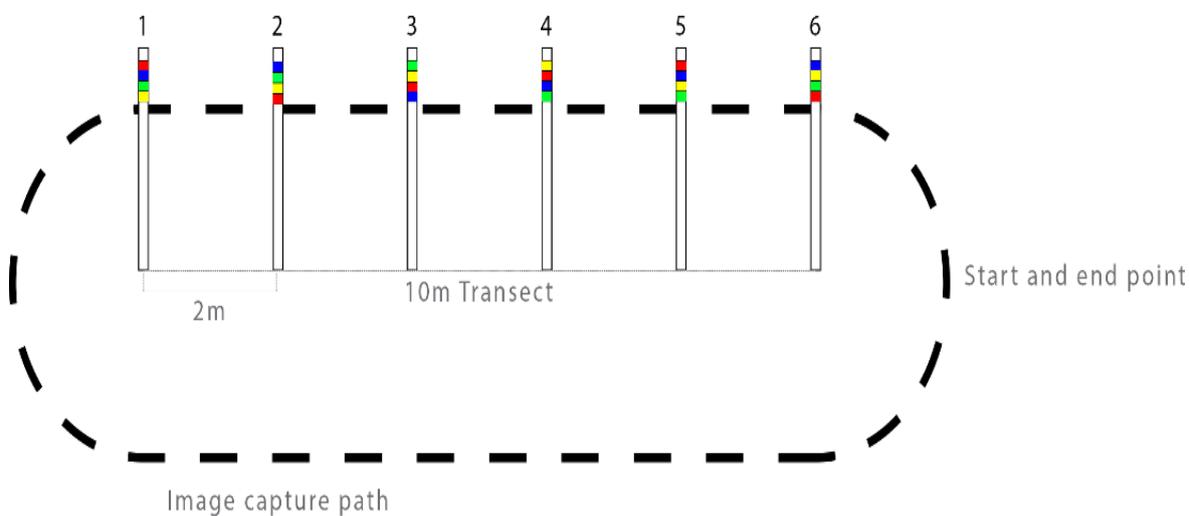


FIGURE 3. THE FUELS3D APP TRANSECT CAPTURE APPROACH

## FUELS3D PROCESSING

Fuels3D processing occurs on a server housed at RMIT University. The images and associated data are transferred to the server through a semi-automatic. Firstly, the user transfers data from the smartphone to a PC. The folder of data is then zipped



and then uploaded to CloudStor. CloudStor is a free service enabling researchers to quickly and securely sync, share and store files using the high-speed AARNet network<sup>5</sup>. It operates similar Dropbox and other cloud based services allowing for the process to be moved off research infrastructure in the future. Once the data is uploaded it will automatically be downloaded by the server.

For the period of the utilization trial the processing of the data occurs on a semi-automatic basis. Once the server identifies that new data exists a notification is sent to an operator who then initiates a python script that controls the creation of a point cloud. The 3D point cloud is created using Agisoft Photoscan with the colour coded target automatically identified and used to provide scale and orientation.

Once the point cloud creation process is finished the operator will check the quality of the output and initiate the fuel metric extraction stage. Metric extraction from the 3D point cloud using scripts developed specifically for Fuels3D.

## FUEL HAZARD METRICS

The fuel hazard metrics, including height, cover and status of the fuel in the surface and near surface, are returned to the user as text-based information. The requirements for how this occur are being handled on an agency by agency basis.

## UTILISATION TRIALS

The development of Fuels3D has moved from concept to end-user trials with the first end-user field day held in July 2016. Participants included staff from SA DEWNR, ACT Parks and Wildlife, VIC DELWP, VIC CFA, Melbourne Water and Parks Victoria. The field day aimed to introduce end-users to the Fuels3D collection protocol and to assess its ease of use and repeatability between data collectors in comparison to traditional visual assessment techniques. Participants were asked to undertake a visual assessment as well as use the Fuels3D app. At the completion of the day, the data collection participants were asked to complete a survey evaluating the Fuels3D data collection workflow providing an early insight into the potential for uptake by end-users.

The survey indicated that the participants found the Fuels3D protocol easy to follow. This was further indicated by the collected data of which more than 90% of the image sets were able to be used in the Fuels3D processing method. From the results of this study several areas of improvement in the data collection and processing methods were identified and incorporated into the ongoing development of the Fuels3D solution.

Since the first workshop, improvements in user interface have been implemented and in-field scaling methods have been assessed for accuracy, reliability and user friendliness resulting in a sampling technique that couples with the Fuels3D app to provide a complete in-field mapping approach for surface and near-surface fuels. The Fuels3D app is available for both Android and iPhone devices and in-field trials are currently underway with end-users from Victorian CFA, Victorian Department of Environment, Land, Water and Planning, South Australian Department for Environment and Water, and ACT Parks and Conservation. End users are provided with access to the Fuels3D app (Android and iPhone supported) and provided with portable vertical targets necessary for image scaling. Quick Guide



documents have been provided to instruct end-users through the solution, and an open spreadsheet for end-user feedback and issue reporting is also given. The next step following this trial will be to return the fuel hazard metrics – as calculated from the data collected – back to the end-user, thus completing the end-to-end solution.



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