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MAPPING THE EFFICACY OF A FUEL REDUCTION BURN USING FUELS3D POINT CLOUDS

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AIM

To evaluate the short term effects of a fuel reduction burns using in-field remote sensing

- Approach should provide **quantifiable** metrics equivalent to currently collected information

- Approach should be **accessible** to **landscape assessors**

CASE STUDY

Low intensity fuel reduction burn undertaken on 28th April 2016

1) Lowland Forest, Victoria, Australia
   - **a) Surface fuels:**
     - leaf litter/mosses
   - **b) Near surface fuels:**
     - Bracken and fallen branches
2) 4 years since last burn

Before (11th March 2016)

After (5th May 2016)

SAMPLING DESIGN

- 3 x 10 m radius plots

- 10 Sample areas per plot
  - 36^{o} intervals
  - Random distance (d)

- Each sample coordinated based on total station measurements to 4 markers

SAMPLING METHOD

1) At each sample
   a) Between 34 and 42 photos captured with an Olympus OMD-EM 10 camera
      - Inward looking imagery collect in ~3m radius from plot center at random heights above the ground
      - 12 downward looking images in grid pattern

   b) Collection time of 2 – 4 mins per sample

   c) Standard Agisoft photoscan workflow with high quality settings to produce a point cloud

POINT CLOUD PROCESSING – LAYER EXTRACTION

Three strata of Interest

Near Surface fuels

Fuels in contact with the ground but not laying on it

Extracted as point not belonging to largest contiguous component of a 1cm resolution voxel space

Surface fuels

Fuels in contact with the ground and laying on it

Remaining points

Ground

Mineral earth

Extracted as the lowest point in course grid

POINT CLOUD PROCESSING – METRIC CALCULATION

For each layer extract pre and post metrics representing …

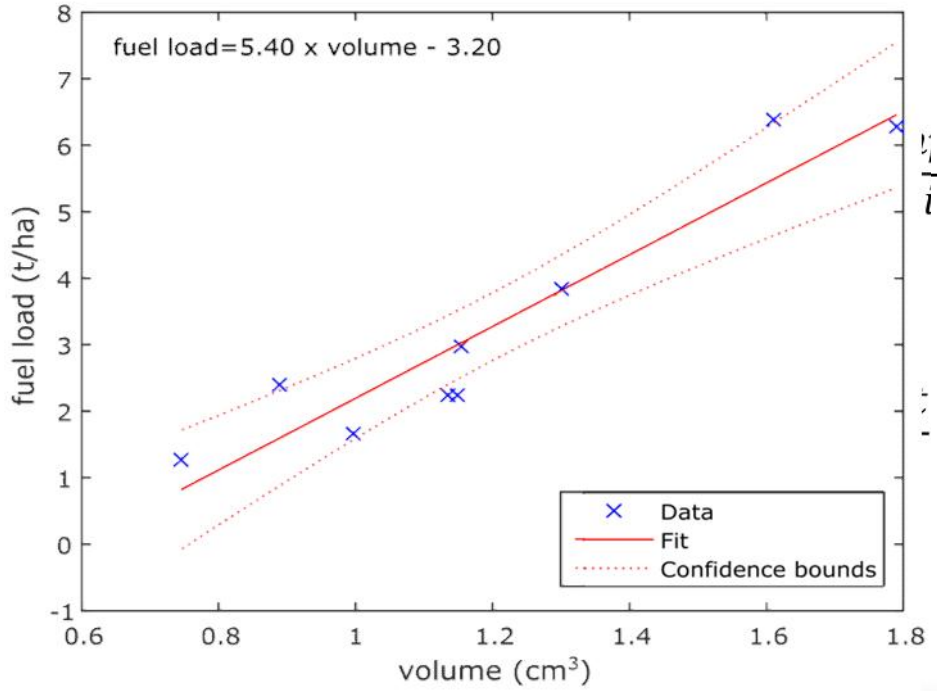
Metric	Reason	Method
% Cover	To assess change in horizontal structure	A cell of a 0.5 cm raster was considered covered when any point had an AGH > 1cm
Above Ground Height	To assess change in vertical structure	Maximum AGH within a 0.5 cm raster cell
Fuel Volume/Load	To assess change in fuel load	Linear Regression (Next Slide)

FUEL LOAD ESTIMATION

1) Calculated from point clouds via linear regression based on nine 0.5x0.5 m samples:

Dependent

Explanatory



Fuel load =

$$\frac{h}{i}$$

volume =

+ Near Surface volume

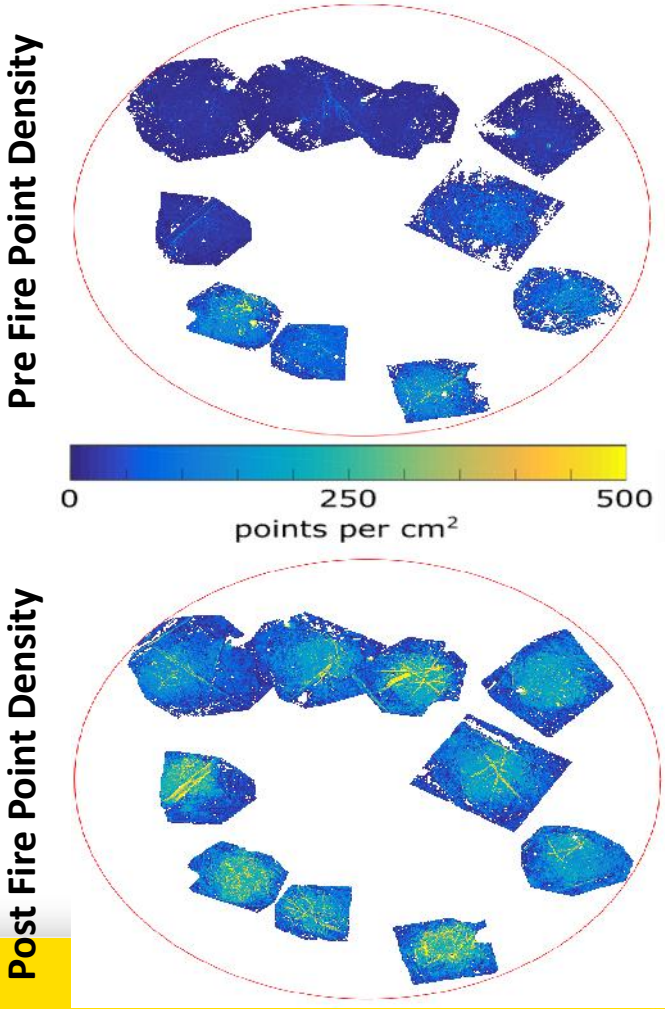
= ( )

*

RESULTS - POINT CLOUD PROPERTIES

1) Average area captured per plot
   a) 108 m^2 or 34 % of plot area

2) Average point density
   a) Pre fire (40 points per m^2)
   b) Post fire (110 points per m^2)



RESULTS - POINT CLOUD INTERCOMPARISON

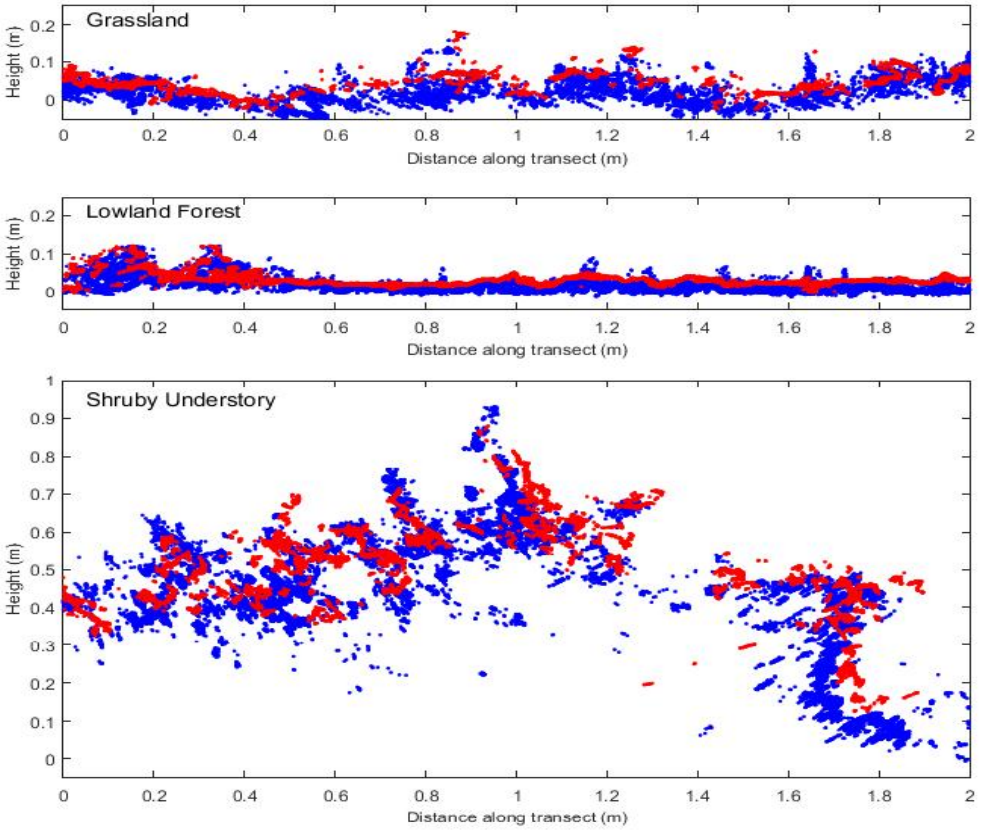
TLS point clouds

Result of 4 merged scans from a Trimble TX8 scanner

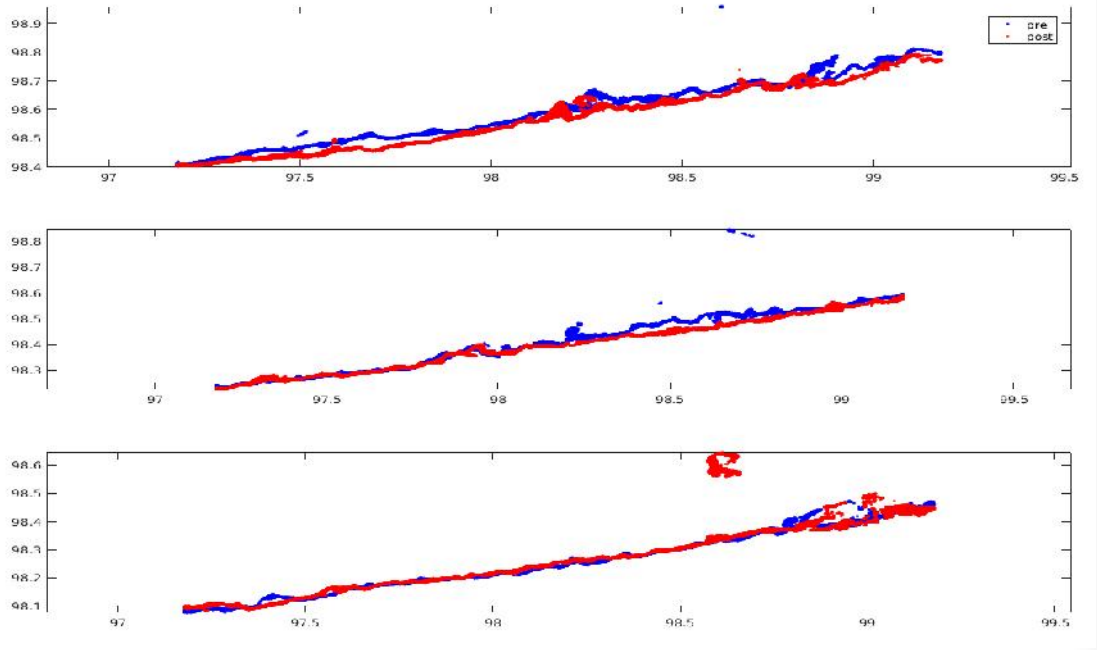
29 – 46 points per cm

Image based point clouds

16 – 58 points per cm



RESULTS – CO-REGISTRATION



RESULTS – SURFACE FUEL CONDITIONS

Pre fire

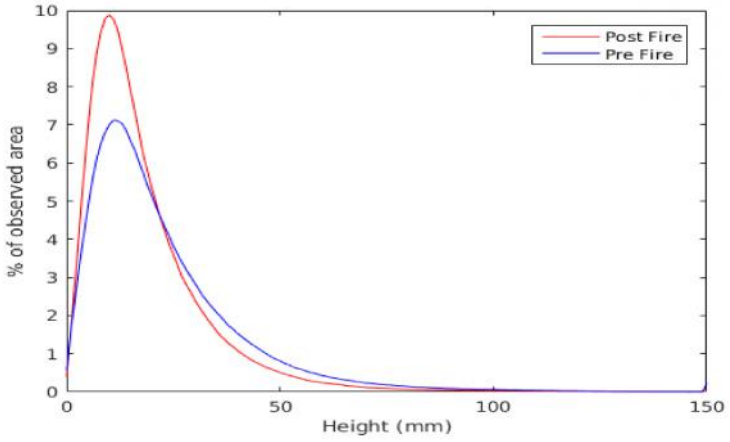
Cover = 71 % Height = 25 mm

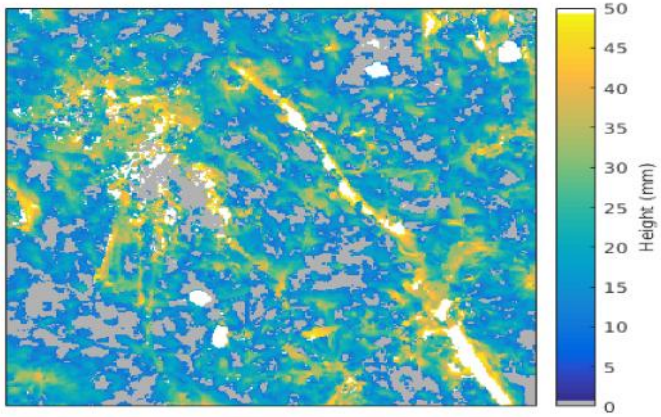
Post fire

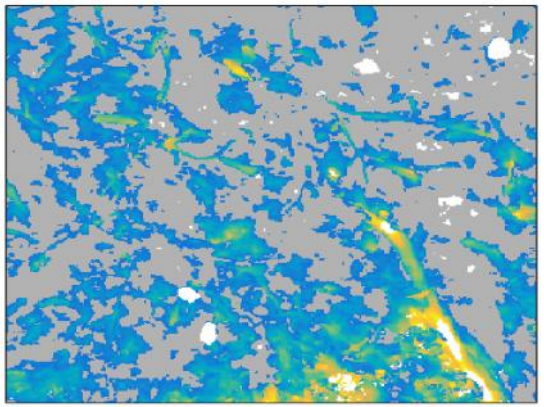
Cover = 69 % Height = 26 mm

Pre fire

Post fire







RESULTS – NEAR SURFACE FUEL CONDITIONS

Pre fire

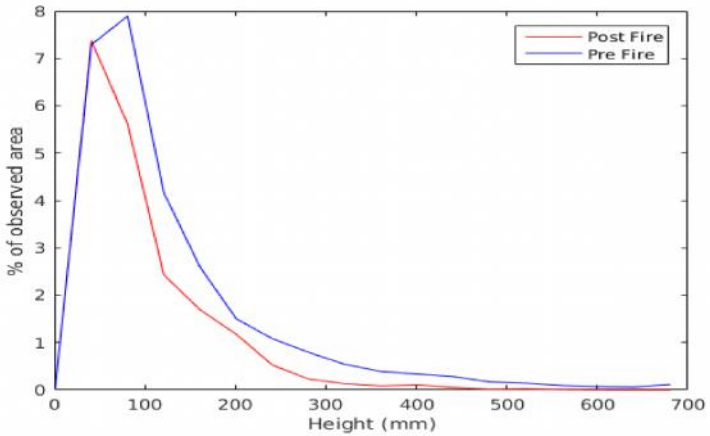
Cover = 125 mm 17 % Height =

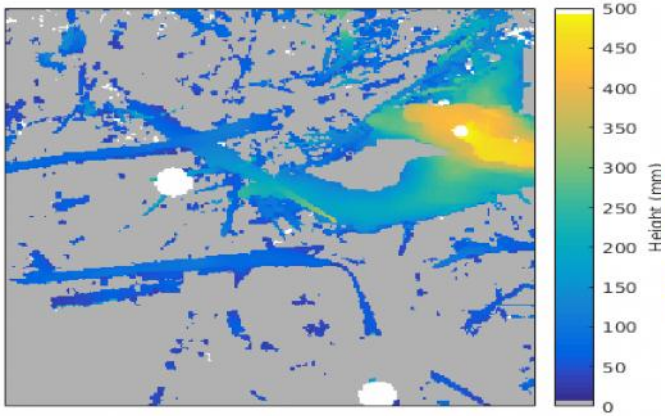
Post fire

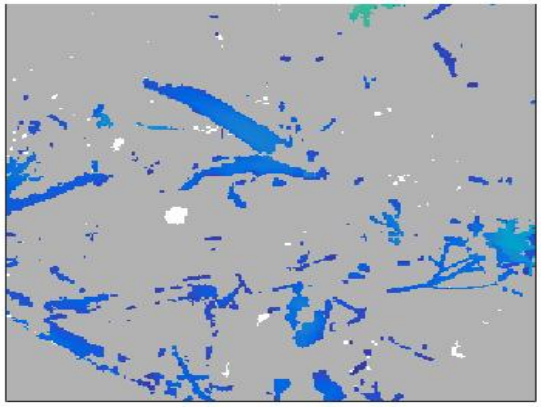
Cover = 13 % Height = 91 mm

Pre fire

Post fire

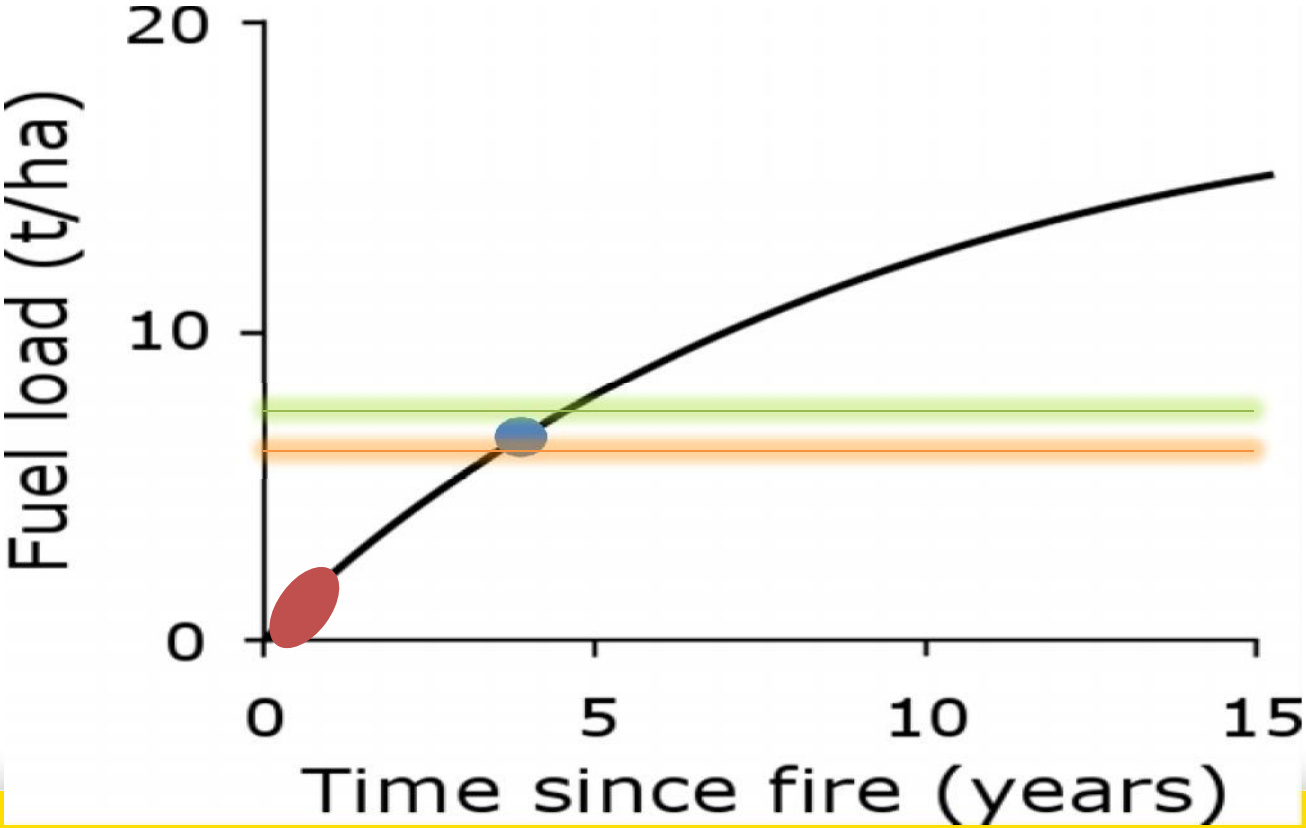






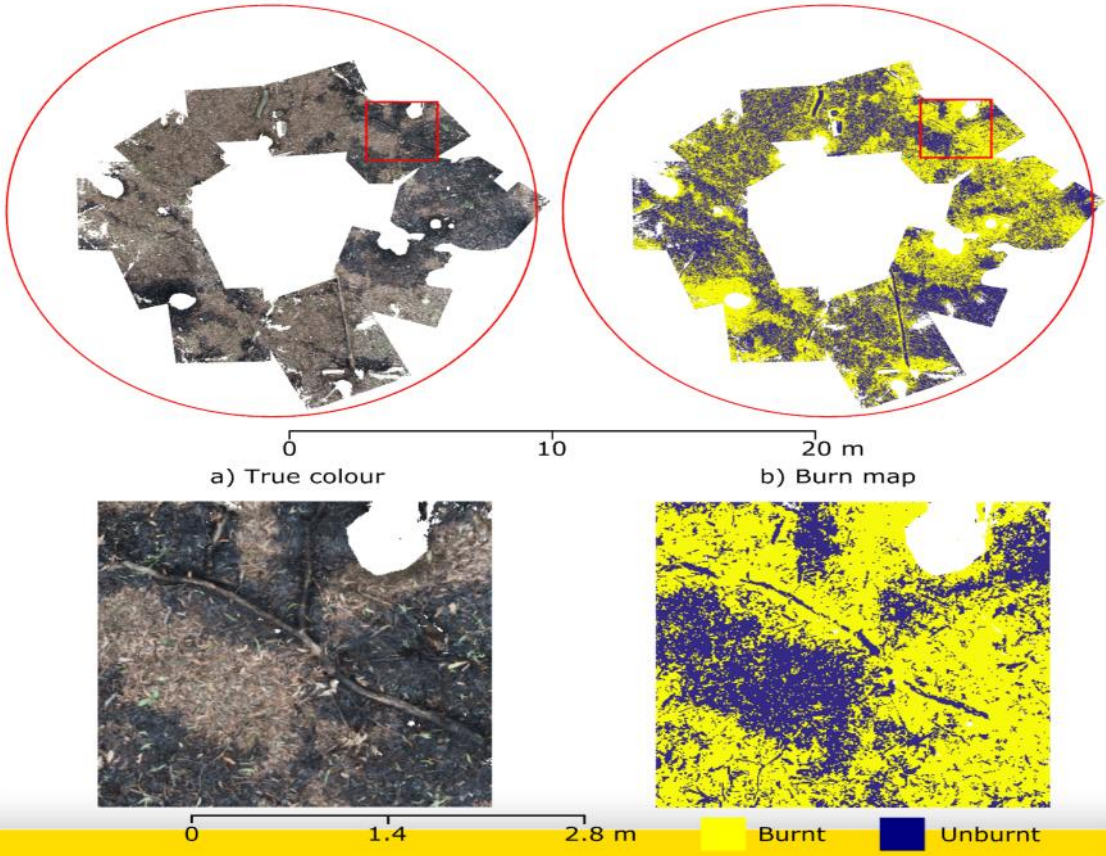
FIRE EFFICACY

Only a 12% reduction in fuel load across plot 1



FIRE EFFICACY

1) Horizontal fuel connectivity was broken by the burn



CONCLUSIONS

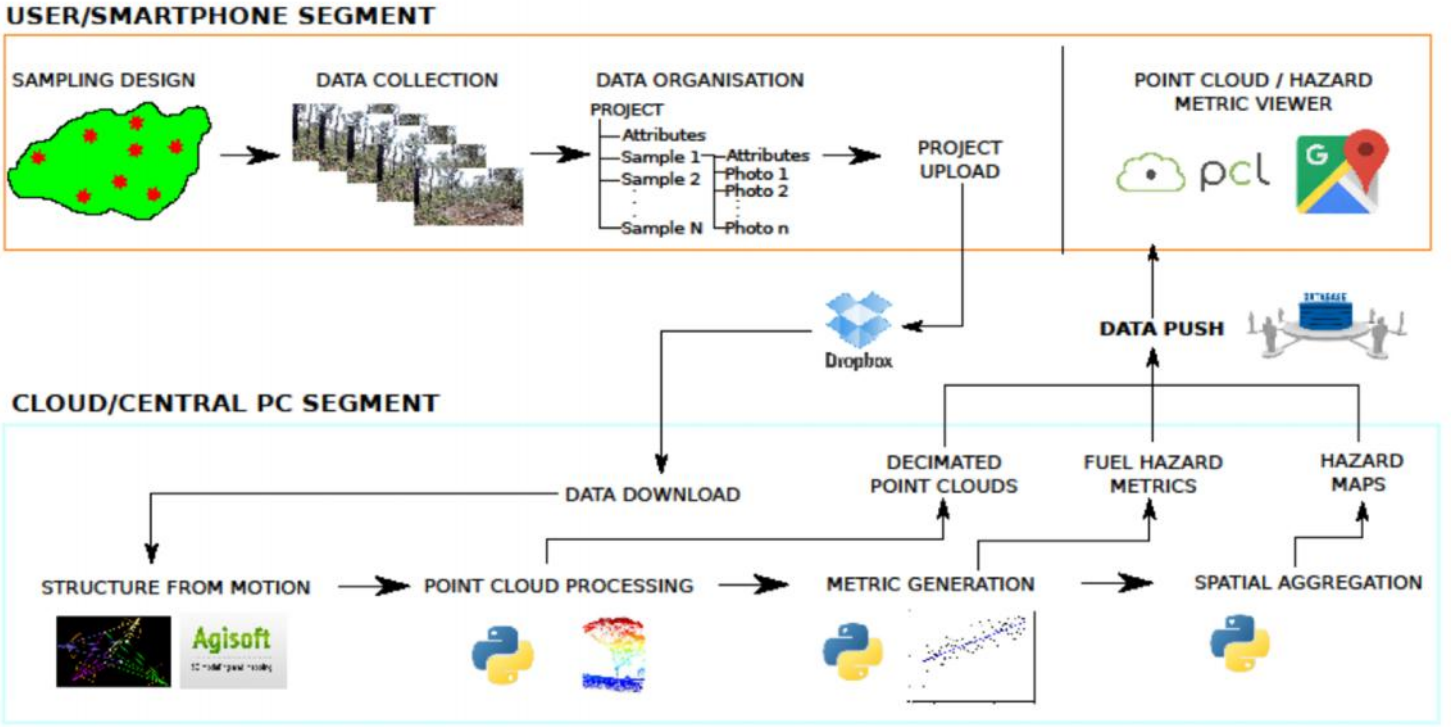
Comparison to current objective assessments

1) Similar infield time to visual assessments
2) Quantified and spatial representation of change

Future work

1) Defining ground and fuel layers
   a) Currently errors in ground are effecting surface fuel metrics
2) Moving towards an accessible field tool for utilisation
3) Larger area data capture

SMARTPHONES – FUELS3D



THANK YOU

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