Metadata Report

Project Name *"Pre-fire UAV surveys of watersheds draining Yucaipa Ridge, CA, 2018*

Summary

Point clouds and 1-cm resolution orthophotos spanning 10^5-10^6 m^2 regions across steep hillslope and headwater channel terrain in Yucaipa Ridge, CA, USA, prior to the 2020 El Dorado Fire. 1-cm orthophotos were compressed following procedures suggested here. Original photographs are available upon request. Surveys collected in 2018 predate the El Dorado Fire and are paired with surveys collected in 2020 that postdate the El Dorado Fire.

Imagery was collected using a Mavic Pro quadcopter. Data processing was performed in Agisoft Metashape (version 2.0.2 build 16404). Alignment and georeferencing performed using iterative-closest-point alignment in CloudCompare (v2.12.0) with clipped airborne lidar-derived point cloud without vegetation filtering used as reference dataset: (U.S. Geological Survey (2020) USGS One Meter CA SoCal Wildfires B1 2018, United States Geological Survey 3D Elevation Program 1-meter Digital Elevation Model).

See publication: 'The grain size of sediments delivered to steep debris-flow prone channels prior to and following wildfire'

Model Name†	Date	Number of Photos	§Areal Extent (m^2)	SfM Points	Lidar Points Bare Earth	Lidar Points Vegetation	‡Mean cloud to Mesh (m)	RMS (m)‡‡	¶Mean distance (m)	¶75th percentile distance (m)	¶95th percentile distance (m)
University Creek 2018	Sept. 5 2018	301	81,600	$4.1x10^7$	284675	1242145	5.38	2.53	2.40	3.00	7.86
Mill Creek 1 Downstream 2018	Sept. 5 2018	404	56,400	$3.7x10^7$	99320	494141	6.30	1.53	1.76	1.76	7.64
Mill Creek 2 2018	Sept. 4 2018	620	112,800	$5.6x10^7$	300671	807877	8.13	1.98	2.33	3.08	8.69
Mill Creek 3 2018	Sept. 4 2018	461	123,000	$4.1x10^7$	254953	777061	4.89	2.03	1.01	1.97	7.19
Ford Canyon 2018	Sept. 4 2018	456	40,400	$4.0x10^7$	79995	321643	3.45	1.26	1.09	1.07	4.02
Wilson Canyon 2018	Aug. 18 2018	60	7,100	$1.7x10^6$	14076	23447	1.81	0.63	0.91	1.13	1.82

† Name of 3D structure-from-motion photogrammetry models.
‡Mean cloud to mesh distance between 2.5D Delaunay best-fitting plane mesh with a maximum edge length of 10 m fit to bare-earth classified lidar points and vegetation classified lidar points (CloudCompare software: https://www.danielgm.net/cc/). Lidar points collected in 2013 represent prefire vegetation canopy.
‡‡RMS of iterative closest point alignment between reference lidar point cloud and SfM-derived point cloud. Reference lidar point cloud either consisted of merged bare-earth and vegetation-classified points or bare-earth

points only (Wilson Canyon 2020 surveys only). The reference cloud type with respect to vegetation filtering that produced the minimum RMS was used for SfM alignment (CloudCompare software: https://www.danielgm.net/cc/). ¶ Distances measured using M3C2 plugin between reference lidar point cloud and SfM-derived point cloud (Lague et al., 2013); CloudCompare software: https://www.danielgm.net/cc/). The lidar-derived point cloud is used as the reference cloud (cloud 1), and 10-m normal, 10-m projection, subsampling of cloud 1 at 1 m, and a maximum depth of 25 m were used as input parameters. Median and 75th percentile distances between reference lidar point cloud and SfM-derived point cloud are less than cloud-to-mesh measurements of vegetation canopy height for all SfM-derived point clouds.

Personnel

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Site Information

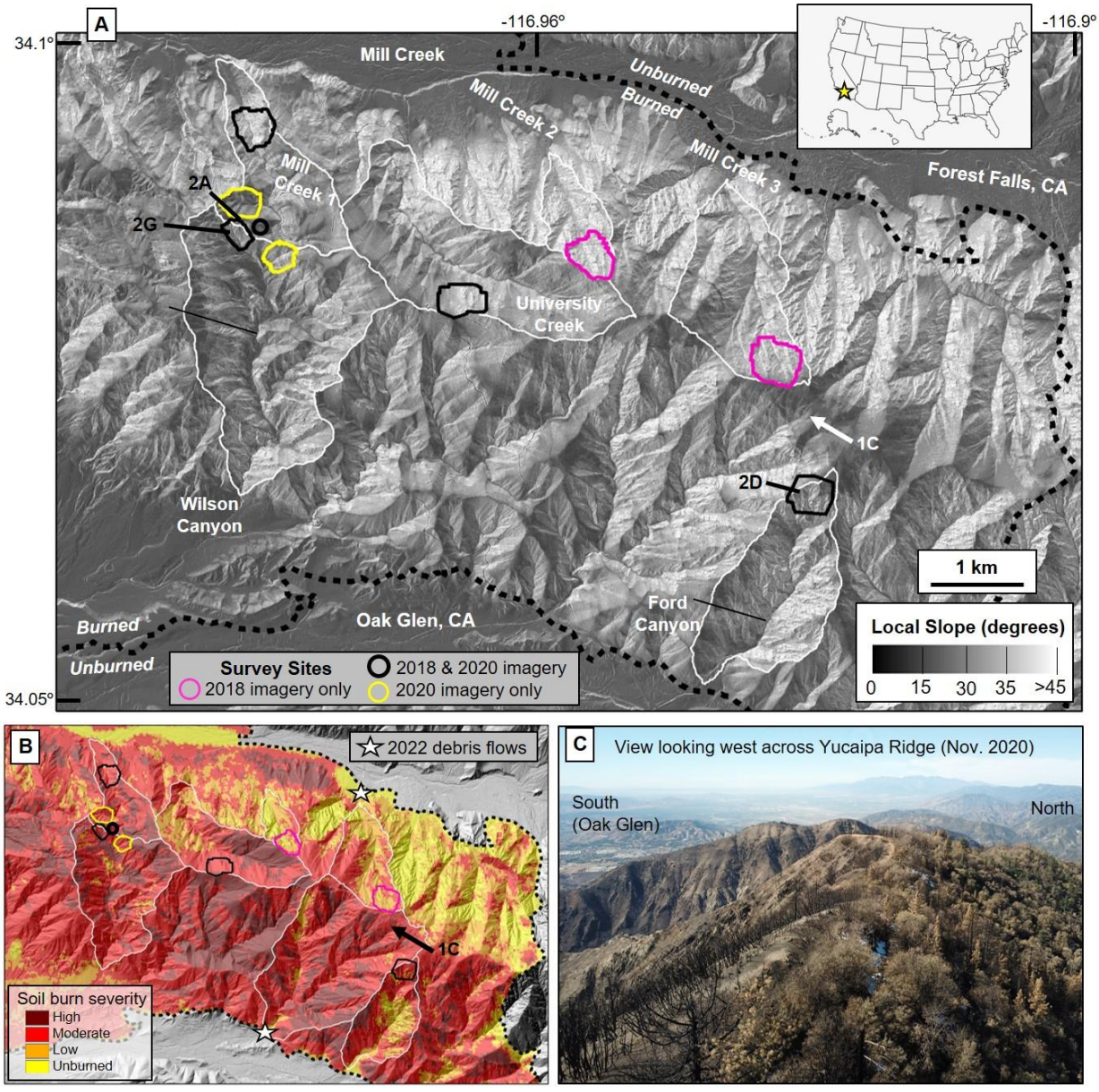
- Steep debris-flow prone hillslopes and headwater channels across Yucaipa Ridge, CA.
- Goals 2018: characterize vegetation and soil cover across a gradient in hillslope steepness and erosion rate
- Site location (GPS cords and/or map)

Name	Date	Width (E-W)	Width (N-S)	Midpoint Lat	Midpoint Lon
Ford 2018	Sept. 4, 2018	247 m	231 m	34.064267	-116.934058
Mill Creek 1 Downstream 2018	Sept. 5, 2018	239 m	285 m	34.090558	-116.981071
Mill Creek 2 (2018)	Sept. 4, 2018	395 m	381 m	34.073941	-116.936852
Mill Creek 3 (2018)	Sept. 4, 2018	319 m	383 m	34.081271	-116.952253
University Creek (2018)	Sept. 5, 2018	389 m	283 m	34.078339	-116.963779
Wilson (2018)	Aug. 18, 2018	93 m	106 m	34.083115	-116.983203

Notes:

Reconstruction quality is poorer for Wilson Canyon (2018) due to poor photo overlap. This point cloud and orthoimage contains considerable distortion.

Flight was initially a training flight and not necessarily planned to render 3D structure-from-motion data. These are the only photos available for these region prior to the fire.



Map information: (A) Map of local slope across the burned region on Yucaipa Ridge, CA measured from a 1-m resolution digital elevation model (U.S. Geological Survey, 2020). Thick lines outline the extent of photo surveys prior to and immediately following fire (black), only prior to fire (pink), and only following fire (yellow). The burn perimeter from the 2020 El Dorado wildfire is marked with a black-dashed line (USDA Forest Service, 2020). (B) Soil burn severity classifications from burned area emergency response (BAER) team (USDA Forest Service, 2020). Stars indicate locations of destructive debris flows that occurred in fall 2022. (C) Postfire photograph of Yucaipa Ridge looking west from Ford Canyon peak (viewpoint indicated in (A)).

- Site conditions: Dry, 2018 surveys are prior to wildfire and heavily vegetated.
- See table above for dates, time spent at each site is approximately 2-3 hours.

Survey Results

- DJI Mavic Pro Quadcopter
- Internal GPS with UAV unit. UAV SfM-derived point clouds are georeferenced to airborne lidar derived point cloud following SfM reconstruction.
- See the table above for error assessment.
- Iterative closest point alignment within CloudCompare using airborne lidar derived point cloud as reference cloud. Reference airborne lidar point clouds are clipped in CloudCompare to the extent of the reconstructed SfM-derived 3D point cloud.
- Mix of oblique and nadir imagery. Direct nadir imagery and raw photos available with request.

Products

- See tables above
- All data products referenced to NAD83(2011)/UTM zone 11n (EPSG::6340)
- 1-cm resolution orthophotos. Mean point densities can be calculated from table 1.
- Horizontal accuracy varies. See table above for cloud to cloud distances between reference airborne lidar dataset and reconstructed 3D SfM datasets.
- Vertical accuracy varies. See table above for cloud to cloud distances between reference airborne lidar dataset and reconstructed 3D SfM datasets.
- Data formats: .tif file for orthoimages and laz files for point cloud data
- Data processing methods:

3D models and orthophotos constructed in Agisoft metashape (version 2.0.2 build 16404). Camera alignment performed with accuracy of 'high' reference preselection of 'source' using GPS coordinates from EXIF data of UAV internal GPS. Key point limit of 40,000 and tie point limit of 4,000. Adaptive camera model fitting was used. Alignment tie points were clipped using a manual selection tool to remove tie points outside of the reconstruction area. Reconstruction of dense point cloud run on 'medium' with aggressive depth filtering. Mesh reconstruction using depth maps, arbitrary surface type, medium quality, high face count, and enabled interpolation. Texture maps constructed with diffuse map type, source data: images, mosaic blending mode, and texture count of 4096x20. Hole filling enabled. Orthomosaics constructed in geographic projection (EPSG:6340), surface mesh, blending mode Mosaic, enable hole filling, pixel size of 0.01 m.

Misc Notes

Contact abngeology@gmail.com for questions, suggestions, or if you would like raw photographs used for reconstructions.