Office work

Step		How
1	Site selection	We need to find places where: • The target vegetation type is: Mixed conifer, Chaparral/Coastal Sage Scrub and Mixed evergreen/redwood • A prescribed burn is planned (*and there is a high probability that it will be carried out this year*). • ALS exists (or can exist) and we can use it. • Easy logistics

2	Crew	• Hiring process
		• Training
		• Research safety
		  ○ Field Safety plan
		  ○ First Aid Kit
		  ○ Activate Satellite Communication Device
		  ○ Travel insurance (UC Away)
		  ○ Crew Emergency contact
		• Safety training (Wilderness First Aid Training)
		• Carry UC identification (official doc about the job)
		• Department key (building, lab and Hugh Office)
		• Lab Computer access

2	Car	• Rent a car (first day logistics,…) • Card to pay the Gas (Lease service provide one). No use in ARCO. • Drivers' license • Where will we park in the off time? Cal Fire Station • Access to UC davis
3	Material	• Review • Buy
4	Cartography	• Create maps (Topo and orthophotomap) with the plot points. • Add maps to Avenza and print them • Add point to GPS
5	Field protocol	• Create Open Foris survey and add to tablets • Review de field protocol and practice it in the field • Permits to crew members in Open Foris • Box offline
6	Logistics	• Search places to sleep • Manage the permits • Payments

Field work

Overview

This protocol is a mix of protocols used in the California Prescribed Fire Monitoring Program (CPFMP) and by Interagency LiDAR Monitoring & Research Applications (IntELiMon).

We have mixed the two protocols with the objective of:

- To collect data for the CPFMP
- To have data to create 3D fuel models (Lidar, voxels,..)
- To evaluate the interactions between both protocols to assess possible improvements in both in the future

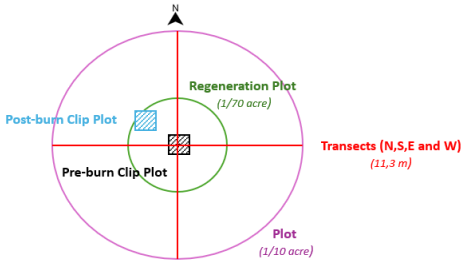


Figure 1. Inventory Plot Scheme

At each sampling point there are two concentric circular inventory plots, one of 1/10 acre (radius of 11.3 m) and another of 1/70 acre (radius of 4.37 m), 4 transects (N, S, E and O) for the fuel inventory and two cutting plots (pre and postburn).

Within a burn unit we have at least a 35m buffer from the edge of the boundary and then the minimum distance is 50m between plots. Generally we will use 100m distance between plots and sometimes up to 150m (It depends on how large the units are and how many plots you want within it)

All data recording will be completed on data sheets designed with the Open Foris Arena app.

Step		Where	How	Data collected	Equipment Needed
1	Navigate to the plot center	Field	1) Take all the necessary inventory material from the car and transport it to the plot (drop off outside the plot). **Tread lightly.** The plot center is also the pre-burn clip plot! 2) Find the plot center using Avenza (Appendix 1). If the determined plot center is unsuitable, move plot center 5m N. If that does not make plot suitable, start from original plot center again and move plot center 5m E. If needed, continue to move plot center clockwise in cardinal directions until plot becomes suitable. If plot is still unsuitable, discard plot and make a note (which plot and why it was discarded) in site notes and/or on map. 3) Things that make a plot center unsuitable are for example: • Unable to put in rebar (eg big bolder, tree bole)	Descriptive data about project, Site, plot and inventory: • **inventory_id**: (Automatically calculated. plot_num+'_'+inventory_pre_post_fire+'_'+site_name+'_'+site_project • **site_project**: Project name (in our case 3dBurn) • **site_name**: Site name (list with the sites) • **inventory_pre_post_fire:** Select the inventory type (Prefire, postfire_inm or Postfire 1) • **plot_num**: Plot number (see the map) • **inventory_date**: inventory date • **inventory_hour**: inventory start time • **inventory_obs**: Observers • **plot_coord**: Coordinates (from GPS)	Tablet (*with Avenza Maps and Open Foris Arena*) GPS (*with plot waypoints*), pink pin flag)

Step		Where	How	Data collected	Equipment Needed
			• Trail or road within plot, trail or road right on the edge of plot (plot edge needs to be at least 5m away), plot is dissected by fence. • Special exceptions (depending on landowner preferences) may include, e.g.discarding plots that have fewer than 2 live trees within the plot, no live trees within plot (minimum 2 live trees within plot). Carefully note any reasons why plots were moved or discarded. • If the designated plot center is close to a tree, adjust plot center so that the laser is not within an estimated distance of three times the tree's diameter, if possible. • If there are burning piles in the plot center, we move the center of the plot until the piles are 7 meters from the center. This will be done randomly: we choose a random orientation and follow it until we are x meters away from the pile) 4) Mark the plot center with a short pink pin flag 5) Open the Open Foris app and create a new Form and enter the data. • project: in our case 3dBurn • Site name • Inventory type (Prefire, postfire_inm or Postfire 1) • Plot number (see the map) • Inventory date • Inventory start time • Observers • Coordinates (from GPS). Select SRS (EPSG:26910=zone 10N or EPSG:26911=zone 11N. See the map). • Compass declination. See the map.	• **plot_declination**: Compass declination	
2	Measure regeneration	Regeneration plot	1) Establish a plot with a radius of 4.37 m, area = 60 sq m. Flag four places around the perimeter for reference (N, E, S and W – to correct magnetic declination) 2) Enter the data in the "Regeneration" form (Open Foris) • Plot regeneration diameter (4.37 m) • Tally the number of seedlings (trees less than 1.37 m in height) of each tree species (conifer and hardwood) for age class 0 (first year) and 1+ (older) seedlings. Record height for the tallest individual seedling in each species. i) If regen plot is covered with homogeneous, extremely dense seedlings, count all seedlings in one quarter of regen plot and multiply by 4. In the Appendix 2 is the seedling key. • Enter data for each individual sapling (trees >1.37 m tall but <7.6 cm DBH) of all tree species (conifer and hardwood). Use a separate	General information about regeneration plots: • **reg_id** (Automatically calculated) • **reg_obs:** Observators • **reg_plot_diam**: Plot diameter in meters (In our case 4,37m) Quantitative data of regeneration in the regeneration subplot divided into 3 categories: • Seedlings (trees less than 1.37 m in height). For each tree species and status: ○ **reg_tse_id** (Automatically calculated) ○ **reg_tse _sp**: Seedling species ○ **reg_tse _status** live or dead ○ **reg_tse _num** number of seedlings ○ **reg_tse_ht** record height for tallest individual seedling in meters	Compass ,5 flags, tape measure (5m), Wood ruler (1m), DBH tape, Laser Rangefinder, Plant ID guides,

Step		Where	How	Data collected	Equipment Needed
			row for each individual entry. Measure and enter the DBH and height. If groups of saplings (>5) are an obvious cohort, find modal DBH and height, and count the number of individuals from the cohort. • Enter data for each individual resprout of tree species (hardwood/broadleaved species). Hardwood clusters/resprouts may be counted as a group unless clumps are >1 meter apart, in which case they should be considered as separate resprouts. ii) Record the number of sprouts originating from each resprout clump, and the height of the tallest sprout. iii) Resprouts move to sapling category when they reach >1.37 m tall iv) If there is no visible stump for origin of resprout, count stems as seedlings (not resprouts) 3) Remove Flags	○ **reg_tse_age** Age class (Zero or more1) ○ **reg_tse_notes** • Sapling (trees >1.4 m tall but <7.6 cm DBH). For each individual tree: ○ **reg_tsa_id** (Automatically calculated) ○ **reg_tsa_sp** Sapling specie ○ **reg_tsa_status** live or dead ○ **reg_tsa_dbh** : dbh in cm ○ **reg_tsa_ht** total height in meters ○ **reg_tsa_numcourt** number of individuals from the cohort If groups of saplings (>5) are an obvious cohort ○ **reg_tsa_notes** • Resprout of tree species (Enter data for each individual resprout of tree species) ○ **reg_tre_id** (Automatically calculated) ○ **reg_tre_sp** Resprout specie ○ **reg_tre_status** live or dead ○ **reg_tre_ht** height of the tallest sprout in meters ○ **reg_tre_clump** Number of sprouts originating from each resprout clump ○ **reg_tre_notes**	
3	Pre-burn clip plot	Plot center	1) Place quadrat (*with the pink pin in the center*) and ordinate with top of frame facing north. 2) Remove pink pin flag. 3) Open the "Clip plot" form in the Open Foris and enter the data. Select Preburn clip plot. 4) With the tablet (Open Foris) take nadir and oblique photos of plot where the top of the photo is North 5) Voxel sample vegetation (top down) and clip • Use ruler or reel tape to determine the 3 strata: i) 0 cm to 30 cm ii) 30 cm to 100 cm iii) More than 100 cm • Record vegetation categories (Appendix 3) in each stratum • Clip all the vegetation for each stratum and place in sandbag. Close bags and Label with ID cable ties with a "Label name" (from Open Foris) 6) Short pink pin flag in the center and remove quadrat	General information: • **clip_plot_id** (Automatically calculated) • **clip_plot_type** pre or post fire • **clip_plot_nadirphoto** nadir photo • **clip_plot_obliquephoto** oblique photo • **clip_photo_notes** Presence or absence of forest fuels within each stratum (height of 0-30cm, 30-100cm and more than 100cm) in a 50x50cm plot in the center of the plot ("dark" LIDAR zone). All fuel from each stratum would be clip and stored together for their lab processing. • **clip_plot_fuel_id** (Automatically calculated) • **clip_plot__fuel strata** 0-30cm, 30-100cm and more than 100cm • **clip_plot_fuel_fuel** fuel categories (WoodyLive, WoodyLitter, 1h, 10h, 100h, 1000h, Pinecones, ConiferLitter, PineNeedles and FineVegetation)	Compass, quadrat (0,5 m x 0,5 m), tablet, pencil, papers, sharpie, sandbags, ID cable ties, Wood ruler (1m), pruning shears, Go-No-Go Gauge and Trowel

Step		Where	How	Data collected	Equipment Needed
				• **clip_plot_fuel_label** to tag the fuels bags (inventory_id+'_'+clip_plot_type+'_'+clip_plot_fuel_strata+'_'+inventory_date) • **clip_plot_fuel_weight** Dry weight in grams	
4	Scan BLK plot	Plot center	1) Place the laser on the tripod at maximum height and situate the tripod so that the laser is directly over the plot center and make sure the laser is plumb, stability is prioritized on hills 2) Turn on laser by pressing power button once and wait for solid green light. 3) Press power button again when ready to scan. BLK will flash yellow indicating scan is about to begin. 4) Within 5 seconds, move 20-30 meters away from laser to avoid being detected. If veg is too dense, get behind large tree. If veg is minimal, keep distance and crouch low. 5) It is recommended that you keep watch on the laser to make sure it goes thru the entire collection process (3 mins): • The LED on the laser will turn yellow indicating that it is busy, spin to find its location and begin taking photos. • After collecting photos from all directions, the laser will pivot in the opposite direction an unspecified amount (usually 90 degrees) and stop. Then it will begin spinning the mirror and start the collection of point cloud data. • A solid green light indicates that the laser has finished scanning.	• **plot_blk** 19-character BLK plot ID (in the lab)	BLK, tripod, BLK battery, tablet
5	Mark macro plot center	Plot center	Remove the pink flag and Permanently mark the plot locations with a 2-foot piece of 3/8" or 1/2" rebar and topped with a rubber/plastic **orange rebar** cap. Leave only 3-5" above ground. Flag the rebar at the center of the plot and the witness tree (see item 3, next section). Use a permanent marker (Sharpie) to label cap with plot ID and UC Davis.		2-foot piece of ½" rebar, Hammer, rubber/plastic orange rebar cap, label and sharpie.
6	Plot Description	Plot center	1) Stake out the plot on the ground (11.3 meters radius). With a tape measure and the compass, mark the 4 ends (N, S, E and W - Correct the magnetic declination) with a small flag. Leave the tapes on the floor. **The ends of the plot are the starting points (0 m)** 2) Open the "Plot identification" form in the Open Foris and enter the data. 3) Enter the plot diameter (in our case 11.3 m) 4) Identify witness tree - this is the first live tree (> 7.6 cm dbh) tagged, clockwise from 0 degrees (true north). Where permitted, mark witness tree with pink or other highly visible flagging at approx. eye-level. Record the distance (nearest 0.1m) from base of tree to plot center and the azimuth looking from the witness tree to center. Note tag number. If	Descriptive data about the plot, inventory and estimate ground cover: • Plot data ○ **inventory_plot_diam** plot diameter in meters ○ **plot_slopeper** Slope in % ○ **plot_aspectdegre** Aspect in degree ○ **plot_wtreetag_yn** the witness tree is tag? (Yes or no) ○ **plot_wtreeTag** witness tree tag number ○ **plot_wtreesp** witness tree species (if it isn't tag number)	Small flag, Tablet, 4 tapes (20m), 1 tape (20m), compass, tree tag, Aluminum nails, hammer, GPS, clinometer

Step		Where	How	Data collected	Equipment Needed
			trees aren`t allowed to be tagged, record tree species and dbh instead of tag number 5) Assess the fire severity class of any recent fire (Appendix 4). Add observations of old signs of fire to plot notes. 6) Take photos with the tablet using Open Foris. Take one photo of each cardinal direction moving clockwise, from the end of the opposite transect (N, E, S, W). For example, you should be standing at the S transect end to take a photo of the N transect end. Take the picture in a horizontal direction with the horizon located the middle of the picture 7) Slope, in percent: using a clinometer, measure the slope to the nearest 1% from point center in the two directions of the aspect axis to the plot edge and average these two numbers. Slope does not need to be collected on already established plots. 8) Aspect, in degrees: using a hand-held compass, measure and record the predominant aspect across the entire plot to the nearest 1 degree. Aspect is measured in the same direction as the slope. Aspect does not need to be collected on already established plots. 9) Ground cover, percent. Using the categories of bare soil, litter, blacklitter, ash, rock (non-combustible), CWD, Burn Piles and basal vegetation (live and dead), estimate percent ground surface cover to the nearest 5%. Values must sum to 100%. • For basal vegetation, think about what the plot would look like if you cut everything off right at ground level, capturing just the emerging stems/trunks of plants. • As reference 2x2m = 1% of plot • If there are some ground cover typologies with a less than 1% of cover mark as a trace. Is it necessary to correct the slope when we establish the plot?	○ **plot_wtreedbh** witness tree DBH in cm (if it isn't tag number) ○ **plot_wtreedistance_m** Distance in meters to witness tree in m ○ **plot_wtreeazimuth_deg** Azimuth from witness tree to center in degrees • Inventory data ○ **inventory_photon** North photo ○ **inventory_photoe** Est photo ○ **inventory_photos** South photo ○ **inventory_photow** West photo ○ **inventory_firesever** integer (Assess the fire severity class of any recent fire. 0-5) ○ **inventory_notes** • Estimate ground cover. ○ **ground_cover_id** (Automatically calculated) ○ **ground_cover_bare_soil** % of bare soil ○ **ground_cover_litter** % of litter ○ **ground_cover_blacklitter** % of black litter ○ **ground_cover_ash** % of ash ○ **ground_cover_rock** % of rock ○ **ground_cover_cwd** % of cwd ○ **ground_cover_basal_veg** % of basal vegetation ○ **ground_cover_burnpiles** % of burn piles ○ **groundpost_cover_total** summatory all the covers ○ **ground_cover_trace** typologies with less than 1% of cover	
7	Post-burn clip plot	2 to 3 meters from the plot center	1) Find vegetation that is similar to pre burn clip plot that is two to three meters from plot center 2) Place quadrat and ordinate with top of frame facing north 3) Record distance and the azimuth (corrected) from plot center to post-burn clip plot NW corner 4) Sample post burn clip plot • Open the "Burn clip" form in the Open Foris and enter the data. • With the tablet (using Open Foris app) take nadir and oblique photos of plot where the top of the photo is North • Voxel sample vegetation (top down) ONLY (**no clipping**) • Record vegetation categories in each stratum	General information: • **clip_plot_id** (Automatically calculated) • **clip_plot_type** pre or post fire • **clip_plot_distance** • **clip_plot_azimuth** • **clip_plot_nadirphoto** nadir photo • **clip_plot_obliquephoto** oblique photo Presence or absence of forest fuels within each stratum (height of 0-30cm, 30-100cm and more than 100cm) in a 50x50cm plot	Compass, quadrat (0,5 m x 0,5 m), tablet, Wood ruler (1m), Go-No-Go Gauge, tape measure (5m) 2-foot piece of ½" rebar, Hammer, plastic red rebar cap and sharpie.

Step		Where	How	Data collected	Equipment Needed
			5) Monument post burn clip plot with two 2.5 ft conduit and aluminum tag • Place a piece of 2.5 ft conduit on the outside of the NW corner of the ground square, topped with a rubber/plastic red rebar cap and tag (i.e. Plotnumber_Pos_NW)	• **clip_plot_fuel_id** (Automatically calculated) • **clip_plot__fuel strata** 0-30cm, 30-100cm and more than 100cm • **clip_plot_fuel_fuel** fuel categories (WoodyLive, WoodyLitter, 1h, 10h, 100h, 1000h, Pinecones, ConiferLitter, PineNeedles and FineVegetation)	
8	Vegetation cover	Plot	1) Open the "Vegetation cover" form in the Open Foris and enter the data. 2) Estimate cover (to nearest 1%) of total plot for the classes listed under "vegetation cover". For the 1/10 acre plots, about 4 m sq (2x2) is equal to 1% cover. Diameter at breast height (DBH) equals 1.37m (4.5 feet). • "Total Vegetation (TOT VEG)" is the cover of all living vegetation as a % of the plot when viewed from an airplane/satellite. • "Total Overstory Trees (TOV)" = trees >1.37m tall and DBH > 7.6 cm, refer only to live trees. • "Total Understory Layer (TOT UND)" as a % of the plot when viewed from above (e.g., from a plane or satellite). All saplings (= trees >1.37m tall and DBH < 7.6 cm) and seedlings (= trees <1.37m tall) combined. • "Total live shrub cover (TOS)" refers only to live shrub cover (shrubs defined based on species). • Record percent cover for all plants in "Herb Layer (TOT HERB)". This includes forbs and graminoids. Note: If any above-ground cover types are present in the plot but make up less than 1%, record the percent cover as "tr" - this represents trace cover (tr definition can be modified based on user, e.g., < 0.5%, but default is <1% and any change should be clearly noted).	Estimate % cover to the nearest 1% at less than 5% and to the nearest 5% greater than for the classes listed under "vegetation cover". • **veg_cover_id** (Automatically calculated) • **veg_cover_tot_veg_percent** cover of living vegetation as a % • **veg_cover_tov_percent** cover of live tree >1.37m tall and DBH > 7.6 cm as a % • **veg_cover_und_percent** As a % of the plot when viewed from above (e.g., from a plane or satellite). All saplings (= trees >1.37m tall and DBH < 7.6 cm) and seedlings (= trees <1.37m tall) combined • **veg_cover_tos_percent** cover of living shrub as a % • **veg_cover_herb_percent** cover of forbs and graminoid as a % • **veg_cover_tr** above-ground cover types are present in the plot but make up less than 1%	Tablet
9	Trees	Plot	All live trees will be tagged in clockwise order from plot center beginning at the North transect (0 degrees). If two trees are right behind each other, measure the closest one to plot center first. If a live tree is not tagged, add a new tag and note the tag number in the datasheet in notes. Should a qualified sprouting tree species have numerous individuals that are relatively similar in size within the plot, those individuals may be assessed together as group (i.e., modal height, diameter). In this case, each tree gets its own line and live trees get their own tag, but the heights and diameters will be the same modal numbers. Open the "Trees" form in the Open Foris and enter the data. 1) Nail the tag label to the tree (Only live trees and so that it can be seen from the center of the plot. The nail should be placed below the lower edge of the tape so that when tape is resting on the nail, it is at 1.37m)	Quantitative and descriptive data about trees (DBH cutoff of 7.6 cm and a height cutoff of 1.37 m): • **tree_id** (Automatically calculated) • **tree_tag** Number of TAG or letters code for no tag trees. It's the code that identify the same trees • **tree_status** live or dead • **tree_burn** yes/no • **tree_firedamage** This tree is affected by the fire (broken after the fire) yes/no • **tree_sp** species • **tree_dbh** DBH in cm • **tree_HT** total height in m • **tree_HTLCB** height to live crown base in m • **tree_decay_class** decay class, 1-5	Tablet, DBH tape, Hypsometer, Tree Tag, Nails, hammer, Tree ID guides

Step		Where	How	Data collected	Equipment Needed
			2) Enter the tag # *(In the case of dead trees or if you cannot label in the field the live trees, enter a letter code in TAG in order of the alphabet (A,B,C,D,..)*. Live trees that have died since previously tagged should retain their tags. 3) Enter status as live or dead (L, D) 4) Enter species (live and dead trees). 5) Measure DBH in cm. Measure trees at DBH (1.37m) from uphill side of slope (if there is one) with diameter increment tape measure (d-tape) for live and dead trees. • For trees that have a burl, split or other anomaly that exaggerates their DBH, take the DBH measurement above or below anomaly and put a remark in Notes column. • For leaning trees, measure vertical height at 1.37m. • A tree on the edge of the plot counts as "in" if when center of bole (pith) at the base is 11.3m or closer to plot center (when not sure, measure with tape). If there is a cohort on the edge of the plot, only measure trees that are within. Trees with base originating outside the plot but leaning in do not count. If only some stems on a multi-stemmed individual are in plot, only measure stems that are in the plot. 6) Measure height to top of the tree 7) Measure height to live crown base (HTLCB) to the nearest 0.1 m (only live trees). See Fig. 1 below. • This is defined as the height to the lowest live, vertically continuous crown (see appendix 5). • Measure HTLCB from the point where the lowest live branch intersects with the bole of the tree, not the tip of the branch. • For epicormically sprouting trees, write "epicormic crown" in notes column. If dead, enter decay class (1-5; see appendix 6) 8) Note health codes of pests, disease, or damage (e.g., mistletoe, catface, etc.) (Appendix 8) 9) If you are in a recently burned area, fire severity metrics will be taken (bole char height, crown scorch height/%, crown torch height/% and change in status live/dead). See Postfire protocol.	• **tree_health** health status (pests, disease, or damage • **tree_scorch_m** height to scorch in m • **tree_scorch_per** % to scorch • **tree_torch_m** height to torch in m • **tree_torch_per** % to torch in m • **tree_bole_char_m** height to bole char in m • **tree_notes**	
10	Basal Area	Plot center	1) Open the "Basal Area" form in the Open Foris and enter the data. • Use a hand-held basal area gauge to conduct plotless estimate of stand basal area. We will use a basal area factor (BAF) of 20 in most cases, but user can choose a different BAF if fewer than 6 trees (use	Estimate the stand basal area, by sp and status, using "Cruzall" or prism • **ba_id** (Automatically calculated) • **ba_sp** tree species	Cruzal/prims, tablet, Plant ID guides, counter

Step		Where	How	Data collected	Equipment Needed
			smaller BAF) or more than 9 trees (use larger BAF) enter. Hardwood stands often require a BAF of 10. Make sure to record the BAF used. If dropping to a lower BAF does not increase the count, use the default BAF = 20. • Carry out a plotless estimate of stand basal area. Enter the number of live and dead trees counted with the basal area gauge ("Cruzall") or prism, by species, using the BAF factor entered above. In each blank cell, write the tree name above the line (if unknown, write "UNK"), and the number of live or dead hits. Live and dead counts of the same species will be recorded on two different lines. Enter the number of live and dead trees counted with the basal area gauge ("Cruzall") or prism, by species.	• **ba_status** live or dead • **ba_baf** baf number • **ba_treenum** tree number for each sp, status and BAF • **ba_basalarea** (calculated value ba in feet2/acree + BAF * Number tree)	
11	Species cover	Plot	1) Open the "Species cover" form in the Open Foris and enter the data. • Enter the species lifeform (shrub, forb, graminoid, fern, etc.) and live/dead status. • Enter the layer code of the plants you are measuring (TOV = overstory tree; TSA = saplings; TSE = seedlings; TRE= resprout) i) For each tree and shrub species, there may be multiple layer classes ii) For example, most tree species will be in the TOV layer as well as the TSA/TSE layer for both live and dead • Enter the species code and record percent cover to nearest 1%. i) If the phenology is not well-aligned with the sampling episode, then species ID for the forb and graminoids may not be possible. ii) For woody species, enter layer code (TOV, TSA, TSE, TRE) • Enter modal height of each shrub species to the nearest 0.1m. • If any cover types are present in plot but make up less than 1%, record the percent cover as "tr" - this represents trace cover.	Information about species cover inventory: • **sp_invcov_id** (Automatically calculated) • **sp_cov_inv_obs** observers Estimate % cover to the nearest 1% at less than 5% and to the nearest 5% greater than for species, status and layer: • **sp_cov_id** (Automatically calculated) • **sp_cov_sp** species • **sp_cov_status** live or dead • **sp_cov_lifeform** Enter the species lifeform (shrub, forb, graminoid, fern, etc.) • **sp_cov_layer** (TOV = overstory tree; TSA = saplings; TSE = seedlings; TRE= resprout) • **sp_cov_tr** Mark if any cover types are present in the plot but make up less than 1% • **sp_cov_percent** cover in % • **sp_cov_shrub_ht** Modal height of each shrub species to the nearest 0.1m • **sp_cov_notes**	Tablet, Hypsometer, 2 meters tape, Plant ID guides
12	Woody fuels	Transects	1) Fuels data will be collected from four Brown's Transects. The transects are laid out at the cardinal directions, stretching from the plot center 11.3 m. The ends of the transects are the starting points, i.e. they are read starting from at the edge of the plot, heading toward the middle. 2) Enter the azimuth of the transect (N, S, E, W; unless there is a need to move the transect and then enter azimuth in degrees). There will be four transects with the same plot number. Record transect slope if >20 percent. If a burn pile overlaps a section of transect where FWD are	Fuels data will be collected from four Brown's Transects. The transects are laid out at the cardinal directions, stretching from the plot center 11.3 m. The ends of the transects are the starting points. • Fuels: ○ **fuels_id** (Automatically calculated) ○ **fuels_observ** observers ○ **fuels_azimuth** transect azimuth	Metric tape, DBH tape, clinometer, compass, 6" small rulers, Mini measuring tapes, Go-No-Go Gauge. Trowel

Step		Where	How	Data collected	Equipment Needed
			measured, offset the 4m section down the tape and measure the burn pile (record in observations) 3) Open the "fuels" form in the Open Foris and enter the data • The number of 1-hr fuels (<0.64 cm) that intersect the transect between the last 2 meters of the transect line (11.3 m - 9.3 m). • The number of 10-hr fuels (0.64-2.54 cm) that intersect the transect between the last 2 meters of the transect line (11.3 m - 9.3 m). • The number of 100-hr fuels (2.54-7.62 cm) that intersect the transect between the last 4 meters of the transect line (11.3 m - 7.3 m) • Measure litter and duff at transect starting point (outside edge of plot) and again at the 4 meters mark. i) Litter is undecomposed or only partially decomposed organic material that can be readily identified (e.g., plant leaves, needles, twigs, etc.). ii) Duff is between the litter and mineral soil, and includes decomposing organic material, decomposed to the point that there are no clearly identifiable whole organic materials like pine needles, leaves, twigs, etc., although larger decomposing tree branches etc. can sometimes be found in duff. • Measure fuelbed depth at the transect starting point (0 m) and at 4 m in from edge of plot. Fuelbed depth is the height between the bottom of the litter layer (top of duff) to the highest dead fuel not attached to a rooted plant (branch or needle or stick, etc). 4) Collect information, on every piece of coarse woody debris (CWD) that intersects the transects and meets the criteria: Central longitudinal axis of the CWD intersects the transect and the diameter at the point of intersection is >3" (7.6 cm). Open the "fuels" form in the Open Foris and enter the data: • Species code of CWD particle (if possible). If unknown, use UNKN as species code. • Diameter at intersection with tape • Length • Location of the CWD piece on the transect (distance from plot center). • Decay class (1-5; see appendix 6) Observations	○ **fuels_slope_percent** Transect slope in % ○ **fuels_x1h_length_m** Transect length for 1h fuels (in our case 2 meters) ○ **fuels_x10h_length_m** Transect length for 10h fuels (in our case 2 meters) ○ **fuels_x100h_length_m** Transect length for 100h fuels (in our case 4 meters) ○ **fuels_x1000h_length_m** Transect length for 1000h fuels (in our case 11.3 meters) ○ **fuels_count_x1h** number of intersects for 1h fuels ○ **fuels_count_x10h** number of intersects for 10h fuels ○ **fuels_count_x100h** number of intersects for 100h fuels ○ **fuels_duff1_cm** starting point duff depth in cm ○ **fuels_litter1_cm** starting point litter depth in cm ○ **fuels_duff2_cm** 4 meters duff depth in cm ○ **fuels_litter2_cm** 4 meters litter depth in cm ○ **fuels_fuel1_cm** starting point fuelbed Depth in cm ○ **fuels_fuel2_cm** 4 meters fuelbed Depth in cm ○ **fuels_notes** • Coarse woody debris (CWD): ○ **cwd_id** (Automatically calculated) ○ **cwd_sp** species ○ **cwd_diam** Diameter at intersection with tape in cm ○ **cwd_lenght** length ○ **cwd_dist_m** Location of the CWD piece on the transect (distance from plot center) ○ **cwd_decay** Decay class ○ **cwd_notes**	

Step		Where	How	Data collected	Equipment Needed
			• To qualify as fuels, particles must be severed from the original source of growth. • Be sure not to count dead shrub limbs that are attached to a standing shrub, whether the standing shrub is dead or alive. You may need attempt to move fuels to see if they are free from their source of growth. • Do not count needles, grass, bark, or cones. • If a branch or log intersects the transect at its end, the central axis must intersect the transect for the piece to be tallied (see figure below). • Count both intersections for a curved piece (appendix 7) • Regardless of size, pieces are only tallied when their intersection with the transect lies above the litter and duff layers (appendix 7). • Do not count stumps that are still rooted in the ground.		
13	Burn piles	Plot	1) Describe and count each burn piles within the entire 1/10th acre plot. If a burn pile overlaps a section of transect where FWD are measured, offset the 4m section down the tape and measure the burn pile. Record the following: • Maximum height • Maximum diameter • Dominant species • Dominant size class: either small (<7.6cm) or large (>7.6cm) • Foliage (y/n) • Record the percent of the pile that is within the plot (plots fully within the plot would be 100%)	Describe and count each burn piles within the entire 1/10th acre plot • **burn_pile_id** • **burn_pile_height_max** Maximum height in m • **burn_pile_radius_max** Maximum diameter in m • **burn_pile_sp** Dominant species • **burn_pile_class** either small (<7.6cm) or large (>7.6cm) • **burn_pile_percent** Record the percent of the pile that is within the plot • **burn_pile_foliage** foliage yes or no • **burn_pile_notes**	Metric tape
Prescribed burn					
1	Find plot center	Plot center	1) Find the plot center using the cartography and the witness tree information and find the 2-foot piece of ½" 2) Tread lightly. The plot center is also the post-burn clip plot! 3) Open the "plot identification" form in the Open Foris and enter the data	Descriptive data about project, Site, plot and inventory: • **inventory_id**: (Automatically calculated. plot_num+'_'+inventory_pre_post_fire+'_'+site_name+'_'+site_project • **site_project**: Project name (in our case 3dBurn) • **site_name**: Site name (list with the sites) • inventory_pre_post_fire: Select the inventory type (Prefire, postfire_inm or Postfire 1) • **plot_num**: Plot number (see the map) • **inventory_date**: inventory date • **inventory_hour**: inventory start time • **inventory_obs**: Observers • **plot_declination**: Compass declination	Tablet (*with Avenza Maps and Open Foris Arena*) GPS (*with plot waypoints*), pink pin flag) **check the declination of the site in the shared folder* **check the information about preburn inventory (tree, clip plot photos,..)*

Step		Where	How	Data collected	Equipment Needed
2	Scan BLK plot	Plot center	1) Place the laser on the tripod at maximum height and situate the tripod so that the laser is directly over the plot center and make sure the laser is level with the ground (using level) as possible, stability is prioritized on hills 2) Turn on laser by pressing power button once and wait for solid green light. 3) Press power button again when ready to scan. BLK will flash yellow indicating scan is about to begin. 4) Within 5 seconds, move 20-30 meters away from laser to avoid being detected. If veg is too dense, get behind large tree. If veg is minimal, keep distance and crouch low. 5) It is recommended that you keep watch on the laser to make sure it goes thru the entire collection process (3 mins): • The LED on the laser will turn yellow indicating that it is busy, spin to find its location and begin taking photos. • After collecting photos from all directions, the laser will pivot in the opposite direction an unspecified amount (usually 90 degrees) and stop. Then it will begin spinning the mirror and start the collection of point cloud data. • A solid green light indicates that the laser has finished scanning. Note the time the scan ends on the datasheet.	• **plot_blk** 19-character BLK plot ID (in the lab)	BLK360, tripod, BLK battery, tablet
3	Post-burn clip plot	Post-burn clip plot	1) Find the conduits (you can see the distance and orientation from the center in the Open Foris) 2) Place quadrat and ordinate with top of frame facing north (*The conduit will be in the outside of the NW corner ant the other at SE corner*) 3) Sample post burn clip plot • Open the "Clip plot" form in the Open Foris and enter the data. Select Preburn clip plot. • With the tablet (Open Foris) take nadir and oblique photos of plot where the top of the photo is North 4) Voxel sample vegetation (top down) and clip • Use ruler or reel tape to determine the 3 strata: i) 0 cm to 30 cm ii) 30 cm to 100 cm iii) More than 100 cm • Record vegetation categories (Appendix 3) in each stratum	General information: • **clip_plot_id** (Automatically calculated) • **clip_plot_type** pre or post fire • **clip_plot_distance** • **clip_plot_azimuth** • **clip_plot_nadirphoto** nadir photo • **clip_plot_obliquephoto** oblique photo Presence or absence of forest fuels within each stratum (height of 0-30cm, 30-100cm and more than 100cm) in a 50x50cm plot. All fuel from each stratum would be clip and stored together for their lab processing. • **clip_plot_fuel_id** (Automatically calculated) • **clip_plot__fuel strata** 0-30cm, 30-100cm and more than 100cm • **clip_plot_fuel_fuel** fuel categories (WoodyLive, WoodyLitter, 1h, 10h, 100h, 1000h, Pinecones, ConiferLitter, PineNeedles and FineVegetation)	Compass, quadrat (0,5 m x 0,5 m), tablet, pencil, papers, sharpie, sandbags, ID cable ties, Wood ruler (1m), pruning shears, Go-No-Go Gauge and Trowel

Step		Where	How	Data collected	Equipment Needed
			• Clip all the vegetation for each stratum and place in sandbag. Close bags and Label with ID cable ties with a "Label name" (from Open Foris) 5) Remove the conduits	• **clip_plot_fuel_label** to tag the fuels bags (inventory_id+'_'+clip_plot_type+'_'+clip_plot_fuel_strata+'_'+inventory_date) • **clip_plot_fuel_weight** Dry weight in grams	
4	Plot Description	Plot center	1) Stake out the plot on the ground (11.3 meters radius). With a tape measure and the compass, mark the 4 ends (N, S, E and W - Correct the magnetic declination) with a small flag. Leave the tapes on the floor. The ends of the plot are the starting points (0 m) 2) Open the "Plot identification" form in the Open Foris and enter the data. 3) Enter the plot diameter (in our case 11.3 m) 4) Review the witness tree (mark again if it's necessary). If witness tree died, choose new witness tree (next live tree within plot clockwise) If there is no live tree left in plot, choose closest live tree outside of plot and record tree species, dbh, distance from plot center and azimuth towards plot center. 5) Assess the fire severity class of any recent fire (Appendix 4). Add observations of old signs of fire to plot notes. 6) Take photos with the tablet using Open Foris. Take one photo of each cardinal direction moving clockwise, from the end of the opposite transect (N, E, S, W).For example, you should be standing at the S transect end to take a photo of the N transect end. Take the picture in a horizontal direction with the horizon located the middle of the picture 7) Ground cover, percent. Using the categories of bare soil, litter, blacklitter, ash, rock (non-combustible), CWD, Burn Piles and basal vegetation (live and dead), estimate percent ground surface cover to the nearest 5%. Values must sum to 100%. • For basal vegetation, think about what the plot would look like if you cut everything off right at ground level, capturing just the emerging stems/trunks of plants. • As reference 2x2m = 1% of plot 8) Estimate the % scorch (volume affected by fire) for lifeform categories of shrubs, seedlings and saplings.	Descriptive data about the plot, inventory and estimate ground cover: • Plot data ○ **inventory_plot_diam** plot diameter in meters ○ **plot_slopeper** Slope in % ○ **plot_aspectdegre** Aspect in degree ○ **plot_wtreetag_yn** the witness tree is tag? (Yes or no) ○ **plot_wtreeTag** witness tree tag number ○ **plot_wtreesp** witness tree species (if it isn't tag number) ○ **plot_wtreedbh** witness tree DBH in cm (if it isn't tag number) ○ **plot_wtreedistance_m** Distance in meters to witness tree in m ○ **plot_wtreeazimuth_deg** Azimuth from witness tree to center in degrees • Inventory data ○ **inventory_photon** North photo ○ **inventory_photoe** Est photo ○ **inventory_photos** South photo ○ **inventory_photow** West photo ○ **inventory_firesever** integer (Assess the fire severity class of any recent fire. 0-5) ○ **inventory_notes** • Estimate ground cover. ○ **ground_cover_id** (Automatically calculated) ○ **ground_cover_bare_soil** % of bare soil ○ **ground_cover_litter** % of litter ○ **ground_cover_blacklitter** % of black litter ○ **ground_cover_ash** % of ash ○ **ground_cover_rock** % of rock ○ **ground_cover_cwd** % of cwd ○ **ground_cover_basal_veg** % of basal vegetation ○ **ground_cover_burnpiles** % of burn piles	Small flag, Tablet, 4 tapes (20m), 1 tape (20m), compass, tree tag, Aluminum nails, hammer, GPS, clinometer

Step		Where	How	Data collected	Equipment Needed
				○ **groundpost_cover_total** summatory all the covers ○ **ground_cover_trace** typologies with less than 1% of cover • Scorch percent (%) for volume affected by fire) for lifeform categories of shrubs, seedlings, and saplings: ○ **inventory_seedling_sco_per** seediling scorch percent in % ○ **inventory_shrubs_sco_per** shrubs scorch percent in % ○ **inventory_saplings_sco_per** shrubs sapling percent in %	
5	Trees	Plot	Open the prefire tree inventory database and identify each tree with those found on the plot. To do this. Yeah: 1) The trees are labeled. • they have the label. Verify the tag and enter the original TAG • they have lost the label. Label again and note in observations: Relabeling and the value of the old label. 2) The trees are not labeled. Enter the value (letters) from the preburn database. Open the "Trees" form in the Open Foris and enter the data. 3) Assess the status (L/D) of each tree previously measured in the plot. 4) If a tree was damaged or broken during the fire, re-measure: • Height (m) • Height to live crown (m). 5) Decay class (dead trees) (1-5; see appendix 6) 6) Indicate whether or not the tree is resprouting 7) Assess crown scorch and torch for each tree previously measured in the plot. • Measure average scorch height (m) and torch height (m) for each tree. • Estimate % crown scorch (discolored, dead foliage still present) and % crown torch (foliage and limbs consumed by fire, now absent) for each tree. • Measure the average continuous bole char height (m) for each tree. This is an average of the high and low sides (if difference exists).	Quantitative and descriptive data about trees (DBH cutoff of 7.6 cm and a height cutoff of 1.37 m): • **tree_id** (Automatically calculated) • **tree_tag** Number of TAG or letters code for no tag trees. It's the code that identify the same trees • **tree_status** live or dead • **tree_burn** yes/no • **tree_firedamage** This tree is affected by the fire (broken after the fire) yes/no • **tree_sp** species • **tree_dbh** DBH in cm • **tree_HT** total height in m • **tree_HTLCB** height to live crown base in m • **tree_resprouting** tree is resprouting after the fire (yes/no) • **tree_decay_class** decay class, 1-5 • **tree_health** health status (pests, disease, or damage • **tree_scorch_m** height to scorch in m • **tree_scorch_per** % to scorch • **tree_torch_m** height to torch in m • **tree_torch_per** % to torch in m • **tree_bole_char_m** height to bole char in m • **tree_notes**	Tablet, DBH tape, Hypsometer, Tree Tag, Nails, hammer, Tree ID guides

Step		Where	How	Data collected	Equipment Needed
			8) Note health codes of pests, disease, or damage (e.g., mistletoe, catface, etc.) (Appendix 8)		
6	Woody fuels	Transects	1) Fuels data will be collected from four Brown's Transects. The transects are laid out at the cardinal directions, stretching from the plot center 11.3 m. The ends of the transects are the starting points, i.e. they are read starting from at the edge of the plot, heading toward the middle. 2) Enter the azimuth of the transect (N, S, E, W; unless there is a need to move the transect and then enter azimuth in degrees). There will be four transects with the same plot number. Record transect slope if >20 percent. If a burn pile overlaps a section of transect where FWD are measured, offset the 4m section down the tape and measure the burn pile. 3) Open the "fuels" form in the Open Foris and enter the data • The number of 1-hr fuels (<0.64 cm) that intersect the transect between the last 2 meters of the transect line (11.3 m - 9.3 m). • The number of 10-hr fuels (0.64-2.54 cm) that intersect the transect between the last 2 meters of the transect line (11.3 m - 9.3 m). • The number of 100-hr fuels (2.54-7.62 cm) that intersect the transect between the last 4 meters of the transect line (11.3 m - 7.3 m) • Measure litter and duff at transect starting point (outside edge of plot) and again at the 4 meter mark. i) Litter is undecomposed or only partially decomposed organic material that can be readily identified (e.g., plant leaves, needles, twigs, etc.). Duff is between the litter and mineral soil, and includes decomposing organic material, decomposed to the point that there are no clearly identifiable whole organic materials like pine needles, leaves, twigs, etc., although larger decomposing tree branches etc. can sometimes be found in duff. • Measure fuelbed depth at the transect starting point (0 m) and at 4 m in from edge of plot. Fuelbed depth is the height between the bottom of the litter layer (top of duff) to the highest dead fuel not attached to a rooted plant (branch or needle or stick, etc). 4) Collect information, on every piece of coarse woody debris (CWD) that intersects the transects and meets the criteria: Central longitudinal axis of the CWD intersects the transect and the diameter at the point of	Fuels data will be collected from four Brown's Transects. The transects are laid out at the cardinal directions, stretching from the plot center 11.3 m. The ends of the transects are the starting points. • Fuels: ○ **fuels_id** (Automatically calculated) ○ **fuels_observ** observers ○ **fuels_azimuth** transect azimuth ○ **fuels_slope_percent** Transect slope in % ○ **fuels_x1h_length_m** Transect length for 1h fuels (in our case 2 meters) ○ **fuels_x10h_length_m** Transect length for 10h fuels (in our case 2 meters) ○ **fuels_x100h_length_m** Transect length for 100h fuels (in our case 4 meters) ○ **fuels_x1000h_length_m** Transect length for 1000h fuels (in our case 11.3 meters) ○ **fuels_count_x1h** number of intersects for 1h fuels ○ **fuels_count_x10h** number of intersects for 10h fuels ○ **fuels_count_x100h** number of intersects for 100h fuels ○ **fuels_duff1_cm** starting point duff depth in cm ○ **fuels_litter1_cm** starting point litter depth in cm ○ **fuels_duff2_cm** 4 meters duff depth in cm ○ **fuels_litter2_cm** 4 meters litter depth in cm ○ **fuels_fuel1_cm** starting point fuelbed Depth in cm ○ **fuels_fuel2_cm** 4 meters fuelbed Depth in cm ○ **fuels_notes** • Coarse woody debris (CWD): ○ **cwd_id** (Automatically calculated) ○ **cwd_sp** species ○ **cwd_diam** Diameter at intersection with tape in cm	Metric tape, DBH tape, clinometer, compass, 6" small rulers, Mini measuring tapes, Go-No-Go Gauge. Trowel

Step		Where	How	Data collected	Equipment Needed
			intersection is >3" (7.6 cm). Open the "fuels" form in the Open Foris and enter the data: • Species code of CWD particle (if possible). If unknown, use UNKN as species code. • Diameter at intersection with tape • Length • Location of the CWD piece on the transect (distance from plot center). • Decay class (1-5; see appendix 6) Observations • To qualify as fuels, particles must be severed from the original source of growth. • Be sure not to count dead shrub limbs that are attached to a standing shrub, whether the standing shrub is dead or alive. You may need attempt to move fuels to see if they are free from their source of growth. • Do not count needles, grass, bark, or cones. • If a branch or log intersects the transect at its end, the central axis must intersect the transect for the piece to be tallied (appendix 7). • Count both intersections for a curved piece (see figure below) • Regardless of size, pieces are only tallied when their intersection with the transect lies above the litter and duff layers (appendix 7). Do not count stumps that are still rooted in the ground.	○ **cwd_lenght** length ○ **cwd_dist_m** Location of the CWD piece on the transect (distance from plot center) ○ **cwd_decay** Decay class ○ **cwd_notes**	
7	Burn piles	Plot	1) Describe and count each burn piles within the entire 1/10th acre plot. If a burn pile overlaps a section of transect where FWD are measured, offset the 4m section down the tape and measure the burn pile. Record the following: • Maximum height • Maximum diameter • Dominant species • Dominant size class: either small (<7.6cm) or large (>7.6cm) • Foliage (y/n) • Record the percent of the pile that is within the plot (plots fully within the plot would be 100%)	Describe and count each burn piles within the entire 1/10th acre plot • **burn_pile_id** • **burn_pile_height_max** Maximum height in m • **burn_pile_radius_max** Maximum diameter in m • **burn_pile_sp** Dominant species • **burn_pile_class** either small (<7.6cm) or large (>7.6cm) • **burn_pile_percent** Record the percent of the pile that is within the plot • **burn_pile_foliage** foliage yes or no • **burn_pile_notes**	Metric tape

Checklists

Each morning before going to the field

Step		How
1	GPS unit	Make sure batteries are charged
2	BLK unit	Make sure primary and back up batteries are charged
3	Tablet	Make sure batteries are charged Make sure your navigation tool (Avenza Map) is fully charged and maps are loaded Make sure than the survey is load (Open Foris) Verify that you have the site declination In the case of post-burn plots, verify that you have the pre-burn data on the tablet.
4	Check gear	
5	Water, eat,..	

In the field (*Check after to finish every plot*)

Step		How
Pre-fire plots		
1	Open Foris	All the mandatory survey fields are complete.
2	Plot center mark	Plot center permanently mark with a rebar and tagged (orange)
3	Witness tree	Witness tree identified and tagged.
4	Pre-burn clip plot	Fuels sampled, cut and sorted into bags**. Identify the bags correctly!**
5	Post-burn clip plot	Fuels sampled and NW clip-plot marked with a rebar and tagged (red)
6	BLK	LIDAR measurement done
7	Trees	Trees tagged.
Post-fires plots		
1	Open Foris	All the mandatory survey fields are complete.
2	Post-burn clip plot	Fuels sampled, cut and sorted into bags**. Identify the bags correctly!** **The rebar is removed**
3	BLK	LIDAR measurement done

Each evening

Step		How	Equipment Needed
1	GPS unit	Charge batteries.	

2	BLK unit	**<u>- Download the day's scans</u>** 1. Turn on the BLK360 and disconnect the computer from the Wi-Fi. Then, when the light on the BLK360 turns green, connect the computer to it via Wi-Fi. The Wi-Fi for the laser will be listed as BLK360-3510304 2. Once connected, use the password written inside the battery door to confirm connection, include the dashes (AH2F-337Q-5YPA) 3. Open the BLK360 Data Manager Utility. 4. Click "Discover & Connect Device". **5. Screenshot the screen so that the time of scan is recorded along with the setup number. It is extremely necessary that the scan's date and time is recorded in some way (SAVE THE SCREENSHOT WITH THE BLK FILES IN THE SAME FOLDER)** 6. Select the scans you would like to offload and click "download" 7. Save the .blk files into an easily accessible folder (SITE_DAY) The downloading process may take several minutes depending on the number of scans being downloaded. It is recommended you offload every day because the time increases exponentially with the number of scans. 8. The .blk files save according to "Setup" number. Once you have finished offloading all the files, rename all the .blk files according to the BLK plot ID, followed by the time listed on the scan: LLLLL_####_YYYYMMDD_TTTT. (Do this by looking at your field notes and find the corresponding plot number according to the time listed on the scan.). Example: St. Marks National Wildlife Refuge FLSMR_0030_20210704 o LLLLL- Site code. You can check it in Open Foris (CA+"Site name code") o #### - 4-digit plot number (Plot number 1=0001) o YYYYMMDD - 8-digit date of the plot sample in yyyymmdd format. Example: July 4, 2021 is 20210704. o TTTT - time listed on the scan (10 am = 1000) 9. Take this time to also check that the scan was successful and blk downloaded correctly, the file size should be at least 350,000 KB. **10. Once you have confirmed that all scans have been downloaded successfully, that you have renamed the files, and that you have entered this name in the corresponding OpenForis scan query, the scans can now be deleted. Select the scan and click delete** 11. Saved into an external hard drive the scan files **<u>- Store at least two copies of the data</u> in at least two formats (external hard drive and computer or in the shared BOX folder and computer). Depending on whether or not you have a good internet connection.** - Charge primary and back up batteries - Check the BLK capture settings (Scan Density=Medium and Imager=LDR)	BLK360, Computer and external hard drive,
3	Tablet	**<u>- Load or backup Open Foris records</u>** 1. If we have an Internet connection, we will upload the records to the server (List of records/Check sync status/Export new or updated records/Export) 2. If we do not have an Internet connection, we will make a backup copy of the records in the tablet (List of records/Export/Export all records locally/Export and select the "File Manager +" option. Open "Main Storage" and select "3dBURN Backup" folder. - Charge batteries	Tablets
4	Check-in	Safety procedure	SpotX

5	Check weather forecast and Official warnings/alerts	Safety procedure	Mobile Phone
6	Prepare the next day		

Each week (in the lab)

Step		How	Equipment Needed
1	Upload de data	- Upload the folders with the scans (.BLK) and screenshots to the BOX shared folder. The folders will be named by Site+Date. - Upload Open Foris records to the server - Update Arena Mobile Experiments and last survey version	Tablet, Computer, Hard Disc, Lab key
2	Manage the fuels bags	Store the bags with fuels on the laboratory tables. Try to be orderly.	
3	Declination	Check that the decline data is updated in the shared folder and on the tablets.	Tablets
4	Maps and GPS data	Check that you have updated maps in the shared folder and on the tablets, and the points downloaded to the GPS Print maps	Tablets, GPS
5	Information prefire plots	If you have to inventory post-fire plots, check that you have pre-plot data in the shared folder and on the tablets. Pre-fire data must be downloaded from Open Foris server.	Tablets
6	Manage invoices and tickets	Store the originals of the invoices and tickets in the laboratory, take a photo and save it in the BOX folder (The name of the file will be 1,2,3... respectively, and will correspond to the registration of the invoice in the spreadsheet). Write down the number on the original invoice in pencil.	
7	Check weather forecast, the camping sites and the next hitch planning		
8	Fill gear	Gas, rebars,...	
9	UC Away	Enter in https://ehs.ucop.edu/away	
10	Print spreadsheets		
11	Charge batteries		

Gear

BOX 1 Electric material	BOX 2 Measuring tools	BOX 3 Materials & Tools	BOX 4 Safety Material	BOX 5 Camping	BOX 6 Cooler	BOX 7 Lidar Box
Tablets Samsung (*Avenza, Open Foris Arena and BOX*) [2]	Compass [5]	Sandbags	First Aid kit [2]	Water jugs	Hardhats and vests [5]	Lidar
GPS etrex10 (waypoints) [1]	Tape measure (7,5m) Orange [2]	ID cable ties + ID Plastic	Fire extinguisher [1]	Cooler & ice		4 batteries
Charging cords	Tape measure (2 m) [4]	2-foot piece of ½" rebar	Jumper cables	two-burner stove, propane +attachment		Tripod
Batteries (AAA (1,5 V); cr123a (3V)	Tape measure (50m) [3] and (30m) [2]	1-foot piece of ½" rebar	Thermometer	Trash bags		Adapter
Car chargers for devices	PVC (1m) [1]	Plastic orange rebar cap	Bungee cords	Knife		Chargers
Small portable power bank Ravpower (brick) [2]	DBH tape blue [4], orange [1] and small [2]	Plastic red rebar cap	Rope	Large spoon		2 cords
Solar panel [1]	Quadrat (0,5 m x 0,5 m) [1]	Tree tag		Spatula		1 car cord
Laser Rangefinder (TruPulse 200L, 200X) [2]	Go-No-Go Gauge [3]	Aluminum nails		Can opener		
Laptop + Cord	Clinometer [2]	Duct tape		Cutting board		
Hard Disc	Cruzal [2] and prims [2]	Super glue		Camping Lantern		
Power strip	Counter [1]	Vegetation Sample bags		Dish towels		
Power inverter [2]	6" small rulers	Pruning shears [2]		Dish wash tub		
Satellite Communication Device SpotX [1]	Plastic small Tree Caliper [1]	Trowel [1]		Dish soap		
Binocular [1]	Stakes	Hammer [2]		Camp Table		
Maps printed	Ruler "L" [2]	Saw [1]		1x Tarp 10ftx12ft		
Paper datasheets	Fire extinguisher [1]	Pencil		Pots and pans		
Protocol printed	Pink flags [>10]	Papers				
	Plant ID Guides [4]	Sharpie				
	Clipboard [2]	Roll Flagging Tapes				

**In red the material that must be taken to the field plots.*

OTHER

- Table
- Propane
- Water deposits [3]

Lab work

Overview

In the UC Davis lab, the biomass will be dried, and weighed to determine the dry weight (in g*m^2) of each fuel sample. The samples will be dried at 80°C within 48h

Step		Where	How	Equipment Needed
1	Dry and weight	Lab UC Davis	1. Preheat the drying oven to 80° C. 2. Place the samples in the containers (which will be numbered) and write down in the monitoring table (container number, sample code and date and time of entry into the oven). Save the transport bags. (Appendix 9) 3. Put a piece of paper on the oven door with the message "Do not open - SaffordLab samples". Be careful the temperature dial doesn't slip (we tape it sometimes) 4. Place the containers on the stove without lids. 5. Dry samples for 48 hours at 80° C. Do not place additional samples in the oven while drying a set of samples. If you do this, the original samples will absorb moisture from the new samples and the assembly. The samples should dry for another 24 hours. 6. Take out the containers (after 24 hours) and weigh them. Place the container in the center of the scale platform and record the "wet" weight to the nearest 0.1 gram. Enter the weight obtained in the table, empty the contents of the container (fuels) again into the transport bag with its identification label (the samples will be kept until the data is validated). 7. Weigh the empty container and record the result. 8. The weight of the dry fuel will be (weight of dry fuel and container) - (weight of the container). Enter the result in the table and in Open Foris (guarantee that it is entered correctly) **A model table to record the information is in appendix 8.* **https://gacc.nifc.gov/rmcc/predictive/fuels_fire-danger/live_fm/Live_moisture_sampling_procedures.pdf*	Oven, Scale, aluminum trays or Tin Sample Canisters

Data management

Database scheme

Here there is the scheme: https://dbdiagram.io/d/65d688c8783e8c6ca51ee396

Database collect

We use Open Foris Arena and Open Foris Arena Mobile to collect and to manage the data.

Data		Format	Observations

TLS	Preburn
	Postburn
		.ptx
		(*Naming of plots files and data identification will follow a standard nomenclature*)
			• Exporting scans from .blk to .ptx format. The files name must be: LLLLL_####_YYYYMMDD_#
			  ○ LLLLL- Site code: 5-character NWCG identifier of the area within the location. NWCG identifiers defined list on (https://gacc.nifc.gov/swcc/dispatch_logistics/dispatch/documents/National_Unit_Identifiers.pdf)
			  ○ #### - 4-digit plot number within the area Example: 0030 Plot number at each site starting with 0001. This allows for the establishment of up to 9999 plots per each site and plots will be numbered in order of establishment.
			  ○ YYYYMMDD - 8-digit date of the plot sample in yyyymmdd format. Example: July 4, 2021 is 20210704.
			  ○ #: BLK360 model (1, in our case)
			• Use Globus to send the files (TLS MONITORING - EROS ONBOARDING PROCEDURE for DATA PROCESSING)
			  ○ Plot Location Format in CSV format (comma). The CSV file should have three columns: (1) site, (2) 4-digit plot number, and (3) geom. The values of the geom column should be in WKT (Well Known Text) format point (Longitude Latitude) (in EPSG:3857 projection). Sent to National Lidar Monitoring Coordinator Laila Lienesch (Laila_lienesch@fws.gov)

Data Plots	Preburn Postburn	.csv	• Open Open Foris and clean data. Experts with knowledge of field conditions and data work with a copy of the data to correct or remove invalid values. Once all data errors are resolved, the record may then be submitted for data analysis. This locks the record so that no further changes may be made. • Export data to .CSV with related data and photos • Sent by mail to Scott Pokswinski (spokswinski@newmexicoconsortium.org)

Appendix 1. Using the Avenza Maps

1. With the "More" button select Download or import a map.
2. Add a map of a cloud storage or device
3. Select BOX (3d Burn Project / Maps)
4. Select the maps corresponding to the Site

Appendix 2. Seedling key

- Cotyledons needle-like, isosceles triangle, glaucus above (except PICA)
    - Glaucus above
        - 3-4 (~7) cotyledons, 16-30 mm.....PICO
        - 6-10 (usu 7-8) cotyledons, 16-30 mm.....PIMO
        - 7-13 cotyledons, 40-80 mm, ±serrulate near base.....PIJE
    - Not glaucus above
- Cotyledons linear, obtuse triangle
        - >10 mm long cotyledons <--> <10 mm, 3-4 cotyledons, glaucus above.....TSME
        - Outer bud scales elongate and free, not resinous, light red-brown, 6-13 cotyledons, 30-45 mm.....ABMA
        - Outer bud scales not elongated or free, resinous, dark brown, 5-8 cotyledons, 20-30 mm.....ABCO
        - Young needles with acute end, tiny bristle, not glaucus, reddish scales, 5-8 (~10) cotyledons, 12-25 mm.....PSMA

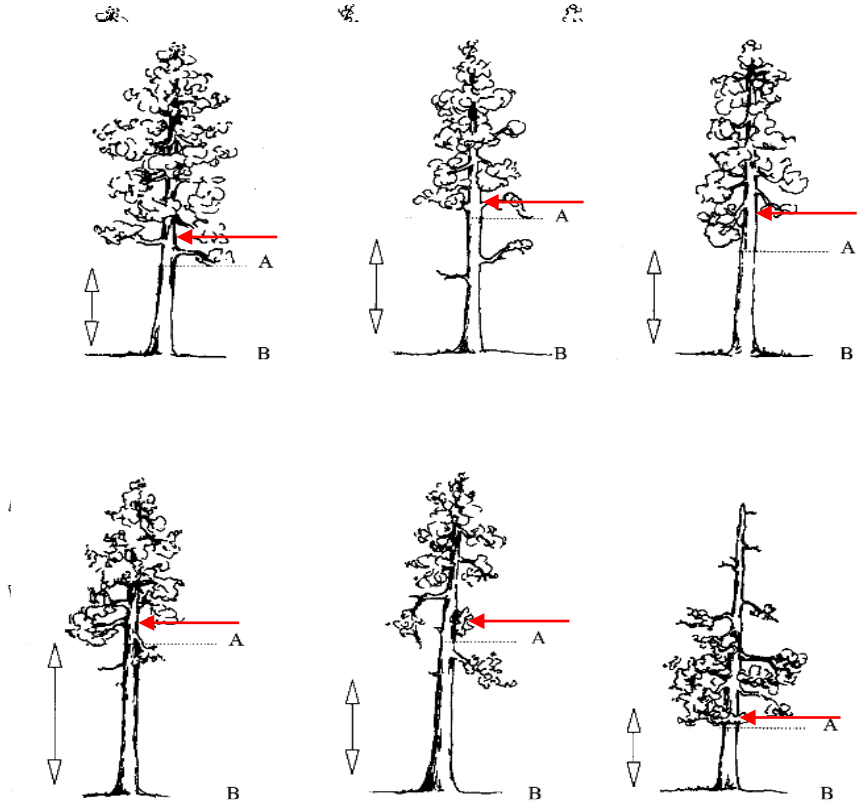
Appendix 3. Vegetation or Fuel Category Description

Vegetation or Fuel Category	Description
Woody Live	Live material from evergreen and deciduous broadleaf shrubs or trees aboveground (i.e., stems, leaves, flowers, buds, etc.)
Now Dead Woody Vegetation	Only in post-burn sampling to classify pre-burn woody live stems that were partially consumed by the prescribed fire and the aboveground plant was clearly dead (aka top-killed)
Woody Litter	Downed leaf and litter material from evergreen and deciduous broadleaf shrubs or trees detached from its source (i.e., leaves, flowers, buds, etc.)
1 h	Downed dead branches, twigs, and other small woody pieces that are severed from their original source of growth, and dead woody species that is still standing and attached to the ground and is less than 0.25 inch (0.64 cm) in diameter
10 h	Downed, dead branches, twigs, and other small woody pieces that are severed from their original source of growth, female cones (i.e., megastrobilus, seed cone, or ovulate cone) from non-*Pinus* species, and dead woody species that are still standing and attached to the ground and is 0.25 inch to 1.0 inch (0.64 to 2.54 cm) in diameter
100 h	Downed, dead tree and shrub boles, large limbs, and other woody pieces that are severed from their original source of growth and dead woody species that is still standing and attached to the ground and is 1.0 inch to 3.0 inch (2.54 to 7.6 cm) in diameter
1000 h	Downed, dead tree and shrub boles, large limbs, and other woody pieces that are severed from their original source of growth and is 3.0 inch to 8 inch (7.6 cm to 20.3 cm) in diameter. Note that no 1000 h fuels were found in our plots for this study.
Pinecones	Intact female cones (i.e., megastrobilus, seed cone, or ovulate cone) from *Pinus* species
Conifer Litter	Needle from conifers other than Pinus species and downed woody material from conifer species that is too small to fit into the 1-h fuel category (ex: paper-thin pieces of bark, male pollen cones (aka microstrobilus), and pinecone fragments)
Pine Needles	Downed needles from *Pinus* species with long or short needles
Fine Vegetation	Live and dead material from bunchgrass species, wiregrass species, other graminoids, forbs, vines, and conifer seedlings

Appendix 4. Fire severity class

Fire Severity Class	Description
0	Unburned
1	Light patchy burn pattern, very little overstory mortality, groups of surviving shrubs/saplings
2	Lightly burned, isolated overstory mortality, most shrubs/saplings dead
3	Moderately burned, mixed overstory mortality, understory mostly burned to ground
4	High severity, significant proportion (75-100%) of overstory killed, dead needles remaining on trees 1 year later
5	High severity burn, total/near total mortality of overstory, most needles consumed in fire

Appendix 5. Height to Crown (branches in two quadrants)



Appendix 6. Decay class

Trees

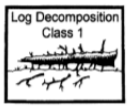
Table 13.5. Snag decay class codes and descriptions.

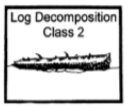
Code	Limbs and branches	Top	Percentage of bark remaining	Sapwood presence	Sapwood condition	Heartwood condition
1	All present	Pointed	100	Intact	Sound, incipient decay, hard, original color	Sound, hard, original color
2	Few limbs, no fine branches	Broken	Variable	Sloughing	Advanced decay, fibrous, firm to soft, light brown	Sound at base, incipient decay in outer edge of upper bole, hard, light to red brown
3	Limb stubs	Broken	Variable	Sloughing	Fibrous, soft, light to reddish brown	Incipient decay at base, advanced decay throughout upper bole, fibrous, hard to firm, reddish brown
4	Few or no stubs	Broken	Variable	Sloughing	Cubical, soft, reddish to dark brown	Advanced decay at base, sloughing from upper bole, fibrous to cubical, soft, dark reddish brown
5	None	Broken	< 20%	Gone	Gone	Sloughing, cubical, soft, dark brown, OR fibrous, very soft, dark reddish brown, encased in hardened shell

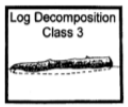
Downed Log Decomposition

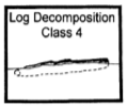
Log Decay Class

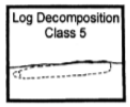
Code	Bark	Twigs	Texture	Shape	Wood Color	Portion of log on ground
1	Intact	Present	Intact	Round	Original	None, elevated on supporting points
2	Intact	Absent	Intact to soft	Round	Original	Parts touch, still elevated, sagging slightly
3	Trace	Absent	Hard large pieces	Round	Original to faded	Bole on ground
4	Absent	Absent	Soft blocky pieces	Round to oval	Light brown to faded brown	Partially below ground
5	Absent	Absent	Soft, powdery	Oval	Faded light yellow or gray	Mostly below ground



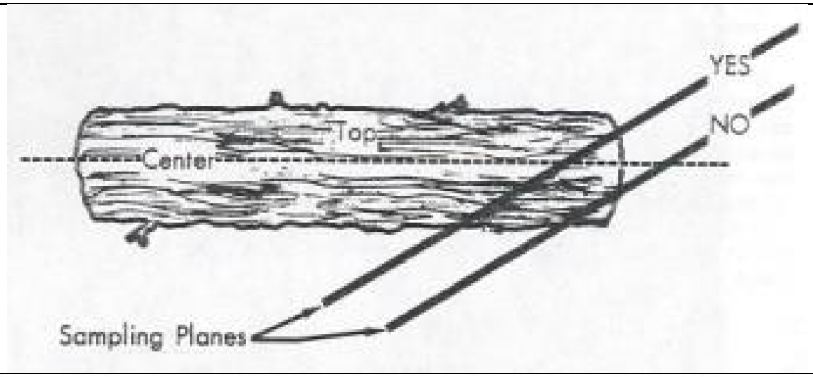
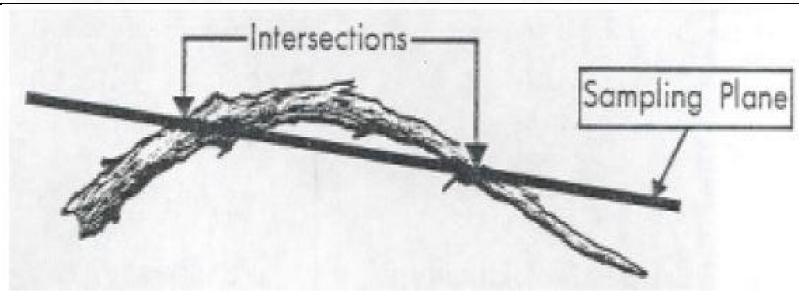
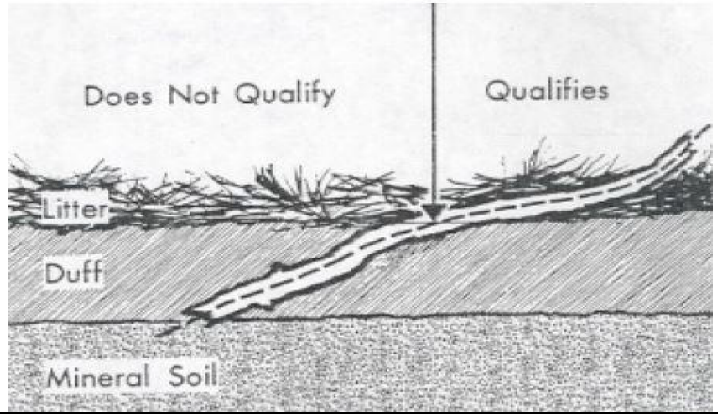








Appendix 7. Woody Fuels Criteria

If a branch or log intersects the transect at its end, the central axis must intersect the transect for the piece to be tallied	
Count both intersections for a curved piece	
Regardless of size, pieces are only tallied when their intersection with the transect lies above the litter and duff layers	

Appendix 8. Tree pests, disease or damage

white pine blister rust		dead top	
split top		mistletoe	
catface		dwarf mistletoe	
red turpentine beetle		mountain pine beetle	

western pine beetle	 	jeffery pine beetle	 
pitching on bole of tree	 	scars from heavy equipment	

Appendix 9. Drying of fuels samples

Container number	Sample code	Data	Hour	Who?	Dry weight (g) [sample+container]	Dry weight (g) [container]	Dry weight (g) [sample]