**Common Stand Exam (CSE) protocol notes for postfire vegetation inventory**

Version: June 30, 2017

Contact: Hugh Safford, Regional Ecologist, USDA Forest Service, Pacific Southwest Region; 707-562-8934

[hughsafford@fs.fed.us](mailto:hughsafford@fs.fed.us)

CSE plots are standard Forest Service plots used to collect data on trees, vegetation composition, ground surface cover, and down woody material/fuels. Complete information on the protocol, use of field data recorders, and the FSVEG database, can be found at <http://www.fs.fed.us/emc/nris/products/fsveg/>

Protocol: Use the Region 5 guidance for fixed-radius CSE plots (you can ignore the information on the field data recorders). As a default, carry out “extensive” CSE plots, unless it is determined that “intensive” plots are required (intensive plots require more data collection, including growth and age measurements of trees).

For codes, diagrams of methods, and other info, please consult the file <CSE\_protocol\_Codes-Tables-Diagrams\_7-2011.docx>, referred to as the “cheatsheet” in this protocol description. Also see the FSVEG Chapter 4 directions for data collection procedures (available at: <http://www.fs.fed.us/nrm/fsveg/index.shtml>).

Plot shape: Circular. Set up two 50 m tapes crossing the center point along the cardinal directions (don’t forget to set your compasses to the proper declination), put pin flags at 16.05 m from plot center (809 sq m plot; if you are using the 809 sq m plot size), 11.35 m from center (405 sq m plot) (standard for most studies) and 4.37 m from center (60 sq m regen plot).

Plot size: Default for forested vegetation: 405 sq m (11.3 m radius) = 1/10 acre, but depending on study purpose, you may also sample species presence and cover in an expanded 809 sq m plot (16 m radius = 1/5 acre), centered at the same point (see below). For shrubby vegetation or very dense forest with difficult access, it is OK to use 405 sq m (11.3 m radius).

Plot location: User defined. We recommend siting plots on the vertices of a predetermined UTM grid. For postfire inventories, the standard practice is to center the plots on the vertices of a 400 m north-south grid laid out across the fire area in GIS. Sample at least 10 plots in each fire severity class (there are 7 classes of basal area mortality, including an unburned class, which will act as a control), as mapped on the Region 5 Deforested Conditions website (see: <http://www.fs.fed.us/r5/rsl/projects/postfirecondition/methods/>), taking care to choose a range of slopes, aspects, and – if applicable – soil types. This results in 70 CSE plots as a minimum sample number; sample more if there is time. If it is impossible to get 10 plots in each severity class, make sure that about ½ of the plots are found in areas with >50% basal area mortality and ½ below 50% mortality; in any case, it is important to get 10 plots in unburned control areas.

Permanently mark the CSE plot locations with 2’ rebar topped by plastic caps. Leave only 8-12 cm/3-5” above ground. Flag the rebar and a few trees near the center of the plot. Remove the pin flags and flagging (at the ends of the 50 m tapes, e.g.) when you finish the plot.

Logistics: Depending on the terrain and the complexity of the vegetation, you will accomplish usually between one and four CSE plots per day.

Fill out the data forms in the following order:

1. Tree regeneration protocol:

Carry out the regeneration protocol first, in a 60 sq m (4.37 m radius) plot centered at the same point

(note: in postfire inventories, there will also be regen plots in places without CSE exams, since the regen plots are on a 200 m grid). You don’t need to take two sets of photos (i.e., for the regen and then the CSE protocol), just take one set, with five photos: first, a close-up of the pin flag with the plot number on it; second, from just beyond the S terminus (16 m from plot center) of the N-S tape, looking N; third from the W terminus of the E-W tape, looking E; fourth, from the N terminus of the N-S tape, looking S; fifth, from the E terminus of the E-W tape, looking W (you will thus have five photos, first the plot number, then N, E, S, W). It is best to have someone or something at the plot center so it can be easily recognized in the photos. Important note: if you are only carrying out the CSE protocol (i.e., there is no independent set of regeneration plots also being sampled), the only data you need from the regen protocol are the seedling, sapling, and resprout data (species and age class of all individuals; ht, and last year’s growth for tallest of each species; dbh of saplings, etc.); i.e. you don’t have to take the ground cover data twice. Note: if there will be statistical analysis done that also use data from studies that sampled *only* regen with the R5 regen protocol, it may be good to go ahead and take the ground cover and veg cover at the regen plot scale. Check with your project lead). Also: if you are working in recently burned forest, then you will assess fire severity on the regen data sheet, and you will use the laser rangefinder to estimate distance (and azimuth if desired) to the nearest mature (potentially seed-bearing) individual of every species of every tree you can see from the plot.

1. Enter the plot #, date and observers names
2. Record the species and diameter at breast height (DBH: 1.37m above the ground) of every tree (>1”, 2.5 cm DBH) that survived the fire and is found within the plot
   1. For control (unburned) plots, measured all living trees (>1” DBH) in the plot, unless completing a tree data sheet
3. Tally the number of seedlings (trees less than 4.5’ tall (1.37 m) of each species (conifers and hardwoods) into each age class
   1. Use a separate row for each species
   2. Determine the age by counting the bud scars, subtracting the current year
   3. Note whether the seedling recruited naturally or was planted (species with natural and planted seedlings will have two rows)
   4. Record the height, age and last year’s growth for the tallest individual seedling of each species (species with natural and planted seedlings will have two sets of measurements)
4. Enter data for each individual sapling (trees >4.5’ tall but <3” (7.6 cm) DBH of each tree species (conifer and hardwood)
   1. Use a separate row for each individual
   2. Note whether the sapling recruited naturally or was planted
   3. Measure and enter the DBH of each sapling
   4. Determine age by counting bud scars, subtracting the current year
   5. Record the height, age and last year’s growth for the tallest individual sapling in each species (species with natural and planted saplings will have two sets of measurements)
5. Use the basal area gauge
   1. Turning in a circle while looking through the gauge, tally the number of trees that are larger than the 20 factor aperture. Count the trees separately by species and by live or dead status.
   2. Begin with 20 factor gauge, but use whatever gauge necessary to record at least 7 trees
   3. Remember to have your gauge, at the end of your outstretched hand, centered over the plot center at all times; i.e. you will walk around the plot center as if it were a pivot point. If you are using a prism instead of a gauge, indicate as such on the data sheet, but the protocol is different! With a prism you stand at plot center and swing the prism around.
6. Use the categories in the following to estimate fire severity in the plots, and circle the appropriate class:

**Table 1**

|  |  |
| --- | --- |
| **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 |

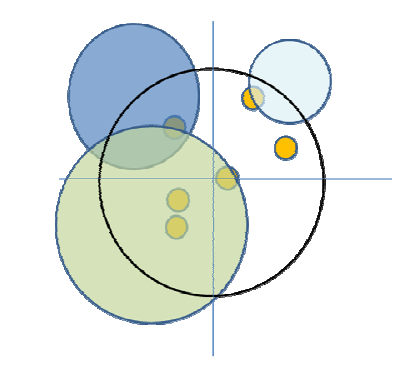
1. Record nearest regenerating individual to the plot
   1. If there are no seedlings or saplings with the plot, search for seedlings or saplings outside the plot, up to 50 feet (15.2m) away from plot center. Its ok to search farther if there is time.
   2. Record the species, distance from plot center and azimuth to the individual
2. Record distance to nearest seed source
   1. Record the distance and azimuth to the nearest living mature tree (capable of producing seed) for all tree species you can see from the plot
3. Tally the number of resprouts found per species
   1. Enter the DBH (if >4.5’ tall), height, last year’s growth and age (if possible) for the tallest sprout of each species

(note: in postfire inventories, there will also be regen plots in places without CSE exams, since the regen plots are on a 200 m grid). You don’t need to take two sets of photos (i.e., for the regen and then the CSE protocol), just take one set, with five photos: first, a close-up of the pin flag with the plot number on it; second, from just beyond the S terminus (16 m from plot center) of the N-S tape, looking N; third from the W terminus of the E-W tape, looking E; fourth, from the N terminus of the N-S tape, looking S; fifth, from the E terminus of the E-W tape, looking W (you will thus have five photos, first the plot number, then N, E, S, W). It is best to have someone or something at the plot center so it can be easily recognized in the photos. Important note: if you are only carrying out the CSE protocol (i.e., there is no independent set of regeneration plots also being sampled), the only data you need from the regen protocol are the seedling, sapling, and resprout data (species and age class of all individuals; ht, and last year’s growth for tallest of each species; dbh of saplings, etc.); i.e. you don’t have to take the ground cover data twice. Note: if there will be statistical analysis done that also use data from studies that sampled *only* regen with the R5 regen protocol, it may be good to go ahead and take the ground cover and veg cover at the regen plot scale. Check with your project lead). Also: if you are working in recently burned forest, then you will assess fire severity on the regen data sheet, and you will use the laser rangefinder to estimate distance (and azimuth if desired) to the nearest mature (potentially seed-bearing) individual of every species of every tree you can see from the plot

II. CSE Plot data form:

1. Enter the plot #, date, and observers last names
2. Enter the UTM zone and easting and northing measurements (GPS)
3. Enter aspect, in degrees (compass; this is the direction that water would run off the plot)
4. Enter the slope, in % (clinometer; this is taken along the compass direction of the aspect)
5. Enter the plot horizontal and vertical shape (BR,CC,CV, etc.), see table in Plot Data Cheatsheet
6. Enter the slope position (SU,SH,BS, etc.), see table and figure in Plot Data Cheatsheet
7. Enter capable growing area (CGA), the % of the plot area capable of growing trees
8. In the existing veg box, list the top three overstory species in order of dominance (e.g., PIPO/ABCO/QUCH). If you only have one or two tree species, you can list a shrub spp or two as well (or graminoid)
9. Make an attempt to estimate the Anderson fuel model (see table in Plot Data Cheatsheet)
10. Estimate % cover of the total plot and modal height (in meters) for the twelve classes listed under “vegetation cover”
    1. “Total vegetation” is the cover of living vegetation as a % of the plot when viewed from an airplane/satellite
    2. “Total tree”, “tree >1.8m’” and “tree <1.8m’” refer only to live trees. Adding TOV and TSA together may give a value higher then TOT, due to crown overlap
    3. Under “shrubs”, all measures aside from “dead shrub” refer only to live shrubs. As above, adding ST, SM, and SL together may give a value > than TOS if you have different shrub species interfingering or if different individuals of the same species are growing above or beneath others, due to crown overlap. ST+SM+SL from the same individual shrub cannot add up to more than its cover-from-above value.
    4. Modal height is the most common height, which is not always the average
    5. Graminoids include grasses, sedges, and rushes
11. Ground surface cover values must sum to 100%
    1. These measures are of the ground cover, i.e. think about what the plot would look like if you could cut all plants off right at ground level. Usually best to leave litter to last and calculate by subtracting the other values from 100.
12. Try to enter info in the history table. It may be difficult to determine history (beyond obvious fire and maybe a previous or subsequent thinning). It is mostly important that you note fire and any obvious signs of forest management on the site, either before or after fire. The history codes are at the bottom of the datasheet
13. Enter fire severity class (refer to table 1 in regen section).

\*\*\*One strategy for estimating cover percentages:



Above, a circular plot (black lines circle), with four species of understory plants (colored). The blue crosshairs are added to aid in estimating cover. The understory vegetation cover is about 64% (the total plot area minus the area that is not covered by live vegetation. The gray species (shrub) has 49% cover, the dark blue species (shrub) has 17% cover, the light blue species (grass) has 4%, and the orange species (forb) has 6% (each orange circle is 1% in this case). Due to plant overlap, summing the different species’ cover values gives a value that is larger than the total understory vegetation cover (76% vs. 64%). Overall shrub cover in this plot is 58% (two shrub species, subtracting overlap; summed up [i.e., ignoring overlap], the two species have 66% cover between them). Herb cover is 9.5%; forb cover is 6%; grass cover is 4%. Each shrub species will have its own cover entered in the species-cover section of the datasheet. Cover is measured by drawing a line around the outside of the plant canopy, ignoring gaps that may be found within the perimeter.

\*\*\*Another strategy for estimating cover percentages:

* Your clipboard/tatum is about 0.1% of the regen plot (~60 m2), and it would take c. 17 clipboards to = 1m2.

\*\*\*Another strategy for estimating cover percentages:

* Your outstretched arms (for most people), at a right angle make roughly 1 m2.

\*\*\*Another strategy:

* For isolated trees or large shrubs you can estimate the crown radius (by pacing or quick measurement) and then use A = πr2 to get the area of the crown, then divide by the plot size to get percent

III. Species composition and cover form:

1. Enter the plot, date and observers’ initials (only need to do this in the first row)
2. Enter the species lifeform (TR, SH, FB, GR, fern, etc.)
   1. Start with all of the tree species, then do the shrub species, then the forbs, then the graminoids
3. Enter the layer code of the plants you are measuring (see the plot data form; TOV = tree overstory [>1.8 m {6.0’} tall]; TSA = trees <1.8 m {6.0’} tall; ST, SM, SL are the shrub layer classes)
   1. For each tree and shrub species, there may be multiple layer classes
   2. For example, many tree species will be in the TOV layer and also in the TSA layer; there may be shrub species that occur in all three shrub layer classes as well
4. Do 2 and 3 in combination, such that all of the trees species in TOV are listed sequentially, then all of the trees in TSA, then all of the shrubs in ST, the shrubs in SM, then shrubs in SL, then list all of the forbs, then all of the graminoids
5. Enter the species code for each species encountered
6. Enter the % of the plot area covered by the projected canopy of the species. Ignore gaps within the outer boundary of the plant canopy (you are estimating canopy cover, not canopy closure, which would require a densitometer)
7. This step is uncommon: If you are also sampling at 1/5 acre (809 sq m), expand the search area to the 809 sq m plot (16 m radius). In the additional area, search for any species you did not encounter in the 405 sq m plot.
   1. Draw a dark line under the species list from the 405 sq m plot, and enter any new species found only in the larger plot below that line, along with their lifeform and their % cover (calculated for the 809 sq m plot).
   2. Also, if you find any species in the 809 sq m plot that are *much* more abundant there than they were in the 405 sq m plot, go ahead and note them and calculate a new cover for the 809 sq m area. In most cases we will simply assume the cover assigned to the species from the 405 sq m plot also applies to the larger plot.

IV. Fine fuels form (see also the Fuels Cheatsheet; you can use the remainder of this datasheet to enter more species if the Species comp/cover form is too small to fit all of the plot species):

1. Fuels data will be collected from four Brown’s Transects (J.K. Brown. 1974. Handbook for inventorying downed woody material. USDA Forest Service Intermountain Research Station General Technical Report INT-16). The transects are laid out at the cardinal directions, stretching from the plot center to 37’ (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 plot number, date and observer initials
3. Enter the azimuth of the transect. Since they will be in the cardinal directions, it is OK to write, N,E, S or W for the four different transects (note that, in this case, “N” means that it is starting from the N side and going S, etc.), rather than putting the azimuth in degrees, but if you have to diverge from the cardinal directions, then write in the azimuth in degrees. There will be four transects with the same plot number
4. Enter the slope of the transect if it is >20% (as a correction factor is needed along steeper transects; see GTR-INT-16)
5. Measure the 1 hour (diameter = 0 to 0.25” or 0-0.64 cm) and 10 hour (0.25” to 1” or 0.64-2.5 cm) fuels along the first 2 m (6.6’) of the transect, and measure the 100 hour (1-3” or 2.5-7.6 cm) fuels along the first 4 m (13.2’). Tally the number of hits for each fuel class in the correct cell.
6. Measure litter and duff depths at the transect starting point (i.e. at the outside edge of the plot) and again at 4 m, enter these values. 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.
7. Measure fuel depth at the transect starting point and at 4 m (13.2’). Find the measurement point, then ID three 30 cm long sections of tape, such that the first starts at 45 cm from the measurement point, second starts at 15 cm from the point and continues to 15 cm on the other side of the point, and the third starts at 15 cm from the measurement point on its opposite side and stretches to 45 cm from the point. Along each of these 30 cm segments, find the highest dead fuel not attached to a rooted plant in that segment, and measure the height between the bottom of the litter layer (top of duff) to that branch or needle or stick, etc. Take the average of the three measures (one from each 30 cm section) and enter this as the fuel depth in the data sheet (see GTR-INT-16 for detail and diagrams)
8. Measure coarse woody debris along the transects as well (see next section)

V. Coarse woody debris form (see also the Fuels Cheatsheet):

1. Enter the plot number, date, and observers initials
2. Collect information on every piece of coarse woody debris (CWD) that intersects the transects and meets the minimum criteria:
   1. Central longitudinal axis of the CWD intersects the transect
   2. The diameter at the point of intersection is >7.6 cm (3”)
3. Enter the diameter of the CWD at the transect intersect, the diameter at the large end, the diameter at the small end, and the length. Measure the first three in cm, the last in meters.
4. Enter the decay class (see the table in the form or the Fuels Cheatsheet)

VI. Tree data form (for trees above cutoff size), for extensive CSE plot:

Tree data: Unless otherwise directed, use a dbh cutoff of 7.6 cm (3”) and a height cutoff of 1.4 m (4.5 feet). This means that within the plot, all live and dead trees at or above 7.6 cm dbh and at or above 1.4 m tall will be *individually* measured (although there are few measures made of dead trees). All trees below these cutoffs will be simply counted as members of certain attribute classes. In some cases there may be so many dead trees that a higher dbh cutoff (e.g., >4” or 5” dbh) may be necessary to facilitate data collection, but this will leave an unmeasured class between saplings and the lowest tree dbh class measured. Determine ahead of time if trees will be tagged. Tagging trees results in the ability to track tree demographics, which is very valuable information. Always nail in your tags at dbh height, such that the dbh tape runs over the top of the nail. This will allow repeatable measurements in the future. If you will be tagging hardwoods (broadleaved trees, like oaks), you will need steel nails, as the aluminum nails will bend due to the dense wood. Usually only live trees will be tagged, unless you intend to resample the plots often (at least every two years), in which case dead trees can be tagged to follow snag fall and decay. Note that for some plots you may need more than one tree data sheet.

General data:

1. Enter the plot number, date, and initials/names of the observers
2. Enter the dbh breakpoint (in most cases 7.6 cm or 3”)
3. Enter the area of the mature tree plot (in most cases 405 m2 = 1/10 acre)
4. Enter the basal area factor (BAF) used to conduct the plotless estimate of stand basal area. In most cases it will be 20, but change the BAF if you can’t hit +/- 6 to 9 trees. Hardwood stands often require a BAF of 10.
5. 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 hits below on the left, and dead (snag) hits below on the right. Separate the live and dead numbers by a diagonal slash (4/3)

Individual trees:

1. Enter the tag # (if necessary; it is best to tag as many plots as we can) (live trees)
2. Enter status (L,D,S,X,Y), see table in Tree Cheatsheet (live and dead trees)
3. Unless specifically directed to measure them, skip HD (horizontal distance) and AZ (azimuth), unless you are mapping the stems (rarely done)
4. Enter species (live and dead trees) using the appropriate code
5. Enter dbh (d-tape) (live and dead trees)
6. Enter tree height (rangefinder) (live and dead trees)
7. Enter crown base height (HT CRN), using the rangefinder (live trees). This is also called “height to live crown”. See the Tree Cheatshet for guidance on measurement.
8. Enter crown class, (OP,DO,CO,IN, etc.), see table in Tree Cheatsheet (live trees)
9. Enter crown width (live trees). This can be paced or directly measured, see the Cheatsheet.
10. Enter decay class (1-5), see table (dead trees)
11. If required, enter damage category, agent, and severity (see table in Tree Cheatsheet) (live and dead trees). This may be skipped, check with your crew chief
12. Enter remarks, if necessary. If you are in a recently burned area and fire severity metrics will be taken (bole char height, crown scorch %, crown torch %, etc.), those data can be entered in this field.