CHIPS Arnold-Avery Hazardous Fuels Reduction & Fuelbreak Maintenance Project: Monitoring Plan

Megan Layhee
Project Manager
meganl.chips@gmail.com

Table of Contents

Background

Calaveras Healthy Impact Product Solutions (CHIPS), working together with the Stanislaus National Forest (STF), has been awarded a CAL FIRE California Climate Investments (CCI) Fire Prevention (FP) Grant to conduct fuel break maintenance and surface and ladder fuels reduction, termed the Arnold-Avery Hazardous Fuels Reduction and Fuelbreak Maintenance Project (herein referred to as the Arnold-Avery Project). This project will promote landscape scale forest restoration and watershed protection through strategic hazardous fuels reduction and will provide critical protection of life and private property within multiple at-risk and low-income communities. This project occurs on lands administered

by the U.S. Forest Service, Sierra Pacific Industries, Inc. industrial timberlands (SPI) and individual private landowner parcels.

The goal of the project monitoring effort is to measure the efficacy of fuelbreak treatments across jurisdictional boundaries and treatment types, assess project implementation affects to ecological, socio-economic, and collaboration-related indices, and ensure FS compliance. The Arnold-Avery Project monitoring questions are derived from the Amador-Calaveras Consensus Group (ACCG) Monitoring Strategy. This monitoring plan has been developed in partnership with STF and the ACCG Monitoring Work Group (MWG).

Monitoring Questions

The project monitoring questions, and associated referenced ACCG Monitoring Strategy Monitoring Questions, are as follows:

A. How did fuel treatments meet the project goals and objectives?
B. How did treatments affect understory vegetation density and species composition? How did treatments affect the tree density and species composition in all size classes?
C. Are target invasive plants spreading throughout the Cornerstone area?
D. Was the project implemented as planned?
E. What are the effects of the individual project in providing work for local forest contractors?
F. Was the collaborative successful at streamlining implementation and increasing pace and scale?
G. Are the projects being implemented a higher quality than baseline?
H. How effective is the collaboration in engaging the community interests to effectively increase trust and partnerships related to forest restoration practices?

Monitoring question associated indictors and methodology can be found in Table 1.

Table 1: Monitoring questions and associated indicators and methods.

Monitoring Question	Type	Indicators	Method
A. How did fuel treatments meet the project goals and objectives?	Ecological Effectiveness: Fire and Fuels	Acres treated; no. snags, down logs/acre; woody debris tons/acre; photos; fuel loading	Unit inspection/ Compliance Monitoring, Photo Points, CSE plots
B. How did treatments affect understory vegetation density and species composition? How did treatments affect the tree density and species composition in all size classes?	Ecological Effectiveness: Conifer Forest	Percent cover type (T, S, F, G, slash, downed logs, bare ground); Shrub species composition	CSE plots
C. Are target invasive plants spreading throughout the Cornerstone area?	Ecological Effectiveness: Invasive Species	Number of invasive plants	CSE plots
D. Was the project implemented as planned?	Implementation	Implementation compared to planning	Unit inspection/ Compliance Monitoring
E. What are the effects of the individual project in providing work for local forest contractors?	Socio-economic	Number of local bidders	RFP bid sheet
F. Was the collaborative successful at streamlining implementation and increasing pace and scale?	Collaboration	Project timeline	Project timeline in grant agreement
G. Are the projects being implemented a higher quality than baseline?	Collaboration	Local appeals/objections and comments	Appeals/objections list
H. How effective is the collaboration in engaging the community interests to effectively increase trust and partnerships related to forest restoration practices?	Collaboration	Amount of volunteer hours	Volunteer list

Project Treatments & Specifications

The project is subdivided into three broad treatment types (see Table 2 and Figure 1 for more information), including:

- Ten FS fuelbreak construction and maintenance units (Butte Dozer Line, 2015) with approximately 502 acres.
- Nine FS fuels treatment units for a total of 313 acres.

- Three industrial timberland units fuelbreak construction and maintenance units with approximately 30 acres.
- Four private landowner fuelbreak construction and maintenance units with approximately 42 acres.

Table 2: Project areas and treatments types.

Project	Treatment type	Units	Estimated acreage
Project A	FS Hand & Mechanical Fuels Treatments	817, 818, 818a, 819	≤ 185
Project B	FS Fuelbreak Construction & Maintenance	902, 903	≤ 150
	Private Parcel Fuelbreak Construction & Maintenance	SPI-1, SPI-2, SPI-3	≤ 30
Project C	FS Fuelbreak Construction & Maintenance	904, 904a, 905, 906	≤ 248
	FS Hand & Mechanical fuels treatments	807	≤ 6
Project D	FS Fuelbreak Construction & Maintenance	907, 908, 909, 910	≤ 104
	FS Hand & Mechanical Fuels Treatments	808, 808a, 809, 810	≤ 122
	Private Parcel Fuelbreak Construction & Maintenance	CA Timber Trails, Bottomley, Ramsey & Vickerman	≤ 42

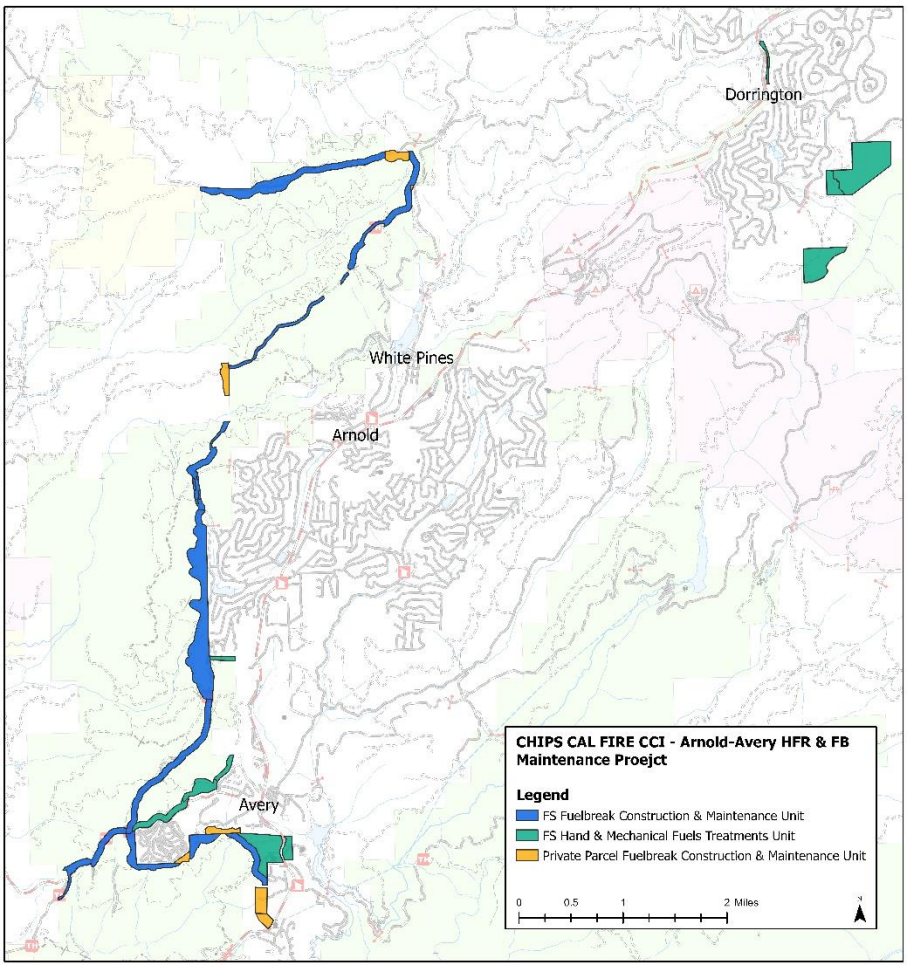


Figure 1. Map depicting project unit locations and unit treatment types.

Prescription for FS Fuelbreak Construction & Maintenance and FS Hand &Mechanical Fuels Treatment Types

A combination of mechanical and hand treatments will be used to accomplish the two treatment types for FS units: 1) fuelbreak construction and maintenance, and 2) hand/mechanical fuels treatments. Please note that the allowed treatment types and equipment types are unique to the unit. Below are detailed specifications for general prescription and treatment-type specific prescriptions:

General FS Prescription Specifications:

- Remove all live brush and live coniferous trees up to 10" dbh to 20 x 20 feet spacing. Remaining stumps will be <8” on uphill side. Shred depth will be <12”.
- Trees are to be retained within the spacing described above in the following priority: 1) Sugar pine (free of white pine blister rust), 2) Douglas-fir, 3) Incense cedar, 4) Ponderosa pine, 5) White fir. Retained trees shall be free of damage and defect. If all trees inside the spacing have defect or damage, retain the healthiest tree with highest species priority. Damage includes but is not limited to broken tops, broken branches, trunk scars and earlier mechanical damage. Defect includes but is not limited to forked tops, crooks, conks, cankers, mistletoe, and blister rust.
- Prune residual trees up to 10 feet or 50% of height.

- Hardwoods - Black oak greater than 12” dbh and aspen, maple, willow, and dogwood greater than 8” dbh shall not be masticated, shredded, or damaged, and shall be included as crop trees to meet spacing requirements, unless removal is required for safety or equipment operability.
- In FS Hand & Mechanical Fuels Treatments units (Units 807, 808, 808a, 809, 810, 817, 818, 818a and 819), dead and dying trees may be felled and removed, though a minimum of 4 snags per acre will be left standing for wildlife. This minimum snag/acre standard does not apply to FS Fuelbreak Construction & Maintenance Treatment units (Units 902, 903, 904, 904a, 905, 906, 907, 908, 909 and 910). Limbs and top of snags will be masticated, and snags greater than 20” diameter at the large end will be mechanically piled (grapple or dozer, depending on unit).
- On terrain with slopes >35%, only hand thinning and hand piling will occur.
- The following is mechanical equipment restrictions for watercourses in FS units: Skidding equipment is prohibited within 50 feet of perennial, intermittent, and special aquatic features, and prohibited within 25 feet of ephemeral streams. Mechanical harvesting/shredding equipment is prohibited within 15 feet of perennial, intermittent, and ephemeral streams, and special aquatic features.
- In certain project areas, Limited Operating Periods for sensitive wildlife will be from February 15th – September 15th or from March 1st – August 15th, depending on the species. More detailed information will be provided to the awarded Contractor(s).
- Avoid protected areas marked with blue and black flagging or orange and white flagging, and as shown on the geo-referenced map provide to each Contractor.

FS Mastication Prescription Specifications:

- Masticate all live brush and coniferous trees less than 10" dbh to average spacing of 20-30’ between residual stems, leaving the most dominant and vigorously growing conifers and oak trees. Also, to masticate all live brush and coniferous trees up to 12” dbh for safety and equipment operability.
- No punji sticks.
- In FS units 902, 903, 906, 907, 908, 909 and 910, mechanical piles will only be constructed with a grapple.
- Pile locations will be determined by Contractor and Project Forester.
- Existing slash piles shall be masticated.
- Where mechanical pile construction is prescribed, slash and existing down woody material shall be piled to the following specifications:

FS Mechanical Piling Prescription Specifications:

- Minimum size of 10 feet x 10 feet and a maximum of 30 feet x 30 feet.
- A 10-ft wide fireline directly around each machine pile shall be cleared of all but fine material, in addition, a 3-ft wide fireline shall be cleared down to mineral soil directly outside of the 10-ft fireline. For a total of 13-ft fireline around each mechanical pile.
- In areas where there is a potential for burning material to roll, firelines shall be trenched on the downhill side of each pile to adequately prevent material from crossing firelines.
- In addition to trenching, material shall be piled perpendicular to the slope to prevent it from rolling.
- Mechanical piling shall be limited to slopes less than 25%.
- All slash and all existing down woody material greater than 1 inch in diameter and greater than 3 feet long shall be piled.
- Material shall be bucked into lengths not exceeding 15 feet prior to piling.
- Piling shall be conducted in such a manner to retain ground cover such as duff and litter largely intact to maintain soil cover.

- All piles shall be reasonably compact and free of soil to facilitate burning and shall be constructed of such size and at such distance from trees so that burning shall not result in unnecessary damage to residual timber.
- Piles shall be located outside of the watercourse protection zones.
- Piles shall be located outside of the crowns of residual trees.
- Piling is not permitted on areas where use of tractors would cause undue damage to residual timber or where slopes exceed 25%.

FS Hand Thinning, Chipping and Piling Prescription Specifications:

- Manually thin all live brush and coniferous trees up to 10" dbh to 20 x 20 feet spacing.
- Retain well-formed trees with single leader, straight bole, increasing internodal length, full crowns, long needles, local dominance, dark green foliage, absence of diseases or insect problems, and no physical damage.
- On residual conifers, prune all limbs, live and dead, to a height of 10 feet from ground level or 50% of tree height.
- Hardwoods - Black oak greater than 12” dbh and aspen, maple, willow, and dogwood greater than 8” dbh shall not be masticated, shredded, or damaged, and shall be included as crop trees to meet spacing requirements.
- Do not cut California hazelnut, California nutmeg, elderberry, or Pacific yew.
- Chip all woody material less than 20 inches diameter at the large end and greater than 1-inch diameter at the small end. Logs larger than 20” diameter at the large end shall be positioned perpendicular to the slope to enhance soil retention.
- Chip depth shall not exceed 6 inches above ground level.
- Chips must not be placed within watercourses or on roads, including associated cut banks and drainage ditches.
- Contractor(s)shall construct hand piles to the following specifications:
- Minimum of 10 x 10 feet.
- A 4-ft wide fireline directly around each hand pile shall be cleared of all but fine material and the very outer 1.5-ftof that line shall be cleared down to mineral soil.
- In areas where there is a potential for burning material to roll, firelines shall be trenched on the downhill side of each pile to adequately prevent material from crossing firelines. In addition to trenching, material shall be piled perpendicular to the slope to prevent it from rolling.
- All piles shall be covered with a durable waterproof covering as approved by Forest Service. The material shall be at least 6 feet in width. Pieces of burnable material shall be placed on top of the durable waterproof covering to keep the covering from blowing off the pile.
- Lopping and scattering of woody material is not permitted.

Prescription for Private Parcel Fuelbreak Construction & Maintenance

- Class II watercourses requires at least 75 feet Watercourse and Lake Protection Zone (no heavy equipment in zone, only hand work, retaining 50% of the understory vegetation and 50% of the overstory vegetation).
- Live trees less than 10” dbh will be mechanically thinned to approximately 20-30’ spacing, and a residual basal area between 75-90 square feet per acre.
- Mechanical equipment not to operate in areas with slope over 40%. On slopes over 40%, use hand crews for lop and scatter.

- Do not operate under saturated soil conditions.
- Masticate brush and trees <10” dbh, standing or downed. No punji sticks. Stumps shall be <6” on uphill side. Shreds generally <12” in depth.
- Suppressed and Intermediate trees are targeted for removal. This will result in a stand that is openly spaced with Dominant and Codominant trees. The residual trees will be the largest and healthiest trees that exist in the preharvest stand. Stocking levels shall be at least 50 SFBA/AC upon completion of operations with general spacing of 20-30’ between stems. The resulting stand will enjoy an increased fire resiliency with more available sunlight, water, and nutrients for residual trees with a larger quadratic mean diameter than the preharvest stand. Fuels that were partially treated (trees that were felled, bucked but not removed and unburned slash piles) will be masticated, reducing fuels into woody shreds and chips which will aid in moisture retention and suppression of sprouting vegetation as well as provide erosion control.
- Retain seedlings & saplings of conifers and black oaks at 20-30’ spacing where no other trees exist in the pre-treatment stand.
- Prune residual conifer trees up to 10 feet from ground level or 50% of height.
- Fall all hazard trees regardless of size; masticate limbs and top; leave logs over 16” dbh and 20’ in length on the ground perpendicular to the slope as Large Woody Debris.
- Existing piles shall be masticated.

Timeline and Work Plan

Monitoring for this project will occur pre-treatment and then immediately after treatment, and 2-years post treatment. For common stand exam plots and photo monitoring, we will attempt to conduct 3 visits, but due to the grant funding period and potential timing of treatment completion, there may not be monitoring during the 2-year post-treatment period for some plots. If funding and timing allow, and permissions are granted, additional CSE plots may be monitored during the above-mentioned timeframe within the project area or outside of the project area on FS lands or on private timberlands (SPI) (see Table 3).

Table 3: Ecological and implementation monitoring questions and relevant treatment types.

Monitoring Question	FS FB Construction/ Maintenance	FS Fuels Reduction	Private FB Construction /Maintenance	Additional FBs outside project area[a]
A	X	X	X	
B	X	X	X[a]	X[a]
C	X	X	X[a]	X[a]
D	X	X	X	

[a]: If funding and timing allow and permissions are granted, additional CSE plots may be monitored during the above-mentioned timeframe within the project area or outside of the project area.

In 2021, pre-treatment (baseline) monitoring of FS fuelbreak units and FS fuels reduction units, including 18 CSE plots and 57 photo monitoring stations will occur just prior to operation commencement (Table 4).

Starting in 2021, and most likely in 2022 as well, immediate post-treatment monitoring of FS fuelbreak units, FS fuels reduction units, SPI fuelbreak units, and private parcel fuelbreak units, including 18 CSE plots, 57 photo monitoring stations, 19 FS-specific compliance monitoring locations and unit inspections, and 7 private unit inspections will occur immediately following unit operation completion (Table 4).

In 2023, 2-year post-treatment monitoring of FS fuelbreak units and FS fuels reduction units, including 18 CSE plots and 57 photo monitoring stations, will occur.

Table 4: Ecological and implementation monitoring questions and relevant treatment types.

Treatment type	2021 baseline	2021/2022 Post-treatment[a]	2023 2-yr Post-treatment[b]
FS FB Construction/ Maintenance Units	• 9 CSE plot • 30 Photo monitoring stations	• 9 CSE plots • 30 Photo monitoring stations • 10 Unit Inspections/ Compliance monitoring	• 9 CSE plots • 30 Photo monitoring stations
FS Fuels Reduction Units	• 9 CSE plot • 27 Photo monitoring stations	• 9 CSE plot • 27 Photo monitoring stations • 9 Unit Inspections/ Compliance monitoring	• 9 CSE plot • 27 Photo monitoring stations
SPI FB Construction/ Maintenance Units		• 3 Unit Inspections/ Compliance monitoring	
Private FB Construction/ Maintenance Units		• 4 Unit Inspections/ Compliance monitoring	

[a]: Immediate post-treatment site visits in 2021 are dependent on treatments occurring early enough to allow time for visits prior to the end of the calendar year.
[b]: 2-yr post-treatment site visits is dependent on when treatments are completed. If treatment completion is in spring 2022 or later, 2-yr post-treatment monitoring will not occur.

Methodology

Vegetation & Fuel Surveys

The vegetation and fuel monitoring protocol are based on the Pacific Southwest Region 5 Common Stand Exam Guide (https://www.fs.fed.us/nrm/fsveg/index.shtml). CSE plots will be circular, 11.3 m radius (1/10 acre) in size, and plots will be randomly located in at least 3 locations per selected subset of project units. The subset of units for monitoring and the center of monitoring plots were identified by randomly selecting centers of a 50m x 50m grid across the project treatment units (Figure 2). Existing vegetation spatial data (R5 CALVEG,

https://www.fs.usda.gov/detail/r5/landmanagement/resourcemanagement/?cid=stelprdb5347192) was used to ensure plots were only located in areas with conifer or mixed conifer-hardwood vegetation classifications.

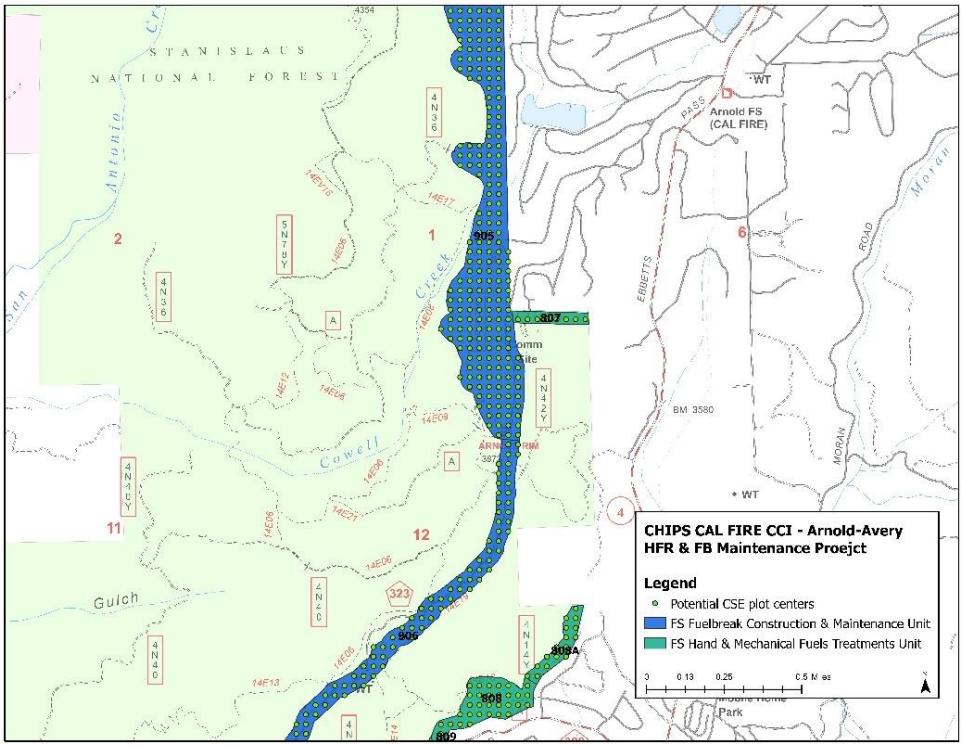


Figure 2. Map depicting possible monitoring plot centers across project units. The subset of units for monitoring and the center of monitoring plots were identified by randomly selecting centers of a 50m x 50m grid across the project treatment units, and using R5 CALVEG data to ensure plots were only located in areas with conifer or mixed conifer-hardwood vegetation classifications.

Location of monitoring plots can be found in Figure 3. We will use a GPS, and also rebar will be driven into the ground at each plot center, to ensure relocation of plot center on subsequent monitoring visits. More information on plot data collection methodology can be found below:

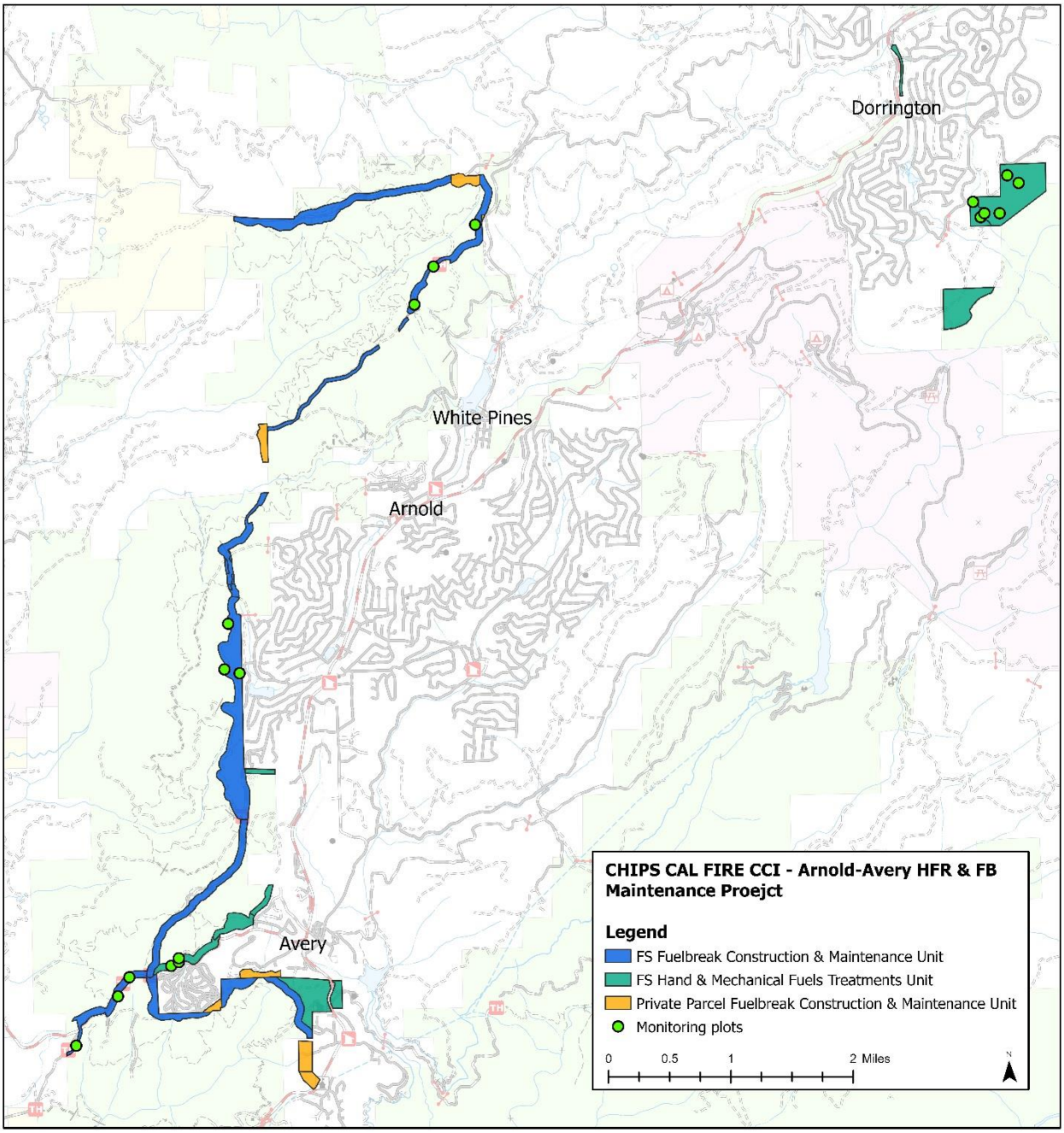


Figure 3. Map depicting location of randomly selected center of monitoring plots in a random subset of units within the project area.

CSE Plot Data

(1/10 acre plot)

I. Enter the plot #, date, time in and time out and observer initials
II. Photos
    a. Take a photo of the plot number to identify the plot number for renaming photos later.

b. Take one photo at each cardinal direction from plot center moving clockwise (N, E, S, W).
c. Record whose camera the photos were taken on. If using a tablet to take photographs, insert text with plot number and direction on the photo.
d. Photos should be renamed as follows: Plot number (for each photo) followed by: _N (For North), _E (East), _S (South), _W (West).

III. Enter the UTM zone and easting and northing measurements for the plot center using GPS.
IV. Enter the slope, in %. Record the slope across the entire plot to the nearest 1 percent. Measure slope, using a clinometer, from point center in the two directions of the aspect axis to the plot edge and average these two numbers (Or calculate slope in GIS).
V. Enter aspect, in degrees. Record the aspect across the entire plot to the nearest 1 degree. Aspect is measured with a hand compass measured in the same direction as the slope.
VI. Enter the plot horizontal and vertical shape (BR,CC,CV, etc.), see table in Cheat sheet A1.
VII. Enter the slope position (SU,SH,BS, etc.), see table and figure in Cheat sheet A2.
VIII. In the existing veg box, list the top three overstory species in order of dominance of the plot not the stand (e.g., PIPO/ABCO/QUCH).

Vegetative Cover

(1/10 acre plot)

I. Enter the plot #.
II. Estimate % cover (to nearest 5%) of the total plot and modal height (in meters) (to the nearest 0.1) for the all-vegetation categories. 4 m sq. is equal to approximately 1% cover. Use the tree diagram on the data sheet to record distance to base and top of tree if calculating height later.
    a. "Total vegetation" is the cover of living vegetation as a % of the plot when viewed from an airplane/satellite.
    b. "Total tree", "tree ≥6.1' (≥1.86 meters)" and "tree <6.1' (<1.86 meters)" refer only to live trees. Adding TOV and TSA together will probably give a value higher then TOT, due to crown overlap.
    c. Under "shrubs", all measures refer only to live shrubs. As above, adding ST, SM, and SL together will usually give a value > than TOS, due to crown overlap.
    d. Modal height is the most common height, which is not always the average.
    e. Graminoids include grasses, sedges, and rushes; forbs include any other vascular plant without significant woody tissue.
    f. Cheatsheet B1.
III. If any of the above vegetation cover types are present in the plot but make up less than 1%, record the percent cover as 0.5%. This represents trace cover.

Ground Cover

(1/10 acre plot)

I. Enter the plot #
II. Ground surface cover values must sum to 100% to nearest 5%
    a. These measures are of the ground cover, i.e. think about what the plot would look like if you could cut everything off right at ground level.

Shrub Species Composition

(1/10 acre plot)

I. Enter the plot #.
II. Enter the species lifeform (Cheatsheet C1).
III. Enter the layer code of the plants you are measuring.
    a. ST= tall shrubs [≥6.1' tall (≥1.86 meters)]
    b. SM= medium shrubs [6.1'-1.6' tall (0.46-1.86 meters)]
    c. SL= low shrubs [<1.6' (<0.46 meters)]
    d. For each shrub species, there may be multiple layer classes.
IV. Enter the species code and record percent cover (live only) to nearest 1% for each layer.

Fuel Loading

I. Enter the plot #
II. Fuel loading 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.
III. Enter the azimuth of the transect. Since they will be in the cardinal directions, it is OK to write, N,S,E, or W for the four different transects, 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
IV. Use a go/no go gauge to record the following:
    a. The number of 1-hr fuels (<0.64 cm) that intersect the transect between the 3.0 and 5.0 m mark.
    b. The number of 10-hr fuels (0.64-2.54 cm) between the 3.0 and 5.0 m marks
    c. The number of 100-hr fuels (2.54-7.62 cm) between the 3.0 and 6.0 m marks
    d. Measure litter and duff depths at the transect starting point (i.e. at the outside of the plot) and again at 25' (7.6 m), enter these values.
    e. Measure fuel depth at the transect starting point, at 12.5' (3.8 m) and at 25' (7.6 m).
V. Collect information on every piece of coarse woody debris (CWD) that intersects the transects and meets the minimum criteria:
    a. Central longitudinal axis of the CWD intersects the transect
    b. The diameter at the point of intersection is ≥3" (7.6 cm)
    c. The piece is at least 1 meter (3.3 feet) long
VI. 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.
    a. Enter the decay class (see Cheatsheet D1)
VII. Notes:
    a. To qualify as fuels, particles must be severed from the original source of growth

b. 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.
c. Do not count needles, grass, bark, or cones.
d. If a branch or log intersects the transect at its end, the central axis must intersect the transect for the piece to be tallied (Cheatsheet D2)
e. Count both intersections for a curved piece (Cheatsheet D3)
f. Regardless of size, pieces are only tallied when their intersection with the transect lies above the litter and duff layers (Cheatsheet D4)
g. Do not count stumps that are still rooted in the ground

Equipment needed include: Data sheets, GPS, clinometer, camera, compass, transect tapes, DBH tape or Biltmore stick, and a laser range finder.

Photo Monitoring

Photo monitoring will be used as one method of assessing how fuel treatments met the project goals and objectives. Photo monitoring locations are TBD, and will be located in multiple, representative locations within each project unit. At each photo monitoring station:

- Take one photo at each cardinal direction from photo monitoring center moving clockwise (N, E, S, W).
- Record whose camera the photos were taken on. If using a tablet to take photographs, insert text with plot number and direction on the photo.
- Photos should be renamed as follows: Unit ID and Photo monitoring number (for each photo) followed by: _N (For North), _E (East), _S (South), _W (West).
- In each photo, include a white board held in the corner of the frame, with the site name ("Unit ID_, Photo station #_), bearing and date written large enough to be read (record photo number on datasheet in case photo board is unreadable).
- A GPS and sunken rebar will be used to relocate photo monitoring stations.

Equipment needed include: Data sheets, GPS, camera, compass, rebar and white board.

Unit Inspections/Compliance Monitoring

For FS units, unit inspections/contract compliance monitoring immediately post-treatment will be used to determine if fuels reduction meet the project goals and objectives, and if operations were implemented as planned, including:

- Total acres treated
- Maintaining the desired vegetation structure for re- pre-project and then 1- and 3-years post project entry on a 5-to-10-year rotation.
- Limiting snags, including those adjacent to roads or other features, to 6 or less per acre on average.
- Limiting woody debris to 5 tons per acre or less on average.

- Limiting the number of down logs greater than 20 inches in diameter to 5 or less per acre on average.

For SPI and private parcel units, site visits and photo monitoring will be used to determine if fuels reduction meet the specifications and if operations were implemented as planned.

Equipment needed include: TBD

Socio-economic & Collaboration Monitoring

The Request for Proposals (RFP) bid sheet associated with this project will be reviewed to determine the number of local and non-local contractors that bid on the project to address the effects of the project in providing work for local forest contractors.

To assess the collaborative's level of success at streamlining implementation and increasing pace and scale, the proposed project timeline for deliverables specified in the grant agreement will be compared against the actual project timelines.

To assess whether the project was implemented at a higher quality than baseline, contractor appeals or objections received during the contractor bidding process will be tabulated.

To assess effectiveness of the collaboration in engaging the community interests to effectively increase trust and partnerships related to forest restoration practices, tabulate number of volunteers on this project.

Appendix A. Data Forms

PLOT # Observer: Date:

TimeIn	TimeOut	Datum	UTM Easting	UTM Northing	Declination	Slope	Aspect

Slope Horizontal Shape	Slope Vertical Shape	Slope Position	Capable Growing Area	Scott Burgan	Existing Veg

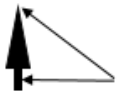
Plot History 1	Plot History 2	Fire Severity	MGT Notes

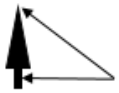
Cover type (11m radius)	% Cover	Modal height
Total Vegetation		
TOT Total Tree		
TOV overstory tree >1.86m		
TSA sapling <1.86m		
TOS Total Shrub		
ST Shrubs >1.86m		
SM Shrubs 0.46-1.86m		
SL Shrubs <0.46		
FB Total Forb		
GR Total Graminoid		
slash		--------
downed logs		--------
bare ground		---------

List invasive species _____

Modal ht to dead canopy ____m; ht to live canopy ____m

NOTES:





SHRUB species -11 m radius

Layer Codes	Species	Percent Cover	Notes

Ground Surface Covers (Sum to 100%)

TYPE	% Cover	Remarks
GRAV (2-75 mm)		
COBB (70-250 mm)		
STON (250-600 mm)		
BOUL (>600 mm)		
BEDR (ock)		
BARE (soil < 2mm)		
WOOD (>3")		
LITTER		
CRYP/MOSS/LICH		
ASH		
ROAD		
OTHER road, trail, water, etc ( )		

CSE Fine Fuels Data 1 hr (0-0.25") length: _____ 10 hr (0.25-1") length: _____ 100 hr (1-3") length: _____ ***Record zero*** if no fuels are present

Plot #	Date	Observers	Azimuth	Slope %	1 hr:	10 hr:	100 hr:	Litter1 cm	Duff1 cm	Litter2 cm	Duff2 cm	Avg Fuel Depth: cm

Fuel Depth: avg depth along transect from top of duff to top of fuelbed including litter, herbs, grasses, shrubs, logs, etc not attatched to trees (cm)

Coarse Woody Debris Data Transect Length: 4*50ft Min. diameter 3". If log is decay class 5, record only diameter at intersection. ***Record blank row*** if plot has no CWD.

Plot #	Date	Obs	AZ	Slope	Diam Inter-sect	Diam Large (in):	Diam Small (in):	Length m	Decay Class:	Char Depth (cm):

PLOTS ON SHEET:

Plot #	Date	Obs	AZ	Slope	Diam Inter-sect	Diam Large (in):	Diam Small (in):	Length m	Decay Class:	Char Depth (cm):

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

Pieces are selected if: **1)** central axis crosses transect **2)** diameter at intersection is at least 7.62 cm (3") **3)** Piece length is at least 1 meter (39").

Appendix B Cheat sheets for Data forms

A1. Plot horizontal and vertical shape

Code	Description
BR	**Broken**. Cliffs, knobs, and/or benches interspersed with steeper slopes generally characterized by sharp, irregular breaks. A marked variation of topography, or an irregular and rough piece of ground.
CC	**Concave.** The gradient decreases down the slope. Runoff tends to decelerate as it moves down the slope, and if it is loaded with sediment the water tends to deposit the sediment on the lower parts of the slope. The soil on the lower part of the slope also tends to dispose of water less rapidly than the soil above it.
CV	**Convex**. The gradient increases down the slope and runoff tends to accelerate as it flows down the slope. Soil on the lower part of the slope tends to dispose of water by runoff more rapidly than the soil above it. The soil on the lower part of a convex slope is subject to greater erosion than that on the higher parts.
LL	**Linear or Planar.** Substantially a straight line when seen in profile at right angles to the contours. The gradient does not increase or decrease significantly with distance (level or little relief).
PA	**Patterned**. A general term for any ground surface exhibiting a discernibly ordered, more-or-less symmetrical, morphological pattern of ground (i.e. micro relief of hummock and swales of several feet).
UN	**Undulating**. One or more low relief ridges or knolls and draws within the plot area.
UA	Unable to Assess.

A2. Slope Position

Code	Description
SU	**Summit/Ridgetop/Plateau**. The topographically highest hillslope position of a hillslope profile and exhibiting a nearly level surface.
SH	**Shoulder**. The hillslope position that forms the uppermost inclined surface near the top of a hillslope. It comprises the transition zone from backslope to summit.
BS	**Backslope**. The hillslope position that forms the steepest inclined surface and principal element of many hillslopes. In profile, backslopes are commonly steep, linear, and bounded by a convex shoulder above and descending to concave footslope. They may or may not include cliff segments. Backslopes are commonly erosional forms produced by mass movement and running water.
FS	**Footslope**. The hillslope position that forms the inner, gently inclined surface at the base of a hillslope. In profile, footslopes are commonly concave. It is a transition zone between upslope sites of erosion and transport.
TS	**Toeslope**. The hillslope position that forms the gently inclined surface at the base of a hillslope. Toeslopes in profile are commonly gentle and linear, and are constructional surfaces forming the lower part of a hillslope continuum that grades to valley bottom.
VB	**Valley Bottom**. Wide valley bottom beyond influence of toeslope.

B1. Cover Codes

Code	Description		Code	Description
TV	Total cover of all vegetation		TOH	Total cover of all herbs
TOT	Total cover of all trees		TAL	Total cover of all algae
TOV	Total cover of trees greater than or equal to 6.1 feet tall		TLC	Total cover of all lichens
TSA	Total cover of trees less than or equal to 6.0 feet tall		TFU	Total cover of all fungi
TOS	Total cover of all shrubs		TLI	Total cover of all woody lianas
ST	Total cover of all shrubs greater than or equal to 6.1 feet tall		TSS	Total cover of all subshrubs
SM	Total cover of all shrubs between 1.6 and 6.0 feet tall		TVI	Total cover of all herbaceous vines
SL	Total cover of all shrubs less than 1.6 feet tall		TNP	Total cover of all nonvascular plants
TOF	Total cover of all forbs		TUN	Total cover of all unknown lifeforms
TOG	Total cover of all graminoids		TVP	Total cover of all vascular plants

B2. Ground Surface Cover

Code	Description	Definition
	ROCKS	
ROCK	Rock	Relatively hard, naturally formed mineral or petrified matter >1/8 inch in dia. appearing on soil surface as small to large fragments or as rel. large bodies, cliffs, outcrops or peaks. Includes bedrock.
GRAV	Gravel (2-75 mm)	Rock fragments between 2 and 75 mm in diameter.
FIGR	Fine gravel (2-5 mm)	Rock fragments between 2 and 5 mm in diameter.
MEGR	Medium gravel (5-20 mm)	Rock fragments between 5 and 20 mm in diameter.
COGR	Course gravel (20-75 mm)	Rock fragments between 20 and 250 mm in diameter.
COBB	Cobbles (70-250 mm)	Rock fragments between 75 and 250 mm in diameter.
STON	Stones (round and flat)	
ROST	Round stone (250-600 mm)	Rock fragments between 250 and 600 mm in diameter.
BOUL	Boulders (round and flat)	Rock > 600 mm in diameter or length. Generic term for use when boulders are not differentiated by round and flat.
ROBO	Round Boulder (>600 mm)	Round Rock fragments >600 mm in diameter.
CHAN	Channers (2-150 mm long)	Long, thin rock fragments up to 150 mm in length, as determined by National Cooperative Soil Survey.
FLAG	Flag stones (150-380 mm long)	Flag Rock fragments 150-380 mm long.
FLBO	Flat boulders (>600 mm long)	Flat Rock fragments >600 mm long.
FLST	Flat Stone (380-600mm long)	Flat Rock fragments between 380 and 600 mm long.
BEDR	Bedrock	A general term for the rock, usually solid, that underlies soil or other unconsolidated, superficial material.
PAVE	Pavement	A natural concentration of closely packed and polished stones at the soil surface in a desert (may or may not be an erosional lag).
RROC	Rock fragments	Rock fragments >19.1 mm (3/4 inch) in diameter.
	WATER, SNOW, AND ICE	
WATE	Water	Where the water table is above the ground surface during the growing season, such as streams, bogs, swamps, marshes and ponds (FIA definition).
TRIC	Transient Ice	Ice covering the surface; the ice will melt during the growing season.
TRSN	Transient Snow	Snow covering the surface; the snow will melt during the growing season.
TRIS	Transient Ice and Snow	Surface area covered by ice and snow at the time of plot measurement, considered transient. For use when permanent ice and snow are not differentiated.
PEIC	Permanent Ice	Ice covering the surface. Does not melt during the growing season. The surface is ice-covered for the entire year (i.e., glaciers).
PESN	Permanent Snow	Snow covering the surface; does not melt during the growing season. The surface is snow-covered for the entire year.
PEIS	Permanent Ice and Snow	Surface area covered with ice and snow at the time of plot measurement, considered permanent. For use when permanent ice and snow are not differentiated.
	WOODY PIECES	
WOOD	Wood	Woody material, slash and debris; any woody material, small and large woody debris, regardless of depth. Litter and non-continuous litter are not included (for example, scattered needles over soil is classified as BARE).

MOSS, LICHEN, FUNGI		
CRYP	Cryptogam	Thin, biotically dominated ground or surface crusts on soil in dry rangeland conditions, e.g. cryptogamic crust (algae, lichen, mosses or cyanobacteria).
CML	Cryptogams, mosses, and lichens	For situations where information is not further differentiated.
LICH	Lichen, fungi, algae	Lichens: an organism generally recognized as a single plant that consists of a fungus and an alga or cyanobacterium living in a symbiotic association. For lichen growing on bare soil in dry rangeland conditions, see cryptogamic crusts.
MOSS	Moss	Nonvascular, terrestrial green plants including mosses, hornworts and liverworts - always herbaceous. This code does not apply to moss growing on bare soils in dry rangeland conditions. For rangeland conditions, see cryptogamic crusts.
DUFF AND LITTER		
LITT	Litter and duff	Leaf and needle litter, and duff not yet incorporated into the decomposed top humus layer. Non-continuous litter is not included (for example, scattered needles over soils is classified a BARE).

BASAL VEGETATION		
BAVE	Basal vegetation	Basal vegetation not differentiated by life form. For use when basal vegetation is not separated into more detailed codes (BAFO, etc.).
BATR	Basal tree	Basal (cross-sectional area at or near the ground level) cover of trees. (Definition adapted from definition of basal area in National Range & Pasture Handbook)
BASH	Basal shrub	Basal (cross-sectional area at or near the ground level) cover of shrubs.
BAFO	Basal Forb	Basal (cross-sectional area at or near the ground level) cover of forbs.
BAGR	Basal graminoid	Basal (cross-sectional area at or near the ground level) cover of grasses or grass-like plants.
OTHER		
ASH	Ash (organic, from fire)	Remaining residue after all combustible material has been burned off.
BARE	Bare Soil (soil particles < 2 mm)	Bare soil, not covered by rock, cryptogams or organic material. Does not include any part of a road (see definition for road).
BARR	Barren	Areas naturally devoid of vegetation, such as intermittent lakebeds and saline flats. Does not include areas denuded of vegetation.
DEVP	Developed surface (other than road) i.e. buildings or other structures	Surface area occupied or covered by any man-made structure other than a road, such as a building, dam, parking lot, electronic site/structure.
ROAD	Road	Improved roads, paved roads, gravel roads, improved dirt roads and off-road vehicle trails regularly maintained or in long-term continuing use. Generally constructed using machinery. Includes cutbanks and fills.
TEPH	Tephra Volcanic	A general term for all material formed by volcanic explosion or aerial expulsion (as opposed to flow) from volcanic vent.
UNKN	Unknown	Other covers not defined elsewhere.

C1. Life Form Definitions

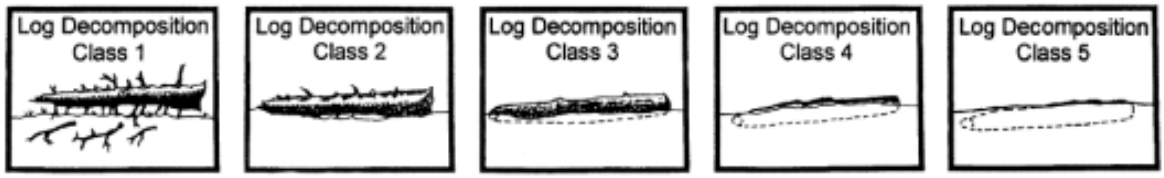
Life Form Definitions (exactly 2 characters) Required

These definitions are consistent across all of the NRIS modules, and are approved national codes.

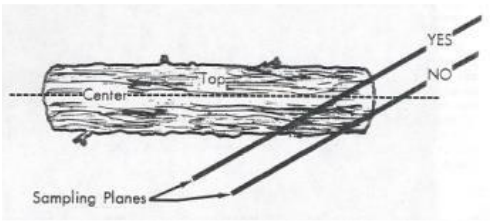
Code	Description	Definition
TR	Woody Tree	Perennial, woody plant with a single stem (trunk), normally greater than 4 to 5 meters or 13 to 16 feet in height; under certain environmental conditions, some tree species may develop a multi-stemmed or short growth form (less than 4 meters or 13 feet in height).
SH	Woody Shrub	Perennial, multi-stemmed woody plant that is usually less than 4 to 5 meters or 13 to 16 feet in height. Shrubs typically have several stems arising from or near the ground, but may be taller than 5 meters or single-stemmed under certain environmental conditions.
FB	Herbaceous forb/herb	Vascular plant without significant woody tissue above or at the ground. Forbs and herbs may be annual, biennial, or perennial but always lack significant thickening by secondary woody growth and have perennating buds borne at or below the ground surface.
GR	Herbaceous graminoid	Grass or grass-like plant, including grasses (Poaceae), sedges (Cyperacea), rushes (Juncaceae), arrow-grasses (Juncaginaceae), and quillworts (Isoetes).
HB	Herbs	Combination of all graminoids and forbs. This is required for FGDC Vegetation Classification Standard (1997).
AL	Algae	A general name for the single-celled plant plankton, sea weeds, and their freshwater allies.
LC	Lichen	Organism generally recognized as a single plant that consists of a fungus and an alga or cyanobacterium living in symbiotic association. Often attached to solid objects such as rocks or living or dead wood rather than soil.
FU	Fungus	A non-flowering plant of the kingdom Fungi, all lacking chlorophyll.
LI	Woody Liana	Climbing plant found in tropical forests with long, woody rope-like stems of anomalous anatomical structure.
SS	Woody Subshrub/half-shrub	Low-growing shrub usually under 0.5 meters or 1.5 feet tall (never exceeding 1 meter or 3 feet tall) at maturity.
VI	Herbaceous Vine	Twining/climbing plant with relatively long stems can be woody or herbaceous.
NP	Nonvascular plant	Nonvascular, terrestrial green plant, including mosses, hornworts, and liverworts. Always herbaceous, often attached to solid objects such as rocks or living or dead wood rather than soil.
UN	Unknown	Growth form is unknown.
VP	All vascular plants	

D1. Log Decay Class

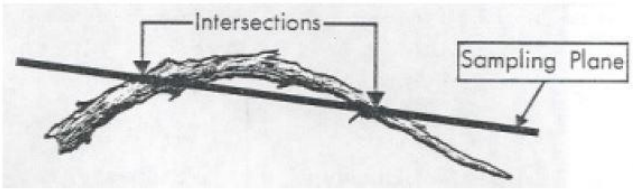
Code	Bark	Twigs	Texture	Shape	Wood Color	Portion of log on ground
1*	Intact	Present	Intact	Round	Original	None, elevated on supporting points
2	Intact	Absent	Intact to soft	Round	Original	Parts touch, still elevated, sagging slightly
3**	Trace	Absent	Hard large pieces	Round	Original to faded	Bole on 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



D2. Woody Fuels



D3. Woody Fuels



D4. Woody Fuels