NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE SPECIFICATION

FUEL BREAK – FORESTLAND

(Ac.)

CODE 383

Fuel Break—NRCS Definition:

A strip or block of land on which the vegetation, debris and detritus have been reduced and/or modified to control or diminish the risk of the spread of fire crossing the strip or block of land.

Figure 1. A fuel break on forest land involves the reduction of flammable fuels, eliminating ladder fuels, and increasing the spacing of residual trees in order to minimize the risk of crown fires.

Purpose

Control and reduce the risk of the spread of fire by treating, removing, or modifying forestland vegetation, debris and detritus.

Conditions Where Practice Applies

This practice applies on all land where protection from wildfire is needed. A fuel break is typically an easily accessible strip of land of varying width (depending on fuel and terrain), where fuel density is reduced, resulting in positive impacts to fire behavior and providing fire control opportunities.

Forestland Protection

This practice is specific to fuel breaks which are applied to forestland including conifer, montane confer-hardwood, and woodlands/grasslands forest types. Fuel breaks are installed in advance of a fire event in order to protect wildland and wildland urban interface forested landscapes and aid in wildfire suppression. This practice may also be used in Wildland Urban Interface settings for safe ingress/egress access on roads during wildfire events.

Fuel breaks are planned and located at strategic locations on the landscape as part of an integrated system on lands that have an elevated risk of wildfire. They break up large, continuous tracts of dense natural fuels, thus limiting the uncontrolled spread of wildfire. They are commonly associated with fire

breaks (permanent or temporary strips of bare or vegetated land planned to retard fire, or other features such as roads).

Fuel breaks aid in firefighting efforts by slowing fire spread, and by providing an area of less extreme fire behavior from which other actions (e.g., back burns) are taken. However, under extreme conditions even properly designed fuel breaks cannot significantly reduce fire behavior in the event of large, rapidly spreading wildfires, regardless of the efforts of firefighters.

A “shaded” fuel break is commonly applied on strategic locations within larger forested areas. Shaded fuel breaks have lower fuel loads relative to areas outside of the fuel break, and the shade provided by the canopy improves the microclimate conditions of the underlying fuels.

Fuel breaks typical have well-spaced, large sized “dominate” trees; a low number of trees per acre (e.g. 50 trees/acre - < 100 sq. ft. of basal area); few understory smaller trees; high “height to live crown” distance; less than 10 % cover of brush arranged in isolated groups; and low levels of snags and down logs.

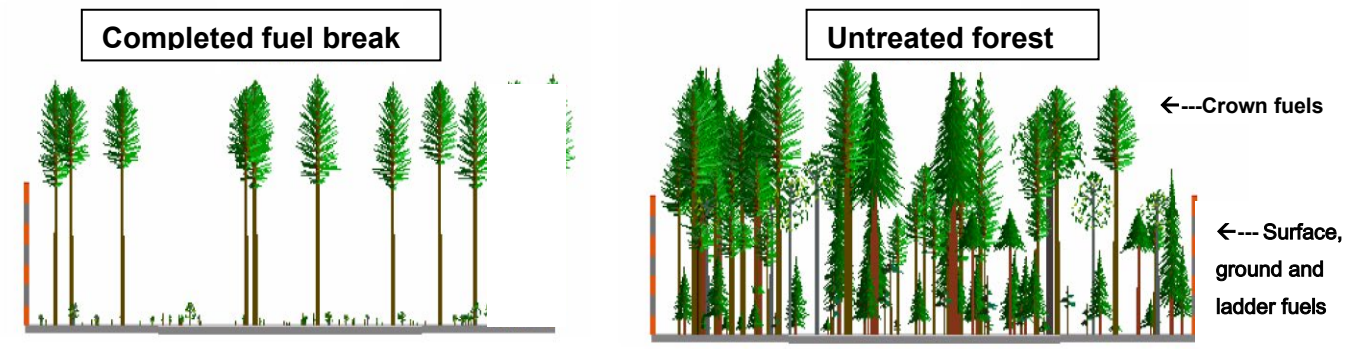


Figure 2. (Right) A typical fuel stratum for forest stands in California prior to fuel break installation. Fire behavior is a function of various inter-related elements including density of tree crown vegetation, smaller tree and brush “ladder” fuels, and ground surface vegetative debris. (Left) A completed fuel break

General guidance

The primary goal of this practice is to significantly alter (modify) fire behavior within the treated area.

This specification is designed to achieve different results from those expected from pre-commercial thinning, applied under NRCS practice 666 (Forest Stand Improvement). Although thinning can produce positive benefits in fuel reduction, the primary purpose of the Forest Stand Improvement as applied by NRCS is to address forest health, productivity and other closely related resource concerns. The post-treated structural attributes of a thinned stand are not exactly the same as those of a fuel break. In many cases thinning operations will not adequately address surface or ladder fuels, and will not increase the distance to the base of the live crown. Siliviculturally thinned stands usually have less crown separation. However, the effectiveness of an applied fuel break will be enhanced when it is located adjacent to a properly thinned stand.

Crown fires (those that rapidly spread from tree to tree) pose the greatest danger to human and ecological values. For that reason, decreasing the overall risk of a rapidly spreading crown fires is the principal objective of the fuel break. The risk of crown fires will be minimized by actions which:

- Reduce surface fuels (grasses, forbs and small brush) – complete treatment/disposal of dead woody debris and slash necessary.
- Increase the height of the base of the live crown of the overstory retention trees
- Reduce ladder fuels (small trees and larger brush species)

- Reduce the continuity of the forest canopy (tree to tree), and
- Reduce the crown bulk density of the canopy.

While some fuel breaks have little to no post treatment vegetation, this CPS 383 requires creation of a “shaded fuel break” (one that retains a degree of canopy cover). This is preferable because of the temperature and relative humidity moderation that shading provides to the surface fuels and can provide some suppression of rapidly resprouting vegetation following the initial site clearing. In addition, any degree of crown retention provides additional benefits in retaining wildlife and aesthetic values within the forested landscape.

The design of fuel breaks varies in width according to numerous factors such as on-site and adjacent fuel loads, topography (both positive and negative attributes), proximity to roads and anchor points, and other factors. There are no absolute standards for fuel break construction, but design must meet minimum criteria in the 383 Practice Standard. When possible, *e*ach situation needs to be tailored to the risk and complexity of expected wildfire and assets at risk when considering terrain, fuels, historic fire regimes, expected occurrence, and the predictable weather and fuel conditions that may be present during a wildfire.

Fuel break widths applied in the United States vary from less than 100 up to 1,000 feet. When possible, a wildland fire fuels specialist or Area Forester with wildfire prevention planning experience should be consulted for designing the width based on the above factors and local site considerations. In this specification widths are therefore presented as general guidelines, especially maximum width guidelines.

Specifications

Fuel breaks shall comply with the following items, and any additional specifications based on purpose(s) and requirements listed for environmental protection and those for facilitating practices (pruning, slash treatment, burning etc.).

Purpose

Implementation Requirements sheets shall identify the purpose for protection, the type of fuel break (road, ridgeline etc.), provide a brief explanation of what is being protected, why it is being protected, and where the protection is needed. Include a map of location and sketch of design of fuel break.

Fuel break siting/location

1. When available, refer to local fire protection plans for information on locations and specifications of fuel breaks. Ideally, installation of fuel breaks should be done when fire service agencies, local community wildfire protection or other local fire safe planning efforts have identified the area as strategic need for a fuel break system.

2. Locate all potential ignition sources that could create hazardous or catastrophic fires. These sources may include public roads, railroads, urban developments, recreation sites, utilities, etc.

3. Locate fuel break(s) between the potential ignition source and the resources/structures to be protected and as close as feasible to the ignition source. Favor locations for fuel break(s) that are on strategic ridgelines for fire suppression control, at the bottoms of canyons leading up to saddles to reduce the risk of fires moving upslope (chimney effect), roads, and other critical public safety infrastructure.

4. Connect fuel break(s) to natural or artificial fire barriers such as rivers, creeks, large rock outcrops, wet meadows, roads, or areas with low fuel loads/cover or flammability such as

existing adjacent fuel break. Favor locations that are linked to road systems to facilitate fire-fighting access.

5. Generally, fuel breaks should not be located on midslope areas or along arbitrary property line boundaries that do not comport with strategic fuels or fire suppression control areas.
6. Often terrain limits the location and dimension of the fuel break. For safety purposes and to protect site resources, treatment methods involving equipment are generally not applied on slopes exceeding 35 percent.
7. Feather the edges of the fuel break(s) as feasible into the adjacent protected areas for aesthetic purposes.

Fuel break Dimensions

Ridges

1. The dimensions of the fuel break (width and length) shall be sufficient to reduce fire spread and intensity with consideration given to the assets being protected by the fuel break.
2. Width on level ground should be 2 ½ times the height of the average codominant tree or brush species vegetation or a minimum of 200 feet. Add 10 feet to the width for every 10 percent increase in slope (e.g., for a 50% slope 200 ft + 50 ft = 250 feet total width).
3. When terrain or other factor limits the width, the minimum fuel break width must be at least 100 feet. Use Practices CPS 666, 384, 660, and 490 (for hand chemical post installation resprout control) when narrower width “fuel breaks” are installed due width limitations.
4. Where slopes are less than 20%, the maximum width of the fuel break will generally not exceed 300 feet unless warranted by specific on-site conditions. Wider fuel break are allowable when conditions and assets at risk justify the widened area.

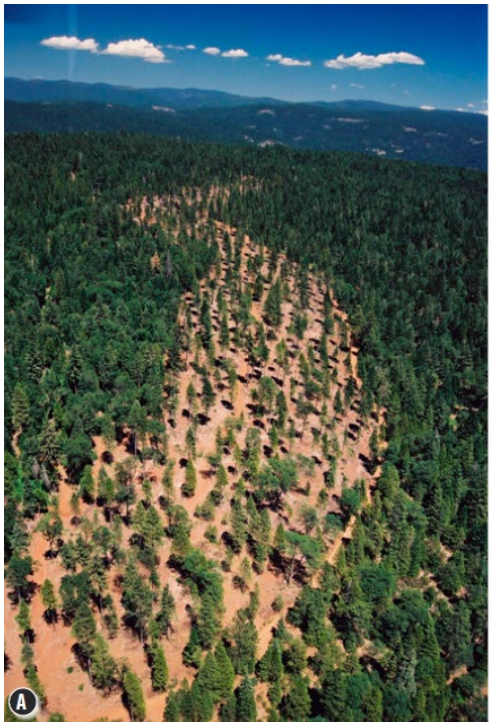


Figure 3: Ridgeline fuel breaks (left) *Photo from El Dorado County and Georgetown Divide RCD. (right) University of California ANR)*

Roads

Apply roadside fuel breaks may along county roads or private roads at an effective minimum width of 2 ½ times the height of the average codominant tree or brush species vegetation or a minimum of 200 feet. Add 10 feet to the width for every 10 percent increase in slope (e.g., for a 50% slope 200 ft + 50 ft = 250 feet total width), on level ground. Ideally, roadside fuel break widths are installed evenly on each side of the road (i.e.100 feet side of road).

Use Practices CPS 666, 384, 660, and 490 (for hand chemical post installation resprout control) when narrower width "fuel breaks" are installed due width limitations. Fuel breaks applied along roads provide enhanced protection due to the minimal fuel levels associated with roads. Roads also allow fire suppression crews quick access to the fuel break, and the road can be used as an anchor point for a back burn. Figures 4 & 5 provides visual examples of a fuel break established in conjunction with a road.

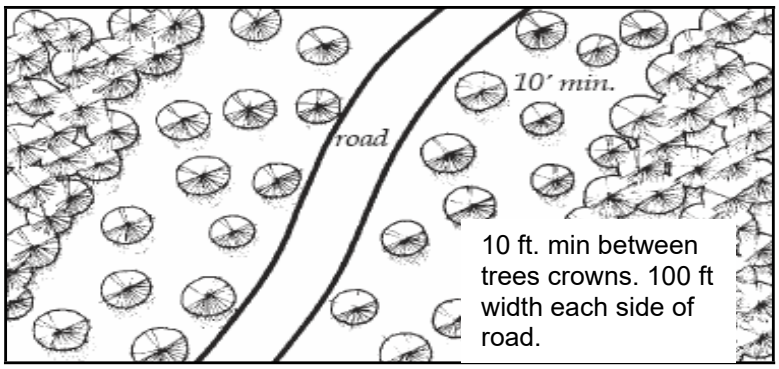


Figure 4: Aerial plan view of a road buffered by a fuel break.

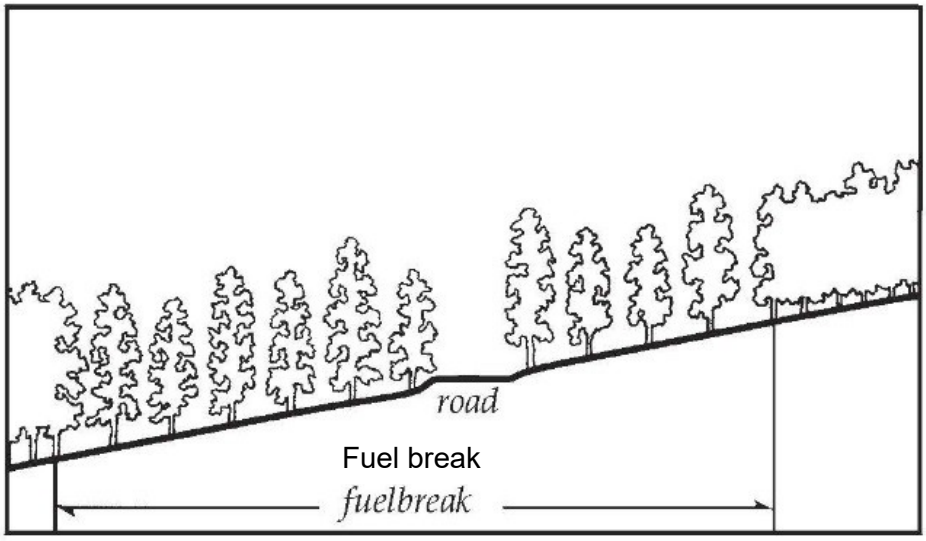


Figure 5: Cross sectional view of a fuel break established on both sides of a road *(Images are from "Fuel break Guidelines for Forested Subdivisions and Communities", Colorado State University)*

Vegetation Treatment Specification

1. Reduce or modify the existing fuel load (live vegetation and debris) to diminish the risk and/or rate of the spread of fire crossing the strip or block of land. Vegetation treatments shall focus on treating/removing fuels in all vegetative layers including tree crowns, understory trees and brush, and dead and down surface fuels or live ground cover. Focus on substantial vegetative removal and debris clean-up.

2. Vegetation treatment shall create both horizontal space and vertical space between retained vegetation.

3. Maximum Tree size removal: The maximum size live tree to be removed is 12 inches DBH. Dead/dying trees have no diameter size limit.

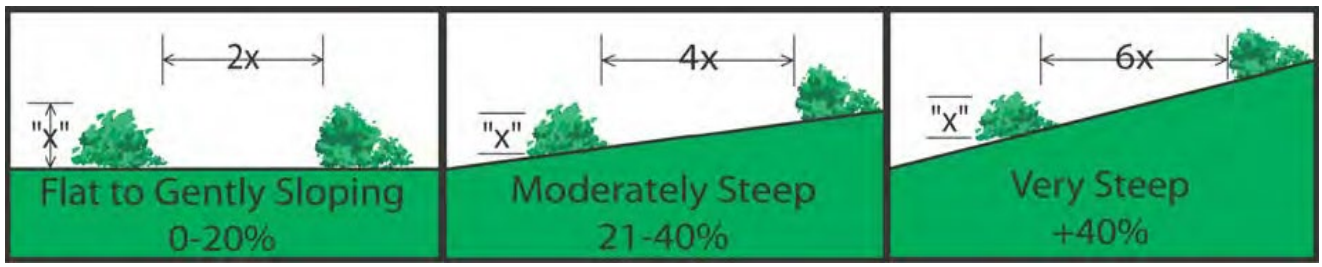
   Larger size live trees may be needed to be removed to effectively create a fuel break. When forest stand conditions necessitate removal of > 12-inch DBH tree, clients should be advised to obtain a commercial tree harvesting permit to remove the larger trees. Commercial tree removal operations should be completed and approved by CAL FIRE prior to implementation of the EQIP fuel break project.

4. Thin trees and brush to spacing standards shown below in Figure 6. Small, isolated clusters or groups of trees can be left for visual diversity or for wildlife value. State in the IR the target post treatment level of brush cover. Generally, brush cover should be less than 20% cover. Wider spacing of vegetation can be included when fire hazard and assets at risk warrant less standing vegetation.

Figure 6:

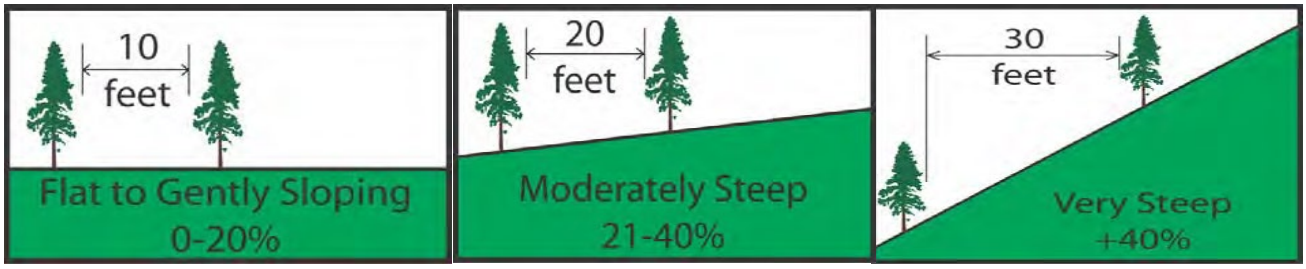
SHRUBS AND SMALL TREES (<15 ft tall): HORIZONTAL SEPARATION DISTANCES

Separation distances are measured between canopies (outer most branches) and not between trunks. Separation can be between individual shrubs/small trees or groups of shrubs/small trees.



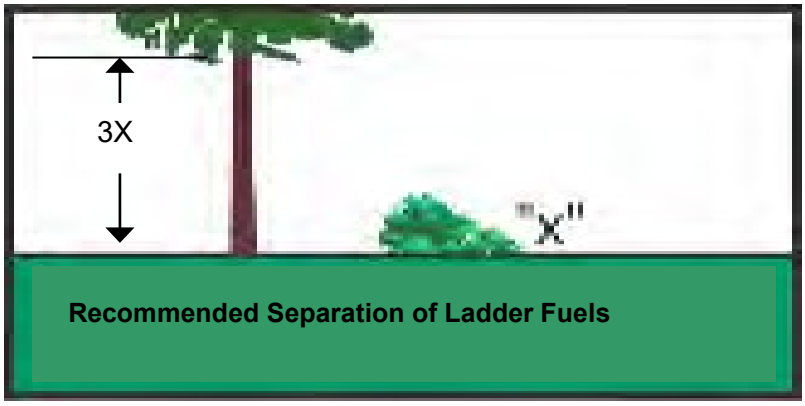
LARGER TREES: HORIZONTAL SEPARATION DISTANCES BETWEEN TREE CANOPIES

For forested areas, the recommended amount of separation between tree canopies is determined by steepness of slope. Crown separation can be between individual trees or groups of trees.



VERTICAL SEPARATION DISTANCES NEEDED BETWEEN FUEL LAYERS

Removal of ladder fuels is the most critical feature of a fuel break. Remove shrubs and small trees within the drip line of trees when sufficient space cannot be created between the tree crown and top of shrub/small trees. Pruning residual trees will also contribute to creating vertical separation of fuels.



Species composition to be favored for retention

Tree species differ in their ability to withstand wildfire. Select trees to retain that are more adapted and fire resistant to the local setting.

Table 1. Resistance of mature trees to fire damage and mortality, in order of decreasing resistance

Coastal species	Interior species
coast redwood, tanoak	ponderosa and Jeffrey pine, Douglas-fir
Douglas-fir	sugar pine, white fir, grand fir
grand fir, white fir	incense cedar
mountain hemlock	western white pine
noble fir	lodgepole pine, western hemlock
western white pine	canyon live oak
lodgepole pine	black oak
western hemlock	
Sitka spruce, western red cedar	

Source: D. Minore, Comparative autecological characteristics of northwestern tree species: A literature review. USDA Forest Service PNW Research Station Gen. Tech. Rep. PNW-87 (1979), p. 39; Forest Service Web site, http://www.fs.fed.us/pnw/pubs/journals/pnw_1979_minore001.pdf.

Prioritize removal of highly flammable shrubs.[1] After treatment retain a cover of low-growing forbs and perennial grasses for easy fire control on fuel breaks. For shrubs select species for ground cover that have low heights and contain low level of dead material.

Vegetation Treatment Methods

Implementation Requirements shall specify vegetation treatment method.

1. Vegetation treatment methods shall use techniques according to specification set forth in CPS 666 Forest Stand Improvement for tree/brush thinning, CPS 660 for pruning limbs of residual trees, CPS 384 for dispose of treated woody debris, and CPS 490 Tree Shrub Site Preparation for post treatment resprouting vegetation control.

[1] Flammability of any species is determined by moisture levels, and by the chemical composition and density of the individual species.

2. Chipping and masticating of thinned trees and shrubs is the preferred method for thinning and woody debris disposal. Lop and scatter slash treatment is generally not used for fuel breaks due to the need for low levels of of hazardous vegetative fuels following treatments. Areas with low vegetative tonage (less than approxiately 2 ton/ac.) may include lop and scatter.

Figure 7 - Mastication equipment grinds vegetation into small debris creating a fire safe fuel profile, organic material for soil health improvement, and avoids burning debris and the associated air quality, fire hazard and pest breeding issues.

Use of straight blade dozers and brush rakes are another treatment option. It can be useful for uprooting vegetation such as live oak that is susecptible to aggressive resprouting. But such methods can create substantial soil disturbance and environmental protection measures should be taken on soils and slopes that are susceptible to erosion and compaction. Mitigations/design features to reduce the soil disturbance impacts include max slope limitations for brush rake use; use of hand treatments on steeper portions of fuel break, retention of isolated vegetation groups to help filter interpret soil erosion, situating down logs on the contour to act as erosion barriers.

Remove all standing dead trees and shrubs except for a limited number of large, dead trees (snags >15" diameter- at-breast-height or larger) that may be retained for wildlife use. Low height snags, less than 20 ft in height, generally do not present a lightening fire ignition source.

3. Remove all downed dead trees and shrubs within the zone if they are solid (not rotten) and are not yet embedded into the ground. Downed trees that are embedded into soil and which cannot be removed without soil disturbance will be left in place.

Facilitating Practices

Most NRCS-CA CPS 383 Practice Scenarios contain cost components to cover costs associated with implementing facilitating practices to complete the fuel break. **Facilitating practices generally should not be included as a payment item in the contract.** Cutting trees, slash treatment, pruning and other necessary vegetative treatments must be implemented as part of the CPS 383, and are not included as separate payment items.

Additional General Requirements

Permitting and Environmental compliance

All activities associated with applying this practice shall comply with federal, state, tribal and local forestry and related laws and regulations. It is the landowner's responsibility to obtain appropriate permits and/or applications prior to commencing an activity. Typical permits that may be needed include slash burning/air quality, commercial harvesting permit from CAL FIRE when cut vegetation is used for commercial purposes, Pesticide Control Advisors Report when herbicides are applied, archeological protection review, and wildlife, threatened, endangered, sensitive species (TES) protection waivers.

Compliance with State fire protection statutes (Public Resource Code 4427) is required regarding equipment needed during open burning (sharp point shovel and fire extinguisher etc.) and fire

suppression tools when operating internal combustion (Public Resource Code 4428). Advise clients to contact local CAL FIRE Office for information. Also, CAL FIRE will advise on periods of no/curtailed operations of equipment use and post operations fire patrols during extreme fire conditions such as Red Flag Warnings or Fire Weather Watch when issued by the National Weather Service.

Watercourse and Meadow Protection Standards

The IR shall include information on watercourses, riparian areas, wetlands, including a map, in the project area.

Protection measures/treatment limitations must be provided when the project affects any Class I or II perennial watercourses, or Class III seasonal/intermittent watercourses[2]. Refer to the Table1 below for watercourse protection zones in non-anadromous water bodies. If slopes are greater than 40%, the buffer will extend to the topographic break above the stream. All watercourse riparian stream buffer areas exclude entry by heavy equipment, except at existing crossing or designated locations.

Vegetation treatment and heavy equipment is generally excluded in watercourse buffer zones, particularly in remote areas that are not associated with WUI areas or presence of public safety infrastructure. These exclusions are needed to continue large snag/wood recruitment and avoid impacts to species that utilize aquatic and riparian areas such as fish, red-legged and yellow-legged frogs, Pacific fisher, and great gray owl.

Table 1 – Protection measures/treatment limitations for watercourse protection zones (Buffer Zones)

	Class 1 wet	**Class II wet**	**Class III dry**	**Class III wet**	**Wet meadow**
Work Exclusion Zone (from channel edge or edge of meadow)	25 ft.	25 ft.	None	25 ft.	100 ft.
Heavy Equipment Exclusion Zone (Hand work only)	75 ft.	25 ft.	25 ft.	25 ft.	N/A
Total Buffer for Limited Work	100 ft.	50 ft.	25 ft.	50 ft.	100 ft.

Vegetative treatments and equipment entry within watercourse buffer zones can be included when an assessment is made that the buffer treatment is needed to protect human life, structures, or public safety or commercial infrastructure assets that are at risk to damage from wildfires. Vegetative treatments and equipment entry to address post wildfire and insect mortality resource concerns can also be included following an assessment and consultation with a NRCS biologist. Contact a NRCS biologist early in the planning process if working in the buffer zones. Consultations may be required with USFWS, NOAA Fisheries, or other state or federal regulatory agencies (i.e. Lake, Streambed Alteration Permit, 401 Water Quality Certification, 404 Clean Water Act.)

Forest management operations outside the watercourse buffer zones will ensure tree falling and other operations will not fell trees into buffer zones so that no part of the tree enters buffer. Slash will not be placed, piled or burned in any watercourse channel, buffer zone, or ephemeral drainage carrying seasonal runoff. Additional operating restrictions around ponds will apply, contact below NRCS Biologist for specification.

[2] See California Forest Practices rules section 14 CCR 895.1

Migratory and Threatened, Endangered or Sensitive Species (TES) Birds and Other Species

Project activities will not commence until a biologist concurrence is received.

Migratory Birds: Work will not occur during the migratory bird nesting season unless an assessment is conducted to determine active nesting or breeding behavior. Assessments will be completed by NRCS staff persons knowledge on migratory birds. Assessments shall be conducted within ten days prior to the start of work. The nesting season varies by region. Below are the nesting season dates by region. Refer to Technical Note TN-Biology-CA-23 for complete information on measures to minimize disturbance migratory birds.

Generally, projects less than 10 acres in size are not required to conduct migratory bird assessments, as well as projects implemented after July 15. These projects are not expected to have migratory bird population level adverse effects. Consider conducting surveys on <10-acre projects when they are adjacent to other areas planned for treatment in the same year.

TES: No known threatened, endangered, sensitive (TES) or rare plants or animals, including migratory birds, will be disturbed or harmed. Measures to avoid disturbance to TES may be required if known species are present or suitable habitat is found on-site in areas accessible to TES. In consultation with NRCS Biologist, develop a project alternative that avoids or minimizes these potential effects. Avoidance and/or minimization measures may include:

- Buffer zones around nests and dens,
- Limitations to types of equipment and/or times used,
- Limited operating periods,
- TES monitoring prior to or during activities,
- Additional snag and downlog retention.
- Any requirements when provided from ESA consultation with USFWS, NOAA Fisheries, or requirements of a state or federal permit (i.e. Lake, Streambed Alteration Permit, 401 Water Quality Certification, 404 Clean Water Act.)

Archeology

No operations may begin until archeological clearance is provided by NRCS. No operations in known archeology or historical sites.

Pest Control

1. **Pine Beetle Infestations**: In areas with bark beetle, piles containing green material will be burned within 2 months if conditions permit. If residues are green and cannot be burned within 2 months of pile creation, it will remain scattered on the ground until a burn window is available. Slash must be piled or chipped before practice can be certified.

2. **Sudden Oak Death and Goldspotted Oak Borer** In areas with known infections of pathogen or insects, specific sanitation precaution will be implement including no transport of woody outside the State Designated Zone of Infestation, covering vegetative debris moved by vehicles, and equipment sanitization measures.

   See: BMP for SOD: http://www.suddenoakdeath.org/wp-content/uploads/2014/12/forestry-08-10-with-new-2014-map.pdf

   Goldspotted Oak Borer: http://ipm.ucanr.edu/PMG/PESTNOTES/pn74163.html

Maintaining Soil Quality/ Soil Health

All operations will be planned and executed in a manner that maintains or improves soil quality. This includes using machinery that minimizes compaction, displacement, rutting and other disturbances to the forest floor. Surface organic material will be retained or improved throughout the treatment process.

Soils, site factors, and timing of application must be suitable for any ground-based equipment utilized for creating a fuel break to avoid excessive compaction, rutting, or damage to the soil surface layer.

Operation and Maintenance

- A maintenance plan will be prepared which shall list various items that are to be inspected and follow-up work to be conducted.
- Treating resprouting ground and surface fuels is the most important factor to ensuring fuel break effectiveness.
- Treat or graze vegetative fuel breaks to avoid a build-up of excess litter and to control noxious and invasive plants.
- The more open the overstory following fuel break construction, the more maintenance will be required.
- Unshaded openings that are created will encourage establishment and growth of understory vegetation.
- Fuel breaks should be inspected annually.
- Maintenance of the fuel break must be conducted at least every three to five years, to the following specifications:

  a. Treat (mow, spray, browse) or graze vegetative fuel breaks to avoid a build-up of excess litter and to control unwanted vegetation. Continuous areas of resprouting vegetation greater than 18 inches in height should be controlled.

  b. Remove lower tree and/or shrub branches that have died and stumps that pose a fire hazard.

  c. Properly dispose of slash created by maintenance.

  d. Inspect all fuel breaks for woody materials such as dead limbs or blown down trees and remove them as necessary to maintain the desired level of fire spread risk. Downed woody material >2 inches in diameter be disposed of or treated.

- Repair erosion control measures as necessary to ensure proper function.
- Access by vehicles or people will be controlled to prevent damage to the fuel break.
- Maintain the functionality of the original design throughout the life of the practice.

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