

# **ECOLOGICAL RESTORATION MARKING GUIDELINES FOR PONDEROSA PINE RESTORATION AREAS**

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**This document is a full restoration marking guide for the Flagstaff Urban/Wildland Interface with modifications to increase spatial clumpiness of residual trees.**

## **1. Objective:**

**Restore presettlement ponderosa pine forest structure, recreating as far as possible the density, spatial distribution, and variability of trees at the time of disruption of the frequent fire regime. Overstory structural restoration is one component of an integrated ecosystem restoration plan, which also includes forest floor fuel treatments, prescribed fire treatments, and possibly revegetation of the herbaceous understory. The rationale for such treatments is described in *Southwestern Ponderosa Forest Structure: Changes since Euro-American Settlement* by W.W. Covington and M.M. Moore, *Journal of Forestry*, 92(1):39-47 (1994) and other references.**

## **2. Forest type:**

**These guidelines apply to ponderosa pine forests, with a component of Gambel oak, in restoration treatment areas at Mt. Trumbull, Camp Navajo, and the Flagstaff Urban/Wildland Interface, Arizona.**

## **3. Goals:**

**3.1. Recreate presettlement tree density by conserving all living presettlement trees (those trees of all species established prior to the fire exclusion date) and replacing dead presettlement trees with large postsettlement trees.**

**3.2. Restore the patchy presettlement tree spatial pattern by retaining all living presettlement trees and locating replacement trees in the close proximity of dead presettlement trees.**

**3.3. Maintain a wide range of age classes by retaining all living presettlement trees, thereby conserving genetic variability to the greatest extent possible.**

**3.4. Maintain tree health by selecting healthy, vigorous replacement trees.**

## **4. Marking criteria—general:**

**4.1. The unit boundary will be marked on border trees with orange paint. Three parallel lines will be painted on each border tree at breast height (4.5 ft). Marked border trees will be spaced so as to be easily visible from each other. Border trees will not be cut; therefore they should meet the leave-tree requirements listed below wherever possible.**

4.2. Leave-tree marking will be used. All leave trees will be marked with a leave-tree paint at breast height (4.5 ft) and below stump height (1ft) on two opposite sides, preferably perpendicular to the cruising transect.

4.3. All living presettlement trees of any species will be retained, as well as appropriate replacement trees as described below. Presettlement snags will be marked as leave trees.

#### 5. Marking criteria—ponderosa pine:

5.1 All trees with yellowed bark, indicating presettlement age, will be retained. An initial training period will be needed to acquaint markers with the characteristics and variability of yellow bark. Size and age often correlate poorly in ponderosa pine, but yellow bark is a consistent sign of presettlement age in the Southwest.

Trees which are of questionable age, often those with only slightly yellowed bark, or those of large size but dark bark, should be cored to establish age with a field count of the rings. In a given area, initial coring of several questionable trees should be sufficient to train the eye to differentiate between presettlement trees and fast-growing postsettlement trees. Questionable trees should be cored at 18 in above ground level and 8 years should be added to the counted rings to estimate total age. If total age is greater than the marking year minus the settlement year (for example, 1995 - 1870 = 125 years), then the questionable tree is considered a presettlement tree.

5.2. Replacement trees will be retained for all dead presettlement trees. Evidence of dead presettlement trees includes stumps, snags, dead and downed trees, or stump holes of presettlement origin, as shown by yellow bark and large size, generally 16 in dbh or greater. A training period will be needed for markers to become familiar with the diversity of dead presettlement material, since rot, fire, and past slash treatments can affect the appearance and size of dead presettlement trees.

#### THE FOLLOWING THREE ALTERNATIVES ARE AVAILABLE FOR RESIDUAL TREE SELECTION:

##### Alternative 1 (Largest available trees, 60' radius)

This alternative selects the largest possible replacement trees, but often leaves them widely spaced.

For each dead presettlement tree, living postsettlement trees will be retained as replacements. These trees will be selected from within a 30 ft radius of the dead presettlement tree according to the following criteria:

5.2.1. Dominants or co-dominants, minimum 6 in dbh. In a "doghair" thicket of dense, suppressed trees, only dominant trees should be selected.

5.2.2. Largest and most vigorous trees available. Retained trees may be damaged or host insects or disease, but should be apparently capable of surviving the restoration treatment (thinning, fuel treatment, burning) and living a full natural lifespan of 300+ years.

5.2.3. Timber quality characteristics such as forks, crook, sweep, dead top, lightning or fire scarring, heavy branching, etc., will not be considered in selecting replacement trees,

except where these conditions appear to reduce the ability of the individual tree to live a full natural lifespan.

**5.2.4. When the only available trees within the 30 ft radius are not acceptable replacements according to the above criteria, the search radius can be extended to 60 ft (approximately the bole length of a presettlement tree).**

#### **Alternative 2 (Reduced search radius--30')**

This alternative requires leave trees to be within 30' of presettlement evidence, maintaining a close spatial pattern. The tradeoff is that some desirable large potential replacement trees further than 30' away cannot be retained.

For each dead presettlement tree, living postsettlement trees will be retained as replacements. These trees will be selected from within a 30 ft radius of the dead presettlement tree according to the following criteria:

**5.2.1. Dominants or co-dominants, minimum 6 in dbh. In a "doghair" thicket of dense, suppressed trees, only dominant trees should be selected.**

**5.2.2. Largest and most vigorous trees available. Retained trees may be damaged or host insects or disease, but should be apparently capable of surviving the restoration treatment (thinning, fuel treatment, burning) and living a full natural lifespan of 300+ years.**

**5.2.3. Timber quality characteristics such as forks, crook, sweep, dead top, lightning or fire scarring, heavy branching, etc., will not be considered in selecting replacement trees, except where these conditions appear to reduce the ability of the individual tree to live a full natural lifespan.**

**5.2.4. To maintain residual tree clumpiness, the search radius will not be extended beyond 30 ft.**

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#### **Alternative 3 (Grouped residual trees, 60' radius)**

This alternative selects the best large replacement tree within 60' of presettlement evidence, then requires that the remaining replacements be chosen from nearby trees to form a clump.

For each dead presettlement tree, living postsettlement trees will be retained as replacements. These trees will be selected from within a 30 ft radius of the dead presettlement tree according to the following criteria:

**5.2.1. Dominants or co-dominants, minimum 6 in dbh. In a "doghair" thicket of dense, suppressed trees, only dominant trees should be selected.**

**5.2.2. Largest and most vigorous trees available. Retained trees may be damaged or host insects or disease, but should be apparently capable of surviving the restoration treatment (thinning, fuel treatment, burning) and living a full natural lifespan of 300+ years.**

5.2.3. Timber quality characteristics such as forks, crook, sweep, dead top, lightning or fire scarring, heavy branching, etc., will not be considered in selecting replacement trees, except where these conditions appear to reduce the ability of the individual tree to live a full natural lifespan.

5.2.4. When the only available trees within the 30 ft radius are not acceptable replacements according to the above criteria, the search radius can be extended to 60 ft (approximately the bole length of a presettlement tree)

5.2.5. Tree selection will be done in two steps. First, the single best replacement tree will be selected from within the 30-60' radius. Second, the remaining replacements will be selected from trees near to the first replacement trees, so that they form a group. "Near" is defined to mean that the replacements either have interlocking (touching or overlapping) crowns, or will have interlocking crowns when they grow to maturity.

In all alternatives, the replacements for several presettlement evidences may be aggregated to form larger clumps of residual trees as long as they remain within the appropriate radius limit.

Because large dead presettlement trees must sometimes be replaced with small postsettlement trees, the number of replacement trees required per presettlement remnant (snag, stump, log, stumphole) will vary depending on the size of suitable replacements. Where replacements over 16" dbh are available, 1.5 such trees will replace each presettlement remnant. Where replacements are below 16" dbh, 3 such trees will replace each presettlement remnant. Biomass comparisons indicates that this ratio will maintain an adequate replacement foliage, bark, and branch biomass. However, excess tree density in areas of small replacement trees will require future treatments (e.g., snag creation) after 10-20 years.

5.3 If one or more dead presettlement trees cannot be replaced within the 30-60 ft search radius, the following procedure will be used to ensure that the presettlement tree or group is retained as forest rather than converted to a grassy opening: (1) locate the site on a sketch map of the treatment unit and assign a group ID number; (2) note the number of trees in the group; (3) leave a wire flag at the site with the group ID number; and (4) after marking, replace the wire flag with a permanent post (such as a fencepost) and ID tag. These sites will be replanted after the restoration treatment.

## 6. Marking criteria—other:

6.1. Gambel oak: living presettlement oaks will be retained. Gambel oak often develops heartrot and cores can be difficult to date, but generally oaks over 10 in dbh are of presettlement origin. Where evidence of dead presettlement oaks is found, the 2 largest replacement trees within a 15 ft radius should be retained. A well-established oak clump (several stems > 8 in dbh) can be taken as evidence of presettlement oak presence even in the absence of a large dead stem, because the central stem could have rotted away but the clump often persists over time and maintains the clonal genotype through sprouting. Replacement trees should be vigorous and appear likely to survive to a full natural lifespan. Deficiencies in replacements should be made up as quickly as possible. When a large contiguous clump is encountered, divide it into 12 ft units and treat each separately for marking purposes.

**6.2 Juniper and Pinyon: living presettlement junipers (all species) and pinyon will be retained. Juniper cores are often difficult to extract and date, but in general junipers over 12 in drc [diameter root collar] and pinyons over 10 in dbh are of presettlement origin. Where evidence of dead presettlement juniper or pinyon trees is found, the 2 largest replacement trees within a 15 ft radius should be retained. Replacement trees should be vigorous and appear likely to survive to a full natural lifespan. Deficiencies in replacements should be made up as quickly as possible.**