Appendix J: Fuels and Vegetation Modeling

Forest Vegetation Simulator

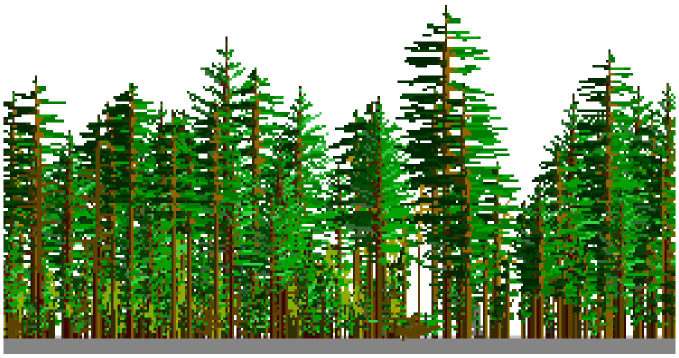


Figure J-1. Simulated model of existing condition in project units

The Forest Vegetation Simulator (FVS) is a family of forest growth simulation models. The basic FVS model structure has been calibrated to unique geographic areas to produce individual FVS variants. Since its initial development in 1973, it has become a system of highly integrated analytical tools. These tools are based upon a body of scientific knowledge developed from decades of natural resources research.

The Fire and Fuels Extension to the Forest Vegetation Simulator (FFE-FVS) links FVS with models of fire behavior, fire effects, fuel loading, and snag dynamics. Model outputs include predictions of potential fire behavior and effects and estimates of snag levels and fuel loading over time. Because FFE is linked to the FVS growth model, it can help assess both the short and long term effects of fuel treatments and other management activities.

Forest stand data collected in the Gemmill Thin project area was used to run the Forest Vegetation Simulator model (FVS) along with the Fire and Fuels Extension to the Forest Vegetation Simulator (FFE-FVS). FVS is an individual tree, distance independent growth and yield model. It simulates growth and yield for most major forest tree species, forest type, and stand conditions. FVS can simulate a wide range of silvicultural treatments. We used the 'ICASCA' variant of FVS for the specific geographic area that includes the project area. FFE-FVS links FVS with models of fire behavior, fire effects, fuel loading, and snag dynamics. Model outputs include predictions of potential fire behavior and effects and estimates of snag levels and fuel loading over time. Because FFE is linked to the FVS growth model, it was helpful in assessing both the short and long term effects of our proposed thinning and fuels treatments. More detailed information about FVS can be found at the following website: http://www.fs.fed.us/fmsc/fvs/index.php.

FVS Model limitations

- **Maintaining the largest/oldest trees**:

  The model assumes an even distribution of the trees proposed for removal. Therefore, when we modeled thinning from an existing canopy closure (or basal area) down to a target canopy closure the model assumes the "cut trees" are relatively evenly distributed through the stand. This assumption is essentially true in the mature stands that are much more homogeneous than the older stands (or older portions of mature stands). In the mature stand treatments the model predicts logical results reasonably consistent with our past experience with similar thinning treatments. Conversely, the prescription related to the older more heterogeneous portions of the stands is more nuanced in that we identify trees for removal on both a relatively evenly distributed canopy closure (basal area) basis as well as on a much more scattered, very site specific basis dictated by individual tree's proximity to, and competition with, very large/old trees. Consequently, in the older stands the model seems to give credible results for growth, fuels, or fire behavior but shows little or no affects to the mortality rate for the largest/oldest trees in the stands even though the prescription specifically targets thinning competing trees around them. The model's assumed even distribution of "cut trees" misses this nuance of the prescription even though our field reviews of the stands shows that many of these large/old trees are already beginning to display obvious signs of distress such as fungal/insect damage and fading/yellowish foliage.

- **Hardwoods**:

  The relatively small diameter of the existing hardwoods in the lower levels of the stand structure (i.e., stratum 3) results in this important stand component being largely missed by the modeling even though we specifically target all hardwoods for retention. This limitation is reflected in the model under predicting canopy closure recovery after thinning. Our extensive field reviews of the project area indicate that the hardwood component would add another 10 to 20 percent canopy closure (average roughly 15%).

  We assume the model's predicted results to canopy closure after fire events are still valid because hardwoods represent a vulnerable component in the lower understory that would be lost regardless. We also assume that the predicted mortality of the smaller size class trees with no treatment includes hardwoods.

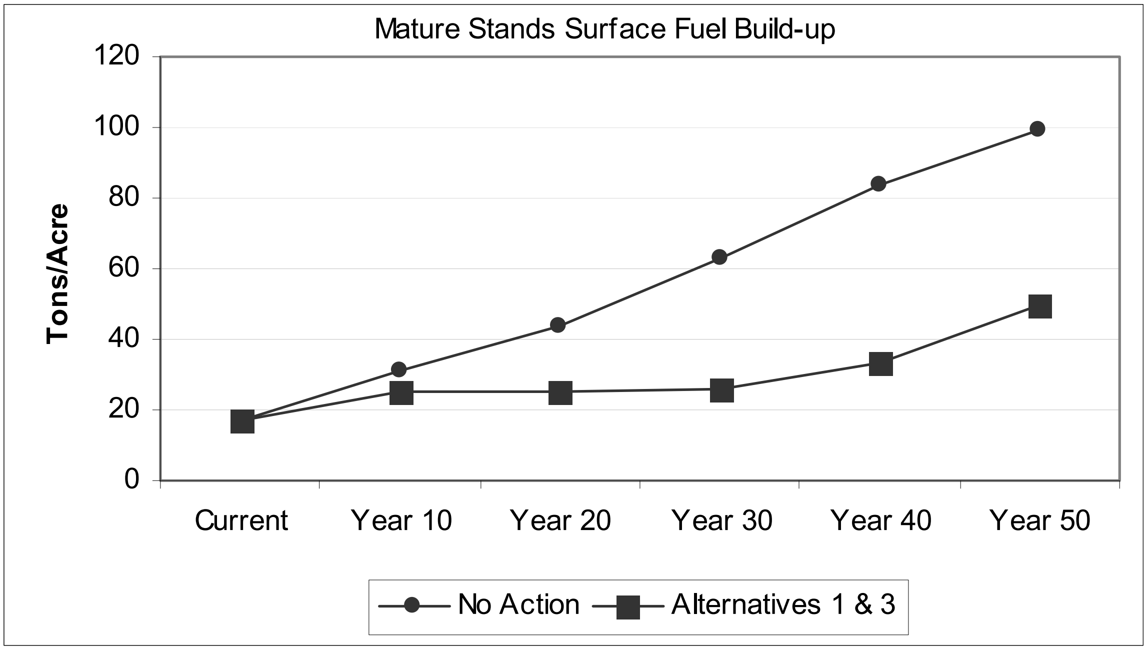
- **Low density conifer size classes**:

  Because of their low density, our sampling failed to pick up conifers within the 18 through 26 inch dbh size classes within mature stands and 16 through 20 inch dbh size classes within the older stands. Intensive field reviews of the project area revealed that these size classes do occur, but at very low density. We did not consider this to be a limiting factor in the usefulness of the modeling. The only time these trees would be considered for removal is in the rare occasion when they occur in direct competition with much larger predominant (legacy) conifers or they occur in temporary landings (<24"). Additionally, our data collection did not account for conifers below roughly 8 inches dbh. Field reviews indicate that this heavily suppressed 'sapling' component occurs at a density of well over 200 trees per acre.

Modeling Results

Fuel Build-Up (No Fire)

Based upon intense field reviews and long-term experience, we see an existing excessive fuel load in the stands proposed for thinning and anticipate this to worsen with time as competition for limited site resources leads to increasing tree mortality. Our modeling indicates that without treatment dying trees will increase surface fuels from an existing 17 tons per acre to about 100 tons per acre in mature stands and from an existing 44 tons per acre to about 57 tons per acre in the older stands while the proposed thinning would reduce this fuel build-up (Figure J-2). This accumulation of coarse woody material could be viewed as a positive trend for old-growth habitat. However, the projected mortality leading to this accumulation of material involves primarily smaller understory trees (i.e., those targeted for thinning) that would not provide 'large' snags/logs associated with old-growth habitat. Additionally, the tree mortality with no thinning would have a negative impact on canopy closure, another important component of old-growth habitat.



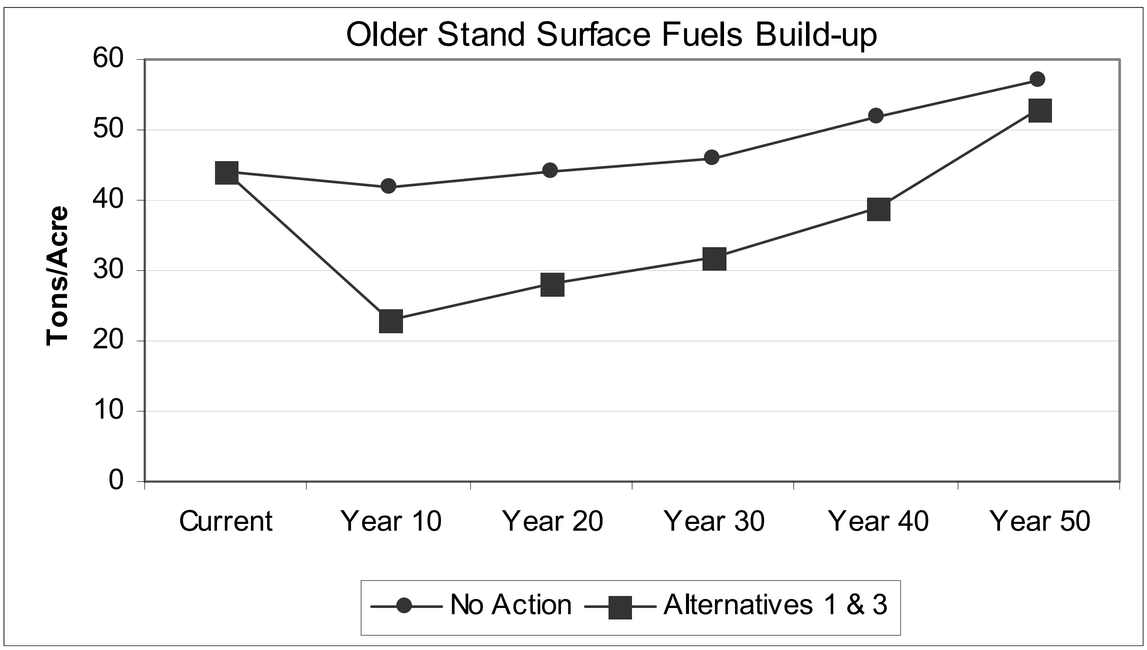


Figure J-2. The proposed thinning treatments within dense forest stands would reduce fuel build-up into the future. Existing large snags and logs as well as large overstory conifers will be retained to provide owl and fisher nesting and denning sites and large snags and logs into the future.

Canopy Closure (No Fire)

Intense field reviews, long-term experience and our modeling indicate that even without treatment, canopy closure will drop as competition for limited site resources leads to tree mortality. Within about 15 years in mature stands and about 10 years in older stands projected mortality in the untreated scenario will reduce canopy closure to or below the projected canopy closure that would result from the proposed thinning (Figure J-3). We project higher canopy closures in the treated stands than in untreated stands from about 20 years on, especially in the mature stands. This indicates that either we remove trees or trees will fall out of the stands through mortality. Allowing the mortality to 'thin' the stands would increase fuel build-up and maintain dense fuel ladders up into the overstory.

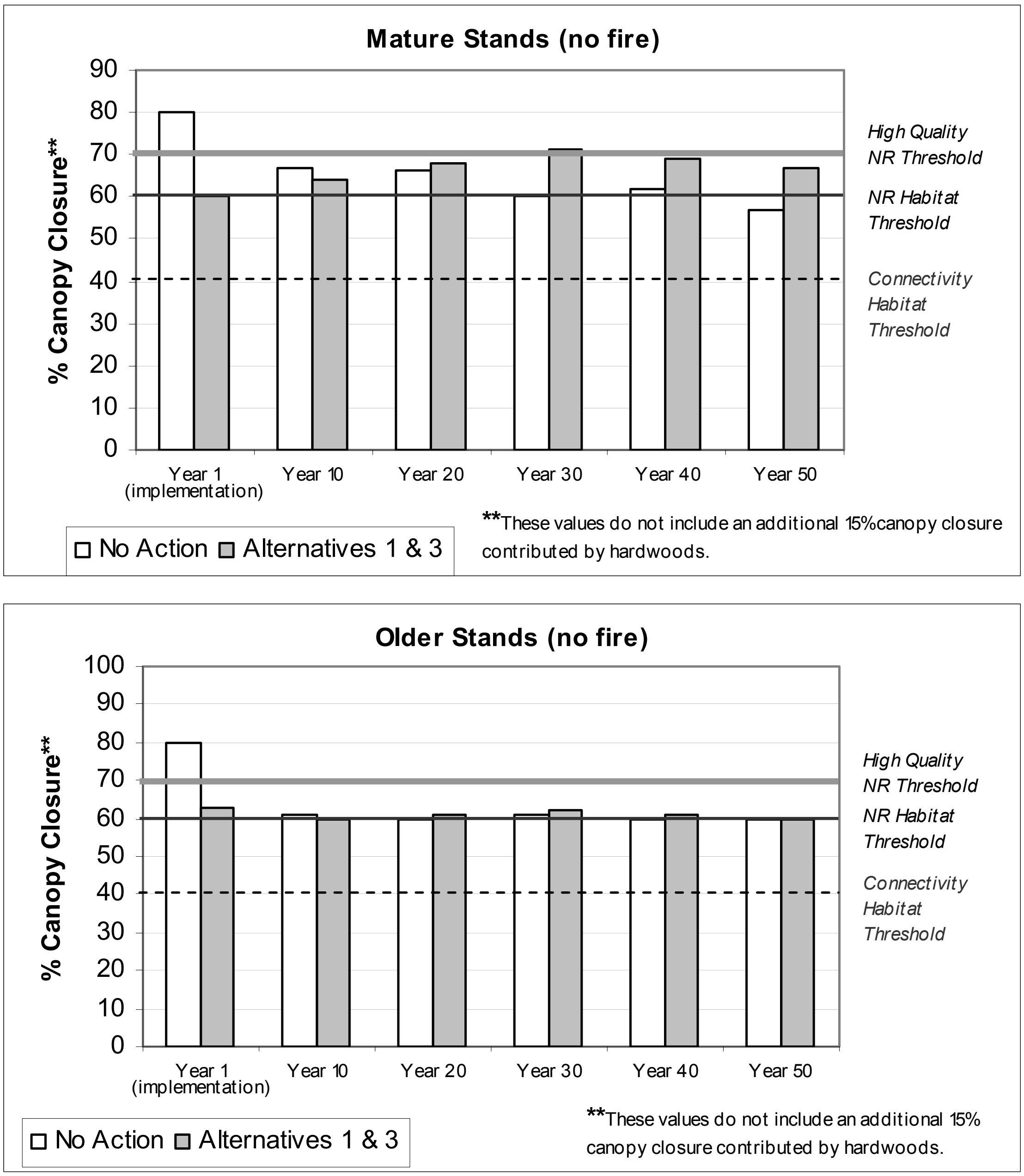
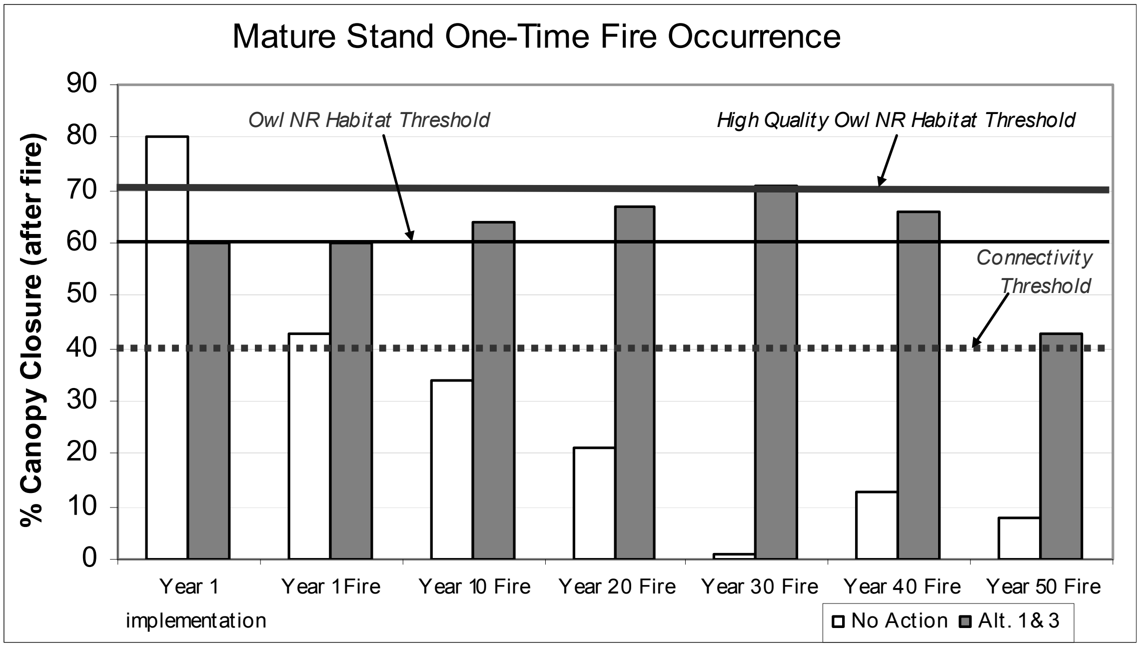


Figure J-3. The proposed thinning treatments within dense forest stands maintain a moderate to dense canopy closure. Note that this modeling does not include an additional 15% canopy closure contributed by hardwoods that would be retained. Moderate to high canopy closure is a key habitat component for species associated with old-growth conifer forests such as the northern spotted owl and Pacific fisher. Large overstory conifers will be retained to provide owl and fisher nesting and denning sites and large snags and logs into the future.

What Happens With Fire

The proposed thinning treatments will dramatically reduce the loss of overstory conifers (canopy closure) due to late summer fire into the future (Figure 5). That is to say, fire at this point in time in untreated stands would reduce canopy closure well below owl NR suitability and below even connectivity habitat conditions in roughly 5 years (mature stands) to 25 years (older stands) of continuing fuel build-up. Conversely, because of the reductions of existing/future fuels coupled with the increased vigor of the remaining trees, fire after the thinning treatments would not reduce canopy below owl NR habitat conditions out past about 45 years of fuel build-up in the mature stands and canopy closure would be at or just below NR habitat conditions in the older stands for the same time period. Note that Figure J-4 depicts projected effects from a one-time fire event. For example, a “year 30 fire” assumes no fires for the previous 30 years.



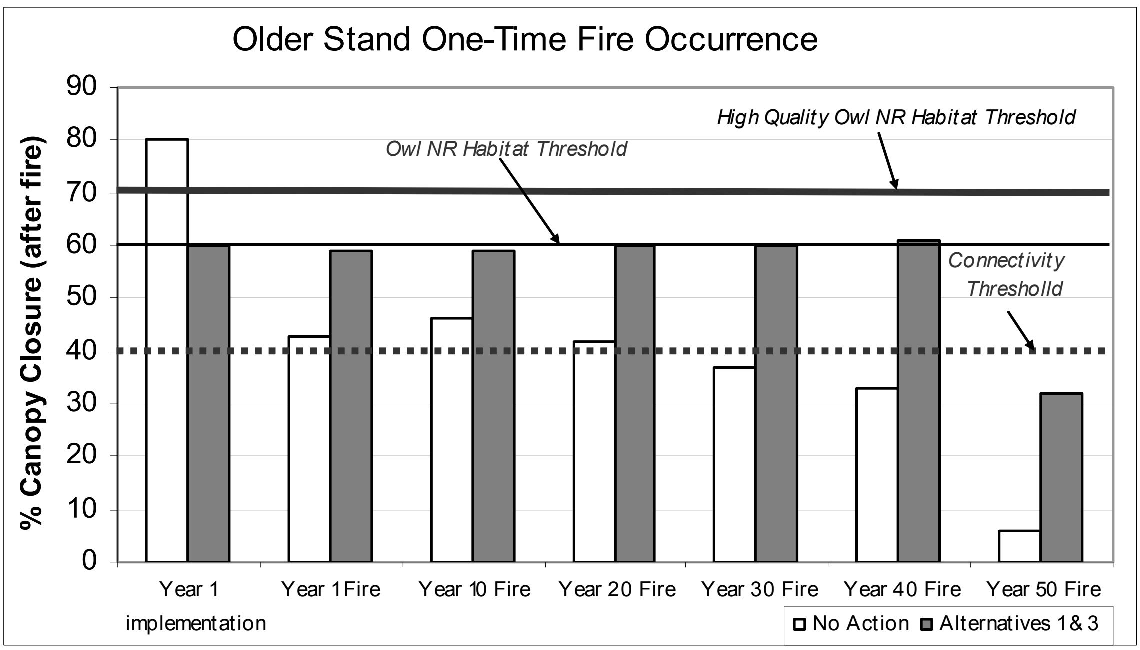


Figure J-4. The proposed thinning treatments within dense forest stands will dramatically reduce the loss of overstory conifers (canopy cover) due to fire into the future. Moderate to high canopy closure is a key habitat component for species associated with old-growth conifer forests such as the northern spotted owl and Pacific fisher. Large overstory conifers are those trees that will provide owl and fisher nesting and denning sites and large snags and logs into the future. Late summer fire was modeled because this is the driest time of the year and the period when most catastrophic wildfires occur in the project area vicinity.

A synopsis of these modeling results shows that:

- While our proposed thinning treatments would reduce canopy closure, the same level of canopy reduction would be quickly exceeded if we did nothing due to tree mortality related to competition for limited site resources.
- By thinning the stands, smaller diameter snags/logs would be reduced with a concurrent reduction of existing and future fuel. These smaller diameter trees would either die due to competition induced mortality or be removed through thinning. They would not provide 'large' snags/logs associated with old-growth habitat.
- The reduction in fuels and the concurrent increase in the vigor of the remaining trees would allow the treated stands to better survive late-summer fire events and provide relatively dense late-successional habitat (i.e., fisher, marten, goshawk, spotted owl habitat) into the future. Without thinning, the stands would not provide late-successional habitat after a late-summer fire.