EXAMPLE SDI-BASED PRESCRIPTIONS
Treatment Prescriptions for Commercial Harvest Units, Trout West Fuels Reduction Project, Manitou Experimental Forest

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November 7, 2003

Prescription Narrative

Introduction
The sites described below are located in Ponderosa pine Forest Type on the Manitou Experimental Forest. The sites are bounded by meadows along Trout Creek on the west, Hotel Gulch, on the south, Missouri Gulch on the north, and the Ridgewood subdivision on the east. The area consists of gentle west-sloping terrain intersected by a series of small east-west ridges. No live streams exist in the area. Elevations range from 7,700 to 8,000 ft. Annual Precipitation averages 15.7 inches. Site Index averages 35, (base 100). Tree species present in these stands include ponderosa pine, Douglas-fir, aspen, Rocky Mountain juniper, and occasional limber pine. Understories are grassy with Arizona and Idaho fescues, predominating. Mountain mahogany, gooseberry, and common juniper are common shrubs.

Background
Historically, these forests once contained several different age classes of trees and were subjected to periodic mixed surface/crown fire regimes which occurred on about 30-year intervals (data on file, RMRS). This fire regime resulted in a mosaic of forest and meadows in the area. Extensive harvests in the 1880’s removed many of the largest and best quality trees from these stands. These harvests and the accompanying interruption of the natural fire regime resulted in extensive regeneration establishing between 1890 and 1920. Twentieth century harvests to remove mistletoe- and mountain pine beetle-infected trees further modified the forest, stimulating newer age classes in some areas. Recent drought-induced mortality has been heavy among trees most severely infected with dwarf mistletoe. The resulting stand structures are multi-aged with both young (<120 years) and legacy (pre 1880) trees present in the overstory canopy. Dense overstocked patches of suppressed trees exist in some areas while others are more open, but contain clumps and groups of young trees under the canopy of larger trees.

Cultural considerations to address when treating this area include avoiding established permanent research plots and known cultural resource sites within the area. In addition, treatment operations must be coordinated to avoid conflict with the livestock grazing permit active in the area and to insure that public OHV access remains restricted at all times.
Objectives

Treatment objectives for these stands are to reduce the risk of crownfire downslope and upwind of the Ridgewood subdivision, to protect the integrity of research plots and cultural resources, and to improve the long term health and vigor of these forests. These prescriptions aim to accomplish these objectives by use of uneven-aged management treatments to establish open, irregularly-stocked multi-aged stands which can be maintained through time by periodic prescribed burning and harvests. This will be the first operational use of a new innovative stocking control procedure being developed at RMRS based on Stand Density Index. This procedure allows stocking to be controlled in all sizes of trees to insure that: 1) The crownfire threat from small diameter live fuels is adequately reduced, 2) overall stocking is reduced to a level to improve the health and vigor of the stands, 3) species composition are brought more into balance with pre-settlement conditions, and 4) the desired stocking of these stands is based on an established, scientifically accepted methodology derived from known stocking and growth relationships of tree species in this eco-region. Although residual stocking goals are slightly higher than many fuels reduction treatments, and some small trees are retained, similar stocking levels proved very effective in preventing crownfire when the Hayman Fire burned into the Trout Creek Timber sale just west of this area in 2002.

Data Collection and Summary

An initial reconnaissance of the portion of the Trout West Fuels Project within the Manitou Experimental Forest was done in October, 2003 to identify areas that could potentially be treated using commercial timber sale contracts. A total of 12 stands were selected for further analysis (see accompanying jpg photo files). T.E.A.M.S. personnel delineated the stands and inventoried them using BAF 20 cruise plots tallying trees by species and 2-inch diameter classes. This data was forwarded to RMRS where it was summed on per acre summaries in an Excel spreadsheet (see EXAMPLE_Presc_Analysis.xls). Treatment prescriptions were developed using a flexible Stand Density Index based technique to help select residual stocking guides that met treatment objectives for the stands.

Since no tree heights were measured, relationships that predicted gross per acre cubic and merchantable board foot stem volumes given tree diameter class were developed from intensive cruise data obtained in the Chip-Chunk Study site at Manitou Experimental Forest. The resulting per tree stem volumes were multiplied by the desired tree/ac removals in the 12 Trout-West units to obtain the per acre volume estimates that appear in EXAMPLE_Presc_Analysis.xls.

General Marking Guides applying to all treated stands - The goal of these treatments is to produce natural-appearing irregularly spaced, multi-storied, open stands that will not be as susceptible to crownfire as existing stands. In addition, the treatment should improve the general heath and vigor of the forests and allow for the retention of some future replacement trees in smaller diameter classes.

Because aspen is rare in this landscape, leave all aspen, regardless of condition. However, cut conifers (including pine) from within and around all aspen clones containing more than 10 stems for a distance of one aspen tree height away from the perimeter of the clone. Trees removed within and around aspen clones should be
included in stocking goals for theirdbh classes. However, it is OK to remove conifers within aspen clones if theirdbh class is not slated for cutting.

Within specified removal guidelines, remove small, trees located in positions where they might serve as live fuel ladders to allow fire to climb into the crowns of large trees. Leave healthy trees where possible, but avoid cutting legacy trees (orange bark, flat topped pine). These are likely the oldest trees in the population. Similarly, avoid cutting any tree with cavities used by wildlife. Avoid regular spacing by marking or leaving clumps or groups of trees. It’s OK to have clumps of trees that might crown in a fire, so long as they are spaced apart. The final tree tally should closely approximate stocking goals. Slight over- or under-marked dbh classes are OK, so long as the overall residual BA is close to the target.

Specific Prescriptions and Marking Guides for each Unit

Unit 1.
This small stand is located on the north slope of a small ridge at the southern end of the treatment area, adjoining Hotel Gulch. The majority of the stocking is Douglas-fir, but ponderosa pine and aspen are also present. Currently, 340 trees per acre above 4 inches exist in the stand, comprising 128 ft²/ac of basal area (See spreadsheet EXAMPLE_Presc_Analysis.xls). Current stocking is at 52% of maximum SDI, indicating that densities are approaching the point of self-thinning and should be reduced to keep the stand in a healthy condition. In addition, the stocking of Douglas-fir should be reduced as much as possible to promote pine and aspen regeneration. The proposed treatment is to reduce stocking to 27% of maximum SDI by removing about half of the basal area, by cutting 70% of the trees. To accomplish this, removals will be concentrated in smaller diameter classes, but a few small trees will be left to eventually grow into larger diameter classes. However, the treatment is not strictly an underthinning. Several large trees need to be removed to keep stocking at the desired level. Most pine will be left, unless heavily dying from mistletoe. Also leave all existing aspen.

Marking guides – Use either the Cut TPA or Residual TPA columns in the attached spreadsheet. Multiply these values by the acreage of the stand to determine the total number of trees to cut or leave in each diameter class. Diameter classes can be lumped into 4-inch classes, if desired. To meet residual stocking objectives for a dbh class, remove Douglas-fir first. Retain pine if possible, but remove those pine dying of mistletoe.

Unit 2
This mixed stand of ponderosa pine and Douglas-fir adjoins the Ridgewood subdivision on the east side of the area. Containing 192 trees per acre and a BA of 83 ft²/ac it is not as heavily stocked as Unit 1. However, the abundance of smaller trees in the stand makes it at high risk to crownfire. The prescription goal is to reduce stocking to 29% maximum SDI by heavily under-thinning in the 4-16 inch dbh classes, but still preserve the uneven-aged multi-structured character of the stand. Treating the stand as shown in the accompanying spreadsheet and graph will reduce basal area by half and remove 61% of the trees, greatly reducing the likelihood of crownfire.
**Marking Guides** – Calculate trees to be left or removed as described in Unit 1 above. Discriminate against Douglas-fir as much as possible, recognizing that some will need to be retained to maintain stocking goals. Remove severely mistletoe-infested ponderosa pine when possible. Leave all aspen, regardless of condition. However, cut conifers (including pine) from within and around all aspen clones containing more than 10 stems for a distance of one aspen tree height away from the perimeter of the clone. The goal should be a natural-appearing irregularly spaced, multi-storied, stand. As in Unit 1, avoid cutting old legacy trees, and trees with wildlife cavities, regardless of their condition.

**Unit 3**

This pure ponderosa pine stand is not typical of uneven-aged forests, in that most trees are in the 8-14-inch dbh classes. It is likely a 2-3 aged stand, resulting from regeneration that occurred following earlier entries. It is heavily stocked, containing 108 sq ft of basal area /ac, but appears open due to the lack to small trees. The goal for this stand is to continue to move it toward an uneven-aged condition, but to reduce stocking to avoid risk of mountain pine beetle attack and continue to maintain it’s open low crownfire risk condition.

**Marking Guides** - Reduce stocking to 60 BA by cutting trees in the 8-14 inch dbh classes as shown in the accompanying spreadsheet. Do not cut larger, or smaller trees.

**Unit 4.**

This 10 acre area is a near pure ponderosa pine stand with one or two aspen inclusions. Stocking is dense at 318 TPA, 112 BA, and 47% maximum SDI. Although it is not near private land and is adjoined by open forest and a meadow to the east and west, reducing stocking would lower the risk of crownfire within this stand and improve its growth and vigor. Using an uneven-aged prescription in this stand will insure that the aesthetic qualities and relatively good health of this stand can be preserved. The treatment goal for this stand is to halve the basal area by removing 62% of the trees, bringing the stocking to 28% of maximum SDI.

**Marking Guides**- Calculate the total trees to be left or removed using the attached spreadsheet for Unit 4. Remove mistletoe-infected ponderosa pine wherever possible. Leave all aspen, regardless of condition. However, cut conifers (including pine) from within and around all aspen clones as described above. Note that the majority of trees to be removed will come from the 4 and 10-inch dbh classes. Spacing in this stand is much more uniform than in Units 1 or 2, so increasing the irregularity of spacing is desired. Avoid cutting old legacy trees, and trees with wildlife cavities, regardless of their condition.

**Unit 5**

This nearly pure ponderosa pine stand is located on a slight rise immediately east of the Manitou Experimental Forest Headquarters compound. Stocking averages 272 trees/ac and 84 BA in the 4-20 inch dbh classes. The management goal for this stand is to reduce stocking to lower crownfire risk and promote forest health, yet maintain it’s...
current diameter class distribution, and promote the growth of larger trees for aesthetics near the Headquarters compound.

**Marking Guides** – Reduce stocking to 55 BA by cutting trees in the 4-14 inch dbh classes as shown in spreadsheet *EXAMPLE_Presc_Analysis.xls*. Retain all trees above 14 inches, regardless of condition.

**Unit 7**

This pure ponderosa pine stand is located north of the long-term GSL research thinning plots that are north of the road into the Ridgewood subdivision. It currently contains 367 trees /ac in the 4 – 22 inch classes, although larger trees are not abundant. Basal area is currently 85 sq ft/ac, which is not overstocked from a growth standpoint, but the abundant stocking in smaller dbh classes does pose a crownfire risk to adjoining private land and research plots. The management objective for this stand is to reduce the stocking in smaller diameter classes, but allow existing larger trees to increase in size, or remain as legacy trees.

**Marking Guides** – Reduce BA to 49 sq ft/ac (20% of maximum SDI) by cutting trees less than 10 inches dbh in the proportions indicated in spreadsheet *EXAMPLE_Presc_Analysis.xls*. Cut only 8 trees/ac in the 10-inch class and retain all larger trees above 10 inches, regardless of condition.

**Unit 8**

This dense Douglas-fir/ponderosa pine stand contains 365 trees per acre (124 BA) in trees 4-22 inches dbh distributed in a pattern typical of an uneven-aged forest. It has been located as two separate areas north of Unit 7, surrounding several large research growth plots. The eastern boundary abuts a tract of private land. The close proximity of these features requires that crownfire risk be reduced in this stand. The management objective for this site is to meet that objective while continuing to preserve the uneven-aged nature of the stand. Reduction of the Douglas-fir component is also desired.

**Marking Guide** – Remove trees in the 4-12 inch dbh classes in the proportions indicated in spreadsheet *EXAMPLE_Presc_Analysis.xls*. Remove Douglas-fir wherever possible, but cut no trees above 12.9 inches dbh. Stocking should be reduced to approximately 56 BA (22% of maximum SDI).

**Unit 9**

This mixed Douglas-fir/ponderosa pine stand lies between the Ridgewood subdivision road and White Spruce Gulch between a private tract to the west and the Ridgewood subdivision to the east. At 104 BA and 193 trees/ac, the stand is rather heavily stocked in the 6-14-inch dbh classes. Reducing stocking in these size classes will preserve the uneven-aged character of this forest and greatly reduce crownfire risk.

**Marking Guide** – Remove trees in the 6-14 inch dbh classes in the proportions indicated in spreadsheet *EXAMPLE_Presc_Analysis.xls*. Remove Douglas-fir wherever possible, but cut no trees above 14.9 inches dbh. Stocking should be reduced to approximately 50
BA (18% of maximum SDI). Preserve all pine trees in the 4-inch dbh class, unless deformed, or severely infested with dwarf mistletoe.

Unit 10
This mixed species stand is located along a north-facing slope on Missouri Gulch adjoining the Ridgewood subdivision to the northeast. In addition to Douglas-fir and ponderosa pine, the stand also contains blue spruce, lodgepole pine, and limber pine. The stand currently contains 212 trees/ac (93 BA) distributed in a classic uneven-aged diameter distribution. Management objectives for this stand are to preserve the uneven-aged diverse character of the forest while reducing the crownfire risk.

Marking Guide – Remove trees in the 4-14 inch dbh classes in the proportions indicated in spreadsheet EXAMPLE_Presc_Analysis.xls. Remove Douglas-fir wherever possible, but cut no trees above 14.9 inches dbh. When possible, leave all blue spruce, lodgepole pine, and limber pine to insure continued species diversity. Stocking should be reduced to approximately 47 BA (18% of maximum SDI).

Unit 11
This stand is located on the north-facing slope to the south of White Spruce Gulch, northwest of Unit 9 and north of Unit 8. A parcel of private land lies between Units 9 and Units 8 and 11. This densely-stocked, mixed species stand contains Douglas-fir, ponderosa pine and some spruce. It currently contains 233 trees/ac. in the 6 – 26 inch dbh classes (144 BA) distributed in a classic uneven-aged diameter distribution. This is currently the most heavily stocked stand in this landscape. Management objectives for this stand are to preserve the uneven-aged character of the forest while reducing the fuels hazard to adjoining private property. In addition, it is desirable to move the successional stage of this stand back to more of a pure ponderosa pine forest while retaining a somewhat higher stocking to provide diversity in the larger landscape.

Marking Guide – Remove trees in the 4-18 inch dbh classes in the proportions indicated in spreadsheet EXAMPLE_Presc_Analysis.xls. Remove Douglas-fir and spruce and retain ponderosa pine wherever possible. Residual stocking should be reduced to approximately 75 BA (27% of maximum SDI).

MEF HQ Unit 6
This stand surrounds the buildings of the Manitou Experimental Forest Headquarters. Repeated past thinning has allowed this stand to develop into a mature even-aged forest, currently stocked with 136 trees/ac (122 BA). The stand currently contains trees from 4 – 20+ inches dbh, distributed in a normal-shaped size class curve indicative of an even-aged population, with some new recruitment. The large average stand diameter (DQ = 12.8 inches) makes this stand appear open in spite of its heavy current stocking. As a consequence, mountain pine beetles are currently active in the stand. The management objective for this stand is to retain its large tree character, but reduce stocking to lessen the mountain pine beetle risk and provide openings to recruit some new seedlings to provide future replacement trees. Although fuel hazard and
crownfire risk is currently not high, treatment of slash is essential to avoid increasing fuels hazard around the buildings.

Marking Guides – RMRS personnel have already banded trees to be removed in this stand with white flagging. Removing these 231 10-24 inch trees would reduce the basal area to BA 93 and produce an estimated 14,500 gross mbf (see EXAMPLE_Presc_Analysis.xls). Marked trees need to be painted as soon as possible before flagging begins to fall off. Trees should be painted on the east side, so the marks are not visible from the road in front of the MEF office. Note that the volume listed above is a gross volume and does not account for the considerable defect in many of the marked trees. In addition a number of marked trees contain wire, nails, and other metallic objects that have accumulated in the 130 years that the site has been occupied. Because many of the marked trees are located close to buildings and powerlines in the Headquarters compound, this unit should be logged with mechanical harvesters capable of maneuvering trees in tight quarters. Some trees less than 10 inches dbh also need to be removed from this stand. Mike Kerrigan, Pikes Peak RD FMO had agreed to have the fuels crew fell and hand pile those trees.