Assessing the Need, Costs, and Potential Benefits of Prescribed Fire and Mechanical Treatments to Reduce Fire Hazard in Montana and New Mexico

A report to the Joint Fire Sciences Program

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KEY FINDINGS

MONTANA

Thin-from-below to 9 inches DBH with a minimum residual basal area then burn, reevaluate for thinning and burn every 30 years (TB9).

1. The initial effect of this prescription on fire hazard was modest. Repeat entries did little more than maintain the initial gains.
2. There was a substantial long-term downward trend in the projected basal area mortality expected during prescribed burn treatments.
3. Basal area built up over time, perhaps to levels that would put the stands at risk of insect outbreaks.
4. There was no merchantable volume harvested under this prescription after the first thinning.
5. No cases were found where the harvested material would cover the cost of conducting the thinning either currently or in future entries given existing market conditions.
6. If the TB9 prescription is widely implemented careful scheduling will be necessary because after the first entry it yields minimal volumes of sub-merchantable trees and no merchantable trees.

Thin-from-below up to 50% of standing basal area with a minimum residual basal area then burn, reevaluate for thinning and burn every 30 years (50BA)

1. The initial effect of this prescription on fire hazard was modest, but there was continued improvement with successive entries.
2. There was a substantial long-term downward trend in the projected basal area mortality expected during prescribed burn treatments.
3. Basal area stabilized near the minimum basal area required by the prescription to be left at each thinning entry.

4. The merchantable volume harvested was lower in future entries than in the initial entry, but the DBH of harvested trees increased to greater than 16 inches over the simulation period.
5. The prescription made no provision for regenerating the stand so repeated entries often lowered the number of trees per acre to well below full stocking levels. In practice, managers would probably alter prescriptions to regenerate stands before this happened.
6. Some cases were found where the harvested material would cover the cost of conducting the initial thinning and most cases showed a positive net return from thinnings by the end of the simulation period.

NEW MEXICO

Thin-from-below to 9 or 16 inches DBH with a minimum residual basal area then burn 10 years later and every 20 years thereafter, reevaluate for thinning every 30 years (TB9 and TB16)

1. The initial effect on fire hazard of thinning to either 9 inches or 16 inches DBH limit was modest, but there was continued improvement with successive treatments.
2. There was a substantial long-term downward trend in the projected basal area mortality expected during prescribed burn treatments.
3. The minimum basal area after the first entry was 80 sq. ft. and basal area under both treatments tended to stabilize near that level over time.
4. There were few cases where any harvested volume from any entry was considered merchantable.
5. There were no cases found where the harvested material could be expected to cover the cost of conducting the thinning either now or in the future, given existing market conditions.

EXECUTIVE SUMMARY

This report covers Objective 5 “compare the future mix of timber products under alternative treatment scenarios” of the Joint Fire Sciences Funded project ”Assessing the need, costs, and potential benefits of prescribed fire and mechanical treatments to reduce fire hazard.” Under this objective we developed and demonstrated an analytical method that uses readily available tools to evaluate: pre- and post-treatment stand conditions; size, species, and volume of merchantable wood removed during thinnings; size and volume of sub-merchantable wood cut during treatments; and financial returns of prescriptions that are applied repeatedly over a 90 year period.

Our approach uses existing modeling tools and inventory data, linked in a way that allows a comprehensive analysis of treatment options. Primary tools include the forest vegetation simulator (FVS) growth and yield model with the Fire and Fuels Extension (FFE) and the Financial Evaluation of Ecosystem Management Activities (FEEMA) model. Data are stored in a Microsoft Access database and a standard set of reports was developed within the database. This analytical protocol is portable to anywhere in the western United States where an FVS variant with an FFE extension and a FEEMA variant are available. The tools are familiar to, or can be readily learned, by forest planning and analysis staff within Federal agencies and most state or private organizations. Where they exist, other growth models, fire models, and financial models could be substituted for those used in this study.

In this report, we used Forest Inventory and Analysis (FIA) data for Montana and New Mexico as categorized and processed in the companion reports by Fiedler and others

that cover Objectives 1-4 of this project[1]. Our methods are robust, however, and can accept stand level data that is available from many sources. Suitable stand exam data must be usable as input data for FVS and comprise a statistically representative sample of the vegetation on the target landscape. This means that our methods could be used for analyses at many scales from environmental assessments of individual projects, to forest or estate level planning, to state or regional planning.

Analyses presented here cover two thin from below prescriptions for each of two forest types in Montana and New Mexico. One of the Montana prescriptions was diameter limited and the other was basal area limited. Both New Mexico prescriptions are diameter limited. All four prescriptions included prescribed burning at regular intervals (30 years in Montana and 20 years in New Mexico).

The results suggest that all of these prescriptions reduced fire hazard over the long term, but they were not equally effective. Over the course of several entries, the basal area limited prescription modeled for Montana created stands that were open with a few scattered large trees while the diameter limited prescription created dense stands with many mid-sized trees. The diameter limited prescription as applied in Montana sometimes resulted in combinations of basal area, tree size, and stand age that raise concerns over insect outbreaks, specifically Douglas-fir beetles, western pine beetles, and mountain pine beetles. These conditions were only rarely encountered in New Mexico. Final stand conditions varied in New Mexico depending on initial stand conditions and other factors but in general a wider range of density and tree size combinations developed over the simulation period than were projected for Montana.

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[1] A strategic assessment of fire hazard in Montana, and A strategic assessment of fire hazard in New Mexico by Fiedler, C.E.; Keegan, C.E. III; Woodall, C.W.; Robertson, S.H.; and Chmelik, J. (Submitted under separate cover to the JFSP Board).

Even with the simple prescriptions modeled here, it would be possible to select stands with different initial conditions and ages then apply the prescriptions at different times to develop a diverse set of conditions on a landscape. We did not explore such spatial or temporal arrangements of treatments but this will undoubtedly be important when developing management plans that consider the interactions of hazardous fuel reduction treatments with multiple resource values and episodic disturbances on large landscapes.

In terms of wood utilization, the analysis showed that the diameter limited prescriptions produced only small volumes of small trees from the first entry and minimal volumes in subsequent entries. These prescriptions almost universally had negative net returns, even without considering the costs of a regular cycle of prescribed fire, so some sort of subsidy would be required to implement them. If these prescriptions were widely implemented and if industrial capacity were developed to use the wood removed under them, it would be important to size processing plants and develop treatment schedules to ensure a sustainable supply of raw material.

The basal area limited treatment modeled in Montana resulted in more volume than the diameter limited prescription and sometimes showed a positive net return. This prescription produced trees and logs in a variety of sizes. Although average diameter of cut trees increased with successive entries, the total volume cut generally declined over time.

INTRODUCTION

REASONS FOR THE STUDY

This study was undertaken with funding from the Joint Fire Science Program (JFSP) to develop protocols for use in determining the magnitude of hazard reduction treatment needs, treatment cost, and associated benefits at a state level. The objectives of the study include 1) quantify existing stand conditions for major forest types in terms of density, structure, and species composition, and prioritize by need for hazard reduction treatment, 2) develop and compare alternative cutting and prescribed burning prescriptions for reducing high-hazard conditions in major forest types, 3) determine potential revenue from timber products generated from the hazard reduction harvest treatments, 5) compare the future mix of timber products under alternative treatment scenarios, and 6) describe the potential for analyzing non-commodity resources under treatment and no-treatment scenarios. This report demonstrates the protocols developed under JFSP funding to analyze and illustrate trends in the long term effects of repeated hazard reduction entries in terms of the stocking, size, and species mix of residual stands and the size and species mix of trees and logs that might be removed and utilized for wood products.

Montana and New Mexico were selected as examples because recent inventories are available for both states and the industry in the two states are very different. Montana's forest products industry is well established with the technological capability to process the small diameter logs expected from fuel hazard reduction treatments. New Mexico's forest products industry is in decline and does not currently have mills capable of processing small logs.

QUESTIONS ADDRESSED

The types of treatments proposed as a means of reducing forest fire hazards, if widely adopted, could have implications for future forest conditions as profound as the past management practices that led to the existing conditions. Changes of that magnitude have the potential to affect many forest values such as fisheries, wildlife, non-timber forest resources, environmental services, and amenities. Some of these changes will likely be considered positive and some will likely be considered negative. How they are viewed depends on the resource in question and the relative importance given to different resource values. It is neither our place nor our intent to say which changes are more important or whether they are desirable or undesirable. Our intent is to provide a set of protocols that use existing tools[2] and data[3] that are available to analysts employed by Federal, state, and private land management organizations. The interpretations we provide in this report are intended as neutral examples illustrating these protocols. Our protocols can be used to conduct analyses and display information about fire hazard, stand conditions, and removed materials. We anticipate that this information will be useful to decision makers who set fire management strategies and policy. To test this hypothesis, and to fulfill our technology transfer goal, we are working with the Blue Mountains Demonstration Project in Northeastern Oregon to develop an analysis using our protocols for the three National Forests (Umatilla, Malheur, and Wallowa-Whitman) included in the Blue Mountains Demonstration area as well as state and private lands within the demonstration area.

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[2] For example, FVS, FFE, FEEMA, Microsoft Access, etc. (see Methods section).

[3] We use Forest Inventory and Analysis, FIA, plot level data but many types of stand level data are adequate for these protocols)

The types of treatments proposed to reduce fire hazard, if widely adopted, could have important implications for the volume and characteristics of timber that is available for the production of forest products. Significant shifts in the species or size composition, for example, could influence the economic viability of the existing industry and affect the economic health of the people and communities in which timber processing occurs.

AUDIENCES TO WHICH THIS REPORT IS ADDRESSED

This report is intended to supply information to a broad range of decision makers involved in the forest fire hazard issue including both public and private forest land managers, state and Federal planners, and others with a policy interest in the management of forests in the western US. Although we attempt to keep technical jargon at a minimum, a working knowledge of forestry and land management will be helpful in understanding the data and methods that underlie this report.

GEOGRAPHIC DETAIL AND FOREST TYPES

Montana

The state of Montana is divided into western and eastern regions in our analysis and reporting. The division generally follows the Continental Divide. Within each geographic area, forests are further divided into 11 forest types: Douglas-fir, lodgepole pine, ponderosa pine, moist low elevation mixed conifers, dry low elevation mixed conifers, upper elevation mixed conifers, western larch, spruce/fir, subalpine fir, quaking aspen, and cottonwood. We performed our analyses on the Douglas-fir and ponderosa pine forest types because they were identified by the Montana Technical Contact Team as being of high concern and having a high potential for hazard reduction treatments. These forest types have relatively short fire return intervals and are likely candidates for hazard reduction treatments. There is also sufficient Forest Inventory and Analysis (FIA) data with which to provide a meaningful illustration of our protocols. We report results by two ownership categories: National Forests and non-National Forests. These categories were chosen to make the most efficient use of the available FIA data. With additional stand exam data, it would be possible to further refine ownership classes. Reporting within the two ownership classes is further broken down into current forest fire hazard condition and slope. The maximum number of reporting categories (cases) for the Montana study is 32 (2 regions x 2 owner groups x 2 forest types x 2 slope categories x 2 hazard categories). In this report each combination of region, owner group, forest type, slope category, and hazard category is referred to as a “case” and each application of a treatment (a thinning or prescribed fire) within each case is referred to as an “entry.”

New Mexico

There was no geographic breakdown of data in New Mexico. There are 9 forest types in New Mexico; aspen, juniper, pinyon/juniper, spruce/fir, dry mixed conifer, moist mixed conifer, riparian, oak, ponderosa pine/grass, and ponderosa pine/shrub. Because the same prescription would be used for both ponderosa pine types, they were combined into one type for this analysis. The New Mexico Technical Contact Team selected two forest types (ponderosa pine and dry mixed conifer) as having high fire hazard, a priority for receiving hazard reduction treatments, and covering enough area to have a sufficient number of FIA plots to do the analyses. The maximum number of cases for the New Mexico study is 16 (2 owner groups x 2 forest types x 2 slope categories x 2 hazard categories).

METHODS

GENERAL ANALYTICAL APPROACH

The objective of this analysis is to show the results of several stand treatment options designed to reduce fire hazard both now and in the future. Evaluations include 1) residual stand structure; 2) volume, size, and characteristics of merchantable trees cut through time; 3) the volume and size of submerchantable (biomass) trees cut through time; and 4) the financial feasibility of treatments.

Our general approach uses existing modeling tools and inventory data, linked in a way that allows a comprehensive analysis over a range of treatment options. Primary tools include the forest vegetation simulator (FVS) growth and yield model (Stage, 1973; Crookston, 1990), the Fire and Fuels Extension (FFE) model as part of FVS (Beukema et al., 1997; Scott and Reinhardt, 2001), and the Financial Evaluation of Ecosystem Management Activities (FEEMA) model (Fight and Chmelik, 1998). Data are stored in a Microsoft Access database and a standard set of reports was developed within the database. Use of these tools makes the analysis portable to anywhere in the western United States where an FVS variant with an FFE extension and a FEEMA variant are available. The tools are familiar to, or can be readily learned, by forest planning and analysis staff within Federal agencies and most state or private organizations. Where they exist, other growth models, fire models, and financial models could be substituted for the ones we used.

Measurements of current forest vegetation are from data collected by the Forest Service's Forest Inventory and Analysis (FIA) Program. Our methods are robust, however, and adequate data can be obtained from a wide range of stand exam or other stand level data that are suitable for use as input data to FVS. An important caveat here is that stand level data should be collected in such a way that they comprise a statistically representative sample of the vegetation population on the target landscape.

In Montana we examined 678 candidate FIA plots with a sampling weight of approximately 6,000 acres each. In New Mexico there were 600 candidate plots with a sampling weight of approximately 6,600 acres each. When more than 50 plots were available for a given case, a sample of 50 plots was randomly selected to represent it. When fewer than 50 plots were available for a given case, all of the plots were used in the analysis. Cases with fewer than 10 plots were not included in the analysis because there were insufficient data to adequately represent potential variation. Alternatively, it is possible to analyze all plots regardless of sample size and examine results for individual plots rather than average results. We felt that this method would be tedious and not allow us to provide a compact illustration of our methods. Individual analysts might, however, be interested in identifying plot conditions where the probability of some desired outcome, such as financially viable activities, is high. In that situation, analysis of individual plots might be desirable.

Fire hazard rating is based on estimates of the crowning index for each decade provided by the Fire and Fuels Extension (FFE) of FVS. Crowning index is the wind speed necessary to sustain a crown fire. It is calculated from the crown bulk density for the stand. The lower the crowning index, the higher the probability that a crown fire will be sustained (Scott and Reinhardt, 2001). Crowning index values reported are after thinning (if any occurred) and before prescribed fire treatment.

Forest Inventory and Analysis data were converted into FVS input files and a silvicultural treatment regime was simulated. The silvicultural regimes simulated in this analysis were intentionally kept simple to provide an uncomplicated illustration of the protocols and to provide benchmark results that could be used to refine treatment options. In our interaction with the Blue Mountain Demonstration Area project, a set of prescriptions more representative of actual project level activities is being developed and modeled by the Forest Silviculturists on the three Blue Mountain Demonstration Area forests. Input will also be solicited from private and state forest managers with land inside the demonstration area.

For each harvest made in FVS, a list of cut trees was recorded and then imported into the FEEMA model. For Montana, FEEMA determined merchantability of each tree, based on a minimum small-end diameter (SED) of 5.0 inches inside the bark and log length of 8 feet for top logs and 16 feet for butt logs. For New Mexico, the minimum SED was 9.5 inches inside the bark and log length of 8 feet for top logs and 16 feet for butt logs. FEEMA tallied individual logs and produced an output file summarizing volume by species, tree diameter at breast height (DBH), and log SED. These results were compiled in a database of simulation output for all sample plots included in the analysis. Results from the simulations were calculated as the average of the FIA plots selected for each case (50 or less as described above) weighted by the appropriate plot expansion factor. For Montana whole-tree stem volumes of unutilized (submerchantable) trees from 1 inch to 7 inches DBH were estimated by FVS. For New Mexico whole-tree stem volumes of unutilized trees from 1 inch to 4 inches DBH were estimated by FVS. Stem volumes of 4-14 inch DBH trees were estimated with FEEMA to a 2-inch top, inside bark. We did not calculate biomass (total stem, limbs, and foliage) volume or weight for the unutilized trees. This could be done from our data given biomass prediction models for specific species and geographic areas.

FIRE HAZARD REDUCTION TREATMENTS

Silvicultural prescriptions were developed in consultation with the Technical Contact Teams for Montana and New Mexico. The objective was to cover a range of treatment options. In general, a treatment can be a thinning, a thinning followed by burning (prescribed fire), or a maintenance burn (prescribed fire) without a thinning. We used thinning treatments that included thinnings from below to different diameter and basal area targets, followed by a prescribed burn. Thinning was simulated with FVS. Prescribed burning was simulated using the FFE model. The crowning index from the FFE model was used as a surrogate for fire hazard. We segregated all plots into high, medium, and low fire hazard based on crowning indices, which are expressed as wind speed, of <25 mph (high hazard), 25 to <50 mph (moderate hazard), and 50+ mph (low hazard). For some forest types we grouped the plots with high and medium fire hazard and in others we grouped the plots with medium and low fire hazard. This grouping was done differently for different forest types to provide meaningful technical information about each forest type, while using the available plot level data efficiently, and to keep the output tables as uncluttered and understandable as possible. The grouping for each forest type is indicated at the beginning of the results section for that type. For reporting purposes, output tables are labeled as "high" or "low" fire hazard. This designation indicates the relative importance of treating stands in the indicated crowning index classes for that forest type. Treatments in plots designated as low were deferred for one treatment simulation cycle (30 years).

FVS VARIANTS

Three FVS variants were used in Montana. The eastern Montana variant was used for all of eastern Montana. In western Montana, the Northern Idaho variant was used except for the Kootenai National Forest and the Tally Lake Ranger District of the Flathead National Forest where the Kootenai variant was used.

The central Rockies variant was used for all of New Mexico. The 2001 version of this variant was used. This version replaces the GENGYM stand level growth model (Edminster et al., 1991) with a distance independent individual tree growth model similar to those used in most other FVS variants.

PRESCRIPTIONS[4]

MONTANA DOUGLAS-FIR

The thinning reentry interval is 30 years with prescribed burning immediately following each entry (thinning and burning included in the same FVS simulation cycle). One prescription is a thin-from-below to 9 inches DBH, with a minimum residual basal area of 45 ft^2 in Western Montana and 40 ft^2 in Eastern Montana (TB9). The other prescription is a thin-from-below up to 50% of standing basal area with a minimum residual basal area of 80 ft^2 Western Montana and 70 ft^2 in Eastern Montana (50BA). Stands that did not have sufficient basal area to qualify for a thinning were given a prescribed burn and were reconsidered for thinning at the next thinning cycle (30 years).

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[4] The companion reports (Fiedler et al., see footnote 1) include a third prescription, which is referred to as the "comprehensive prescription." This prescription was not included in our analysis because it requires procedures that cannot be modeled in FVS (Crookston, personal communication).

MONTANA PONDEROSA PINE

The thinning reentry interval is 30 years with prescribed burning immediately following each entry (thinning and burning included in the same FVS simulation cycle). One prescription is a thin-from-below to 9 inches DBH with a minimum residual basal area of 40 ft^2 in Western Montana and 35 ft^2 in Eastern Montana. This prescription is referred to as TB9 in the text that follows. The other prescription is a thin-from-below up to 50% of standing basal area with a minimum residual basal area of 50 ft^2 in Western Montana and 40 ft^2 in Eastern Montana. This prescription is referred to as 50BA in the text that follows. Stands that did not have sufficient basal area to qualify for a thinning were given a prescribed burn and were reconsidered for thinning at the next thinning cycle (30 years).

NEW MEXICO PONDEROSA PINE AND DRY MIXED CONIFER

The prescriptions for the two New Mexico forest types are identical. The thinning reentry interval is 30 years with prescribed burning 10 years after the initial thinning entry and repeated every 20 years thereafter. One prescription is a thin-from-below to 9 inches DBH, with a minimum residual basal area of 50 ft^2 for the initial thinning and 80 ft^2 for subsequent thinnings (TB9). The second prescription is a thin-from-below to 16 inches DBH with a minimum residual basal area of 50 ft^2 for the initial thinning and 80 ft^2 for subsequent thinnings (referred to as TB16). Stands that did not have sufficient basal area to qualify for a thinning were reconsidered at the next thinning cycle (30 years). No prescribed burning was done until a thinning had occurred.

EFFECTIVENESS OF HAZARD REDUCTION TREATMENTS

Linear regression analysis was used to identify trends in the long-term effectiveness of treatments in lowering fire hazard. The regression tested for a time trend and a treatment effect in the predicted crowning index. The dependent variable in these regressions was the average predicted crowning index for the high hazard plots for a given forest type and treatment. The independent variables were decades numbered from one to ten and dummy variables for decade of treatment, and the decade following treatment. In New Mexico where the thinning cycle and prescribed fire cycle are different, the decade of prescribed fire and the decade following prescribed fire were also dummy variables. Dummy variables have a value of one for data points that have the attribute and zero otherwise. Any of the three variables that were not statistically significant were deleted from the model and the model was rerun. Results from this analysis helped to illustrate whether there was improvement in crowning index immediately after entries, the decade following entries, how crowning index changed between entries, and whether there was a long-term trend of improvement in crowning index.

A similar analysis was used to identify trends in the average potential basal area mortality expected from the prescribed burns. The dependent variable in these regressions was the average predicted basal area mortality for a prescribed burn for the high hazard plots for a given forest type and treatment.

FINANCIAL ANALYSIS

The FEEMA model was used to rate the potential net revenue from the thinnings. Although in both states the analysis was done for a single set of economic assumptions that represent relatively good market conditions, good market conditions are very different in the two states. The market conditions used, represent a relatively good market for lumber and a market for chip logs down to 5 inches SED in Montana, but no market for chip logs in New Mexico. The financial returns should be regarded as optimistic, but useful in identifying the relative financial feasibility of different cases. Costs include cutting small trees that are cut and treated in place, cutting middle-sized trees that are cut and removed to the landing, and cutting large trees that are utilized for products. Costs of other harvest related activities such as roads and environmental remediation, which can vary widely, are not included. Ground based equipment was assigned a lower cost than cable yarding systems. In Montana ground based equipment is assumed on slopes of less than 35%; in New Mexico ground based equipment is assumed on slopes of less than 40%. See appendix H for a full description of economic assumptions.

RESULTS AND DISCUSSION

MONTANA

Douglas-fir

The total area and number of FIA inventory plots included in this analysis for the Douglas-fir forest type are shown in appendix A. Douglas-fir plots were segregated by high (<25 mph wind speed) crowning index and low/moderate (25+ mph wind speed) crowning index for the analysis presented here. For brevity these two groups are referred to as high fire hazard and low fire hazard in all of the tables for this species.

Treatment effect on fire hazard

Regression analysis indicated both a time trend (positive slope coefficient on decade) and a cyclical treatment effect (a positive coefficient on the decade following treatment) on average crowning index for the 50BA prescription in the Douglas-fir high hazard stands. This means that each subsequent treatment brought the crowning index to a higher level (a lower hazard) than the previous treatment. The results from the Douglas-fir high hazard stands thinned-from-below to a 9" DBH limit had a cyclical treatment effect (a positive coefficient on the decade following treatment) and a small time trend. There was improvement with each entry, but the crowning index returned to a level only slightly above the previous entry by the time of the next entry. These comparisons are clearly seen in the plot of the predicted average values for fire hazard index shown in figure 1. Recall that the crowning index for all high hazard plots was initially less than 25 so the first point in the figure includes the improvement associated with the initial treatment.

Figure 1. Predicted average crowning index over time for high hazard Douglas-fir plots in Montana by prescription.

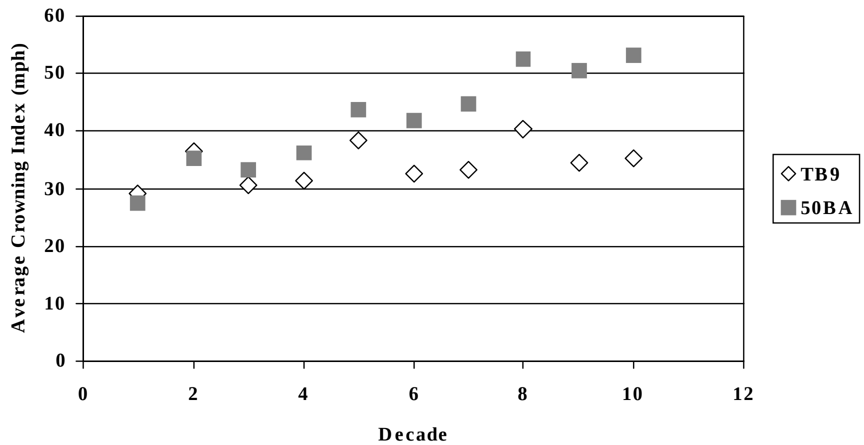
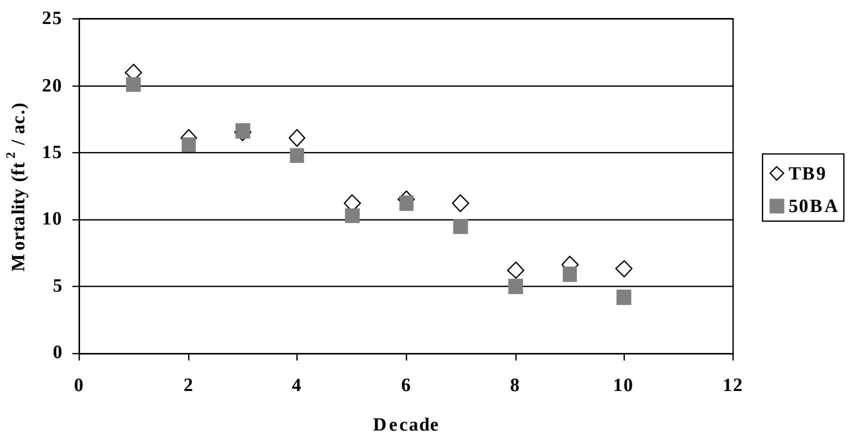


Figure 2 shows the analogous comparison for the predicted average basal area mortality resulting from prescribed burns. In spite of the fact that the effect on crowning index is quite different among treatments, the effect on potential basal area mortality is strikingly similar. This means that even though the ability to carry a crown fire is different the, ability of the trees to withstand prescribed fire is similar with expected basal area mortality dropping to around 5% in both cases by the end of the projection period. This result suggests that by the 10th decade of the simulation both prescriptions create stand conditions where trees are relatively resilient to low intensity fires.

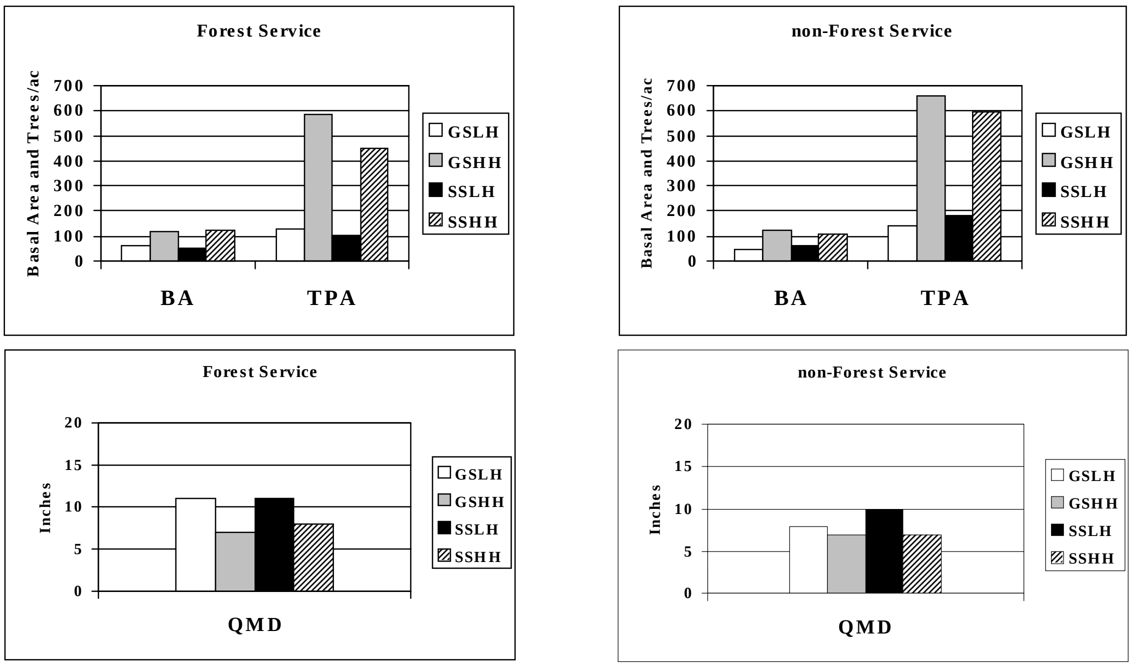
Figure 2. Predicted average basal area mortality over time for high hazard Douglas-fir plots in Montana by prescription.



Initial stand summary

When paired by geographic region, owner, and slope, the initial stand conditions for high and low fire hazard cases differ systematically. The low hazard cases consistently have lower basal area, fewer trees per acre, and larger quadratic mean diameters (appendix B). A typical comparison is shown in for Western Montana Forest Service ownership (figure 3).

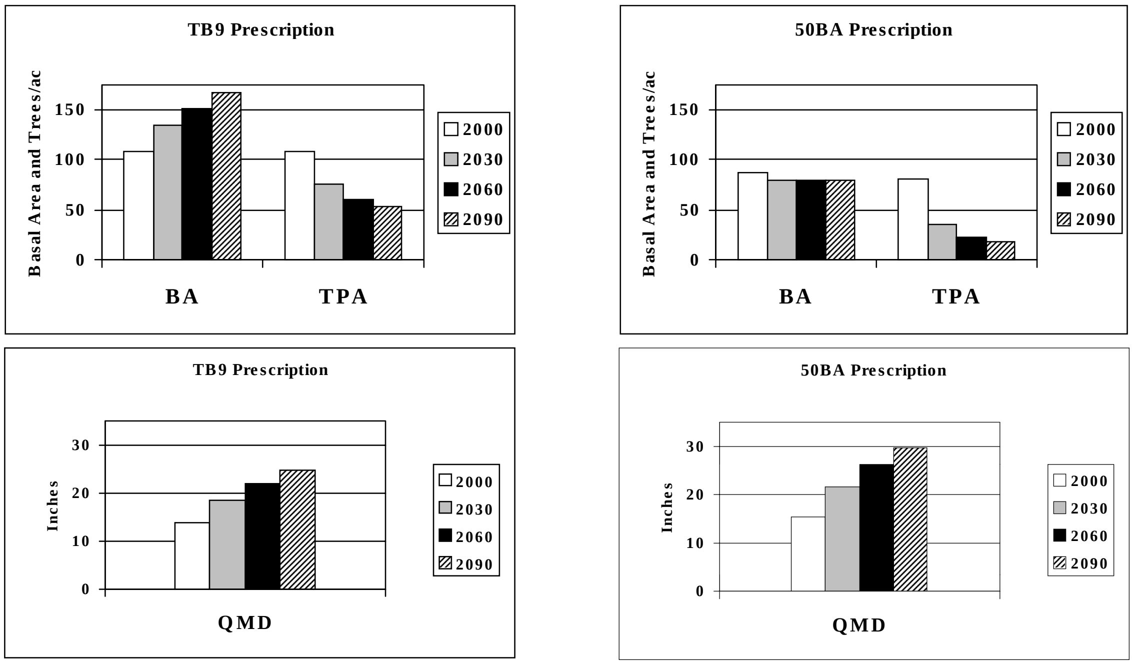
Figure 3. Initial conditions for Douglas-fir plots in Western Montana: basal area (BA; sq.ft./ac), number of trees per acre (TPA), and quadratic mean diameter (QMD; inches) and reported by gentle slope low or high fire hazard (GSLH or GSHH) and steep slope low or high fire hazard (SSLH or SSHH).



Residual stand summary

The results presented in figure 4 illustrate how stand conditions changed over time for Douglas-fir plots. Although the results shown in the figure are for Forest Service land in western Montana, they are similar to those for other ownerships and geographic regions in Montana (appendix C). When the two prescriptions are applied repeatedly over the course of a century our analysis suggests that the 50BA prescription will result in less crowded stand conditions with fewer but larger trees than the TB9 prescription.

Figure 4. Residual conditions over time for Douglas-fir plots on steep slopes with high fire hazard on National Forests in Western Montana, (average values for thinned plots only), TB9 and 50BA prescriptions: basal area (BA; sq.ft./ac), number of trees per acre (TPA), and quadratic mean diameter (QMD; in.).



The main difference between the treatments is that the diameter limited prescription (TB9) resulted in an accumulation of basal area over time while the basal area controlled prescription (50BA) reduced basal area to the minimum value, 80 square feet in this case, and kept it there throughout the simulation. Under the diameter limited prescription (TB9) basal area and quadratic mean diameter (QMD) increased over time while trees per acre declined. This happened because the prescription generally removed all of the trees under 9 inches before the minimum basal area was reached. Basal area increased because the trees over 9 inches DBH are never removed and as they grow, basal area continued to accumulate. Trees per acre declined because few, if any, trees under 9 inches survive to become large trees but some of those larger than 9 inches die from competition related mortality in each growing cycle (10 years). With no understory trees to replace them, the number of trees per acre declines over time.

The accumulation of basal area under the TB9 prescription is an issue that forest planners might want to consider more closely. Our analysis suggests that this prescription will generally be sufficient to keep treated stands in the moderate fire hazard class and that mortality associated with prescribed burns, and presumably other low intensity fires, will decline over time under both prescriptions. Stands managed under these prescriptions for a long time, however, will have very different structures. Both of these stand structures may be regarded as desirable components of a landscape at some level. The 50BA prescription creates open stands with scattered large trees. The TB9 prescription creates densely stocked stands with more uniform sized trees. In some cases the resulting conditions reach a point where the stands are high hazard for Douglas-fir bark beetle outbreaks (Gibson, personal communication). Neither prescription allows for regeneration of an understory and recruitment of smaller trees into the overstory. So both will eventually lead to single story stands. Prescriptions could be altered in future analyses to create stands that retain multiple canopy layers that could be sustained for many decades or at some point most of the overstory could be removed to allow for promote regeneration.

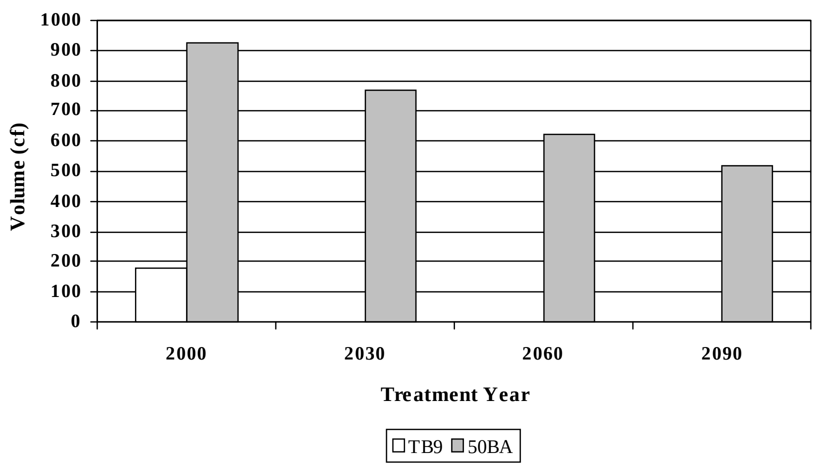
Merchantable volume by DBH class

Data for average removed volume of trees 7 inches DBH and larger are reported in appendix D. As rule of thumb, sale administrators experienced with small diameter timber sales typically look for at least 600 cubic feet of removed volume per acre

(Wynsma personal communication). None of the cases reported for the TB9 prescription yield that much volume, but 12 of the 16 cases under the 50BA prescription did yield at least 600 cubic feet per acre in the first entry. In some cases the merchantable volume in the first entry was more than 1000 cubic feet per acre.

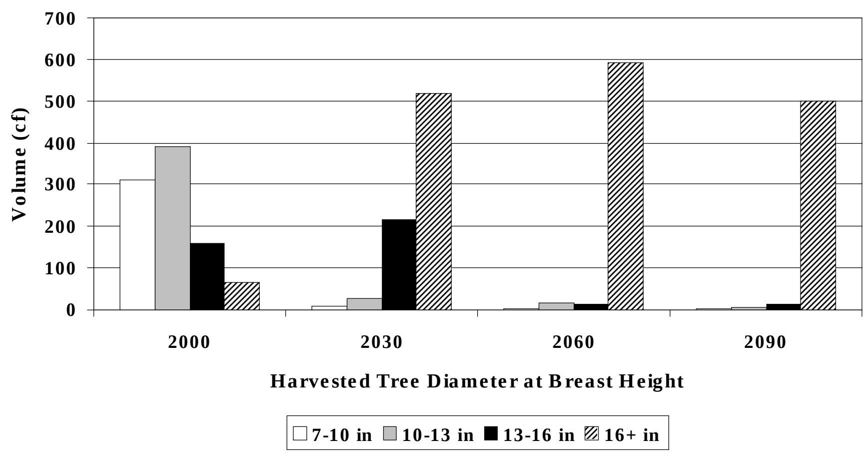
An example of the change in harvest volume for one case by entry is shown in figure 5. The TB9 prescription did not result in any merchantable volume after the first entry and this also was true for all other cases modeled using this prescription. The most volume was removed from the 50BA prescription during the first entry and the volume removed in second entry was less than the first in all but one case. In some cases, the volume remained fairly constant over time from the 50BA prescription but in others it continued to decline as it does in figure 5.

Figure 5. Average merchantable volume (cubic feet) removed from Douglas-fir plots on National Forests in Western Montana with steep slopes and high fire hazard by prescription.



The characteristics of the volume removed under the 50BA prescription also change considerably over time (figure 6). At the beginning of the simulation period (2000), most of the volume removed was in the 7 to 10 inch and 10 to 13 inch DBH classes. By the second entry (2030), almost no volume was in these classes and most of the volume came from trees greater than 13 inches DBH. Volume removed during the third and fourth entries came almost exclusively from trees greater than 16 inches DBH.

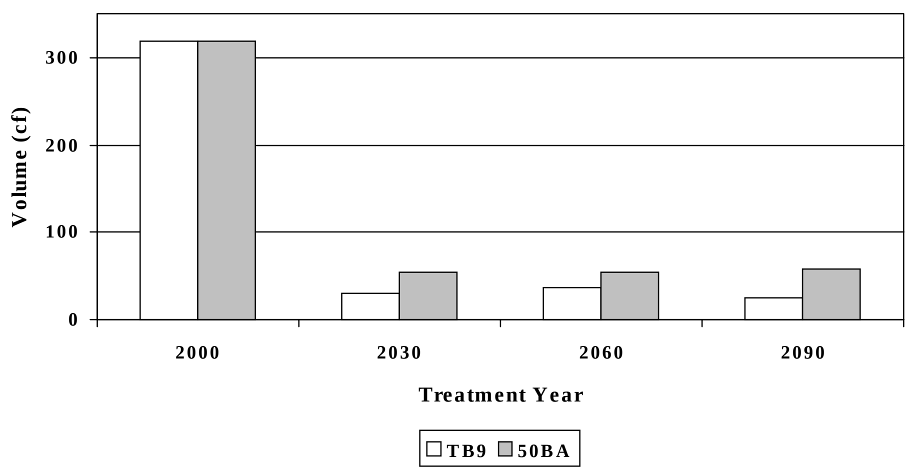
Figure 6. Average merchantable volume (cubic feet) removed from Douglas-fir plots on National Forests in Western Montana with steep slopes and high fire hazard. Change over time by tree diameter at breast height.



Unutilized volume of 1 to 7 inch DBH trees

Characteristic results for the total stem volume of cut trees less than 7 inches DBH are illustrated in figure 7. Under both prescriptions the initial entry yields by far the largest volume of trees in the 1 to 7 inch DBH class. After the initial entry the volume of small trees cut sometimes fluctuated with either prescription, but it always remained well below the initial volume. Detailed results for all cases are found in appendix E. There currently is not a reliable pulp market in Montana and no biomass market. Assuming a moisture content of 50% and a specific gravity of 0.40, these volumes convert to 6 to 10 green tons per acre. This estimate does not include limbs and foliage so the total biomass could be considerably higher. These trees are either an opportunity or a disposal problem. Information from this type of analysis might be useful when considering siting biomass-processing facilities, but scheduling of treatments is also an important issue because most of the volume occurs in the initial entry.

Figure 7. Unutilized volume (cubic feet) in 1-7 inch DBH trees from Douglas-fir plots on National Forests in Western Montana with steep slopes and high fire hazard by prescription.

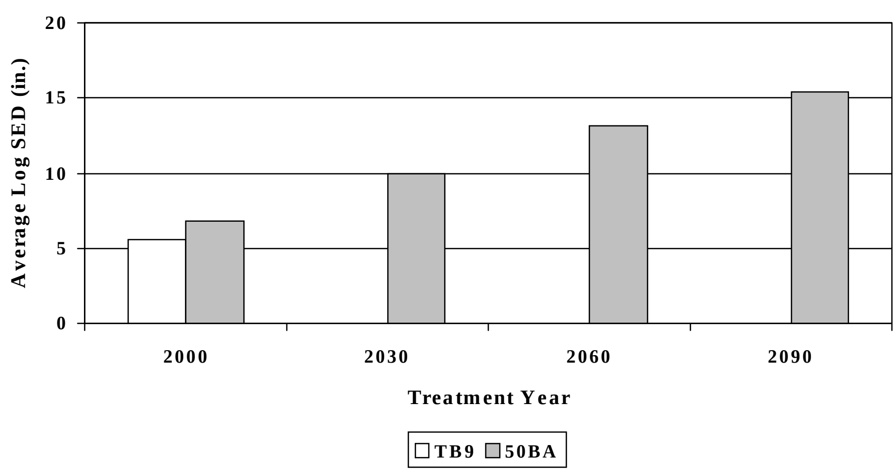


Average small end diameter of removed logs

The TB9 prescription always produces logs that are only slightly larger than 5 inches with small end diameters ranging from 5.0 to 5.7 inches (appendix F). This happens because of the uniformity of tree size (appendix C). Large volumes of logs in this size range would create a problem for conventional solid wood processors because of the inefficiencies of manufacturing either lumber (Barbour, 1999) or veneer (Christensen and Barbour, 1999) from this size of logs. Recently progress has been made in identifying alternative uses for such small diameter logs, e.g., structural round wood (Wolfe and Hernandez, 1999 LeVan-Green and Livingston, 2001), but markets are poorly developed.

Log SED increases over time for the 50BA prescription as expected in light of the comparison of tree sizes (figure 8). Most cases reach average SEDs of 10 inches or more in the third entry and newer random length dimension sawmills often process an average log size smaller than this (USNR, Richard Armstrong, personal communication) so this mix of logs is well suited for these types of mills.

Figure 8. Volume weighted average log small end diameters for wood removed from Douglas-fir plots on National Forests in Western Montana with steep slopes and high fire hazard by prescription.

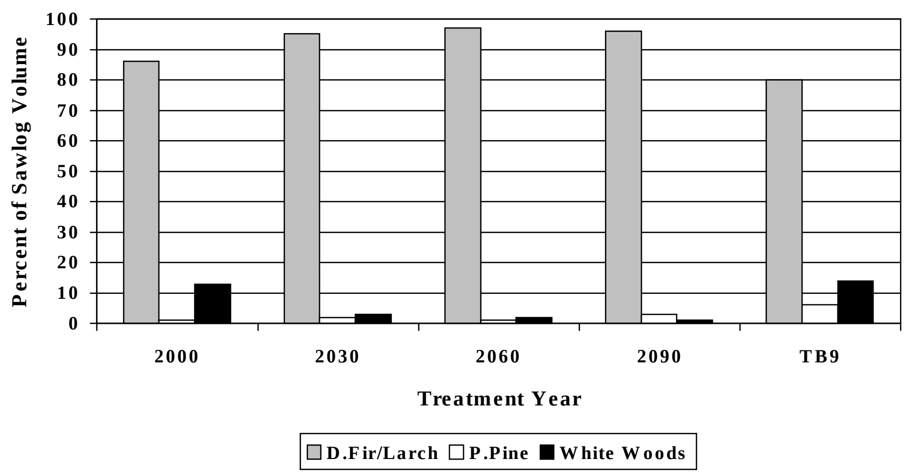


Although the size of the logs increases over time for the 50BA prescription the total removed volume decreases by one half to two thirds over the same period (figure 6). The actual reduction may be more than shown here because sometimes stands that were thinned in the first cycle do not qualify to be thinned in a subsequent cycle and are excluded from the averages shown in this figure. This means that although the quality of the raw material might increase over time, without careful scheduling of treatments the industrial capacity needed to process the raw materials generated by fuel reduction treatments within a fixed area would decline over time. This points to the importance of using analyses, such as this one, that provide information on the average volume expected from various types of prescriptions.

Percentage of volume removed by species

In all cases the majority of the volume removed under both prescriptions is Douglas-fir. Representative results are presented in figure 9. There was little difference in the species composition of the harvested material under the two prescriptions. White woods (true firs, spruce, lodgepole pine, an other minor conifer species) represent a slightly higher proportion of the harvested volume removed during the first entry but over time there is no real species shift. These results suggest that if species dependent processing options were established in an area where large-scale restoration of Douglas-fir stands was taking place, differences in tree size from the two prescriptions would likely be a more important issue than species mix. Detailed results for all cases are found in appendix G.

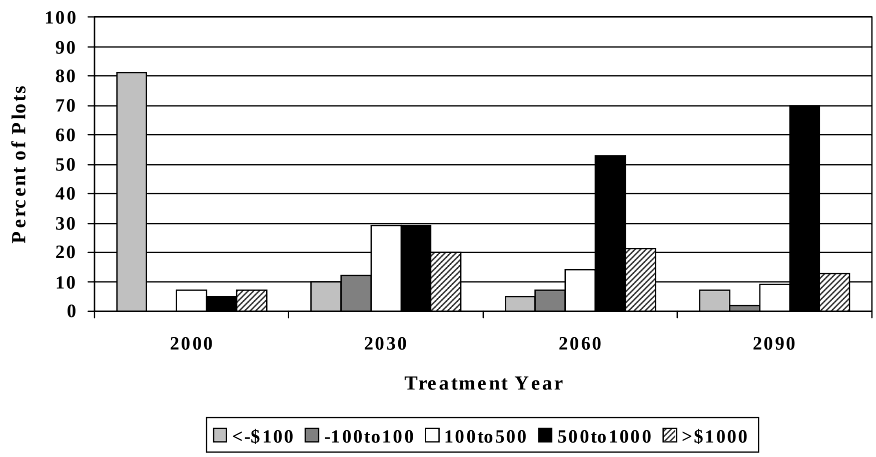
Figure 9. Percent of sawlog volume by species from Douglas-fir plots on National Forests in Western Montana with steep slopes and high fire hazard.



Financial analysis

Results from the financial analysis suggest that in many cases the first entry will require a subsidy of $100 or more if either the TB9 or 50BA prescriptions are used. In fact, all of the plots treated with the TB9 prescription required at least a $100 subsidy. The situation improved over time under the 50BA prescription (figure 10). Except for the first entry, no merchantable volume was removed under the TB9 prescription, so activities under that prescription always had net negative returns. These estimates include the costs of treating or removing material that it is not economical to utilize for products. It does not include the costs of prescribed fire that will occur whether or not a thinning is done.

Figure 10. Net value for the 50BA prescription from Douglas-fir plots on National Forests in Western Montana with steep slopes and high fire hazard.



Ponderosa Pine

The total area and number of FIA inventory plots included in this analysis for the ponderosa pine forest type are shown in appendix A. Ponderosa plots were segregated by high/moderate hazard (<50 mph wind speed) and low hazard (50+ mph wind speed) for the analysis presented here. For brevity these two groups are referred to as high fire hazard and low fire hazard in all of the tables for this species.

Treatment effect on fire hazard

Regression analysis indicated both a time trend (positive slope coefficient on decade) and a cyclical treatment effect (positive coefficients for the decade of treatment and the decade following treatment) on average crowning index for the 50BA prescription in the ponderosa pine high hazard plots. This means that each subsequent entry brought the crowning index to a higher level (a lower hazard) than the previous entry. The results from the ponderosa pine high hazard TB9 prescription plots showed no time trend of improvement and had a small effect of treatment in the decade following treatment. The effect is small enough that the hazard index hovers around 50 mph throughout the 10-decade period. These comparisons are clearly seen in a plot of the predicted average value for fire hazard index in figure 11.

Figure 11. Predicted average crowning index over time for high hazard ponderosa pine plots in Montana by prescription.

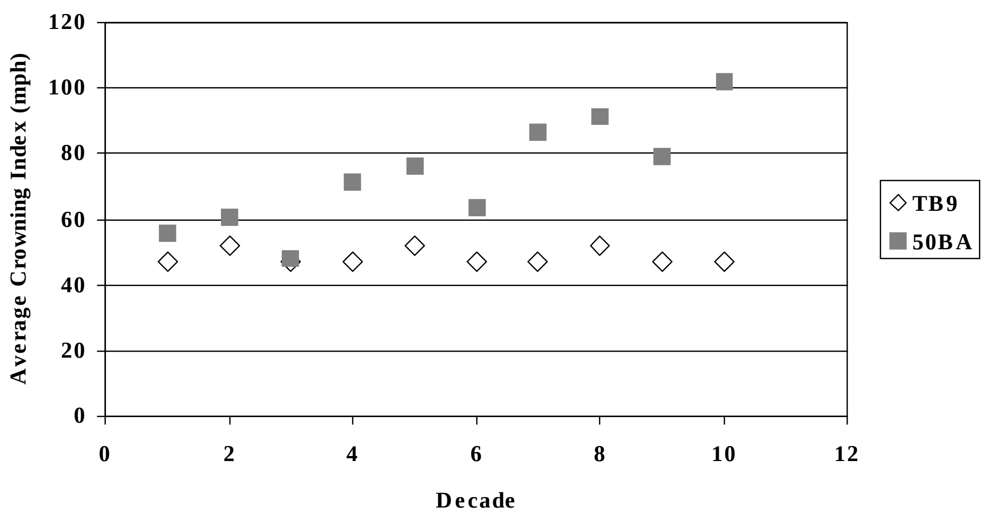
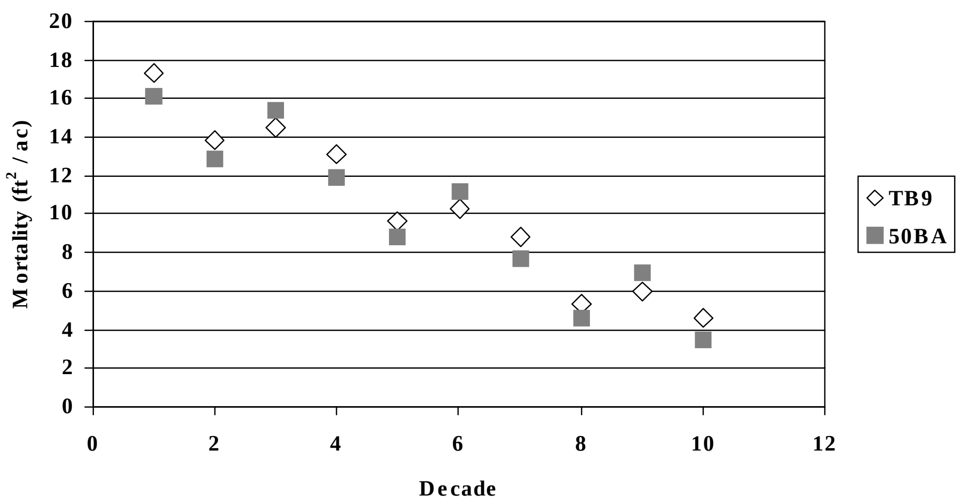


Figure 12 shows an analogous comparison for the predicted average basal area mortality from prescribed burns. In spite of the fact that the effect of the two prescriptions on crowning index is quite different, their effect on potential basal area mortality is strikingly similar. This means that even though the likelihood that trees in plots treated with each prescription will carry a crown fire is different, ability of the trees to withstand prescribed fire is similar with expected basal area mortality dropping to around 5% in both cases over the projection period. This result suggests that by the 10th decade of the simulation both prescriptions create stand conditions where trees are relatively resilient to low intensity fires.

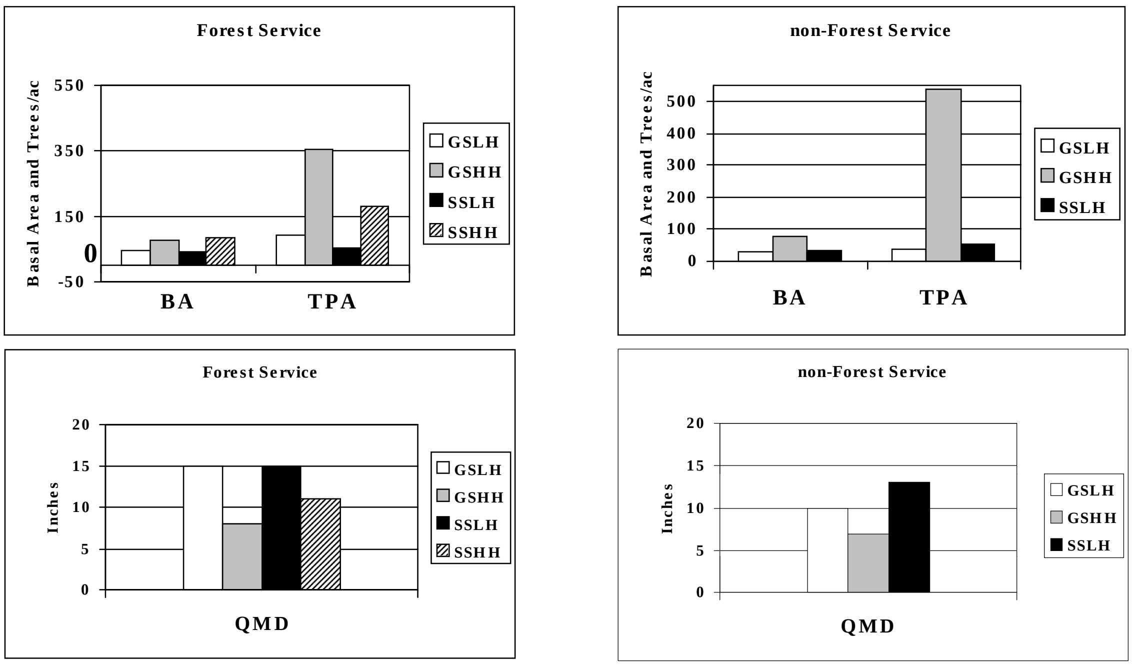
Figure 12. Predicted average basal area mortality over time for high hazard ponderosa pine plots in New Mexico by prescription.



Initial stand summary

When paired by geographic region, owner, and slope, the initial stand conditions for high and low fire hazard cases differ systematically. The low hazard cases consistently have lower basal area, fewer trees per acre, and larger quadratic mean diameters (appendix B). Typical comparisons are shown in for both National Forest land and non-National Forests in Western Montana Forest Service ownership (figure 13).

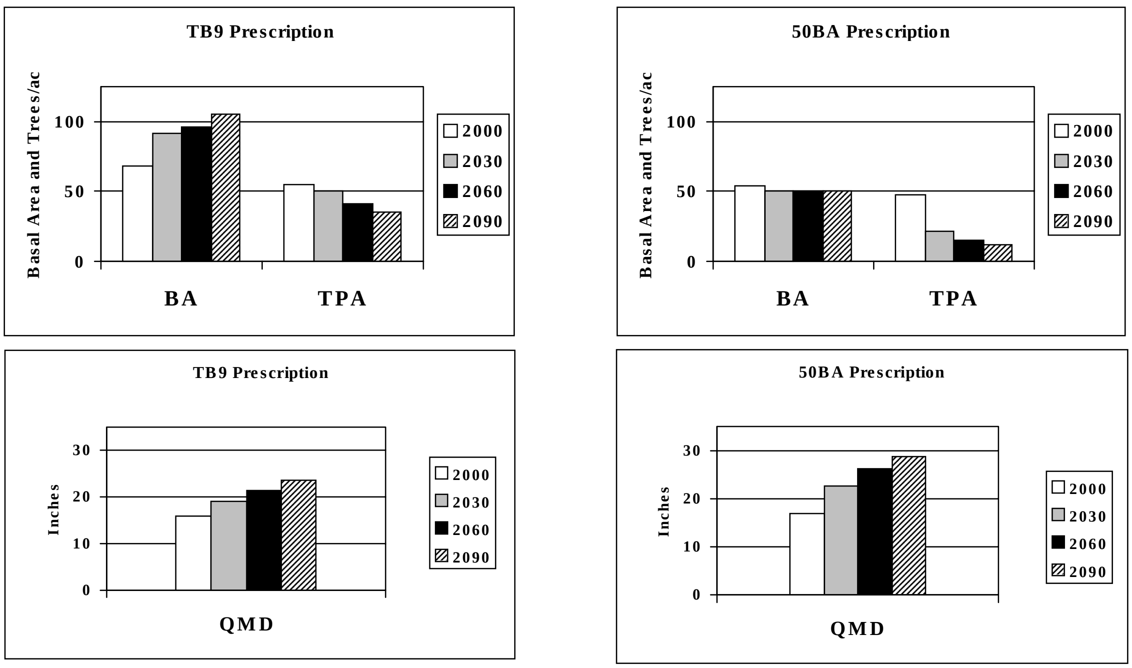
Figure 13. Initial conditions for ponderosa pine plots in Western Montana: basal area (BA; sq.ft./ac), number of trees per acre (TPA), and quadratic mean diameter (QMD; inches) and reported by gentle slope low or high fire hazard (GSLH or GSHH) and steep slope low or high fire hazard (SSLH or SSHH).



Residual stand summary

The results presented in figure 14 illustrate how stand conditions changed over time for ponderosa pine plots. Although the results shown in the figure are for Forest Service land in western Montana they are similar to those for other ownerships and geographic regions in Montana (appendix C). When repeatedly applied over the course of a century our analysis suggests that the 50BA prescription will result in less crowded stand conditions with fewer but larger trees than the TB9 prescription.

Figure 14. Residual conditions over time for ponderosa pine plots on steep slopes with high fire hazard on National Forests in Western Montana, (average values for thinned plots only), TB9 and 50BA prescriptions: basal area (BA; sq.ft./ac), number of trees per acre (TPA), and quadratic mean diameter (QMD; in.).



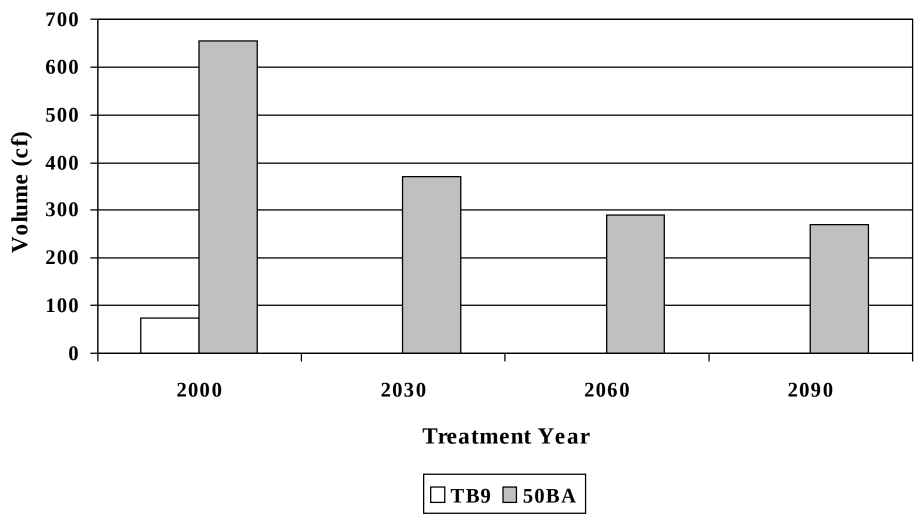
As with Douglas-fir, the diameter limited prescription (TB9) resulted in an accumulation of basal area over time while the basal area controlled prescription (50BA) reduced basal area to the minimum value, 50 square feet in western Montana and 40 square feet in eastern Montana for this forest type, and kept it there throughout the simulation. Basal areas in plots treated under the TB9 prescription reach an average of 90 square feet in the second or third treatment cycle and after a century they were all over 100 square feet. These plots are reaching the combinations of age and basal area where they would be considered at risk for attack by mountain pine beetles and western pine beetles (Gibson, personal communication). If such regimes are followed on a large proportion of the landscape, extensive insect outbreaks could eventually become a problem.

Merchantable volume by tree DBH class

Data for average removed merchantable volume of trees 7 inches DBH and larger are reported in appendix D. As with Douglas-fir cut volumes were not high. Seldom was the harvest volume over 600 cubic feet under the 50BA prescription and it never averaged more than 150 cubic feet under the TB9 prescription.

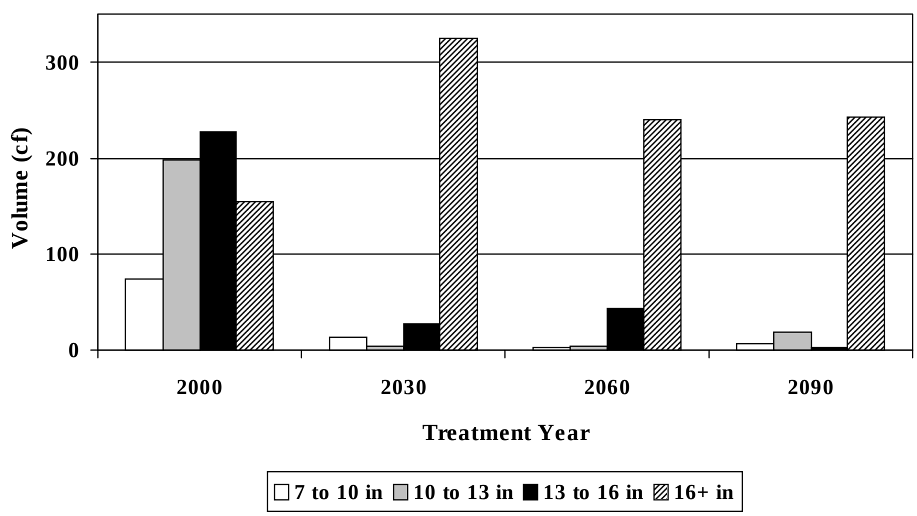
An example of the change in harvest volume for one case by entry is shown in figure 15.

Figure 15. Average merchantable volume (cubic feet) removed from ponderosa pine plots on National Forests in Western Montana with steep slopes and high fire hazard by prescription.



The TB9 prescription did not result in measurable merchantable volume after the first entry. This was true for all cases analyzed for ponderosa pine both in eastern and western Montana. The greatest volume was removed from the 50BA prescription during the first entry and the volume removed in subsequent entries declined. Trees in all diameter classes are removed during the first entry (figure 16). In subsequent entries volume was almost exclusively removed in the largest diameter class (16+ inches at breast height). This is a fairly common result in the other cases for ponderosa pine regardless of ownership, geographic location, or slope class.

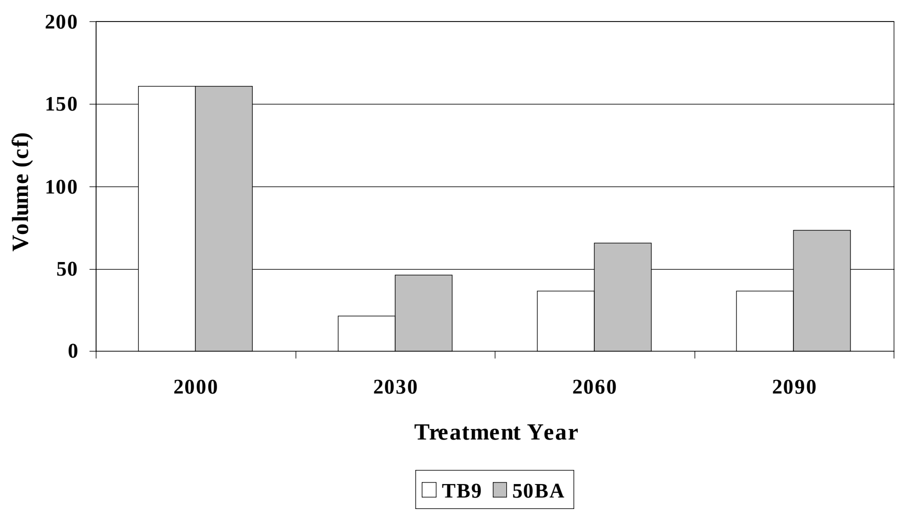
Figure 16. Average merchantable volume (cubic feet) removed from ponderosa pine plots on National Forests in Western Montana with steep slopes and high fire hazard. Change over time by tree diameter at breast height.



Unutilized volume of 1 to 7 inch DBH trees

Under both prescriptions the initial entry yields by far the largest volume of trees in the 1 to 7 inch DBH class. Characteristic results for the total stem volume of trees less than 7 inches DBH are illustrated in figure 17. Depending on the case the volume cut in this size class ranged from about 160 cubic feet to more than 350 cubic feet in the initial entry and between 50 and 150 cubic feet in subsequent entries (appendix E). After the initial entry the volume of small trees cut was generally lower for the TB9 prescription and volumes from both prescriptions sometimes fluctuated, but they always remain well below the initial volume. There are few markets for trees less than 7 inches DBH in Montana. Occasionally there is a pulp market but otherwise posts and poles are the only outlets for this material, consequently most of this material will be either cut and treated in place or cut and left at the landing.

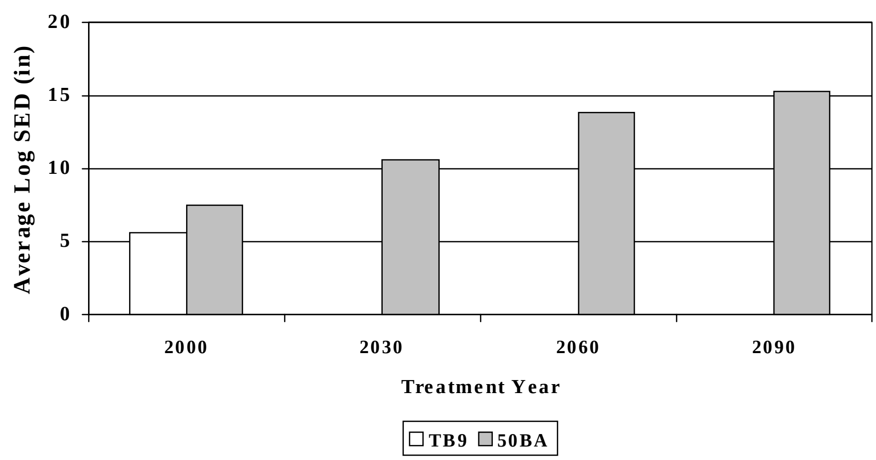
Figure 17. Unutilized volume (cubic feet) in 1-7 inch DBH trees from ponderosa pine plots on National Forests in Western Montana with steep slopes and high fire hazard by prescription.



Average small end diameter of removed logs

Results for average small-end log diameter (SED) for one case are shown in figure 18. The TB9 prescription always produces logs that are only slightly larger than 5 inches on the small end (5.0 to 5.7 inches). See appendix F. This happens because the largest merchantable tree removed under this prescription is 9 inches DBH and such trees do not yield logs much larger than 5 inches SED. Processing problems for this size log were already discussed for Douglas-fir but the problem is even more pronounced for ponderosa pine because dimension lumber is a poor option for this material (Lowell and Green, 2001).

Figure 18. Volume weighted average log small end diameters for wood removed from ponderosa pine plots on National Forests in Western Montana with steep slopes and high fire hazard by prescription.



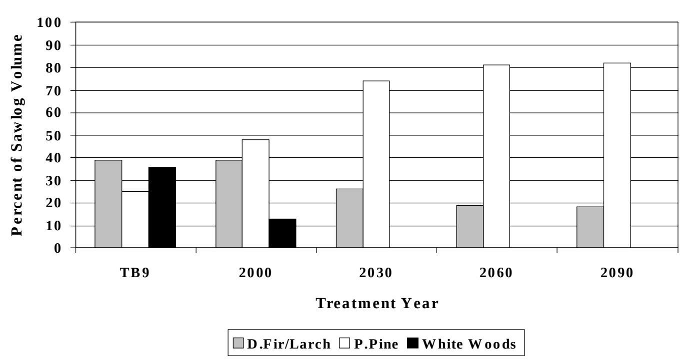
Log SED increases over time for the 50BA prescription and often reaches averages of greater than 15 inches. If logs in these diameter classes were to become available they would almost certainly find markets. They are small enough to be accommodated by newer high technology mills yet large enough, and in this situation old enough, that reasonable yields of higher valued appearance grades of lumber might be expected from them (Plank, 1985; Willits, 1994).

As with Douglas-fir, there was a tradeoff between log size and total volume removed. In the example shown in figures 15 and 17 volume removed declined by about one half between the first and the last entry. This means that over time the timber volume removed to maintain low fire hazard might decrease but the value of wood products might increase.

Percentage of volume removed by species

Ponderosa pine was the most important species removed from the ponderosa pine plots (appendix G). The results in figure 19 for the TB9 prescription show one of the few entries in any case where pine was not the major contributor of removed volume. The results shown for the 50BA prescription are far more characteristic. There was a moderate shift in species because the amounts of Douglas-fir and white woods removed tended to decline rapidly after the first entry so timber removed after the first entry was about 80% pine.

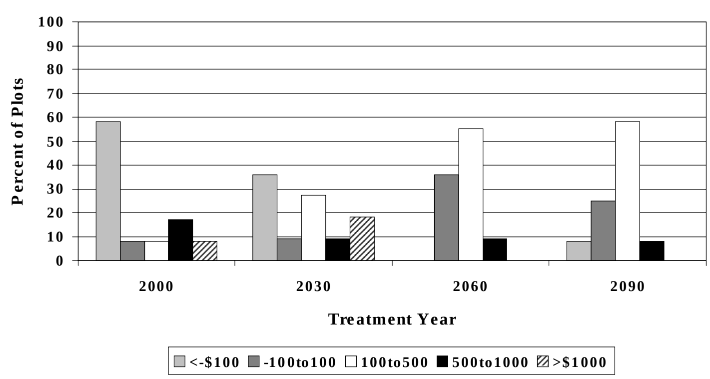
Figure 19. Percent of sawlog volume by species from ponderosa pine plots on National Forests in Western Montana with steep slopes and high fire hazard.



Financial analysis

Results from the financial analysis suggest that in many cases the first entry will require a subsidy of $100 or more per acre when either the TB9 or 50BA prescriptions are used. In fact, all of the plots treated with the TB9 prescription required at least a $100 subsidy. Except for the first entry, no merchantable volume was removed under the TB9 prescription, so activities under that prescription always had net negative returns. The situation improved over time under the 50BA prescription (figure 20). During the first entry a mix of diameters are removed (figure 16), but nearly 60% of the plots had negative net returns. In the subsequent entries almost all of the removed volume is from trees greater than 16 inches DBH. Many of these entries have a positive net value. These estimates include the costs of treating or removing material that it is not economical to utilize for products. They do not include the costs of prescribed fire, which occur on a 30-year cycle on high hazard stands whether or not a thinning is done. They also occur on a 30-year cycle on low hazard stands, but do not start until the beginning of the second cycle.

Figure 20. Net value for the 50BA prescription from ponderosa pine plots on National Forests in Western Montana with steep slopes and high fire hazard.



Montana Summary

Both the TB9 and 50BA prescriptions improved the fire hazard rating over the initial conditions but the 50BA prescription was more effective. The 50BA further reduced fire hazard with each sequential entry while the TB9 prescription merely lowered fire hazard rating and kept it there with subsequent treatments. The residual stands from the two prescriptions were also quite different and these differences increased over time. The most noticeable difference was the accumulation of basal area under the TB9 prescription. Over the course of many decades this will create very different stand conditions. The 50BA prescription resulted in less dense stands with fewer, but larger, trees than the TB9 prescription. Neither prescription, as written, makes a provision for recruitment of young trees into the overstory so this aspect of the prescriptions would need to be changed if they were used operationally.

The TB9 prescription does not produce substantial amounts of merchantable timber and after the first entry it does not produce any merchantable timber. The 50BA prescription produces merchantable timber at every entry and the size of the trees removed increases with each subsequent entry, although volume declines with time. Both prescriptions yield moderate amounts (usually 100 to 400 cubic feet per acre) of small trees (<7 inches DBH) in the first entry but in later entries they produce much less of this small timber. This is primarily a result of the use of prescribed burning following each entry. Without the prescribed burns, small trees would probably be more abundant. The result does suggest that, if a wide scale prescribed burning schedule were implemented, it would be important to plan for a declining volume of small diameter timber over time regardless of the prescription(s).

Only small sawlogs are produced from the TB9 prescription and none are produced after the first entry. Unless they are available in large volumes with a reliable supply, for example sufficient volumes to supply a stud mill for 5 to 10 years, it is unlikely that they will find markets. The 50BA prescription produces larger logs and their size increases over time. The fact that there was no species shift over time suggests that size is a more important issue than species mix. Understanding the log mix from these two types of prescriptions might make it possible to implement a variety of prescriptions within the working circles of various mills and in this way supply a resource that could be used. Coordination between mill owners and forest planners would probably be necessary to array treatments in such a way that an industry with an appropriate capacity and product mix could be developed to handle the material produced from fire hazard reduction treatments.

Financial analyses suggest that at least initially, the two prescriptions analyzed here will require subsides to implement in a large proportion of the forest conditions in Montana even without considering the cost of the prescribed fire treatments. The results also suggest that using prescriptions like the 50BA prescription the situation could improve with time.

NEW MEXICO

Dry Mixed Conifers

The total area and number of FIA inventory plots included in this analysis for the dry mixed conifer forest type are shown in appendix A. Dry mixed conifer plots were segregated by high hazard (<25 mph wind speed) and low/moderate hazard (25+ mph wind speed) for the analysis presented here. For brevity these two groups are referred to as high fire hazard and low fire hazard in all of the tables for this species.

Treatment effect on fire hazard

Regression analysis indicated both a time trend (positive slope coefficient on decade) and a cyclical treatment effect (a positive coefficient on the decade following burning and a smaller negative coefficient on the decade following thinning) on average crowning index for both the TB9 and the 50BA prescriptions in the dry mixed conifer high hazard stands (figure 21). This means that each successive prescribed fire brought the crowning index to a higher level (a lower hazard) than the previous one. The negative effect in the decade following thinning was similar in magnitude to the positive time trend. Therefore the only decades where the fire hazard increased were those decades when the prescribed burning occurred. It is not surprising that thinning did not have a strong effect statistically because after the first thinning many stands did not qualify for any further thinning during the simulation period. Although the trends identified here are large, the regressions are weak in explaining the total variation. It is probably unreasonable to draw conclusions about the effectiveness of the individual treatments from this analysis. It is reasonable to conclude that the treatments in aggregate have a large effect on crowning index.

Figure 21. Predicted average crowning index over time for high hazard dry mixed conifer plots in New Mexico by prescription.

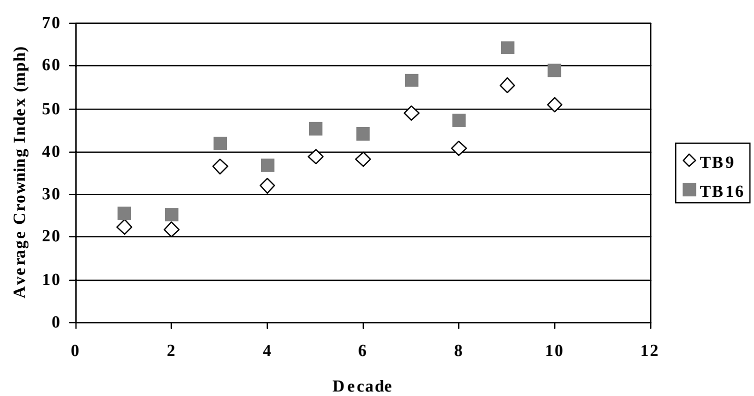
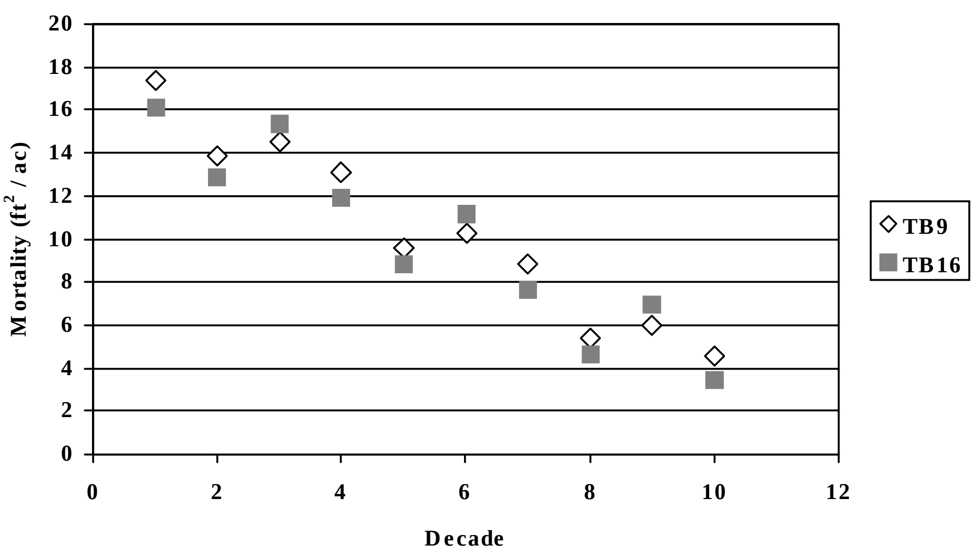


Figure 22 shows the analogous comparison for the predicted average basal area mortality resulting from prescribed burns. The effect on potential basal area mortality is almost the same for the two prescriptions. In both cases there is a time trend (a negative coefficient on decade) and an effect in the decade following the decade in which prescribed burning is done (a negative coefficient on the decade following prescribed fire). It is also interesting that at the end of the simulation period the potential average basal area mortality is very similar to what was found in both ponderosa pine and Douglas-fir forest types in Montana (approximately 5%). This result suggests that by the 10th decade of the simulation both prescriptions create stand conditions where trees are relatively resilient to low intensity fires.

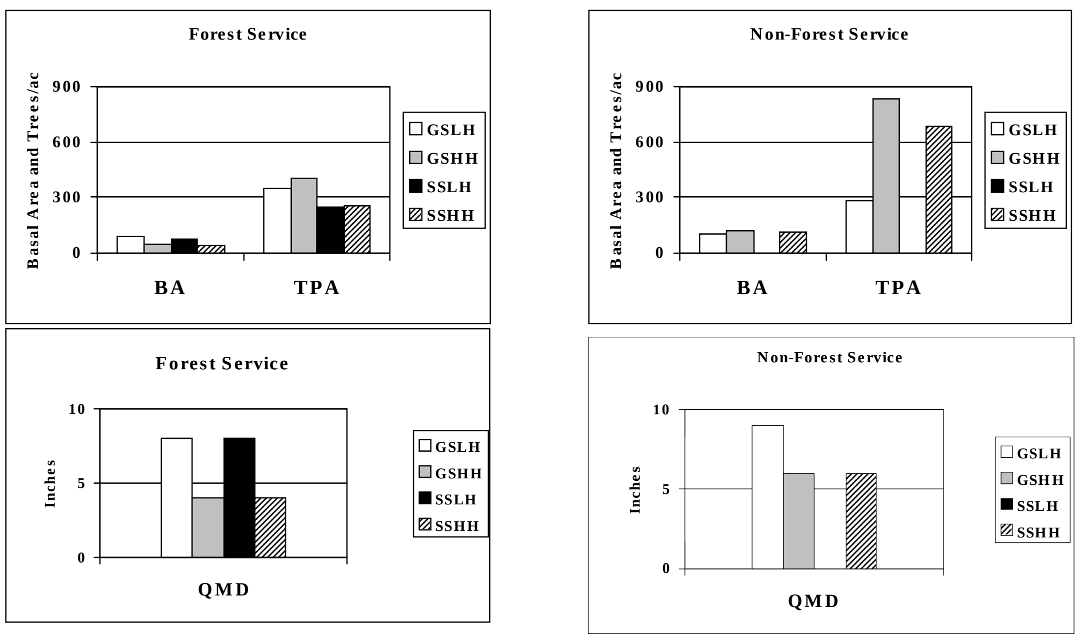
Figure 22. Predicted average basal area mortality over time for high hazard dry mixed conifer stands in New Mexico by prescription.



Initial stand summary

When paired by owner and slope, the initial stand conditions for high and low fire hazard cases differ in that low hazard stands clearly have larger trees and fewer trees per acre. Basal areas are similar and do not have a consistent pattern of differences (figure 23).

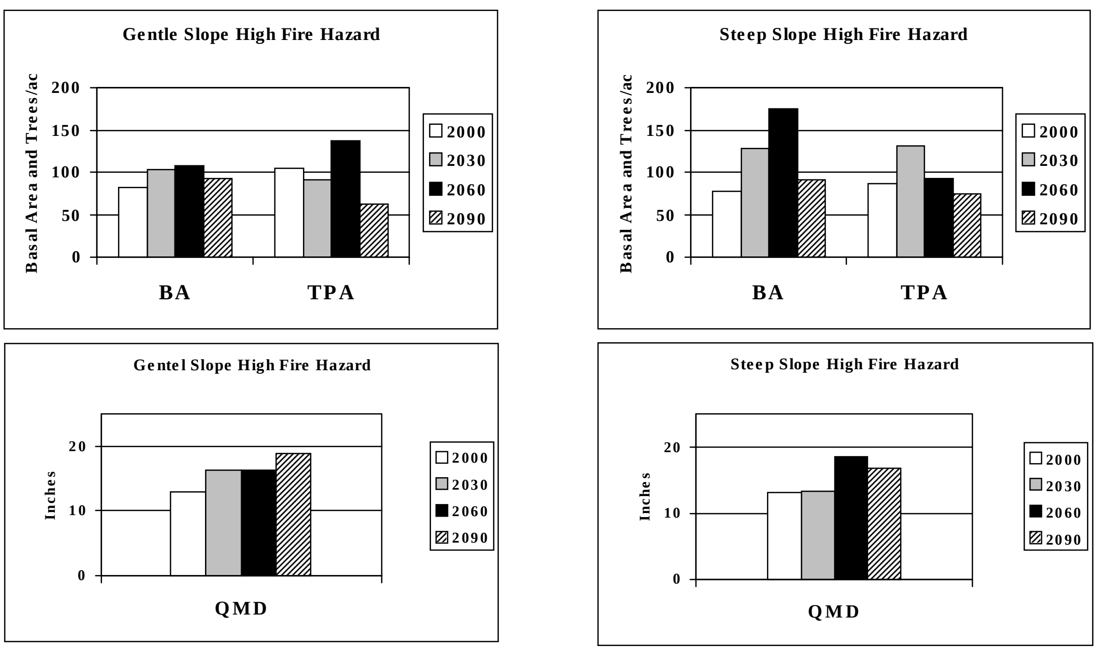
Figure 23. Initial conditions for dry mixed conifer plots in New Mexico: basal area (BA; sq.ft./ac), number of trees per acre (TPA), and quadratic mean diameter (QMD; in.) and reported by gentle slope low or high fire hazard (GSLH or GSHH) and steep slope low or high fire hazard (SSLH or SSHH).



Residual stand summary

The residual stand summary shows conditions after thinning for thinned stands only. It is important to understand that after the first thinning occurs (year 2000 for high hazard stands and year 2030 for low hazard stands) many stands are never thinned again. The residual stand summaries beyond that period generally represent less than a third of the total stands for that case. Thinned stands show basal area stabilizing at around 80 sq. ft. (the required minimum for second and all future thinnings) whether it started above or below that level. The number of trees per acre tended to fluctuate depending on the amount of regeneration and the effect of thinning and prescribed fire on suppressing it. Quadratic mean diameter tends to increase except in those cases where large pulses of regeneration cause the average basal area per tree to drop (appendix C). Two examples that cover most of the range in residual stand characteristics are shown in figure 24.

Figure 24. Residual conditions over time for dry mixed conifer high fire hazard plots on gentle and steep slopes from New Mexico on non-National Forests, (average values for thinned plots only), TB9 prescription: basal area (BA; sq.ft./ac), number of trees per acre (TPA), and quadratic mean diameter (QMD; in.).



Basal areas do not generally reach extreme levels under repeated entries of either the TB9 or TB16 prescription in this forest type and as a result insects and disease outbreaks would probably not be of as widespread a concern as they are for some of the cases in Montana (appendix A).

Merchantable volume by tree DBH class

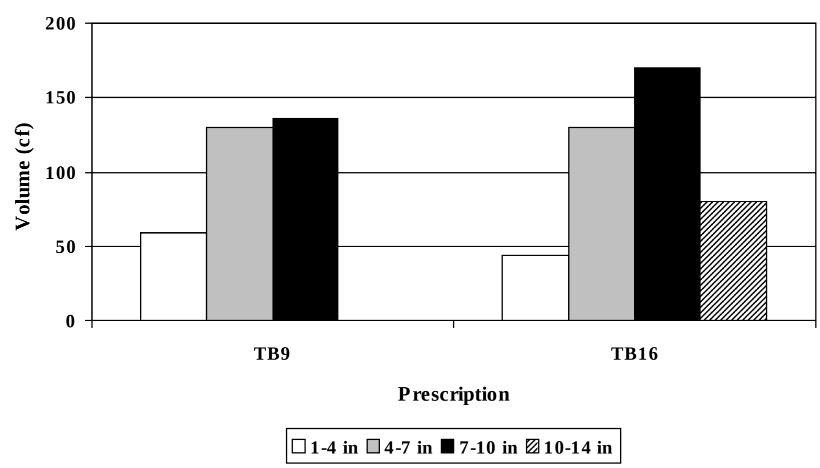
Three of the low hazard cases produce small volumes (<175 cf) of merchantable timber under the TB16 prescription during the first entry. None of the other cases produce any merchantable timber from the first entry and only one case; non-Forest Service, steep slope, high fire hazard; yields merchantable timber in the second thinning cycle (177 cf). No merchantable timber is removed from any of the other cases.

The low yields of sawlogs results from a combination of stand conditions, the type of prescriptions and the utilization standard. Prescriptions that create generally more open conditions or involve group selections would yield greater quantities and larger diameter sawlogs than the thin from below prescriptions simulated here. The market for small sawlogs is, however, very limited in New Mexico and indeed in the entire Southwest (Mater Engineering, 1998; Temple et al., 1999; Larson and Mirth, 2001) so it is not clear whether such logs would find purchasers even if they were available. Much of the existing capacity in the Southwest was established to process larger and older pine logs than would be expected from most restoration treatments and in their survey of the existing industry Mater Engineering (1998) listed only one sawmill mill that purchased logs in the 9 inch diameter range and none that used smaller logs. They did identify several users of house logs who purchase logs down to 8 inches SED and 8 feet long, but it is unlikely that these manufacturers could use substantially larger volumes or these short small diameter logs then they already do.

Unutilized volume of 1 to 14 inch DBH trees

The volumes of small trees that need to be dealt with to implement the prescriptions in the first thinning cycle are not large. They are typically 100 to 300 CF per acre for the TB9 prescription and 150 to 500 CF per acre for the TB16 prescription. These volumes tended to be distributed over all diameter classes with greater volumes being in the classes above 7 inches DBH. This is an encouraging result for those who are interested in trying to find uses for currently submerchantable material (see LeVan-Green and Livingston, 2001) because it means that of the volume that might potentially be removed more of it is in size classes that approach current merchantability standards than in the very small classes. Figure 25 shows a case that is on the high end of the range. After the first entry the volumes are typically much less than in the initial thinning. But in addition many stands are not thinned at all after the initial thinning because they do not build up the 80 sq. ft. of basal area required to qualify for a subsequent thinning. Details for all cases are found in appendix E.

Figure 25. Unutilized volume (cubic feet) in 1-14 inch DBH trees from dry mixed conifer plots on non-Forest Service lands with gentle slopes and high fire hazard in New Mexico by prescription. Total stem volume removed by tree DBH.



Average small end diameter of removed logs

Merchantable sawlogs were only produced in one entry in each of four cases (appendix F). These logs varied from 10.0 to 10.2 inches SED. A size for which according to Mater Engineering (1998) there should be several outlets in the southwest.

Percentage of volume removed by species

There are so many cases where no merchantable timber is harvested that it is not possible to identify any common patterns in the species mix initially or any change in the species mix over time (appendix G).

Financial analysis

It appears that thinnings that would yield a positive net return when valued for conventional solid wood products are few and far between. There is an occasional stand where the net return for the TB16 regime falls in the plus or minus $100 category. None of the TB9 cases showed a net return in the plus or minus $100 category. In the majority of cases the net return for both regimes falls in the -$500 to -$100 category. This includes the cost of slashing and treating trees less than 4 inches DBH and the cost of skidding or yarding other unutilized trees to a landing. It does not include the cost of prescribed fire that occurs 10 years after the first thinning and on a 20-year cycle thereafter (appendix I).

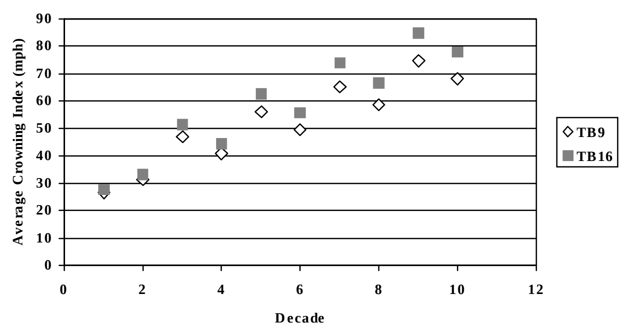
Ponderosa Pine

The total area and number of FIA inventory plots included in this analysis for the ponderosa pine forest type are shown in appendix A. Ponderosa plots were segregated by high hazard (<25 mph wind speed) and low/moderate hazard (25+ mph wind speed) for the analysis presented here. For brevity these two groups are referred to as high fire hazard and low fire hazard in all of the tables for this species.

Treatment effect on fire hazard

Regression analysis indicated both a time trend (positive slope coefficient on decade) and a cyclical treatment effect (a positive coefficient on the decade following burning) on average crowning index for both the TB9 and the 50BA prescriptions in the ponderosa pine high hazard stands (figure 26).

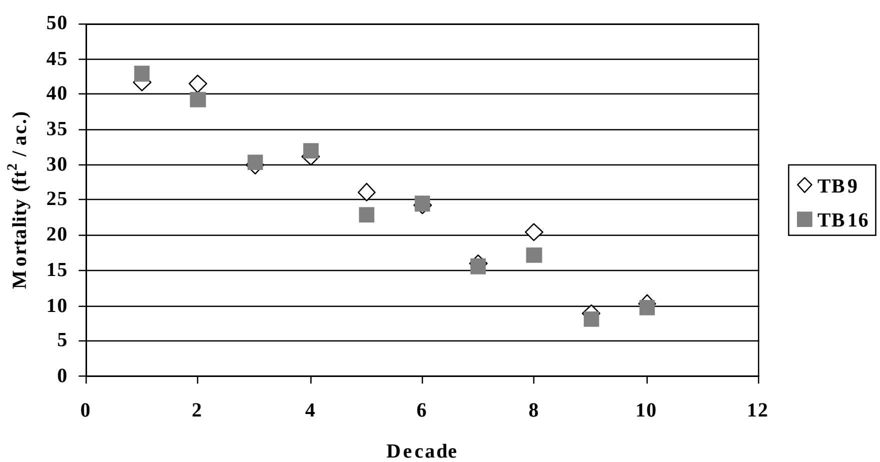
Figure 26. Predicted average crowning index over time for high hazard ponderosa pine plots in New Mexico by presciption.



This means that each subsequent prescribed fire brought the crowning index to a higher level (a lower hazard) than the previous one. Therefore the only decades where the fire hazard got worse were those decades when the prescribed burning occurred. It is not surprising that thinning did not enter the equation because after the first thinning many stands did not qualify for any further thinning during the simulation period. These results suggest that after the stands have been thinned (a prerequisite to doing prescribed burning) that maintenance burning probably has a bigger effect on maintaining a low fire hazard than thinning has.

Figure 27 shows the analogous comparison for the predicted average basal area mortality resulting from prescribed burns. The effect on potential basal area mortality is almost the same for the two prescriptions. In both cases there is a time trend (a negative coefficient on decade) and an effect in the decade following the decade in which prescribed burning is done (a negative coefficient on the decade following prescribed fire). There is also a small positive effect (increasing potential mortality) in the decade following thinning, but it is small enough that the prediction points still almost plot on top of each other. The potential basal area mortality begins much higher for ponderosa pine in New Mexico than for ponderosa pine on Montana, Douglas-fir in Montana, and dry mixed conifer in New Mexico (Over 40% versus about 20%). By the end of the simulation period, however, it is only about 5% higher (10% versus 5%). This result suggests that by the 10th decade of the simulation both prescriptions create stand conditions where trees are relatively resilient to low intensity fires.

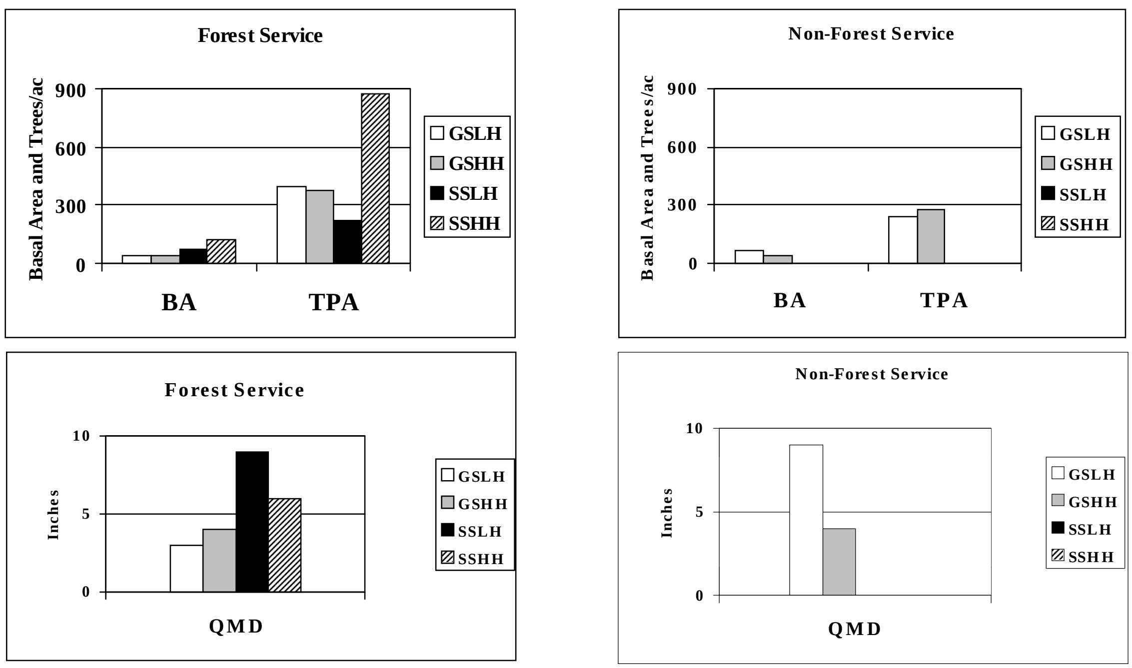
Figure 27. Predicted average basal area mortality over time for high hazard ponderosa pine plots in New Mexico by prescription.



Initial stand summary

There is no obvious pattern of differences between high hazard stands and low hazard stands in the ponderosa pine forest type in New Mexico (figure 28). This is in sharp contrast to the data for Montana where low hazard stands consistently had lower basal areas, and fewer but larger trees (figure 3).

Figure 28. Initial conditions for ponderosa pine plots in New Mexico: basal area (BA; sq.ft./ac), number of trees per acre (TPA), and quadratic mean diameter (QMD; in.) and reported by gentle slope low or high fire hazard (GSLH or GSHH) and steep slope low or high fire hazard (SSLH or SSHH).

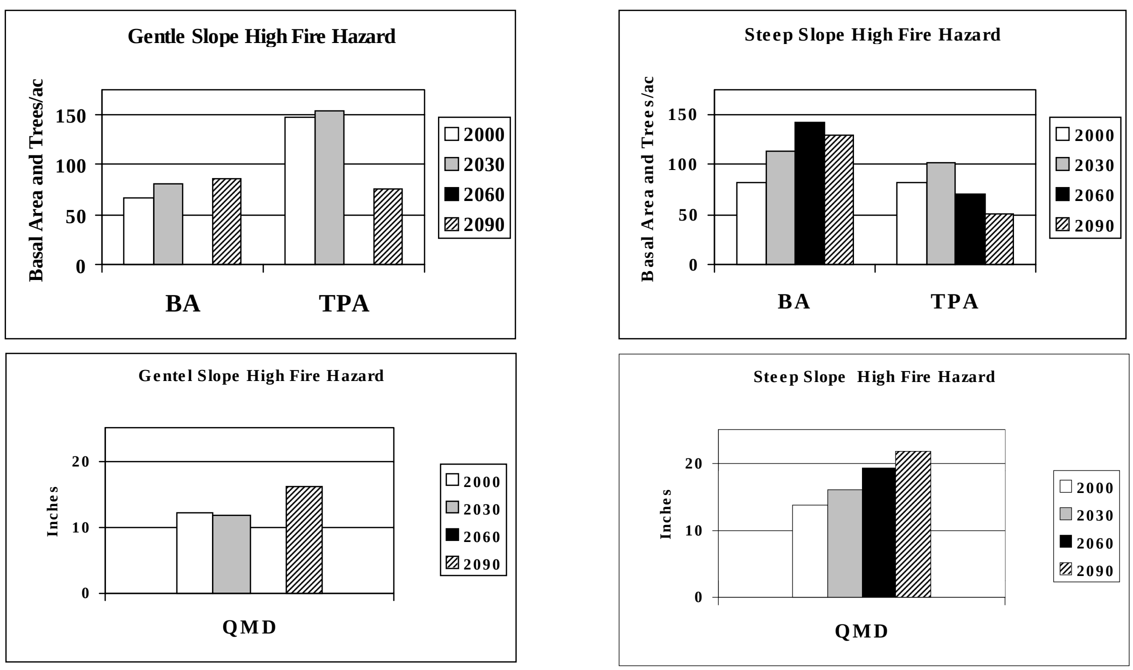


Residual stand summary

The results for ponderosa pine in New Mexico were different from those for Montana (appendix C). In the New Mexico simulation, basal area did not always accumulate over time in response to repeat low thinnings as it did for ponderosa pine in Montana.

In two of the three high hazard cases, the prescriptions reduced basal area to the minimum of 80 sq. ft. by the second entry then kept it at that level through all subsequent entries. In the other case, basal area increased between each of the first three entries then declined slightly during the last entry. These two results are illustrated in figure29. The other stand characteristics varied fairly consistently over the simulation. Trees per acre generally declined with each subsequent entry and quadratic mean diameter generally increased but occasionally there was a large pulse of regeneration that greatly increased trees per acre.

Figure 29. Residual conditions over time for ponderosa pine high fire hazard plots on gentle and steep slopes from National Forests in New Mexico, (average values for thinned plots only), TB9 prescription: basal area (BA; sq.ft./ac), number of trees per acre (TPA), and quadratic mean diameter (QMD; in.).



The different responses observed for basal area for low thinned plots in New Mexico and Montana might have resulted from basic differences in the prescriptions. In

Montana, each plot was evaluated for thinning every 30 years. A prescribed burn was applied whether or not the plot was eligible for thinning. In New Mexico prescribed burning followed the first thinning by 10 years and then was repeated on a 20-year cycle. Sometimes this coincided with the 30 year thinning cycle and sometimes it did not. It is also possible that growing conditions in New Mexico are sufficiently different that they do not promote accumulation of basal area while those in Montana do. If the difference in results is correct and not an artifact of the simulation, it means that conditions thought to promote insect and disease outbreaks might be less likely in New Mexico then they are in Montana under repeated application of the TB9 prescription.

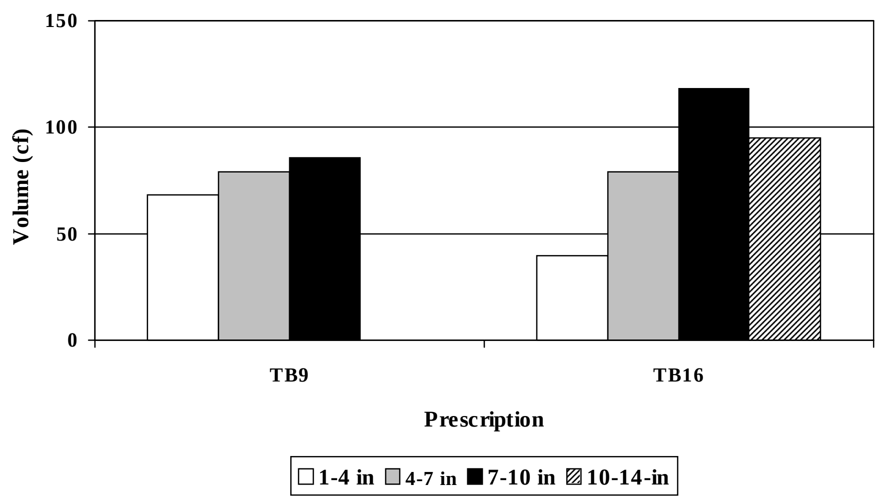
Merchantable volume by tree DBH class.

The utilization standard for logs in New Mexico was assumed to be 10 inches SED and this roughly corresponds to a 14-inch DBH tree. No volume from the TB9 prescription is considered merchantable in our analysis and only logs that come from trees greater than 14 inches DBH in the TB16 prescription are counted as merchantable. As a result in the first entry only two cases for ponderosa pine plots in New Mexico produced any merchantable volume (appendix D). The remainder of the volume was classified as unutilized.

Unutilized volume of 1 to 14 inch DBH trees.

In most cases the only volume cut in either the TB9 or TB16 prescription after the first entry was in the 1-4 inch DBH class. The exceptions were the second and fourth entry for high hazard plots on steep slopes in National Forests and the fourth entry for gentle slope plots in the same ownership and hazard class. Cut volumes in the first entry were generally less than 300 cubic feet and often much lower than that (appendix E). An example of unutilized volumes for the steep slope, high fire hazard, National Forest case is shown in figure 30. More volume is cut in the 7 to 10 inch diameter class under the TB16 prescription than the TB9 prescription because 10 inch DBH trees are sometimes removed.

Figure 30. Unutilized volume (cubic feet) in 1-14 inch DBH trees from ponderosa pine plots on National Forests with steep slopes and high fire hazards in New Mexico by prescription. Total stem volume removed by tree DBH.



Although trees in the 4 to 14 inch diameter range are not considered merchantable in this analysis, considerable research effort is being expended in trying to find ways to process this type of material to partially or wholly offset the costs of fuels reduction treatments (Larson and Mirth, 2001; Lowell and Green, 2001; Barbour, 1999; LeVan-Green and Livingston, 2001; Wolfe and Hernandez, 1999). Even so, there are currently only limited markets for logs less than 10 inches SED (Mater Engineering, 1998, Temple et al., 1999).

Average small end diameter of removed logs.

Two low hazard ponderosa pine cases in New Mexico yielded merchantable logs. They had average SEDs of 10.0 and 9.9 inches. No merchantable logs were produced from any of the high hazard ponderosa pine cases in New Mexico (appendix F). If merchantability standards were changed to match those used for the Montana analysis some sawlogs would be produced from all of the other cases. There was, however, much less volume removed from the New Mexico plots. So, even if markets existed for small logs much more area would need to be thinned to supply a comparable size mill in New Mexico.

Percentage of volume removed by species.

Ponderosa pine was the most important species removed from the two cases where sawlogs were produced accounting for 76% and 91% of the volume. In both cases most of the remaining volume was in white woods with only a small amount of Douglas-fir (appendix G). The value of this material for forest products depends on the age and growing conditions of these stands. Larger and older pine with few scattered branches could yield high value appearance grades of lumber but smaller and younger pine does not make good quality structural lumber (Erikson et al., 2000, Willits et al., 1996) or veneer (Willits et al. 1997).

Financial analysis

Apparently few thinning treatments in this forest type will yield a positive net return when valued for conventional solid wood products. There is an occasional stand where the net return for the TB16 regime falls in the plus or minus $100 category. None of the TB9 cases showed a net return in the plus or minus $100 category. In the majority of cases the net return for both regimes falls in the -$500 to -$100 category. This includes the cost of slashing and treating trees less than 4 inches DBH and the cost of skidding or yarding other unutilized trees to a landing. It does not include the cost of prescribed fire that occurs 10 years after the first thinning and on a 20-year cycle thereafter (appendix I).

New Mexico Summary

The thin from below regimes used in this analysis do not produce any noteworthy volume after the first entry. In addition, volume that is produced from the first entry is largely unmerchantable because of the structure of the existing industry in New Mexico. Even if markets were available for the smaller material removed during thinning treatments, average per acre volume yields are low. This may make it difficult to site and supply wood processing facilities that require large volumes to operate economically. The JFSP board is currently considering funding of additional work that will address the issues of capacity and potential supply (Prestemon and Apt, 2001).

Our results do, however, suggest that in most cases the thin from below regime in combination with regular prescribed burning usually does reduce fire hazard over the long term and does not result in an accumulation of basal area that might lead to insect or other forest health problems. Broad application of these treatments would likely be limited by considerations beyond fire hazard. For example, while some of our treatments create stands that would be a component of suitable habitat for the northern goshawk, goshawks and many other important wildlife species require a landscape composed of a variety of stand conditions (Reynolds et al. 1992).

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ACRONYM GLOSSERY

50BA - thin-from-below up to 50% of standing basal area with a minimum residual basal area

DBH - diameter at breast height

FEEMA - Financial Evaluation of Ecosystem Management Activities

FFE - Fire and Fuels Extension

FIA - Forest Inventory and Analysis

FVS - forest vegetation simulator

JFSP – Joint Fire Science Program

QMD - quadratic mean breast-height diameter

SED - small-end diameter of logs

TB9 - thin-from-below to 9 inches DBH with a minimum residual basal area

TB16 -thin-from-below to 16 inches DBH with a minimum residual basal area

APPENDICES

APPENDIX A - Acreages and Number of Inventory Plots

APPENDIX B - Average Initial Stand Characteristics

APPENDIX C - Average Residual Stand Characteristics

APPENDIX D - Average Volume of Utilized Trees

APPENDIX E - Average Volume of Unutilized Trees

APPENDIX F - Average Small End Diameter of Utilized Logs

APPENDIX G - Average Percent of Volume of Utilized Trees by Species

APPENDIX H - Cost and Log Price Assumptions

APPENDIX I - Average Proportion of Stands by Net Value Category

APPENDIX A
Acreages and Number of Inventory Plots

The number of forest inventory plots and the number of acres that they represent for each case (a combination of state, forest type, region, ownership, fire hazard, and slope) for which we report results.

A.1 Acreages and Number of Inventory Plots for Douglas-fir Forest Type in Montana

A.1.1

TYPE	TREATMENT:	Acres	Number of plots
Western MT			
NFS			
Steep slope, high fire hazard		1,110,929	50
Gentle slope, high fire hazard		391,177	50
Steep slope, low fire hazard		377,362	50
Gentle slope, low fire hazard		180,592	29
	Sub-total:	2,060,060	
NON-NFS			
Steep slope, high fire hazard		320,337	50
Gentle slope, high fire hazard		681,644	50
Steep slope, low fire hazard		247,955	44
Gentle slope, low fire hazard		582,582	50
	Sub-total:	1,832,518	
Eastern MT			
NFS			
Steep slope, high fire hazard		788,983	50
Gentle slope, high fire hazard		397,766	50
Steep slope, low fire hazard		196,576	31
Gentle slope, low fire hazard		177,926	28
	Sub-total:	1,561,251	
NON-NFS			
Steep slope, high fire hazard		394,057	50
Gentle slope, high fire hazard		322,964	50
Steep slope, low fire hazard		56,647	10
Gentle slope, low fire hazard		241,519	38
	Sub-total:	1,015,187	
	Total:	6,469,016	

A.2 Acreages and Number of Inventory Plots for Ponderosa Pine Forest Type in Montana

TYPE TREATMENT:		Acres	Number of plots
Western MT			
NFS			
Steep slope, high fire hazard		74,843	10
Gentle slope, high fire hazard		62,709	11
Steep slope, low fire hazard		57,627	12
Gentle slope, low fire hazard		43,472	10
	Sub-total:	238,651	
NON-NFS			
Steep slope, high fire hazard*		n/a	<10
Gentle slope, high fire hazard		194,724	28
Steep slope, low fire hazard		73,065	12
Gentle slope, low fire hazard		119,736	20
	Sub-total:	387,525	
Eastern MT			
NFS			
Steep slope, high fire hazard		24,137	13
Gentle slope, high fire hazard		222,140	32
Steep slope, low fire hazard*		n/a	<10
Gentle slope, low fire hazard*		n/a	<10
	Sub-total:	246,277	
NON-NFS			
Steep slope, high fire hazard		261,392	32
Gentle slope, high fire hazard		840,053	46
Steep slope, low fire hazard		167,702	26
Gentle slope, low fire hazard		565,328	39
	Sub-total:	1,834,475	
	Total:	2,706,928	

A.3 Acreages and Number of Inventory Plots for Dry Mixed Conifer Forest Type in New Mexico

TYPE TREATMENT:	Acres	Number of plots
Forest Service Ownership		
Steep slope, high fire hazard	368,876	50
Gentle slope, high fire hazard	505,578	50
Steep slope, low fire hazard	58,726	10
Gentle slope, low fire hazard	72,912	12
Sub-Total:	1,006,092	
Non-Forest Service Ownership		
Steep slope, high fire hazard	163,233	23
Gentle slope, high fire hazard	249,426	38
Steep slope, low fire hazard	n/a	<10
Gentle slope, low fire hazard	60,462	10
Sub-Total:	473,121	
Total:	1,479,213	

A.4 Acreages and Number of Inventory Plots for Ponderosa Pine Forest Type in New Mexico.

TYPE TREATMENT:	Acres	Number of plots
Forest Service Ownership		
Steep slope, high fire hazard	124,169	20
Gentle slope, high fire hazard	622,272	50
Steep slope, low fire hazard	66,952	10
Gentle slope, low fire hazard	765,147	50
Sub-Total:	1,578,540	
Non-Forest Service Ownership		
Steep slope, high fire hazard	n/a	<10
Gentle slope, high fire hazard	522,877	50
Steep slope, low fire hazard	n/a	<10
Gentle slope, low fire hazard	309,587	42
Sub-Total:	832,464	
Total:	2,411,004	

APPENDIX B
Average Initial Stand Characteristics

Average basal area (BA) (sq. ft./ac), average trees per acre (TPA), and average quadratic mean diameter (QMD) (inches) were all calculated for trees one inch in DBH and larger. The standard errors for each variable are also reported. It is important to recognize that these data represent average stand conditions and it is not possible to calculate the third variable from the other two as can be done for a single stand.

B.1 Average Initial Stand Characteristics for Douglas-Fir Forest Type in Montana

Western Montana, Forest Service Ownership

Gentle Slope - Low Hazard

Year: **1997**	BA	TPA	QMD
Mean	63	129	10.5
SE	*10*	*22*	*0.8*

Gentle Slope - High Hazard

Year: **1997**	BA	TPA	QMD
Mean	117	586	6.7
SE	*8*	*62*	*0.3*

Steep Slope - Low Hazard

Year: **1996**	BA	TPA	QMD
Mean	51	102	11.0
SE	*4*	*11*	*0.8*

Steep Slope - High Hazard

Year: **1997**	BA	TPA	QMD
Mean	126	451	8.0
SE	*8*	*51*	*0.4*

BA = Basal Area (sq.ft./ac) TPA = Trees/ac QMD = Quadratic mean diameter(in.)

SE = Standard Error (+/- Cubic Ft./ac.)

Note: Values are averages and cannot necessarily be cross-referenced.

B.1 Average Initial Stand Characteristics for Douglas-Fir Forest Type in Montana

Western Montana, Non - Forest Service Ownershi

Gentle Slope - Low Hazard

Year: **1995**	BA	TPA	QMD
Mean	48	142	8.0
SE	*6*	*22*	*0.7*

Gentle Slope - High Hazard

Year: **1997**	BA	TPA	QMD
Mean	124	656	6.9
SE	*8*	*79*	*0.4*

Steep Slope - Low Hazard

Year: **1989**	BA	TPA	QMD
Mean	60	183	9.5
SE	*4*	*23*	*0.6*

Steep Slope - High Hazard

Year: **1989**	BA	TPA	QMD
Mean	109	594	6.6
SE	*6*	*59*	*0.3*

BA = Basal Area (sq.ft./ac) TPA = Trees/ac QMD = Quadratic mean diameter(in.)

SE = Standard Error (+/- Cubic Ft./ac.)

Note: Values are averages and cannot necessarily be cross-referenced.

B.1 Average Initial Stand Characteristics for Douglas-Fir Forest Type in Montana

Eastern Montana, Forest Service Ownership

Gentle Slope - Low Hazard

Year: **1998**	BA	TPA	QMD
Mean	58	99	11.3
SE	*6*	*16*	*0.9*

Gentle Slope - High Hazard

Year: **1998**	BA	TPA	QMD
Mean	147	336	9.8
SE	*9*	*29*	*0.4*

Steep Slope - Low Hazard

Year: **1998**	BA	TPA	QMD
Mean	55	97	12.3
SE	*6*	*17*	*0.9*

Steep Slope - High Hazard

Year: **1998**	BA	TPA	QMD
Mean	131	451	8.5
SE	*9*	*60*	*0.5*

BA = Basal Area (sq.ft./ac) TPA = Trees/ac QMD = Quadratic mean diameter(in.)

SE = Standard Error (+/- Cubic Ft./ac.)

Note: Values are averages and cannot necessarily be cross-referenced.

B.1 Average Initial Stand Characteristics for Douglas-Fir Forest Type in Montana

Eastern Montana, Non - Forest Service Ownership

Gentle Slope - Low Hazard

Year: **1988**	BA	TPA	QMD
Mean	50	88	10.2
SE	*6*	*13*	*0.8*

Gentle Slope - High Hazard

Year: **1998**	BA	TPA	QMD
Mean	123	406	8.7
SE	*7*	*61*	*0.4*

Steep Slope - Low Hazard

Year: **1998**	BA	TPA	QMD
Mean	57	148	10.8
SE	*13*	*52*	*2.3*

Steep Slope - High Hazard

Year: **1998**	BA	TPA	QMD
Mean	115	458	8.0
SE	*6*	*59*	*0.4*

BA = Basal Area (sq.ft./ac) TPA = Trees/ac QMD = Quadratic mean diameter(in.)

SE = Standard Error (+/- Cubic Ft./ac.)

Note: Values are averages and cannot necessarily be cross-referenced.

B.2 Average Initial Stand Characteristics for Ponderosa Pine Forest Type in Montana

Western Montana, Forest Service Ownership

Gentle Slope - Low Hazard

Year: **1995**	BA	TPA	QMD
Mean	44	94	14.7
SE	*11*	*46*	*3.9*

Gentle Slope - High Hazard

Year: **1995**	BA	TPA	QMD
Mean	78	357	8.0
SE	*15*	*74*	*1.4*

Steep Slope - Low Hazard

Year: **1996**	BA	TPA	QMD
Mean	41	53	15.4
SE	*6*	*15*	*3.1*

Steep Slope - High Hazard

Year: **1997**	BA	TPA	QMD
Mean	84	179	11.0
SE	*8*	*42*	*1.0*

BA = Basal Area (sq.ft./ac) TPA = Trees/ac QMD = Quadratic mean diameter(in.)

SE = Standard Error (+/- Cubic Ft./ac.)

Note: Values are averages and cannot necessarily be cross-referenced.

B.2 Average Initial Stand Characteristics for Ponderosa Pine Forest Type in Montana

Western Montana, Non - Forest Service Ownershi

Gentle Slope - Low Hazard

Year: **1989**	BA	TPA	QMD
Mean	30	38	10.4
SE	*6*	*8*	*1.5*

Gentle Slope - High Hazard

Year: **1989**	BA	TPA	QMD
Mean	78	537	6.6
SE	*10*	*97*	*0.6*

Steep Slope - Low Hazard

Year: **1989**	BA	TPA	QMD
Mean	33	55	12.8
SE	*5*	*16*	*1.3*

BA = Basal Area (sq.ft./ac) TPA = Trees/ac QMD = Quadratic mean diameter(in.)

SE = Standard Error (+/- Cubic Ft./ac.)

Note: Values are averages and cannot necessarily be cross-referenced.

B.2 Average Initial Stand Characteristics for Ponderosa Pine Forest Type in Montana

Eastern Montana, Forest Service Ownership

Gentle Slope - High Hazard

Year: **1997**	BA	TPA	QMD
Mean	80	270	8.0
SE	*12*	*49*	*0.6*

Steep Slope - High Hazard

Year: **1997**	BA	TPA	QMD
Mean	54	377	8.5
SE	*11*	*158*	*1.3*

BA = Basal Area (sq.ft./ac) TPA = Trees/ac QMD = Quadratic mean diameter(in.)

SE = Standard Error (+/- Cubic Ft./ac.)

Note: Values are averages and cannot necessarily be cross-referenced.

B.2 Average Initial Stand Characteristics for Ponderosa Pine Forest Type in Montana

Eastern Montana, Non - Forest Service Ownership

Gentle Slope - Low Hazard

Year: **1988**	BA	TPA	QMD
Mean	27	44	10.3
SE	*2*	*5*	*0.6*

Gentle Slope - High Hazard

Year: **1988**	BA	TPA	QMD
Mean	75	299	7.7
SE	*5*	*34*	*0.3*

Steep Slope - Low Hazard

Year: **1988**	BA	TPA	QMD
Mean	28	65	9.1
SE	*3*	*9*	*0.7*

Steep Slope - High Hazard

Year: **1988**	BA	TPA	QMD
Mean	66	390	6.9
SE	*6*	*69*	*0.4*

BA = Basal Area (sq.ft./ac) TPA = Trees/ac QMD = Quadratic mean diameter(in.)

SE = Standard Error (+/- Cubic Ft./ac.)

Note: Values are averages and cannot necessarily be cross-referenced.

B.3 Average Initial Stand Characteristics for Dry Mixed Conifer Forest Type in New Mexico

Forest Service Ownership

Gentle Slope - Low Hazard

Year: **1998**	BA	TPA	QMD
Mean	85	351	7.8
SE	*8*	*71*	*0.7*

Gentle Slope - High Hazard

Year: **1999**	BA	TPA	QMD
Mean	46	403	4.0
SE	*7*	*113*	*0.7*

Steep Slope - Low Hazard

Year: **1997**	BA	TPA	QMD
Mean	73	247	8.4
SE	*14*	*69*	*0.9*

Steep Slope - High Hazard

Year: **1999**	BA	TPA	QMD
Mean	37	252	4.1
SE	*6*	*71*	*0.7*

BA = Basal Area (sq.ft./ac) TPA = Trees/ac QMD = Quadratic mean diameter(in.)

SE = Standard Error (+/- Cubic Ft./ac.)

Note: Values are averages and cannot necessarily be cross-referenced.

B.3 Average Initial Stand Characteristics for Dry Mixed Conifer Forest Type in New Mexico

Non - Forest Service Ownership

Gentle Slope - Low Hazard

Year: **1999**	BA	TPA	QMD
Mean	98	285	9.0
SE	*14*	*66*	*0.7*

Gentle Slope - High Hazard

Year: **1999**	BA	TPA	QMD
Mean	119	836	5.8
SE	*8*	*109*	*0.3*

Steep Slope - High Hazard

Year: **1999**	BA	TPA	QMD
Mean	113	686	5.9
SE	*9*	*84*	*0.3*

BA = Basal Area (sq.ft./ac) TPA = Trees/ac QMD = Quadratic mean diameter(in.)

SE = Standard Error (+/- Cubic Ft./ac.)

Note: Values are averages and cannot necessarily be cross-referenced.

B.4 Average Initial Stand Characteristics for Ponderosa Pine Forest Type in New Mexico

Forest Service Ownership

Gentle Slope - Low Hazard

Year: **1999**	BA	TPA	QMD
Mean	39	397	2.8
SE	*7*	*110*	*0.5*

Gentle Slope - High Hazard

Year: **1999**	BA	TPA	QMD
Mean	42	379	3.8
SE	*7*	*101*	*0.6*

Steep Slope - Low Hazard

Year: **1998**	BA	TPA	QMD
Mean	75	223	9.3
SE	*9*	*46*	*0.9*

Steep Slope - High Hazard

Year: **1998**	BA	TPA	QMD
Mean	118	872	5.6
SE	*10*	*126*	*0.4*

BA = Basal Area (sq.ft./ac) TPA = Trees/ac QMD = Quadratic mean diameter(in.)

SE = Standard Error (+/- Cubic Ft./ac.)

Note: Values are averages and cannot necessarily be cross-referenced.

B.4 Average Initial Stand Characteristics for Ponderosa Pine Forest Type in New Mexico

Non - Forest Service Ownership

Gentle Slope - Low Hazard

Year: **1999**	BA	TPA	QMD
Mean	68	241	8.8
SE	*6*	*47*	*0.5*

Gentle Slope - High Hazard

Year: **1999**	BA	TPA	QMD
Mean	37	274	3.8
SE	*6*	*80*	*0.6*

BA = Basal Area (sq.ft./ac) TPA = Trees/ac QMD = Quadratic mean diameter(in.)

SE = Standard Error (+/- Cubic Ft./ac.)

Note: Values are averages and cannot necessarily be cross-referenced.

APPENDIX C
Average Residual Stand Characteristics

Average residual stand characteristics are intended to provide resource managers with an idea of the composition and structure of residual stands after each thinning entry. These summary statistics were generated using output from the FVS growth model simulations from the individual FIA plots included in each case. Average BA (sq. ft./ac), average TPA and average QMD are averages of plot level results weighted by the expansion factor for the plot. Trees less than 1 inch in DBH were eliminated from this analysis to give a more meaningful representation of the overstory stand conditions.

The major focus of this analysis was the types of raw materials that might be produced from various cutting treatments. As a result, only plots where thinnings were applied in any given entry are included in the analysis presented for residual stand conditions. This makes the information reported in this appendix consistent with the other results included in this report. It is a relatively simple matter to alter the Microsoft Access reports to include any combination of plots so the tables and appendices could include all plots, only the unthinned plots, or only the thinned plots (as is reported here).

C.1 Average Residual Stand Characteristics for Douglas-Fir Forest Type in Montana

Western Montana, Forest Service Ownership

Gentle Slope - Low Hazard

Year: **2030**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	119	92	16.9	12
SE		*10*	*18*	*0.8*	*2*
Mean	50%	85	57	20.8	37
SE		*3*	*14*	*1.3*	*3*
Year: 2060	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	126	54	21.4	7
SE		*9*	*5*	*0.8*	*2*
Mean	50%	80	25	26.3	26
SE			*4*	*1.1*	*2*
Year: 2090	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	142	41	25.3	5
SE		*9*	*3*	*0.7*	*1*
Mean	50%	80	20	29.7	22
SE			*3*	*1.1*	*1*

Gentle Slope - High Hazard

Year: **2000**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	92	100	13.0	32
SE		*6*	*6*	*0.3*	*2*
Mean	50%	85	106	13.8	38
SE		*2*	*11*	*0.6*	*2*
Year: 2030	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	97	72	16.0	7
SE		*5*	*4*	*0.4*	*2*
Mean	50%	80	66	17.5	20
SE			*10*	*0.7*	*1*
Year: 2060	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	111	56	19.2	5
SE		*5*	*3*	*0.4*	*1*
Mean	50%	80	39	21.2	19
SE			*3*	*0.6*	*1*
Year: 2090	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	124	48	21.9	3
SE		*5*	*2*	*0.4*	*1*
Mean	50%	80	26	24.8	18
SE			*2*	*0.6*	*1*

Steep Slope - Low Hazard

Year: **2030**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	100	69	18.2	9
SE		*6*	*9*	*0.7*	*1*
Mean	50%	82	40	21.7	32
SE		*1*	*5*	*1.0*	*3*
Year: 2060	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	116	47	22.4	4
SE		*6*	*3*	*0.6*	
Mean	50%	80	32	25.0	23
SE			*7*	*0.9*	*1*
Year: 2090	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	132	39	25.9	3
SE		*7*	*3*	*0.6*	
Mean	50%	80	21	29.3	19
SE			*4*	*0.8*	*1*

Steep Slope - High Hazard

Year: **2000**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	108	109	13.8	25
SE		*6*	*7*	*0.4*	*2*
Mean	50%	87	81	15.4	40
SE		*2*	*7*	*0.6*	*2*
Year: 2030	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	135	76	18.5	2
SE		*7*	*5*	*0.4*	*1*
Mean	50%	80	35	21.5	26
SE			*2*	*0.6*	*1*
Year: 2060	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	151	60	21.9	4
SE		*8*	*4*	*0.4*	*1*
Mean	50%	80	22	26.3	23
SE			*1*	*0.5*	*1*
Year: 2090	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	167	53	24.8	3
SE		*8*	*3*	*0.5*	
Mean	50%	80	18	29.7	20
SE			*1*	*0.5*	*1*

Rx = Treatment BA = Basal Area (sq.ft./ac) TPA = Trees/ac QMD = Quadratic mean diameter(in.)

SE = Standard Error (+/- Cubic Ft./ac.) %BACUT = % of total basal area harvested

Note: Values are averages and cannot necessarily be cross-referenced.

C.1 Average Residual Stand Characteristics for Douglas-Fir Forest Type in Montana

Western Montana, Non - Forest Service Ownershi

Gentle Slope - Low Hazard

Year: **2030**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	110	71	17.3	10
SE		*6*	*5*	*0.4*	*1*
Mean	50%	82	43	20.3	37
SE		*1*	*4*	*0.9*	*3*
Year: 2060	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	118	57	20.8	6
SE		*7*	*6*	*0.6*	*1*
Mean	50%	80	45	24.5	23
SE			*18*	*0.9*	*1*
Year: 2090	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	130	42	24.2	5
SE		*8*	*2*	*0.6*	*1*
Mean	50%	80	20	29.0	21
SE			*3*	*0.7*	*1*

Gentle Slope - High Hazard

Year: **2000**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	86	110	12.2	36
SE		*5*	*6*	*0.5*	*3*
Mean	50%	84	128	13.3	39
SE		*1*	*15*	*0.7*	*2*
Year: 2030	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	97	69	16.4	7
SE		*5*	*4*	*0.4*	*2*
Mean	50%	80	59	17.3	22
SE			*6*	*0.7*	*2*
Year: 2060	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	106	52	19.4	5
SE		*5*	*2*	*0.4*	*1*
Mean	50%	80	41	21.4	19
SE			*6*	*0.7*	*1*
Year: 2090	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	121	44	22.5	3
SE		*6*	*2*	*0.3*	
Mean	50%	80	31	24.8	17
SE			*6*	*0.7*	*1*

Steep Slope - Low Hazard

Year: **2030**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	103	73	16.9	7
SE		*5*	*5*	*0.5*	*1*
Mean	50%	80	49	18.8	31
SE			*4*	*0.7*	*2*
Year: 2060	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	126	57	20.8	1
SE		*5*	*3*	*0.5*	
Mean	50%	80	28	24.1	20
SE			*2*	*0.7*	*1*
Year: 2090	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	145	48	24.2	1
SE		*6*	*3*	*0.5*	
Mean	50%	80	20	28.0	17
SE			*1*	*0.6*	*1*

Steep Slope - High Hazard

Year: **2000**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	78	96	12.2	37
SE		*6*	*5*	*0.3*	*2*
Mean	50%	83	139	12.0	33
SE		*1*	*12*	*0.6*	*2*
Year: 2030	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	95	63	16.5	3
SE		*7*	*4*	*0.3*	*1*
Mean	50%	80	57	17.7	20
SE			*5*	*0.8*	*2*
Year: 2060	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	112	51	19.9	2
SE		*8*	*3*	*0.4*	
Mean	50%	80	35	21.9	20
SE			*3*	*0.7*	*1*
Year: 2090	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	124	43	22.8	2
SE		*8*	*2*	*0.4*	
Mean	50%	80	26	25.7	17
SE			*3*	*0.7*	*1*

Rx = Treatment BA = Basal Area (sq.ft./ac) TPA = Trees/ac QMD = Quadratic mean diameter(in.)

SE = Standard Error (+/- Cubic Ft./ac.) %BACUT = % of total basal area harvested

Note: Values are averages and cannot necessarily be cross-referenced.

C.1 Average Residual Stand Characteristics for Douglas-Fir Forest Type in Montana

Eastern Montana, Forest Service Ownership

Gentle Slope - Low Hazard

Year	Stat	Rx	BA	TPA	QMD	%BA CUT
2030	Mean	9 in.	89	119	12.0	22
	SE		*11*	*18*	*0.5*	*5*
	Mean	50%	71	64	17.9	32
	SE		*1*	*15*	*1.1*	*3*
2060	Mean	9 in.	106	164	10.9	1
	SE					
	Mean	50%	70	27	23.2	20
	SE			*3*	*0.9*	*2*
2090	Mean	9 in.	110	44	21.5	5
	SE		*6*	*2*	*0.5*	*1*
	Mean	50%	70	21	26.7	16
	SE			*3*	*1.0*	*1*

Steep Slope - Low Hazard

Year	Stat	Rx	BA	TPA	QMD	%BA CUT
2030	Mean	9 in.	93	204	11.3	15
	SE		*10*	*86*	*1.0*	*3*
	Mean	50%	71	47	20.6	34
	SE		*1*	*15*	*1.5*	*4*
2060	Mean	9 in.	113	97	14.6	3
	SE					
	Mean	50%	70	26	24.0	15
	SE			*3*	*1.4*	*1*
2090	Mean	9 in.	103	38	22.7	4
	SE		*8*	*3*	*0.8*	*1*
	Mean	50%	70	20	26.6	15
	SE			*2*	*1.2*	*1*

Gentle Slope - High Hazard

Year	Stat	Rx	BA	TPA	QMD	%BA CUT
2000	Mean	9 in.	117	119	13.3	27
	SE		*9*	*7*	*0.5*	*3*
	Mean	50%	87	84	15.8	43
	SE		*3*	*10*	*0.7*	*2*
2030	Mean	9 in.	136	86	16.9	2
	SE		*10*	*5*	*0.4*	
	Mean	50%	70	40	20.1	25
	SE			*4*	*0.8*	*2*
2060	Mean	9 in.	145	68	19.6	4
	SE		*10*	*5*	*0.4*	*1*
	Mean	50%	70	29	23.2	17
	SE			*4*	*0.8*	*1*
2090	Mean	9 in.	155	58	22.2	4
	SE		*11*	*4*	*0.4*	*1*
	Mean	50%	70	20	26.4	16
	SE			*1*	*0.7*	*1*

Steep Slope - High Hazard

Year	Stat	Rx	BA	TPA	QMD	%BA CUT
2000	Mean	9 in.	95	113	12.6	32
	SE		*8*	*8*	*0.5*	*3*
	Mean	50%	85	105	14.6	42
	SE		*3*	*14*	*0.9*	*2*
2030	Mean	9 in.	106	69	17.0	2
	SE		*10*	*6*	*0.6*	
	Mean	50%	70	36	21.1	20
	SE		*1*	*4*	*1.4*	*3*
2060	Mean	9 in.	114	55	19.7	3
	SE		*11*	*5*	*0.7*	
	Mean	50%	70	30	23.2	15
	SE			*4*	*1.3*	*1*
2090	Mean	9 in.	127	47	22.5	3
	SE		*11*	*4*	*0.7*	
	Mean	50%	70	22	25.6	15
	SE			*2*	*1.0*	*1*

Rx = Treatment BA = Basal Area (sq.ft./ac) TPA = Trees/ac QMD = Quadratic mean diameter(in.)

SE = Standard Error (+/- Cubic Ft./ac.) %BACUT = % of total basal area harvested

Note: Values are averages and cannot necessarily be cross-referenced.

C.1 Average Residual Stand Characteristics for Douglas-Fir Forest Type in Montana

Eastern Montana, Non - Forest Service Ownership

Gentle Slope - Low Hazard

Year: **2030**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	80	106	11.6	3
SE		*20*	*23*	*0.5*	*1*
Mean	50%	71	38	20.2	32
SE		*1*	*4*	*1.1*	*3*
Year: **2060**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	68	147	9.1	1
SE		*14*	*18*	*0.4*	*1*
Mean	50%	70	25	23.7	21
SE			*1*	*0.7*	*2*
Year: **2090**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	123	45	22.6	3
SE		*4*	*2*	*0.4*	
Mean	50%	70	18	27.6	19
SE			*1*	*0.6*	*1*

Gentle Slope - High Hazard

Year: **2000**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	101	106	13.2	28
SE		*6*	*6*	*0.3*	*3*
Mean	50%	81	86	14.6	42
SE		*2*	*8*	*0.5*	*2*
Year: **2030**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	120	76	17.0	5
SE		*7*	*4*	*0.3*	*1*
Mean	50%	71	39	19.9	31
SE		*1*	*4*	*0.7*	*2*
Year: **2060**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	139	60	20.5	6
SE		*8*	*3*	*0.4*	*1*
Mean	50%	70	25	24.8	26
SE			*2*	*0.8*	*1*
Year: **2090**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	155	49	24.0	6
SE		*9*	*3*	*0.5*	*1*
Mean	50%	70	17	29.4	25
SE			*1*	*0.9*	*1*

Steep Slope - Low Hazard

Year: **2030**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	92	121	11.5	17
SE		*26*	*6*	*1.8*	*8*
Mean	50%	73	42	22.4	37
SE		*2*	*14*	*3.0*	*7*
Year: **2060**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.				
SE					
Mean	50%	70	18	28.8	22
SE			*4*	*2.7*	*3*
Year: **2090**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	133	35	26.4	6
SE		*17*	*4*	*1.7*	*1*
Mean	50%	70	13	34.0	21
SE			*3*	*3.0*	*1*

Steep Slope - High Hazard

Year: **2000**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	89	103	12.7	35
SE		*6*	*7*	*0.3*	*3*
Mean	50%	80	102	13.4	40
SE		*2*	*9*	*0.5*	*2*
Year: **2030**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	111	74	16.8	4
SE		*7*	*5*	*0.3*	
Mean	50%	70	42	18.8	23
SE			*3*	*0.7*	*2*
Year: **2060**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	130	58	20.7	4
SE		*9*	*4*	*0.4*	
Mean	50%	70	26	23.4	23
SE			*2*	*0.7*	*1*
Year: **2090**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	148	48	23.9	4
SE		*10*	*3*	*0.6*	
Mean	50%	70	19	28.2	23
SE			*2*	*0.8*	*1*

Rx = Treatment BA = Basal Area (sq.ft./ac) TPA = Trees/ac QMD = Quadratic mean diameter(in.)
SE = Standard Error (+/- Cubic Ft./ac.) %BACUT = % of total basal area harvested
Note: Values are averages and cannot necessarily be cross-referenced.

C.2 Average Residual Stand Characteristics for Ponderosa Pine Forest Type in Montana

Western Montana, Forest Service Ownership

Gentle Slope - Low Hazard

Year	Rx	BA	TPA	QMD	%BA CUT
2030					
Mean	9 in.	80	71	15.0	15
SE		*13*	*18*	*1.1*	*5*
Mean	50%	56	46	17.7	35
SE		*6*	*14*	*2.3*	*6*
2060					
Mean	9 in.	97	54	18.7	7
SE		*13*	*12*	*0.9*	*3*
Mean	50%	52	20	23.0	35
SE		*2*	*4*	*1.8*	*4*
2090					
Mean	9 in.	112	46	21.7	4
SE		*12*	*8*	*0.9*	*2*
Mean	50%	50	13	27.4	32
SE			*2*	*1.5*	*3*

Gentle Slope - High Hazard

Year	Rx	BA	TPA	QMD	%BA CUT
2000					
Mean	9 in.	72	92	13.4	29
SE		*11*	*17*	*1.6*	*5*
Mean	50%	58	114	14.9	38
SE		*4*	*48*	*2.2*	*5*
2030					
Mean	9 in.	90	63	17.1	9
SE		*11*	*8*	*1.4*	*4*
Mean	50%	52	33	20.7	38
SE		*1*	*10*	*1.9*	*3*
2060					
Mean	9 in.	112	52	20.7	4
SE		*11*	*6*	*1.2*	*1*
Mean	50%	50	16	26.0	36
SE			*3*	*1.5*	*3*
2090					
Mean	9 in.	130	46	23.6	3
SE		*12*	*5*	*1.2*	*1*
Mean	50%	50	11	30.1	31
SE			*1*	*1.4*	*2*

Steep Slope - Low Hazard

Year	Rx	BA	TPA	QMD	%BA CUT
2030					
Mean	9 in.	67	36	21.1	9
SE		*7*	*8*	*2.5*	*4*
Mean	50%	50	24	21.0	33
SE			*4*	*2.0*	*5*
2060					
Mean	9 in.	82	30	24.6	6
SE		*9*	*6*	*2.3*	*2*
Mean	50%	50	13	28.2	25
SE			*2*	*2.1*	*2*
2090					
Mean	9 in.	94	27	27.7	4
SE		*11*	*6*	*2.3*	*1*
Mean	50%	50	9	32.5	25
SE			*1*	*1.9*	*2*

Steep Slope - High Hazard

Year	Rx	BA	TPA	QMD	%BA CUT
2000					
Mean	9 in.	68	55	15.9	21
SE		*11*	*9*	*1.3*	*6*
Mean	50%	54	48	17.1	40
SE		*2*	*13*	*1.5*	*4*
2030					
Mean	9 in.	91	50	19.0	3
SE		*11*	*7*	*1.1*	*1*
Mean	50%	50	21	22.7	24
SE			*4*	*1.5*	*3*
2060					
Mean	9 in.	96	41	21.3	5
SE		*11*	*5*	*1.0*	*1*
Mean	50%	50	15	26.3	23
SE			*2*	*1.4*	*1*
2090					
Mean	9 in.	105	35	23.8	3
SE		*12*	*4*	*1.0*	*1*
Mean	50%	50	12	28.8	22
SE			*2*	*1.5*	*1*

Rx = Treatment BA = Basal Area (sq.ft./ac) TPA = Trees/ac QMD = Quadratic mean diameter(in.)

SE = Standard Error (+/- Cubic Ft./ac.) %BACUT = % of total basal area harvested

Note: Values are averages and cannot necessarily be cross-referenced.

C.2 Average Residual Stand Characteristics for Ponderosa Pine Forest Type in Montana

Western Montana, Non - Forest Service Ownershi

Gentle Slope - Low Hazard

Year: **2030**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	70	42	17.9	9
SE		*7*	*4*	*0.9*	*1*
Mean	50%	52	26	21.0	37
SE		*1*	*5*	*1.4*	*4*
Year: **2060**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	85	45	21.1	9
SE		*7*	*8*	*1.4*	*2*
Mean	50%	50	25	26.0	37
SE			*11*	*1.6*	*2*
Year: **2090**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	105	34	26.0	6
SE		*8*	*6*	*1.5*	*2*
Mean	50%	50	31	29.5	29
SE			*13*	*2.2*	*2*

Gentle Slope - High Hazard

Year: **2000**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	71	74	13.2	34
SE		*8*	*6*	*0.5*	*4*
Mean	50%	60	68	14.2	42
SE		*3*	*7*	*0.8*	*2*
Year: **2030**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	100	53	18.7	10
SE		*8*	*4*	*0.4*	*2*
Mean	50%	55	22	22.4	44
SE		*2*	*1*	*0.7*	*1*
Year: **2060**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	126	44	23.1	3
SE		*8*	*3*	*0.5*	*1*
Mean	50%	51	12	28.6	38
SE		*1*	*1*	*0.7*	*2*
Year: **2090**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	146	38	26.7	2
SE		*9*	*2*	*0.5*	
Mean	50%	50	9	33.5	33
SE				*0.8*	*1*

Steep Slope - Low Hazard

Year: **2030**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	78	43	20.3	8
SE		*6*	*9*	*1.4*	*2*
Mean	50%	52	20	23.2	36
SE		*2*	*3*	*1.5*	*4*
Year: **2060**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	93	34	24.0	4
SE		*8*	*6*	*1.4*	*1*
Mean	50%	50	13	28.5	30
SE			*2*	*1.5*	*3*
Year: **2090**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	108	29	27.9	3
SE		*9*	*5*	*1.4*	
Mean	50%	50	8	33.8	26
SE			*1*	*1.4*	*2*

Steep Slope - High Hazard

Year: **2000**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.				
SE					
Mean	16 in.				
SE					
Year: **2030**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.				
SE					
Mean	16 in.				
SE					
Year: **2060**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.				
SE					
Mean	16 in.				
SE					
Year: **2090**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.				
SE					
Mean	16 in.				
SE					

Rx = Treatment BA = Basal Area (sq.ft./ac) TPA = Trees/ac QMD = Quadratic mean diameter(in.)

SE = Standard Error (+/- Cubic Ft./ac.) %BACUT = % of total basal area harvested

Note: Values are averages and cannot necessarily be cross-referenced.

C.2 Average Residual Stand Characteristics for Ponderosa Pine Forest Type in Montana

Eastern Montana, Forest Service Ownership

Gentle Slope - Low Hazard

Year	Rx		BA	TPA	QMD	%BA CUT
2030						
	9 in.	Mean				
		SE				
	16 in.	Mean				
		SE				
2060						
	9 in.	Mean				
		SE				
	16 in.	Mean				
		SE				
2090						
	9 in.	Mean				
		SE				
	16 in.	Mean				
		SE				

Gentle Slope - High Hazard

Year	Rx		BA	TPA	QMD	%BA CUT
2000						
	9 in.	Mean	85	98	12.9	28
		SE	*11*	*12*	*0.5*	*2*
	50%	Mean	62	59	14.6	46
		SE	*6*	*7*	*0.6*	*2*
2030						
	9 in.	Mean	87	61	16.2	11
		SE	*11*	*8*	*0.6*	*4*
	50%	Mean	47	43	18.1	40
		SE	*3*	*11*	*1.0*	*2*
2060						
	9 in.	Mean	90	55	18.1	14
		SE	*11*	*8*	*0.9*	*2*
	50%	Mean	42	29	20.6	32
		SE	*1*	*9*	*1.0*	*2*
2090						
	9 in.	Mean	103	40	21.4	13
		SE	*12*	*4*	*0.6*	*2*
	50%	Mean	40	14	24.0	30
		SE		*1*	*0.8*	*2*

Steep Slope - Low Hazard

Year	Rx		BA	TPA	QMD	%BA CUT
2030						
	9 in.	Mean				
		SE				
	16 in.	Mean				
		SE				
2060						
	9 in.	Mean				
		SE				
	16 in.	Mean				
		SE				
2090						
	9 in.	Mean				
		SE				
	16 in.	Mean				
		SE				

Steep Slope - High Hazard

Year	Rx		BA	TPA	QMD	%BA CUT
2000						
	9 in.	Mean	43	54	12.6	42
		SE	*3*	*7*	*1.2*	*9*
	50%	Mean	50	76	12.8	40
		SE	*5*	*19*	*1.8*	*6*
2030						
	9 in.	Mean	71	41	18.5	10
		SE	*5*	*5*	*0.9*	*2*
	50%	Mean	44	21	20.8	44
		SE	*2*	*2*	*1.2*	*2*
2060						
	9 in.	Mean	89	32	22.8	6
		SE	*7*	*3*	*0.8*	*2*
	50%	Mean	40	10	28.0	43
		SE		*1*	*1.2*	*2*
2090						
	9 in.	Mean	102	27	26.8	4
		SE	*7*	*2*	*0.8*	*1*
	50%	Mean	40	7	33.6	36
		SE			*1.2*	*2*

Rx = Treatment BA = Basal Area (sq.ft./ac) TPA = Trees/ac QMD = Quadratic mean diameter(in.)
SE = Standard Error (+/- Cubic Ft./ac.) %BACUT = % of total basal area harvested
Note: Values are averages and cannot necessarily be cross-referenced.

C.2 Average Residual Stand Characteristics for Ponderosa Pine Forest Type in Montana

Eastern Montana, Non - Forest Service Ownership

Gentle Slope - Low Hazard

Year: **2030**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	54	67	12.2	7
SE		*10*	*12*	*0.6*	*3*
Mean	50%	43	27	17.8	34
SE		*1*	*2*	*0.6*	*3*
Year: **2060**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	86	116	11.8	7
SE		*6*	*6*	*0.4*	*1*
Mean	50%	40	17	21.7	37
SE			*1*	*0.6*	*2*
Year: **2090**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	102	52	18.8	15
SE		*7*	*2*	*0.4*	*1*
Mean	50%	40	13	24.5	37
SE			*1*	*0.6*	*1*

Gentle Slope - High Hazard

Year: **2000**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	63	79	12.0	35
SE		*5*	*5*	*0.3*	*3*
Mean	50%	53	67	12.6	44
SE		*3*	*5*	*0.4*	*2*
Year: **2030**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	81	65	15.4	10
SE		*6*	*4*	*0.4*	*1*
Mean	50%	44	28	17.6	40
SE		*1*	*2*	*0.4*	*2*
Year: **2060**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	99	52	18.7	12
SE		*7*	*3*	*0.4*	*1*
Mean	50%	41	20	20.8	35
SE		*1*	*2*	*0.6*	*2*
Year: **2090**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	115	45	21.5	12
SE		*8*	*3*	*0.5*	*1*
Mean	50%	40	14	24.0	34
SE			*1*	*0.6*	*1*

Steep Slope - Low Hazard

Year: **2030**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	62	75	12.3	16
SE		*9*	*10*	*0.4*	*3*
Mean	50%	45	28	17.9	38
SE		*2*	*2*	*0.6*	*3*
Year: **2060**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	97	121	12.5	6
SE		*12*	*15*	*0.5*	*2*
Mean	50%	41	19	21.7	34
SE		*1*	*2*	*0.9*	*2*
Year: **2090**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	100	46	19.6	12
SE		*10*	*3*	*0.6*	*1*
Mean	50%	40	14	24.4	30
SE			*2*	*0.9*	*2*

Steep Slope - High Hazard

Year: **2000**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	57	67	12.7	34
SE		*3*	*4*	*0.3*	*3*
Mean	50%	48	59	13.7	45
SE		*2*	*8*	*0.6*	*2*
Year: **2030**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	75	46	17.2	8
SE		*5*	*3*	*0.6*	*1*
Mean	50%	41	23	21.1	38
SE			*4*	*1.0*	*3*
Year: **2060**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	89	34	21.7	5
SE		*6*	*1*	*0.6*	*1*
Mean	50%	40	12	27.1	35
SE			*1*	*1.1*	*1*
Year: **2090**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	100	28	25.3	4
SE		*6*	*1*	*0.6*	*1*
Mean	50%	40	8	32.1	32
SE			*1*	*1.2*	*1*

Rx = Treatment   BA = Basal Area (sq.ft./ac) TPA = Trees/ac   QMD = Quadratic mean diameter(in.)

SE = Standard Error (+/- Cubic Ft./ac.)   %BACUT = % of total basal area harvested

Note: Values are averages and cannot necessarily be cross-referenced.

C.3 Average Residual Stand Characteristics for Dry Mixed Conifer Forest Type in New Mexico

Forest Service Ownership

Gentle Slope - Low Hazard

Year: **2030**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	92	75	15.1	29
SE		*5*	*4*	*0.4*	*5*
Mean	16 in.	56	26	20.4	56
SE		*3*	*3*	*0.9*	*4*
Year: 2060	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	93	174	13.7	10
SE		*8*	*110*	*3.9*	*9*
Mean	16 in.	80	942	4.0	17
SE					
Year: 2090	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	80	660	4.7	11
SE					
Mean	16 in.	88	24	25.9	0
SE					

Gentle Slope - High Hazard

Year: **2000**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	76	165	12.5	24
SE		*6*	*41*	*1.0*	*3*
Mean	16 in.	60	133	12.7	34
SE		*4*	*42*	*1.0*	*4*
Year: 2030	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	82	179	11.0	14
SE		*2*	*72*	*3.1*	*3*
Mean	16 in.	80	109	14.9	16
SE			*54*	*4.2*	*6*
Year: 2060	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.				
SE					
Mean	16 in.	80	20	27.3	4
SE					
Year: 2090	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	83	69	17.0	8
SE		*2*	*26*	*2.6*	*3*
Mean	16 in.	82	56	18.3	6
SE		*2*	*20*	*1.9*	*2*

Steep Slope - Low Hazard

Year: **2030**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	101	87	14.6	24
SE		*12*	*7*	*0.8*	*6*
Mean	16 in.	60	39	18.2	53
SE		*4*	*9*	*1.5*	*5*
Year: 2060	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	113	292	14.1	5
SE		*16*	*241*	*4.6*	*5*
Mean	16 in.	80	383	15.6	7
SE			*393*	*10.4*	*7*
Year: 2090	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	98	404	12.8	4
SE		*17*	*378*	*8.0*	*4*
Mean	16 in.	80	809	4.3	7
SE					

Steep Slope - High Hazard

Year: **2000**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	68	148	11.6	25
SE		*6*	*42*	*0.9*	*4*
Mean	16 in.	60	137	12.1	31
SE		*5*	*43*	*1.0*	*5*
Year: 2030	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	82	122	12.2	25
SE		*2*	*38*	*2.5*	*10*
Mean	16 in.	80	96	15.4	21
SE			*34*	*2.7*	*6*
Year: 2060	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	80	300	7.0	35
SE					
Mean	16 in.	80	301	7.0	35
SE					
Year: 2090	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	80	79	15.3	12
SE			*24*	*2.4*	*3*
Mean	16 in.	80	63	16.4	7
SE			*13*	*1.3*	*2*

Rx = Treatment BA = Basal Area (sq.ft./ac) TPA = Trees/ac QMD = Quadratic mean diameter(in.)
SE = Standard Error (+/- Cubic Ft./ac.) %BACUT = % of total basal area harvested
Note: Values are averages and cannot necessarily be cross-referenced.

C.3 Average Residual Stand Characteristics for Dry Mixed Conifer Forest Type in New Mexico

Non - Forest Service Ownership

Gentle Slope - Low Hazard

Year: 2030	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	98	77	16.1	18
SE		*10*	*14*	*0.9*	*3*
Mean	16 in.	64	31	19.6	42
SE		*6*	*1*	*1.0*	*7*
Year: 2060	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	118	67	18.5	2
SE		*9*	*10*	*1.2*	*1*
Mean	16 in.	89	66	19.5	1
SE		*7*	*34*	*5.0*	*1*
Year: 2090	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	102	55	18.5	5
SE					
Mean	16 in.	81	22	26.1	1
SE					

Gentle Slope - High Hazard

Year: 2000	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	82	104	12.9	36
SE		*6*	*13*	*0.5*	*2*
Mean	16 in.	72	86	14.1	44
SE		*6*	*14*	*0.9*	*3*
Year: 2030	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	103	91	16.4	6
SE		*6*	*20*	*1.3*	*3*
Mean	16 in.	97	86	16.9	13
SE		*7*	*25*	*1.3*	*4*
Year: 2060	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	107	137	16.4	5
SE		*8*	*56*	*2.2*	*3*
Mean	16 in.	103	111	17.9	6
SE		*11*	*64*	*2.5*	*4*
Year: 2090	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	92	63	18.9	7
SE		*4*	*16*	*1.8*	*3*
Mean	16 in.	84	43	21.1	9
SE		*3*	*9*	*1.5*	*3*

Gentle Slope - Low Hazard

Year: 2030	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.				
SE					
Mean	16 in.				
SE					
Year: 2060	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.				
SE					
Mean	16 in.				
SE					
Year: 2090	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.				
SE					
Mean	16 in.				
SE					

Steep Slope - High Hazard

Year: 2000	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	78	87	13.1	39
SE		*7*	*7*	*0.6*	*3*
Mean	16 in.	59	60	14.6	51
SE		*5*	*7*	*0.8*	*4*
Year: 2030	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	129	132	13.3	8
SE		*46*	*12*	*3.1*	*8*
Mean	16 in.	80	84	15.8	25
SE			*54*	*5.2*	*8*
Year: 2060	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	174	92	18.6	2
SE					
Mean	16 in.				
SE					
Year: 2090	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	91	75	16.8	2
SE		*7*	*30*	*2.2*	*1*
Mean	16 in.	80	52	19.2	8
SE			*18*	*3.3*	*7*

Rx = Treatment BA = Basal Area (sq.ft./ac) TPA = Trees/ac QMD = Quadratic mean diameter(in.)

SE = Standard Error (+/- Cubic Ft./ac.) %BACUT = % of total basal area harvested

Note: Values are averages and cannot necessarily be cross-referenced.

C.4 Average Residual Stand Characteristics for Ponderosa Pine Forest Type in New Mexico

Forest Service Ownership

Gentle Slope - Low Hazard

Year: **2030**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	84	101	13.1	41
SE		*7*	*11*	*0.7*	*5*
Mean	16 in.	56	60	15.4	59
SE		*3*	*11*	*1.2*	*3*

Year: **2060**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	93	416	12.2	13
SE		*8*	*341*	*3.1*	*8*
Mean	16 in.	80	1078	3.9	29
SE			*422*	*0.9*	*4*

Year: **2090**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	80	239	12.7	8
SE			*233*	*6.1*	*7*
Mean	16 in.	80	1000	3.8	1
SE					

Gentle Slope - High Hazard

Year: **2000**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	67	147	12.1	28
SE		*5*	*45*	*1.1*	*4*
Mean	16 in.	61	136	12.5	33
SE		*5*	*46*	*1.1*	*5*

Year: **2030**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	81	154	11.7	17
SE		*1*	*57*	*2.3*	*3*
Mean	16 in.	80	111	14.1	16
SE			*40*	*3.2*	*5*

Year: **2060**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.				
SE					
Mean	16 in.	80	20	27.3	4
SE					

Year: **2090**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	86	76	16.2	9
SE		*2*	*20*	*1.9*	*3*
Mean	16 in.	81	64	16.8	9
SE		*1*	*15*	*1.5*	*2*

Steep Slope - Low Hazard

Year: **2030**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	95	76	15.7	18
SE		*7*	*8*	*0.7*	*3*
Mean	16 in.	55	27	20.4	51
SE		*4*	*4*	*1.3*	*4*

Year: **2060**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	105	58	18.2	0
SE		*14*	*10*	*0.3*	
Mean	16 in.				
SE					

Year: **2090**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	89	39	20.6	0
SE					
Mean	16 in.				
SE					

Steep Slope - High Hazard

Year: **2000**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	82	82	13.8	33
SE		*9*	*8*	*0.7*	*4*
Mean	16 in.	74	69	14.6	40
SE		*10*	*9*	*0.7*	*4*

Year: **2030**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	113	102	16.0	2
SE		*13*	*33*	*2.1*	*1*
Mean	16 in.	106	97	17.1	5
SE		*18*	*45*	*2.9*	*3*

Year: **2060**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	142	70	19.3	3
SE		*12*	*7*	*0.2*	*1*
Mean	16 in.	152	76	19.2	2
SE					

Year: **2090**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	129	51	21.7	4
SE		*21*	*10*	*0.4*	*2*
Mean	16 in.	105	41	22.5	3
SE		*18*	*10*	*1.9*	*2*

Rx = Treatment BA = Basal Area (sq.ft./ac) TPA = Trees/ac QMD = Quadratic mean diameter(in.)
SE = Standard Error (+/- Cubic Ft./ac.) %BACUT = % of total basal area harvested
Note: Values are averages and cannot necessarily be cross-referenced.

C.4 Average Residual Stand Characteristics for Ponderosa Pine Forest Type in New Mexico

Non - Forest Service Ownership

Gentle Slope - Low Hazard

Year: **2030**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	87	73	15.3	17
SE		*4*	*5*	*0.5*	*2*
Mean	16 in.	58	34	18.4	40
SE		*2*	*2*	*0.6*	*3*
Year: 2060	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	102	97	15.0	15
SE		*12*	*32*	*2.8*	*14*
Mean	16 in.	80	725	4.5	38
SE					
Year: 2090	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	80	735	4.5	11
SE					
Mean	16 in.	83	534	16.4	0
SE		*3*	*491*	*13.3*	

Gentle Slope - High Hazard

Year: **2000**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.	65	116	11.9	31
SE		*5*	*20*	*1.1*	*4*
Mean	16 in.	56	101	12.4	38
SE		*4*	*21*	*1.1*	*5*
Year: 2030	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	82	162	11.6	25
SE		*2*	*74*	*3.0*	*10*
Mean	16 in.	80	162	9.6	24
SE			*29*	*0.9*	*21*
Year: 2060	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	80	300	7.0	35
SE					
Mean	16 in.	80	114	20.5	14
SE			*133*	*9.6*	*15*
Year: 2090	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.	84	62	16.3	12
SE		*4*	*13*	*2.2*	*5*
Mean	16 in.	82	53	17.3	7
SE		*2*	*7*	*1.2*	*3*

Gentle Slope - Low Hazard

Year: **2030**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.				
SE					
Mean	16 in.				
SE					
Year: 2060	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.				
SE					
Mean	16 in.				
SE					
Year: 2090	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.				
SE					
Mean	16 in.				
SE					

Gentle Slope - High Hazard

Year: **2000**	Rx	BA	TPA	QMD	%BA CUT
Mean	9 in.				
SE					
Mean	16 in.				
SE					
Year: 2030	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.				
SE					
Mean	16 in.				
SE					
Year: 2060	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.				
SE					
Mean	16 in.				
SE					
Year: 2090	**Rx**	**BA**	**TPA**	**QMD**	**%BA CUT**
Mean	9 in.				
SE					
Mean	16 in.				
SE					

Rx = Treatment BA = Basal Area (sq.ft./ac) TPA = Trees/ac QMD = Quadratic mean diameter(in.)

SE = Standard Error (+/- Cubic Ft./ac.) %BACUT = % of total basal area harvested

Note: Values are averages and cannot necessarily be cross-referenced.

APPENDIX D
Average Volume of Utilized Trees

Resource managers who plan and conduct fuels mitigation treatments and contractors who bid on the treatments need information on the merchantable volume and size of trees removed during treatments. Such information is presented in this Appendix. The tables included in the appendix summarize average cubic foot volume harvested per acre, with standard errors presented in italics. Reporting results by 3-inch DBH classes provides a sense of the relative importance of different size trees. Processing output for all trees 7-inches DBH and larger through the FEEMA model generates the data needed for tables. Merchantable volume is calculated by summing all of the logs that FEEMA recovered from each tree up to a 5-inch top in Montana and a 9.5-inch top in New Mexico. All values are stand averages weighted by the plot expansion factors. All tree species are combined. Cases where less than 50 cubic feet of material was removed are left blank because this amount of volume is considered insignificant and including it makes the output in later appendices (e.g., F and G) confusing.

D.1 Average Volume of Utilized Trees by DBH Class for Douglas-fir Forest Type in Montana

Western Montana, Forest Service Ownership

Gentle Slope - Low Hazard

Year	RX	7-10	(SE)	10-13	(SE)	13-16	(SE)	16+	(SE)	Total	(SE)
2030	9 in.										
2030	50%	86	31	186	54	266	57	582	163	1,121	69
2060	9 in.										
2060	50%	11	6	6	5	53	35	583	100	652	87
2090	9 in.										
2090	50%	7	4	14	8	27	19	459	53	506	39

Gentle Slope - High Hazard

Year	RX	7-10	(SE)	10-13	(SE)	13-16	(SE)	16+	(SE)	Total	(SE)
2000	9 in.	234	36	0	0	0	0	0	0	234	36
2000	50%	303	52	275	55	40	20	1	1	619	28
2030	9 in.										
2030	50%	50	15	58	17	173	37	122	34	403	20
2060	9 in.										
2060	50%	18	11	52	15	89	24	243	32	402	3
2090	9 in.										
2090	50%	4	4	10	7	28	14	383	33	425	26

Steep Slope - Low Hazard

Year	RX	7-10	(SE)	10-13	(SE)	13-16	(SE)	16+	(SE)	Total	(SE)
2030	9 in.										
2030	50%	58	26	178	37	225	48	334	99	795	9
2060	9 in.										
2060	50%	18	12	10	5	38	11	475	66	541	55
2090	9 in.										
2090	50%	3	1	4	2	6	3	436	34	449	30

Steep Slope - High Hazard

Year	RX	7-10	(SE)	10-13	(SE)	13-16	(SE)	16+	(SE)	Total	(SE)
2000	9 in.	180	27	0	0	0	0	0	0	180	27
2000	50%	311	41	390	80	158	55	66	33	925	40
2030	9 in.										
2030	50%	7	4	27	11	217	40	518	84	769	43
2060	9 in.										
2060	50%	2	2	17	9	13	8	593	38	624	26
2090	9 in.										
2090	50%	2	1	6	3	13	8	499	26	520	18

Rx = Treatment **Volume is merchantable cubic feet/acre by DBH Class(in.)**

SE = Standard Error (+/- cubic ft./ac.)

D.1 Average Volume of Utilized Trees by DBH Class for Douglas-fir Forest Type in Montana

Western Montana, Non-Forest Service Ownership

Gentle Slope - Low Hazard

RX	7-10	(SE)	10-13	(SE)	13-16	(SE)	16+	(SE)	Total	(SE)
Year: 2030										
9 in.	61	24	0	0	0	0	0	0	61	24
50%	115	41	222	50	285	49	395	103	1,017	91
Year: 2060										
9 in.										
50%	10	4	16	7	61	20	482	72	569	56
Year: 2090										
9 in.										
50%	5	2	9	4	10	8	485	36	509	28

Steep Slope - Low Hazard

RX	7-10	(SE)	10-13	(SE)	13-16	(SE)	16+	(SE)	Total	(SE)
Year: 2030										
9 in.										
50%	92	17	177	36	226	47	244	74	738	42
Year: 2060										
9 in.										
50%	2	1	23	9	93	24	382	52	500	28
Year: 2090										
9 in.										
50%	1	0	1	0	1	1	447	33	451	32

Gentle Slope - High Hazard

RX	7-10	(SE)	10-13	(SE)	13-16	(SE)	16+	(SE)	Total	(SE)
Year: 2000										
9 in.	210	29	0	0	0	0	0	0	210	29
50%	277	41	194	46	74	26	46	23	591	12
Year: 2030										
9 in.										
50%	51	19	119	29	130	30	106	38	406	10
Year: 2060										
9 in.										
50%	10	4	40	15	82	24	301	56	433	43
Year: 2090										
9 in.										
50%	8	4	20	9	22	10	345	36	394	27

Steep Slope - High Hazard

RX	7-10	(SE)	10-13	(SE)	13-16	(SE)	16+	(SE)	Total	(SE)
Year: 2000										
9 in.	201	24	0	0	0	0	0	0	201	24
50%	189	40	190	49	64	27	0	0	444	45
Year: 2030										
9 in.										
50%	43	11	58	20	51	19	315	83	468	67
Year: 2060										
9 in.										
50%	5	2	47	12	126	25	273	47	451	11
Year: 2090										
9 in.										
50%	1	0	2	2	24	9	411	28	438	18

Rx = Treatment **Volume is merchantable cubic feet/acre by DBH Class(in.)**

SE = Standard Error (+/- cubic ft./ac.)

D.1 Average Volume of Utilized Trees by DBH Class for Douglas-fir Forest Type in Montana

Eastern Montana, Forest Service Ownership

Gentle Slope - Low Hazard

RX	7-10	(SE)	10-13	(SE)	13-16	(SE)	16+	(SE)	Total	(SE)
Year: **2030**										
9 in.										
50%	69	*20*	135	*42*	168	*39*	187	*91*	559	*41*
Year: **2060**										
9 in.										
50%	16	*13*	9	*7*	38	*29*	305	*56*	368	*48*
Year: **2090**										
9 in.										
50%	2	*1*	3	*3*	33	*17*	236	*33*	275	*25*

Steep Slope - Low Hazard

RX	7-10	(SE)	10-13	(SE)	13-16	(SE)	16+	(SE)	Total	(SE)
Year: **2030**										
9 in.										
50%	20	*14*	183	*62*	122	*51*	301	*119*	627	*72*
Year: **2060**										
9 in.										
50%	3	*3*	0	*0*	38	*38*	214	*39*	255	*44*
Year: **2090**										
9 in.										
50%	1	*1*	8	*6*	2	*2*	246	*30*	258	*25*

Gentle Slope - High Hazard

RX	7-10	(SE)	10-13	(SE)	13-16	(SE)	16+	(SE)	Total	(SE)
Year: **2000**										
9 in.	246	*34*	0	*0*	0	*0*	0	*0*	246	*34*
50%	306	*46*	314	*51*	198	*53*	141	*71*	957	*47*
Year: **2030**										
9 in.										
50%	1	*1*	64	*16*	120	*33*	387	*92*	572	*77*
Year: **2060**										
9 in.										
50%	0	*0*	1	*1*	37	*13*	219	*29*	257	*24*
Year: **2090**										
9 in.										
50%	0	*1*	0	*0*	3	*3*	246	*23*	250	*22*

Steep Slope - High Hazard

RX	7-10	(SE)	10-13	(SE)	13-16	(SE)	16+	(SE)	Total	(SE)
Year: **2000**										
9 in.	176	*38*	0	*0*	0	*0*	0	*0*	176	*38*
50%	201	*40*	255	*57*	100	*31*	91	*53*	646	*32*
Year: **2030**										
9 in.										
50%	17	*9*	71	*56*	56	*21*	327	*90*	470	*83*
Year: **2060**										
9 in.										
50%	1	*0*	15	*7*	44	*16*	140	*31*	200	*24*
Year: **2090**										
9 in.										
50%	1	*0*	7	*5*	25	*10*	207	*28*	239	*22*

Rx = Treatment **Volume is merchantable cubic feet/acre by DBH Class(in.)**

SE = Standard Error (+/- cubic ft./ac.)

D.1 Average Volume of Utilized Trees by DBH Class for Douglas-fir Forest Type in Montana

Eastern Montana, Non - Forest Service Ownership

Gentle Slope - Low Hazard

RX	7-10	(SE)	10-13	(SE)	13-16	(SE)	16+	(SE)	Total	(SE)
Year: 2030										
9 in.										
50%	36	*10*	178	*35*	223	*50*	210	*66*	647	*59*
Year: 2060										
9 in.										
50%	10	*3*	35	*12*	54	*14*	286	*51*	386	*34*
Year: 2090										
9 in.										
50%	6	*3*	3	*3*	4	*4*	380	*55*	393	*53*

Steep Slope - Low Hazard

RX	7-10	(SE)	10-13	(SE)	13-16	(SE)	16+	(SE)	Total	(SE)
Year: 2030										
9 in.										
50%	2	*2*	165	*131*	81	*58*	382	*233*	629	*197*
Year: 2060										
9 in.										
50%	0	*0*	0	*0*	135	*102*	265	*102*	400	*94*
Year: 2090										
9 in.										
50%	0	*0*	0	*0*	0	*0*	364	*52*	364	*52*

Gentle Slope - High Hazard

RX	7-10	(SE)	10-13	(SE)	13-16	(SE)	16+	(SE)	Total	(SE)
Year: 2000										
9 in.	215	*29*	0	*0*	0	*0*	0	*0*	215	*29*
50%	241	*30*	271	*50*	131	*37*	52	*33*	695	*32*
Year: 2030										
9 in.										
50%	8	*4*	69	*28*	135	*34*	385	*83*	598	*70*
Year: 2060										
9 in.										
50%	1	*1*	3	*3*	25	*12*	417	*40*	445	*35*
Year: 2090										
9 in.										
50%	1	*1*	4	*3*	3	*2*	394	*25*	402	*23*

Steep Slope - High Hazard

RX	7-10	(SE)	10-13	(SE)	13-16	(SE)	16+	(SE)	Total	(SE)
Year: 2000										
9 in.	221	*34*	0	*0*	0	*0*	0	*0*	221	*34*
50%	206	*31*	188	*44*	55	*20*	11	*9*	459	*26*
Year: 2030										
9 in.										
50%	6	*3*	98	*26*	91	*27*	162	*42*	358	*28*
Year: 2060										
9 in.										
50%	1	*0*	3	*2*	40	*15*	341	*41*	385	*34*
Year: 2090										
9 in.										
50%	0	*0*	2	*2*	10	*6*	403	*27*	415	*23*

Rx = Treatment **Volume is merchantable cubic feet/acre by DBH Class(in.)**

SE = Standard Error (+/- cubic ft./ac.)

D.2 Average Volume of Utilized Trees by DBH Class for Ponderosa Pine Forest Type in Montana

Western Montana, Forest Service Ownership

Gentle Slope - Low Hazard

RX	7-10	(SE)	10-13	(SE)	13-16	(SE)	16+	(SE)	Total	(SE)
Year: 2030										
9 in.	65	*35*	0	*0*	0	*0*	0	*0*	65	*35*
50%	76	*53*	233	*121*	203	*156*	95	*57*	606	*46*
Year: 2060										
9 in.										
50%	13	*10*	86	*82*	121	*100*	466	*147*	686	*6*
Year: 2090										
9 in.										
50%	6	*4*	0	*0*	0	*0*	605	*167*	610	*164*

Gentle Slope - High Hazard

RX	7-10	(SE)	10-13	(SE)	13-16	(SE)	16+	(SE)	Total	(SE)
Year: 2000										
9 in.	89	*37*	0	*0*	0	*0*	0	*0*	89	*37*
50%	162	*67*	141	*81*	92	*63*	86	*83*	482	*55*
Year: 2030										
9 in.										
50%	22	*14*	153	*66*	145	*83*	357	*148*	677	*68*
Year: 2060										
9 in.										
50%	7	*4*	59	*59*	35	*22*	558	*145*	659	*115*
Year: 2090										
9 in.										
50%	8	*3*	0	*0*	0	*0*	459	*75*	467	*70*

Steep Slope - Low Hazard

RX	7-10	(SE)	10-13	(SE)	13-16	(SE)	16+	(SE)	Total	(SE)
Year: 2030										
9 in.	60	*36*	0	*0*	0	*0*	0	*0*	60	*36*
50%	85	*58*	47	*20*	150	*119*	261	*158*	543	*102*
Year: 2060										
9 in.										
50%	4	*2*	15	*10*	52	*28*	255	*88*	326	*56*
Year: 2090										
9 in.										
50%	7	*3*	0	*0*	7	*7*	301	*58*	315	*47*

Steep Slope - High Hazard

RX	7-10	(SE)	10-13	(SE)	13-16	(SE)	16+	(SE)	Total	(SE)
Year: 2000										
9 in.	74	*34*	0	*0*	0	*0*	0	*0*	74	*34*
50%	74	*32*	198	*81*	227	*91*	155	*77*	655	*79*
Year: 2030										
9 in.										
50%	13	*9*	4	*3*	28	*18*	325	*108*	370	*95*
Year: 2060										
9 in.										
50%	2	*1*	4	*4*	44	*32*	241	*45*	290	*25*
Year: 2090										
9 in.										
50%	6	*4*	19	*18*	2	*2*	243	*32*	269	*13*

Rx = Treatment **Volume is merchantable cubic feet/acre by DBH Class(in.)**

SE = Standard Error (+/- cubic ft./ac.)

D.2 Average Volume of Utilized Trees by DBH Class for Ponderosa Pine Forest Type in Montana

Western Montana, Non - Forest Service Ownership

Gentle Slope - Low Hazard

RX	7-10	(SE)	10-13	(SE)	13-16	(SE)	16+	(SE)	Total	(SE)
Year: **2030**										
9 in.										
50%	26	*7*	124	*36*	228	*69*	393	*158*	771	*7*
Year: **2060**										
9 in.										
50%	19	*3*	30	*10*	65	*30*	563	*97*	677	*48*
Year: **2090**										
9 in.										
50%	19	*5*	8	*2*		*0*	425	*64*	452	*53*

Steep Slope - Low Hazard

RX	7-10	(SE)	10-13	(SE)	13-16	(SE)	16+	(SE)	Total	(SE)
Year: **2030**										
9 in.										
50%	67	*39*	168	*87*	96	*34*	320	*97*	651	*91*
Year: **2060**										
9 in.										
50%	12	*5*	4	*2*	16	*11*	510	*122*	543	*110*
Year: **2090**										
9 in.										
50%	11	*3*	4	*2*	1	*1*	384	*81*	401	*74*

Gentle Slope - High Hazard

RX	7-10	(SE)	10-13	(SE)	13-16	(SE)	16+	(SE)	Total	(SE)
Year: **2000**										
9 in.	139	*22*	0	*0*	0	*0*	0	*0*	139	*22*
50%	144	*23*	190	*51*	119	*52*	65	*54*	518	*46*
Year: **2030**										
9 in.										
50%	24	*10*	46	*19*	122	*25*	786	*126*	978	*79*
Year: **2060**										
9 in.										
50%	10	*2*	2	*1*	18	*14*	862	*107*	892	*99*
Year: **2090**										
9 in.										
50%	18	*4*	3	*1*	1	*1*	547	*57*	570	*49*

Steep Slope - High Hazard

RX	7-10	(SE)	10-13	(SE)	13-16	(SE)	16+	(SE)	Total	(SE)
Year: **2000**										
9 in.										
50%										
Year: **2030**										
9 in.										
50%										
Year: **2060**										
9 in.										
50%										
Year: **2090**										
9 in.										
50%										

Rx = Treatment **Volume is merchantable cubic feet/acre by DBH Class(in.)**

SE = Standard Error (+/- cubic ft./ac.)

D.2 Average Volume of Utilized Trees by DBH Class for Ponderosa Pine Forest Type in Montana

Eastern Montana, Forest Service Ownership

Gentle Slope - Low Hazard

RX	7-10	(SE)	10-13	(SE)	13-16	(SE)	16+	(SE)	Total	(SE)
Year: 2030										
9 in.										
50%										
Year: 2060										
9 in.										
50%										
Year: 2090										
9 in.										
50%										

Steep Slope - Low Hazard

RX	7-10	(SE)	10-13	(SE)	13-16	(SE)	16+	(SE)	Total	(SE)
Year: 2030										
9 in.										
50%										
Year: 2060										
9 in.										
50%										
Year: 2090										
9 in.										
50%										

Gentle Slope - High Hazard

RX	7-10	(SE)	10-13	(SE)	13-16	(SE)	16+	(SE)	Total	(SE)
Year: 2000										
9 in.	135	*36*	0	*0*	0	*0*	0	*0*	135	*36*
50%	214	*53*	225	*64*	56	*26*	13	*10*	508	*9*
Year: 2030										
9 in.										
50%	0	*0*	60	*30*	162	*52*	317	*96*	540	*78*
Year: 2060										
9 in.										
50%	2	*1*	19	*11*	5	*5*	224	*67*	250	*65*
Year: 2090										
9 in.										
50%	1	*1*	4	*3*	2	*1*	121	*19*	129	*18*

Steep Slope - High Hazard

RX	7-10	(SE)	10-13	(SE)	13-16	(SE)	16+	(SE)	Total	(SE)
Year: 2000										
9 in.	90	*45*	0	*0*	0	*0*	0	*0*	90	*45*
50%	35	*16*	21	*21*	25	*19*	3	*3*	83	*17*
Year: 2030										
9 in.										
50%	59	*15*	136	*69*	176	*61*	271	*70*	643	*102*
Year: 2060										
9 in.										
50%	28	*7*	12	*5*	30	*28*	626	*89*	697	*34*
Year: 2090										
9 in.										
50%	40	*6*	15	*5*	1	*1*	384	*52*	440	*31*

Rx = Treatment **Volume is merchantable cubic feet/acre by DBH Class(in.)**

SE = Standard Error (+/- cubic ft./ac.)

D.2 Average Volume of Utilized Trees by DBH Class for Ponderosa Pine Forest Type in Montana

Eastern Montana, Non - Forest Service Ownership

Gentle Slope - Low Hazard

RX	7-10	(SE)	10-13	(SE)	13-16	(SE)	16+	(SE)	Total	(SE)
Year: 2030										
9 in.										
50%	3	*2*	35	*11*	66	*18*	97	*32*	200	*27*
Year: 2060										
9 in.										
50%	3	*1*	3	*2*	5	*3*	132	*23*	143	*21*
Year: 2090										
9 in.										
50%	6	*2*	6	*3*	1	*1*	89	*11*	103	*8*

Steep Slope - Low Hazard

RX	7-10	(SE)	10-13	(SE)	13-16	(SE)	16+	(SE)	Total	(SE)
Year: 2030										
9 in.										
50%	21	*15*	47	*17*	72	*32*	72	*33*	213	*31*
Year: 2060										
9 in.										
50%	0	*0*	0	*0*	8	*6*	170	*30*	179	*28*
Year: 2090										
9 in.										
50%	4	*2*	3	*2*	0	*0*	95	*15*	102	*13*

Gentle Slope - High Hazard

RX	7-10	(SE)	10-13	(SE)	13-16	(SE)	16+	(SE)	Total	(SE)
Year: 2000										
9 in.	120	*20*	0	*0*	0	*0*	0	*0*	120	*20*
50%	141	*25*	119	*28*	64	*30*	0	*0*	324	*28*
Year: 2030										
9 in.										
50%	1	*1*	39	*12*	147	*34*	165	*39*	352	*33*
Year: 2060										
9 in.										
50%	2	*1*	5	*2*	6	*3*	196	*32*	208	*30*
Year: 2090										
9 in.										
50%	3	*1*	2	*1*	6	*3*	118	*16*	128	*15*

Steep Slope - High Hazard

RX	7-10	(SE)	10-13	(SE)	13-16	(SE)	16+	(SE)	Total	(SE)
Year: 2000										
9 in.	74	*15*	0	*0*	0	*0*	0	*0*	74	*15*
50%	98	*15*	109	*26*	46	*20*	5	*5*	258	*7*
Year: 2030										
9 in.										
50%	13	*4*	23	*13*	82	*26*	429	*70*	547	*46*
Year: 2060										
9 in.										
50%	29	*8*	15	*6*	15	*7*	393	*47*	452	*28*
Year: 2090										
9 in.										
50%	21	*4*	10	*2*	16	*12*	282	*26*	329	*8*

Rx = Treatment **Volume is merchantable cubic feet/acre by DBH Class(in.)**

SE = Standard Error (+/- cubic ft./ac.)

D.3 Average Volume of Utilized Trees by DBH Class for Dry Mixed Conifer Forest Type in New Mexico

New Mexico, Forest Service Ownership

Gentle Slope - Low Hazard

RX	14 - 16	(SE)
Year: 2030		
9 in.		
16 in.	85	*26*
Year: 2060		
9 in.		
16 in.		
Year: 2090		
9 in.		
16 in.		

Steep Slope - Low Hazard

RX	14 - 16	(SE)
Year: 2030		
9 in.		
16 in.	168	*40*
Year: 2060		
9 in.		
16 in.		
Year: 2090		
9 in.		
16 in.		

Gentle Slope - High Hazard

RX	14 - 16	(SE)
Year: 2000		
9 in.		
16 in.		
Year: 2030		
9 in.		
16 in.		
Year: 2060		
9 in.		
16 in.		
Year: 2090		
9 in.		
16 in.		

Steep Slope - High Hazard

RX	14 - 16	(SE)
Year: 2000		
9 in.		
16 in.		
Year: 2030		
9 in.		
16 in.		
Year: 2060		
9 in.		
16 in.		
Year: 2090		
9 in.		
16 in.		

Rx = Treatment **Volume is merchantable cubic feet/acre by DBH Class(in.)**

SE = Standard Error (+/- cubic ft./ac.)

D.3 Average Volume of Utilized Trees by DBH Class for Dry Mixed Conifer Forest Type in New Mexico

New Mexico, non - Forest Service Ownership

Gentle Slope - Low Hazard

RX **14 - 16 (SE)**

Year	DBH	Volume	SE
2030	9 in.		
	16 in.	107	*51*
2060	9 in.		
	16 in.		
2090	9 in.		
	16 in.		

Steep Slope - Low Hazard

RX **14 - 16 (SE)**

Year	DBH	Volume	SE
2030	9 in.		
	16 in.		
2060	9 in.		
	16 in.		
2090	9 in.		
	16 in.		

Gentle Slope - High Hazard

RX **14 - 16 (SE)**

Year	DBH	Volume	SE
2000	9 in.		
	16 in.		
2030	9 in.		
	16 in.		
2060	9 in.		
	16 in.		
2090	9 in.		
	16 in.		

Steep Slope - High Hazard

RX **14 - 16 (SE)**

Year	DBH	Volume	SE
2000	9 in.		
	16 in.		
2030	9 in.		
	16 in.	177	*158*
2060	9 in.		
	16 in.		
2090	9 in.		
	16 in.		

Rx = Treatment **Volume is merchantable cubic feet/acre by DBH Class(in.)**

SE = Standard Error (+/- cubic ft./ac.)

D.4 Average Volume of Utilized Trees by DBH Class for Ponderosa Pine Forest Type in New Mexico

New Mexico, Forest Service Ownership

Gentle Slope - Low Hazard

RX **14 - 16 (SE)**

Year	DBH	Volume	SE
2030	9 in.		
2030	16 in.		
2060	9 in.		
2060	16 in.		
2090	9 in.		
2090	16 in.		

Steep Slope - Low Hazard

RX **14 - 16 (SE)**

Year	DBH	Volume	SE
2030	9 in.		
2030	16 in.	167	*53*
2060	9 in.		
2060	16 in.		
2090	9 in.		
2090	16 in.		

Gentle Slope - High Hazard

RX **14 - 16 (SE)**

Year	DBH	Volume	SE
2000	9 in.		
2000	16 in.		
2030	9 in.		
2030	16 in.		
2060	9 in.		
2060	16 in.		
2090	9 in.		
2090	16 in.		

Steep Slope - High Hazard

RX **14 - 16 (SE)**

Year	DBH	Volume	SE
2000	9 in.		
2000	16 in.		
2030	9 in.		
2030	16 in.		
2060	9 in.		
2060	16 in.		
2090	9 in.		
2090	16 in.		

Rx = Treatment **Volume is merchantable cubic feet/acre by DBH Class(in.)**

SE = Standard Error (+/- cubic ft./ac.)

D.4 Average Volume of Utilized Trees by DBH Class for Ponderosa Pine Forest Type in New Mexico

New Mexico, non - Forest Service Ownership

Gentle Slope - Low Hazard

RX	14 - 16	(SE)
Year: 2030		
9 in.		
16 in.	69	*14*
Year: 2060		
9 in.		
16 in.		
Year: 2090		
9 in.		
16 in.		

Steep Slope - Low Hazard

RX	14 - 16	(SE)
Year: 2030		
9 in.		
16 in.		
Year: 2060		
9 in.		
16 in.		
Year: 2090		
9 in.		
16 in.		

Gentle Slope - High Hazard

RX	14 - 16	(SE)
Year: 2000		
9 in.		
16 in.		
Year: 2030		
9 in.		
16 in.		
Year: 2060		
9 in.		
16 in.		
Year: 2090		
9 in.		
16 in.		

Gentle Slope - High Hazard

RX	14 - 16	(SE)
Year: 2000		
9 in.		
16 in.		
Year: 2030		
9 in.		
16 in.		
Year: 2060		
9 in.		
16 in.		
Year: 2090		
9 in.		
16 in.		

Rx = Treatment **Volume is merchantable cubic feet/acre by DBH Class(in.)**

SE = Standard Error (+/- cubic ft./ac.)

APPENDIX E
Average Volume of Unutilized Trees

Volumes for trees in the 1 to <4 and ≥4 to <7 inch DBH classes for Montana and ≥4 to <14 inch DBH classes for New Mexico are reported in this appendix. These biomass volumes are total tree volume estimates taken directly from the FVS model for the Montana cases. For New Mexico, volumes of 1-4 inch DBH trees were taken from FVS, volumes for the 4-14 inch DBH trees were calculated by FEEMA (volume to a 2 inch top). Unutilized tree volumes are reported to provide information on the total amount of bole wood biomass that needs to be processed to accomplish the fuel reduction treatment. This material is generally too small to be handled commercially but occasionally price spikes in either hog fuel or pulp chips make removal of some of these trees financially viable. Also, as new technologies arise alternative uses might be found for these trees so information on their volume is a useful for planning.

E.1 Average volume of Unutilized Trees cut by DBH Class for Douglas-Fir Forest Type in Montana

Western Montana, Forest Service Ownership

Gentle Slope - Low Hazard

RX	1-4	(SE)	4-7	(SE)	Total	(SE)
Year: 2030						
9 in.	103	22	37	9	140	17
50%	103	22	37	9	140	17
Year: 2060						
9 in.	45	4	12	5	57	3
50%	49	5	36	12	85	7
Year: 2090						
9 in.	41	4	7	3	49	1
50%	49	5	24	4	72	7

Steep Slope - Low Hazard

RX	1-4	(SE)	4-7	(SE)	Total	(SE)
Year: 2030						
9 in.	56	10	34	12	90	13
50%	56	10	34	12	90	13
Year: 2060						
9 in.	23	2	6	1	29	1
50%	26	2	16	3	42	2
Year: 2090						
9 in.	22	2	6	1	28	1
50%	26	2	13	2	39	2

Gentle Slope - High Hazard

RX	1-4	(SE)	4-7	(SE)	Total	(SE)
Year: 2000						
9 in.	123	17	311	52	434	37
50%	123	17	311	52	434	37
Year: 2030						
9 in.	32	9	43	17	75	17
50%	34	9	63	18	97	17
Year: 2060						
9 in.	22	4	22	9	44	8
50%	41	5	34	10	75	8
Year: 2090						
9 in.	19	4	9	4	28	5
50%	39	5	43	11	82	9

Steep Slope - High Hazard

RX	1-4	(SE)	4-7	(SE)	Total	(SE)
Year: 2000						
9 in.	80	14	238	38	318	30
50%	80	14	238	38	318	30
Year: 2030						
9 in.	11	3	20	9	31	9
50%	17	3	37	12	54	11
Year: 2060						
9 in.	19	4	19	5	37	6
50%	28	3	26	5	54	
Year: 2090						
9 in.	14	3	11	4	25	4
50%	28	3	30	6	58	4

Rx = Treatment **Volume is total tree cubic feet/acre by DBH Class(in.)**

SE = Standard Error (+/- cubic ft./ac.)

E.1 Average volume of Unutilized Trees cut by DBH Class for Douglas-Fir Forest Type in Montana

Western Montana, Non - Forest Service Ownership

Gentle Slope - Low Hazard

RX	1-4	(SE)	4-7	(SE)	Total	(SE)
Year: **2030**						
9 in.	43	*6*	62	*16*	105	*13*
50%	43	*6*	62	*16*	105	*13*
Year: **2060**						
9 in.	38	*6*	10	*3*	49	*5*
50%	42	*6*	14	*3*	56	*4*
Year: **2090**						
9 in.	36	*5*	11	*3*	47	*5*
50%	40	*5*	25	*5*	66	*3*

Steep Slope - Low Hazard

RX	1-4	(SE)	4-7	(SE)	Total	(SE)
Year: **2030**						
9 in.	18	*3*	46	*12*	64	*10*
50%	18	*3*	46	*12*	64	*10*
Year: **2060**						
9 in.	10	*1*	1		11	*1*
50%	12	*1*	3	*1*	15	
Year: **2090**						
9 in.	10	*1*	1		11	*1*
50%	12	*1*	3	*1*	15	

Gentle Slope - High Hazard

RX	1-4	(SE)	4-7	(SE)	Total	(SE)
Year: **2000**						
9 in.	108	*24*	419	*47*	527	*31*
50%	108	*24*	419	*47*	527	*31*
Year: **2030**						
9 in.	29	*5*	42	*11*	71	*10*
50%	29	*4*	43	*11*	72	*9*
Year: **2060**						
9 in.	24	*4*	21	*4*	45	*4*
50%	39	*5*	38	*6*	76	*1*
Year: **2090**						
9 in.	19	*4*	12	*2*	31	*3*
50%	36	*4*	39	*7*	74	*2*

Steep Slope - High Hazard

RX	1-4	(SE)	4-7	(SE)	Total	(SE)
Year: **2000**						
9 in.	83	*13*	318	*34*	401	*15*
50%	83	*13*	318	*34*	401	*15*
Year: **2030**						
9 in.	21	*4*	17	*3*	38	*4*
50%	16	*2*	27	*4*	42	*3*
Year: **2060**						
9 in.	14	*2*	22	*5*	36	*4*
50%	17	*2*	18	*3*	35	*1*
Year: **2090**						
9 in.	12	*2*	13	*3*	25	*2*
50%	16	*2*	17	*2*	33	*2*

Rx = Treatment **Volume is total tree cubic feet/acre by DBH Class(in.)**

SE = Standard Error (+/- cubic ft./ac.)

E.1 Average volume of Unutilized Trees cut by DBH Class for Douglas-Fir Forest Type in Montana

Eastern Montana, Forest Service Ownership

Gentle Slope - Low Hazard

RX	1-4	(SE)	4-7	(SE)	Total	(SE)
Year: 2030						
9 in.	54	*12*	28	*13*	82	*14*
50%	54	*12*	28	*13*	82	*14*
Year: 2060						
9 in.	22	*4*	18	*5*	41	*2*
50%	22	*4*	13	*2*	35	*2*
Year: 2090						
9 in.	19	*2*	25	*4*	43	*4*
50%	21	*2*	25	*4*	45	*4*

Steep Slope - Low Hazard

RX	1-4	(SE)	4-7	(SE)	Total	(SE)
Year: 2030						
9 in.	50	*12*	30	*12*	80	*14*
50%	50	*12*	30	*12*	80	*14*
Year: 2060						
9 in.	15	*2*	15	*6*	30	*6*
50%	15	*3*	17	*6*	32	*6*
Year: 2090						
9 in.	13	*2*	13	*2*	26	*2*
50%	14	*3*	10	*1*	24	

Gentle Slope - High Hazard

RX	1-4	(SE)	4-7	(SE)	Total	(SE)
Year: 2000						
9 in.	36	*7*	199	*34*	235	*30*
50%	36	*7*	199	*34*	235	*30*
Year: 2030						
9 in.	11	*1*	6	*1*	17	*1*
50%	13	*1*	10	*2*	23	*1*
Year: 2060						
9 in.	24	*4*	13	*3*	38	*3*
50%	25	*4*	19	*3*	44	*2*
Year: 2090						
9 in.	27	*4*	13	*3*	40	*3*
50%	25	*4*	24	*4*	49	*2*

Steep Slope - High Hazard

RX	1-4	(SE)	4-7	(SE)	Total	(SE)
Year: 2000						
9 in.	65	*15*	352	*82*	417	*77*
50%	65	*15*	352	*82*	417	*77*
Year: 2030						
9 in.	8	*1*	5	*1*	13	*1*
50%	10	*1*	10	*3*	20	*2*
Year: 2060						
9 in.	16	*3*	8	*2*	24	*2*
50%	16	*3*	11	*2*	27	*1*
Year: 2090						
9 in.	17	*3*	10	*2*	27	*2*
50%	16	*2*	12	*2*	28	*1*

Rx = Treatment **Volume is total tree cubic feet/acre by DBH Class(in.)**

SE = Standard Error (+/- cubic ft./ac.)

E.1 Average volume of Unutilized Trees cut by DBH Class for Douglas-Fir Forest Type in Montana

Eastern Montana, Non - Forest Service Ownership

Gentle Slope - Low Hazard

RX	1-4	(SE)	4-7	(SE)	Total	(SE)
Year: 2030						
9 in.	18	3	24	7	42	6
50%	18	3	24	7	42	6
Year: 2060						
9 in.	32	2	31	2	62	7
50%	31	2	34	3	65	7
Year: 2090						
9 in.	31	3	40	3	71	7
50%	33	3	40	4	72	7

Gentle Slope - High Hazard

RX	1-4	(SE)	4-7	(SE)	Total	(SE)
Year: 2000						
9 in.	32	10	248	44	279	41
50%	32	10	248	44	279	41
Year: 2030						
9 in.	25	2	20	2	45	4
50%	26	2	24	2	50	4
Year: 2060						
9 in.	29	2	30	3	59	4
50%	28	2	41	3	69	6
Year: 2090						
9 in.	32	3	30	3	62	5
50%	29	2	47	3	76	6

Steep Slope - Low Hazard

RX	1-4	(SE)	4-7	(SE)	Total	(SE)
Year: 2030						
9 in.	52	22	64	38	116	34
50%	52	22	64	38	116	34
Year: 2060						
9 in.	21	5	17	3	38	7
50%	20	5	18	3	39	7
Year: 2090						
9 in.	23	6	25	4	48	9
50%	22	6	21	3	44	8

Steep Slope - High Hazard

RX	1-4	(SE)	4-7	(SE)	Total	(SE)
Year: 2000						
9 in.	45	10	299	52	344	48
50%	45	10	299	52	344	48
Year: 2030						
9 in.	18	1	13	1	32	3
50%	19	1	18	3	37	1
Year: 2060						
9 in.	23	2	21	2	44	3
50%	22	2	26	2	48	4
Year: 2090						
9 in.	25	2	22	2	47	4
50%	23	2	29	2	52	5

Rx = Treatment **Volume is total tree cubic feet/acre by DBH Class(in.)**

SE = Standard Error (+/- cubic ft./ac.)

E.2 Average Volume of Unutilized Tress Cut by DBH Class for Ponderosa Pine Forest Type in Montana

Western Montana, Forest Service Ownership

Gentle Slope - Low Hazard

RX	1-4	(SE)	4-7	(SE)	Total	(SE)
Year: **2030**						
9 in.	26	*9*	90	*27*	116	*12*
50%	26	*9*	90	*27*	116	*12*
Year: **2060**						
9 in.	37	*11*	36	*16*	72	
50%	44	*9*	52	*17*	96	*17*
Year: **2090**						
9 in.	30	*11*	26	*15*	56	*10*
50%	47	*7*	62	*15*	108	*23*

Steep Slope - Low Hazard

RX	1-4	(SE)	4-7	(SE)	Total	(SE)
Year: **2030**						
9 in.	7	*2*	23	*19*	31	*18*
50%	7	*2*	23	*19*	31	*18*
Year: **2060**						
9 in.	20	*3*	20	*7*	40	*7*
50%	25	*3*	34	*7*	59	*14*
Year: **2090**						
9 in.	19	*4*	12	*4*	31	*6*
50%	26	*3*	46	*8*	73	*17*

Gentle Slope - High Hazard

RX	1-4	(SE)	4-7	(SE)	Total	(SE)
Year: **2000**						
9 in.	69	*17*	263	*63*	332	*25*
50%	69	*17*	263	*63*	332	*25*
Year: **2030**						
9 in.	17	*3*	54	*29*	71	*26*
50%	22	*3*	60	*28*	83	*23*
Year: **2060**						
9 in.	23	*5*	14	*7*	37	*4*
50%	44	*4*	51	*11*	95	*18*
Year: **2090**						
9 in.	16	*4*	7	*5*	24	*3*
50%	55	*6*	59	*9*	114	*23*

Steep Slope - High Hazard

RX	1-4	(SE)	4-7	(SE)	Total	(SE)
Year: **2000**						
9 in.	42	*15*	119	*66*	161	*51*
50%	42	*15*	119	*66*	161	*51*
Year: **2030**						
9 in.	14	*3*	7	*2*	21	*1*
50%	16	*3*	30	*12*	46	*8*
Year: **2060**						
9 in.	21	*4*	15	*6*	36	*2*
50%	32	*4*	34	*6*	66	*11*
Year: **2090**						
9 in.	17	*4*	19	*9*	36	*6*
50%	33	*4*	41	*8*	73	*12*

Rx = Treatment **Volume is total tree cubic feet/acre by DBH Class(in.)**

SE = Standard Error (+/- cubic ft./ac.)

E.2 Average Volume of Unutilized Tress Cut by DBH Class for Ponderosa Pine Forest Type in Montana

Western Montana, Non - Forest Service Ownership

Gentle Slope - Low Hazard

RX	1-4	(SE)	4-7	(SE)	Total	(SE)
Year: 2030						
9 in.	15	*2*	57	*10*	72	*5*
50%	15	*2*	57	*10*	72	*5*
Year: 2060						
9 in.	43	*7*	55	*15*	98	*7*
50%	55	*9*	71	*15*	126	*10*
Year: 2090						
9 in.	36	*8*	34	*12*	70	*8*
50%	61	*8*	58	*7*	119	*16*

Steep Slope - Low Hazard

RX	1-4	(SE)	4-7	(SE)	Total	(SE)
Year: 2030						
9 in.	13	*2*	20	*4*	33	*5*
50%	13	*2*	20	*4*	33	*5*
Year: 2060						
9 in.	16	*3*	17	*3*	33	*6*
50%	21	*3*	24	*4*	46	*8*
Year: 2090						
9 in.	13	*2*	12	*3*	25	*4*
50%	25	*4*	25	*5*	50	*9*

Gentle Slope - High Hazard

RX	1-4	(SE)	4-7	(SE)	Total	(SE)
Year: 2000						
9 in.	117	*26*	235	*38*	352	*21*
50%	117	*26*	235	*38*	352	*21*
Year: 2030						
9 in.	38	*5*	49	*12*	87	*7*
50%	53	*7*	39	*6*	93	*7*
Year: 2060						
9 in.	22	*3*	10	*3*	32	*2*
50%	52	*6*	42	*5*	94	*10*
Year: 2090						
9 in.	15	*3*	5	*1*	20	*2*
50%	61	*6*	59	*6*	120	*13*

Steep Slope - High Hazard

RX	1-4	(SE)	4-7	(SE)	Total	(SE)
Year: 2000						
9 in.						
50%						
Year: 2030						
9 in.						
50%						
Year: 2060						
9 in.						
50%						
Year: 2090						
9 in.						
50%						

Rx = Treatment **Volume is total tree cubic feet/acre by DBH Class(in.)**

SE = Standard Error (+/- cubic ft./ac.)

E.2 Average Volume of Unutilized Tress Cut by DBH Class for Ponderosa Pine Forest Type in Montana

Eastern Montana, Forest Service Ownership

Gentle Slope - Low Hazard

RX	1-4	(SE)	4-7	(SE)	Total	(SE)
Year: 2030						
9 in.						
50%						
Year: 2060						
9 in.						
50%						
Year: 2090						
9 in.						
50%						

Steep Slope - Low Hazard

RX	1-4	(SE)	4-7	(SE)	Total	(SE)
Year: 2030						
9 in.						
50%						
Year: 2060						
9 in.						
50%						
Year: 2090						
9 in.						
50%						

Gentle Slope - High Hazard

RX	1-4	(SE)	4-7	(SE)	Total	(SE)
Year: 2000						
9 in.	46	*15*	159	*28*	206	*17*
50%	46	*15*	159	*28*	206	*17*
Year: 2030						
9 in.	43	*16*	51	*24*	94	*26*
50%	38	*14*	73	*33*	111	*33*
Year: 2060						
9 in.	44	*3*	60	*7*	103	*12*
50%	42	*2*	67	*6*	109	*13*
Year: 2090						
9 in.	46	*3*	61	*7*	106	*13*
50%	45	*3*	70	*7*	115	*14*

Steep Slope - High Hazard

RX	1-4	(SE)	4-7	(SE)	Total	(SE)
Year: 2000						
9 in.	92	*44*	172	*57*	263	*35*
50%	92	*44*	172	*57*	263	*35*
Year: 2030						
9 in.	22	*2*	41	*6*	63	*10*
50%	24	*3*	44	*6*	68	*11*
Year: 2060						
9 in.	21	*5*	29	*6*	50	*6*
50%	33	*5*	38	*6*	70	*12*
Year: 2090						
9 in.	17	*4*	23	*6*	40	*4*
50%	35	*5*	42	*5*	77	*14*

Rx = Treatment **Volume is total tree cubic feet/acre by DBH Class(in.)**

SE = Standard Error (+/- cubic ft./ac.)

E.2 Average Volume of Unutilized Tress Cut by DBH Class for Ponderosa Pine Forest Type in Montana

Eastern Montana, Non - Forest Service Ownership

Gentle Slope - Low Hazard

RX	1-4	(SE)	4-7	(SE)	Total	(SE)
Year: 2030						
9 in.	24	1	20	2	44	5
50%	24	1	20	2	44	5
Year: 2060						
9 in.	52	2	64	4	115	12
50%	51	2	71	6	121	12
Year: 2090						
9 in.	51	2	62	4	113	12
50%	54	2	90	7	145	14

Gentle Slope - High Hazard

RX	1-4	(SE)	4-7	(SE)	Total	(SE)
Year: 2000						
9 in.	42	10	175	28	217	22
50%	42	10	175	28	217	22
Year: 2030						
9 in.	40	1	36	3	76	7
50%	39	1	37	3	76	7
Year: 2060						
9 in.	49	2	54	4	104	10
50%	47	2	61	5	107	10
Year: 2090						
9 in.	57	2	69	6	126	11
50%	55	2	79	7	134	12

Steep Slope - Low Hazard

RX	1-4	(SE)	4-7	(SE)	Total	(SE)
Year: 2030						
9 in.	19	1	18	6	37	4
50%	19	1	18	6	37	4
Year: 2060						
9 in.	36	1	42	4	78	10
50%	37	1	45	5	82	10
Year: 2090						
9 in.	40	1	41	3	81	11
50%	40	2	56	6	96	12

Steep Slope - High Hazard

RX	1-4	(SE)	4-7	(SE)	Total	(SE)
Year: 2000						
9 in.	61	21	224	30	286	14
50%	61	21	224	30	286	14
Year: 2030						
9 in.	26	3	35	6	62	4
50%	35	2	50	8	85	7
Year: 2060						
9 in.	23	3	17	3	40	3
50%	38	2	42	4	79	9
Year: 2090						
9 in.	19	2	12	2	31	2
50%	43	3	46	5	89	10

Rx = Treatment **Volume is total tree cubic feet/acre by DBH Class(in.)**

SE = Standard Error (+/- cubic ft./ac.)

E.3 Average Volume of Unutilized Trees Cut by DBH Class for Mixed Conifer Forest Type in New Mexico

Forest Service Ownership

Gentle Slope - Low Hazard

RX	1-4	(SE)	4-7	(SE)	7-10	(SE)	10-14	(SE)	Total	(SE)
Year: 2030										
9 in.	49	26	32	11	73	28	0		154	15
16 in.	89	39	32	11	120	31	234	45	476	94
Year: 2060										
9 in.	250	66	0		0		0		250	66
16 in.	593		0		0		0		593	
Year: 2090										
9 in.	593		0		0		0		593	
16 in.										

Steep Slope - Low Hazard

RX	1-4	(SE)	4-7	(SE)	7-10	(SE)	10-14	(SE)	Total	(SE)
Year: 2030										
9 in.	37	27	60	34	58	26	0		156	17
16 in.	37	27	60	34	78	28	244	95	420	58
Year: 2060										
9 in.	124	92	0		0		0		124	92
16 in.	189	117	0		0		0		189	117
Year: 2090										
9 in.	186	195	0		0		0		186	195
16 in.	395		0		0		0		395	

Gentle Slope - High Hazard

RX	1-4	(SE)	4-7	(SE)	7-10	(SE)	10-14	(SE)	Total	(SE)
Year: 2000										
9 in.	50	23	13	8	24	16	0		87	26
16 in.	37	20	13	8	40	24	63	35	153	39
Year: 2030										
9 in.	15	15	0		0		0		15	15
16 in.	13	13	0		0		0		13	13
Year: 2060										
9 in.										
16 in.										
Year: 2090										
9 in.	27	16	0		0		0		27	16
16 in.	18	13	0		0		0		18	13

Steep Slope - High Hazard

RX	1-4	(SE)	4-7	(SE)	7-10	(SE)	10-14	(SE)	Total	(SE)
Year: 2000										
9 in.	34	22	40	16	72	28	0		145	30
16 in.	29	22	40	16	91	36	50	29	210	37
Year: 2030										
9 in.	24	13	0		0		0		24	13
16 in.	13	8	0		0		0		13	8
Year: 2060										
9 in.	2		0		0		0		2	
16 in.	2		0		0		0		2	
Year: 2090										
9 in.	16	8	0		0		0		16	8
16 in.	19	7	0		0		0		19	7

Rx = Treatment **Volume is merchantable cubic feet/acre by DBH Class(in.)**

SE = Standard Error (+/- cubic ft./ac.)

E.3 Average Volume of Unutilized Trees Cut by DBH Class for Dry Mixed Conifer Forest Type in New Mexico

Non - Forest Service Ownership

Gentle Slope - Low Hazard

RX	1-4	(SE)	4-7	(SE)	7-10	(SE)	10-14	(SE)	Total	(SE)
Year: 2030										
9 in.	57	*27*	25	*12*	49	*25*	0		132	*16*
16 in.	56	*27*	25	*12*	85	*41*	171	*52*	336	*53*
Year: 2060										
9 in.	16	*7*	0		0		0		16	*7*
16 in.	6	*1*	0		0		0		6	*1*
Year: 2090										
9 in.	49		0		0		0		49	
16 in.	42		0		0		0		42	

Gentle Slope - High Hazard

RX	1-4	(SE)	4-7	(SE)	7-10	(SE)	10-14	(SE)	Total	(SE)
Year: 2000										
9 in.	59	*18*	130	*20*	136	*22*	0		324	*27*
16 in.	44	*16*	130	*20*	170	*29*	80	*30*	424	*34*
Year: 2030										
9 in.	27	*11*	0		0		0		27	*11*
16 in.	33	*11*	0		0		108	*54*	141	*49*
Year: 2060										
9 in.	88	*33*	0		0		0		88	*33*
16 in.	117	*39*	0		1	*1*	0		117	*38*
Year: 2090										
9 in.	75	*21*	0		0		0		75	*21*
16 in.	102	*31*	0		0		0		102	*31*

Steep Slope - Low Hazard

RX	1-4	(SE)	4-7	(SE)	7-10	(SE)	10-14	(SE)	Total	(SE)
Year: 2030										
9 in.										
16 in.										
Year: 2060										
9 in.										
16 in.										
Year: 2090										
9 in.										
16 in.										

Steep Slope - High Hazard

RX	1-4	(SE)	4-7	(SE)	7-10	(SE)	10-14	(SE)	Total	(SE)
Year: 2000										
9 in.	70	*18*	134	*24*	109	*28*	0		313	*41*
16 in.	67	*18*	134	*24*	154	*39*	222	*84*	577	*56*
Year: 2030										
9 in.	13	*12*	0		0		0		13	*12*
16 in.	37	*33*	0		0		184	*165*	221	*120*
Year: 2060										
9 in.	85		0		0		0		85	
16 in.										
Year: 2090										
9 in.	146	*98*	1	*1*	1	*1*	0		148	*98*
16 in.	151	*92*	0		0		0		151	*92*

Rx = Treatment **Volume is merchantable cubic feet/acre by DBH Class(in.)**

SE = Standard Error (+/- cubic ft./ac.)

E.4 Average Volume of Unutilized Trees Cut by DBH Class for Ponderosa Pine Forest Type in New Mexico

Forest Service Ownership

Gentle Slope - Low Hazard

RX	1-4	(SE)	4-7	(SE)	7-10	(SE)	10-14	(SE)	Total	(SE)
Year: 2030										
9 in.	90	*37*	19	*10*	48	*22*	0		157	*36*
16 in.	98	*37*	19	*10*	77	*35*	103	*47*	297	*44*
Year: 2060										
9 in.	151	*99*	0		0		0		151	*99*
16 in.	321	*122*	0		0		0		321	*122*
Year: 2090										
9 in.	276	*160*	0		0		0		276	*160*
16 in.	718		0		0		0		718	

Gentle Slope - High Hazard

RX	1-4	(SE)	4-7	(SE)	7-10	(SE)	10-14	(SE)	Total	(SE)
Year: 2000										
9 in.	56	*26*	40	*28*	33	*21*	0		129	*37*
16 in.	33	*22*	40	*28*	47	*28*	44	*30*	165	*43*
Year: 2030										
9 in.	11	*11*	0		0		0		11	*11*
16 in.	11	*10*	0		0		0		11	*10*
Year: 2060										
9 in.										
16 in.										
Year: 2090										
9 in.	19	*11*	0		0		0		19	*11*
16 in.	37	*16*	0		0		6	*7*	43	*15*

Steep Slope - Low Hazard

RX	1-4	(SE)	4-7	(SE)	7-10	(SE)	10-14	(SE)	Total	(SE)
Year: 2030										
9 in.	22	*9*	25	*13*	86	*16*	0		134	*26*
16 in.	25	*9*	25	*13*	122	*22*	264	*69*	436	*87*
Year: 2060										
9 in.										
16 in.										
Year: 2090										
9 in.	22		0		0		0		22	
16 in.										

Steep Slope - High Hazard

RX	1-4	(SE)	4-7	(SE)	7-10	(SE)	10-14	(SE)	Total	(SE)
Year: 2000										
9 in.	68	*24*	79	*21*	86	*22*	0		233	*20*
16 in.	40	*14*	79	*21*	118	*33*	95	*42*	332	*26*
Year: 2030										
9 in.	25	*9*	0		0		0		25	*9*
16 in.	125	*101*	0		0		61	*60*	186	*93*
Year: 2060										
9 in.	84	*33*	0		0		0		84	*33*
16 in.	55		0		0		0		55	
Year: 2090										
9 in.	186	*104*	0		1	*1*	0		187	*103*
16 in.	169	*77*	0		2	*1*	25	*26*	196	*60*

Rx = Treatment **Volume is merchantable cubic feet/acre by DBH Class(in.)**

SE = Standard Error (+/- cubic ft./ac.)

E.4 Average Volume of Unutilized Trees Cut by DBH Class for Ponderosa Pine Forest Type in New Mexico

Non - Forest Service Ownership

Gentle Slope - Low Hazard

RX	1-4	(SE)	4-7	(SE)	7-10	(SE)	10-14	(SE)	Total	(SE)
Year: 2030										
9 in.	36	*11*	27	*9*	54	*11*	0		117	*7*
16 in.	34	*11*	25	*8*	85	*16*	169	*28*	313	*20*
Year: 2060										
9 in.	188	*189*	0		0		0		188	*189*
16 in.	805		0		0		0		805	
Year: 2090										
9 in.	666		0		0		0		666	
16 in.	301	*282*	0		0		0		301	*282*

Gentle Slope - High Hazard

RX	1-4	(SE)	4-7	(SE)	7-10	(SE)	10-14	(SE)	Total	(SE)
Year: 2000										
9 in.	80	*36*	38	*18*	73	*31*	0		191	*35*
16 in.	64	*33*	38	*18*	94	*39*	74	*42*	269	*42*
Year: 2030										
9 in.	10	*10*	0		0		0		10	*10*
16 in.	20	*9*	0		0		0		20	*9*
Year: 2060										
9 in.	2		0		0		0		2	
16 in.	1	*1*	0		0		0		1	*1*
Year: 2090										
9 in.	32	*20*	0		0		0		32	*20*
16 in.	19	*12*	0		0		0		19	*12*

Gentle Slope - Low Hazard

RX	1-4	(SE)	4-7	(SE)	7-10	(SE)	10-14	(SE)	Total	(SE)
Year: 2030										
9 in.										
16 in.										
Year: 2060										
9 in.										
16 in.										
Year: 2090										
9 in.										
16 in.										

Gentle Slope - High Hazard

RX	1-4	(SE)	4-7	(SE)	7-10	(SE)	10-14	(SE)	Total	(SE)
Year: 2000										
9 in.										
16 in.										
Year: 2030										
9 in.										
16 in.										
Year: 2060										
9 in.										
16 in.										
Year: 2090										
9 in.										
16 in.										

Rx = Treatment **Volume is merchantable cubic feet/acre by DBH Class(in.)**

SE = Standard Error (+/- cubic ft./ac.)

APPENDIX F
Average Small End Diameter of Utilized Logs

Information on average sawlog size is reported in this appendix. These data provide mill-owners with information on how the size of logs generated from fuel reduction treatments might be expected to change over time. Tables in the appendix show the average small-end diameter (SED) of logs removed during treatments by entry. The SEDs of individual logs are output by FEEMA weighted by volume and plot expansion factor. The minimum diameter log included in FEEMA output is 5-inches for Montana and 9.5-inches for New Mexico. All tree species are combined.

F.1 Average Small End Diameter of Utilized Logs for Douglas-fir Forest Type in Montana.

TYPE	ENTRY: 1 9 in.	*SE*	50%	*SE*	ENTRY: 2 9 in.	*SE*	50%	*SE*	ENTRY: 3 9 in.	*SE*	50%	*SE*	ENTRY: 4 9 in.	*SE*	50%	*SE*
<u>Western MT</u>																
NFS																
Steep slope, high fire hazard	5.6	*0.05*	6.8	*0.17*			10.0	*0.31*			*13.1*	*0.35*			15.4	0.40
Gentle slope, high fire hazard	5.5	*0.05*	6.4	*0.14*			8.3	*0.29*			10.1	*0.38*			12.5	*0.36*
Steep slope, low fire hazard							9.1	*0.44*			11.6	*0.54*			14.7	*0.53*
Gentle slope, low fire hazard							9.4	*0.41*			13.1	*0.64*			15.3	*0.74*
NON-NFS																
Steep slope, high fire hazard	5.4	*0.04*	6.0	*0.17*			8.1	*0.44*			10.5	*0.48*			13.1	*0.47*
Gentle slope, high fire hazard	5.5	*0.04*	6.4	*0.20*			8.3	*0.35*			10.4	*0.39*			12.1	*0.48*
Steep slope, low fire hazard							7.8	*0.31*			11.2	*0.43*			13.9	*0.47*
Gentle slope, low fire hazard					5.5	*0.09*	8.4	*0.37*			11.8	*0.50*			14.7	*0.52*
<u>Eastern MT</u>																
NFS																
Steep slope, high fire hazard	5.4	*0.04*	6.8	*0.24*			9.6	*0.62*			11.1	*0.64*			12.6	*0.56*
Gentle slope, high fire hazard	5.5	*0.05*	6.9	*0.21*			9.7	*0.36*			11.9	*0.45*			13.3	*0.48*
Steep slope, low fire hazard							8.9	*0.48*			12.0	*0.76*			13.0	*0.83*
Gentle slope, low fire hazard							7.8	*0.39*			10.6	*0.56*			13.2	*0.50*
NON-NFS																
Steep slope, high fire hazard	5.5	*0.04*	6.2	*0.14*			8.8	*0.33*			11.0	*0.43*			14.2	*0.43*
Gentle slope, high fire hazard	5.5	*0.04*	6.4	*0.17*			9.3	*0.31*			12.2	*0.44*			14.8	*0.53*
Steep slope, low fire hazard							9.8	*0.98*			13.2	*1.40*			16.2	*1.53*
Gentle slope, low fire hazard							8.5	*0.33*			10.9	*0.42*			13.7	*0.41*

Treatment:
9 = Thin from below to 9 in. DBH.
50% = Thin from below 50% of standing basal area.

Entry date 1: 2000 for high fire hazard stands, 2030 for low fire hazard stands.
Entry date 2: 2030 for high fire hazard stands, 2060 for low fire hazard stands.
Entry date 3: 2060 for high fire hazard stands, 2090 for low fire hazard stands.
Entry date 4: 2090 for high fire hazard stands.
SE = Standard Error (+/- in.)
Note: Blank entries indicate no logs with small-end diameter > 5 in. harvested.

F.2 Average Small End Diameter of Utilized Logs for Ponderosa Pine Forest Type in Montana

	ENTRY: 1				ENTRY: 2				ENTRY: 3				ENTRY: 4			
TYPE TREATMENT:	9 in.	*SE*	50%	*SE*	9 in.	*SE*	50%	*SE*	9 in.	*SE*	50%	*SE*	9 in.	*SE*	50%	*SE*
<u>Western MT</u>																
NFS																
Steep slope, high fire hazard	5.6	*0.18*	7.5	*0.43*			10.6	*0.97*			*13.9*	*0.92*			15.3	1.18
Gentle slope, high fire hazard	5.5	*0.15*	7.8	*0.95*			9.7	*1.04*			13.5	*0.89*			16.6	*0.82*
Steep slope, low fire hazard					5.5	*0.02*	8.7	*1.20*			12.1	*1.28*			16.5	*1.30*
Gentle slope, low fire hazard					5.4	*0.13*	7.8	*0.74*			11.5	*0.99*			15.1	*1.01*
NON-NFS																
Steep slope, high fire hazard																
Gentle slope, high fire hazard	5.5	*0.06*	6.2	*0.22*			10.5	*0.43*			15.2	*0.47*			18.1	*0.42*
Steep slope, low fire hazard							10.0	*0.81*			13.6	*1.05*			16.0	*0.81*
Gentle slope, low fire hazard							9.1	*0.80*			13.0	*0.73*			16.5	*0.66*
<u>Eastern MT</u>																
NFS																
Steep slope, high fire hazard	5.3	*0.15*	6.2	*0.71*			9.2	*0.62*			14.0	*0.55*			16.1	*0.96*
Gentle slope, high fire hazard	5.4	*0.07*	6.3	*0.15*			9.2	*0.32*			10.7	*0.59*			12.3	*0.65*
Steep slope, low fire hazard																
Gentle slope, low fire hazard																
NON-NFS																
Steep slope, high fire hazard	5.3	*0.04*	6.1	*0.17*			10.4	*0.51*			13.8	*0.67*			15.3	*0.75*
Gentle slope, high fire hazard	5.3	*0.04*	5.9	*0.14*			8.2	*0.21*			10.2	*0.34*			12.1	*0.40*
Steep slope, low fire hazard							7.7	*0.26*			10.3	*0.37*			11.4	*0.60*
Gentle slope, low fire hazard							7.9	*0.26*			10.6	*0.39*			11.4	*0.47*

Treatment:

9 = Thin from below to 9 in. DBH.

50% = Thin from below 50% of standing basal area.

Entry date 1: 2000 for high fire hazard stands, 2030 for low fire hazard stands.

Entry date 2: 2030 for high fire hazard stands, 2060 for low fire hazard stands.

Entry date 3: 2060 for high fire hazard stands, 2090 for low fire hazard stands.

Entry date 4: 2090 for high fire hazard stands.

SE = Standard Error (+/- in.)

Note: Blank entries indicate no logs with small-end diameter > 5 in. harvested.

F.3 Average Small End Diameter of Utilized Logs for Dry Mixed Conifer Forest Type in New Mexico

	ENTRY: 1				ENTRY: 2				ENTRY: 3				ENTRY: 4			
TYPE / TREATMENT:	9 in.	*SE*	16 in.	*SE*	9 in.	*SE*	16 in.	*SE*	9 in.	*SE*	16 in.	*SE*	9 in.	*SE*	16 in.	*SE*
New Mexico																
NFS																
Steep slope, high fire hazard																
Gentle slope, high fire hazard																
Steep slope, low fire hazard							10.2	*0.04*								
Gentle slope, low fire hazard							10.1	*0.20*								
NON-NFS																
Steep slope, high fire hazard							10.0									
Gentle slope, high fire hazard																
Steep slope, low fire hazard																
Gentle slope, low fire hazard							10.1	*0.08*								

Treatment:
9 = Thin from below to 9 in. DBH.
50% = Thin from below 50% of standing basal area.

Entry date 1: 2000 for high fire hazard stands, 2030 for low fire hazard stands.
Entry date 2: 2030 for high fire hazard stands, 2060 for low fire hazard stands.
Entry date 3: 2060 for high fire hazard stands, 2090 for low fire hazard stands.
Entry date 4: 2090 for high fire hazard stands.
SE = Standard Error (+/- in.)
Note: Blank entries indicate no logs with small-end diameter > 5 in. harvested.

F.4 Average Small End Diameter of Utilized Logs for Ponderosa Pine Forest Type in New Mexico

	ENTRY: 1				ENTRY: 2				ENTRY: 3				ENTRY: 4			
TYPE / TREATMENT:	9 in.	*SE*	16 in.	*SE*	9 in.	*SE*	16 in.	*SE*	9 in.	*SE*	16 in.	*SE*	9 in.	*SE*	16 in.	*SE*
New Mexico																
NFS																
Steep slope, high fire hazard																
Gentle slope, high fire hazard																
Steep slope, low fire hazard							10.0	*0.18*								
Gentle slope, low fire hazard																
NON-NFS																
Steep slope, high fire hazard																
Gentle slope, high fire hazard																
Steep slope, low fire hazard																
Gentle slope, low fire hazard							9.9	*0.10*								

Treatment:
9 = Thin from below to 9 in. DBH.
50% = Thin from below 50% of standing basal area.

Entry date 1: 2000 for high fire hazard stands, 2030 for low fire hazard stands.
Entry date 2: 2030 for high fire hazard stands, 2060 for low fire hazard stands.
Entry date 3: 2060 for high fire hazard stands, 2090 for low fire hazard stands.
Entry date 4: 2090 for high fire hazard stands.
SE = Standard Error (+/- in.)
Note: Blank entries indicate no logs with small-end diameter > 5 in. harvested.

APPENDIX G
Average Percent of Volume of Utilized Trees by Species

Information presented in this appendix provides mill managers with estimates of the species mix of logs removed during various treatment entries. The average percentage of volume in each of the 3 main groups, Douglas-fir/larch, ponderosa pine, and white woods, is displayed. Calculation is based on the average merchantable harvest volume (cf/ac) from FEEMA, weighted by the plot expansion factor.

G.1 Average Percent of Volume of Utilized Trees by Species of Utilized Logs for Douglas-fir Forest Type in Montana

Western Montana, Forest Service Ownership

Gentle Slope - Low Hazard

Year	Rx	D.Fir/Larch	P. Pine	White Woods
Year: 2030	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	67	8	25
SE		*16*	*2*	*6*
Year: 2060	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	71	17	12
SE		*15*	*4*	*3*
Year: 2090	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	79	15	6
SE		*16*	*3*	*1*

Steep Slope - Low Hazard

Year	Rx	D.Fir/Larch	P. Pine	White Woods
Year: 2030	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	71	13	16
SE		*13*	*2*	*3*
Year: 2060	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	89	9	2
SE		*15*	*1*	
Year: 2090	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	91	8	1
SE		*14*	*1*	

Gentle Slope - High Hazard

Year	Rx	D.Fir/Larch	P. Pine	White Woods
Year: 2000	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.	77	3	20
SE		*13*		*3*
Mean	50%	75	3	22
SE		*14*	*1*	*4*
Year: 2030	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	85	5	10
SE		*14*	*1*	*2*
Year: 2060	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	85	11	4
SE		*13*	*2*	*1*
Year: 2090	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	89	8	3
SE		*13*	*1*	

Steep Slope - High Hazard

Year	Rx	D.Fir/Larch	P. Pine	White Woods
Year: 2000	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.	80	6	14
SE		*14*	*1*	*2*
Mean	50%	86	1	13
SE		*14*		*2*
Year: 2030	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	95	2	3
SE		*15*		
Year: 2060	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	97	1	2
SE		*15*		
Year: 2090	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	96	3	1
SE		*14*		

Rx = Treatment D.Fir/Larch = Douglas-fir and Larch P. Pine = Ponderosa Pine White Woods = All other species

SE = Standard Error (+/-)

Note: Blanks indicate no harvested volume.

G.1 Average Percent of Volume of Utilized Trees by Species of Utilized Logs for Douglas-fir Forest Type in Montana

Western Montana, Non-Forest Service Ownership

Gentle Slope - Low Hazard

Year: **2030**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.	62	12	26
SE		*16*	*3*	*7*
Mean	50%	77	9	14
SE		*15*	*2*	*3*

Year: **2060**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	78	16	5
SE		*14*	*3*	*1*

Year: **2090**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	76	21	2
SE		*12*	*3*	

Steep Slope - Low Hazard

Year: **2030**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	80	12	8
SE		*13*	*2*	*1*

Year: **2060**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	79	19	1
SE		*13*	*3*	

Year: **2090**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	75	23	3
SE		*11*	*3*	

Gentle Slope - High Hazard

Year: **2000**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.	77	3	20
SE		*13*	*1*	*3*
Mean	50%	77	7	16
SE		*14*	*1*	*3*

Year: **2030**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	91	6	3
SE		*16*	*1*	

Year: **2060**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	90	9	1
SE		*14*	*1*	

Year: **2090**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	85	12	3
SE		*13*	*2*	

Steep Slope - High Hazard

Year: **2000**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.	88	3	8
SE		*13*		*1*
Mean	50%	81	4	15
SE		*17*	*1*	*3*

Year: **2030**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	89	6	4
SE		*16*	*1*	*1*

Year: **2060**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	90	9	1
SE		*15*	*1*	

Year: **2090**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	86	13	0
SE		*14*	*2*	

Rx = Treatment   D.Fir/Larch = Douglas-fir and Larch   P. Pine = Ponderosa Pine   White Woods = All other species

SE = Standard Error (+/-)

Note: Blanks indicate no harvested volume.

G.1 Average Percent of Volume of Utilized Trees by Species of Utilized Logs for Douglas-fir Forest Type in Montana

Eastern Montana, Forest Service Ownership

Gentle Slope - Low Hazard

Year: **2030**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	79	0	21
SE		*19*		*5*
Year: 2060	**Rx**	**D.Fir/Larch**	**P. Pine**	**White Woods**
Mean	9 in.			
SE				
Mean	50%	99	0	0
SE		*22*		
Year: 2090	**Rx**	**D.Fir/Larch**	**P. Pine**	**White Woods**
Mean	9 in.			
SE				
Mean	50%	96	4	0
SE		*20*	*1*	

Steep Slope - Low Hazard

Year: **2030**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	89	0	11
SE		*24*		*3*
Year: 2060	**Rx**	**D.Fir/Larch**	**P. Pine**	**White Woods**
Mean	9 in.			
SE				
Mean	50%	86	0	14
SE		*22*		*4*
Year: 2090	**Rx**	**D.Fir/Larch**	**P. Pine**	**White Woods**
Mean	9 in.			
SE				
Mean	50%	95	4	1
SE		*21*	*1*	

Gentle Slope - High Hazard

Year: **2000**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.	86	2	12
SE		*15*		*2*
Mean	50%	83	2	16
SE		*13*		*2*
Year: 2030	**Rx**	**D.Fir/Larch**	**P. Pine**	**White Woods**
Mean	9 in.			
SE				
Mean	50%	93	1	6
SE		*15*		*1*
Year: 2060	**Rx**	**D.Fir/Larch**	**P. Pine**	**White Woods**
Mean	9 in.			
SE				
Mean	50%	98	0	2
SE		*16*		
Year: 2090	**Rx**	**D.Fir/Larch**	**P. Pine**	**White Woods**
Mean	9 in.			
SE				
Mean	50%	96	2	1
SE		*15*		

Steep Slope - High Hazard

Year: **2000**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.	97	0	3
SE		*17*		*1*
Mean	50%	90	0	10
SE		*17*		*2*
Year: 2030	**Rx**	**D.Fir/Larch**	**P. Pine**	**White Woods**
Mean	9 in.			
SE				
Mean	50%	95	0	5
SE		*21*		*1*
Year: 2060	**Rx**	**D.Fir/Larch**	**P. Pine**	**White Woods**
Mean	9 in.			
SE				
Mean	50%	92	4	3
SE		*18*	*1*	*1*
Year: 2090	**Rx**	**D.Fir/Larch**	**P. Pine**	**White Woods**
Mean	9 in.			
SE				
Mean	50%	95	2	4
SE		*17*		*1*

Rx = Treatment D.Fir/Larch = Douglas-fir and Larch P. Pine = Ponderosa Pine White Woods = All other species

SE = Standard Error (+/-)

Note: Blanks indicate no harvested volume.

G.1 Average Percent of Volume of Utilized Trees by Species of Utilized Logs for Douglas-fir Forest Type in Montana

Eastern Montana, Non-Forest Service Ownership

Gentle Slope - Low Hazard

Year	Rx		D.Fir/Larch	P. Pine	White Woods
2030	9 in.	Mean			
		SE			
	50%	Mean	87	6	7
		SE	*18*	*1*	*1*
2060	9 in.	Mean			
		SE			
	50%	Mean	80	16	4
		SE	*14*	*3*	*1*
2090	9 in.	Mean			
		SE			
	50%	Mean	88	10	2
		SE	*15*	*2*	

Steep Slope - Low Hazard

Year	Rx		D.Fir/Larch	P. Pine	White Woods
2030	9 in.	Mean			
		SE			
	50%	Mean	79	0	21
		SE	*35*		*9*
2060	9 in.	Mean			
		SE			
	50%	Mean	91	0	9
		SE	*37*		*4*
2090	9 in.	Mean			
		SE			
	50%	Mean	95	5	0
		SE	*39*	*2*	

Gentle Slope - High Hazard

Year	Rx		D.Fir/Larch	P. Pine	White Woods
2000	9 in.	Mean	87	4	9
		SE	*13*	*1*	*1*
	50%	Mean	90	3	7
		SE	*13*		*1*
2030	9 in.	Mean			
		SE			
	50%	Mean	90	5	5
		SE	*13*	*1*	*1*
2060	9 in.	Mean			
		SE			
	50%	Mean	91	8	1
		SE	*13*	*1*	
2090	9 in.	Mean			
		SE			
	50%	Mean	90	8	2
		SE	*13*	*1*	

Steep Slope - High Hazard

Year	Rx		D.Fir/Larch	P. Pine	White Woods
2000	9 in.	Mean	88	5	8
		SE	*13*	*1*	*1*
	50%	Mean	91	1	8
		SE	*15*		*1*
2030	9 in.	Mean			
		SE			
	50%	Mean	89	3	7
		SE	*16*	*1*	*1*
2060	9 in.	Mean			
		SE			
	50%	Mean	84	12	4
		SE	*13*	*2*	*1*
2090	9 in.	Mean			
		SE			
	50%	Mean	92	7	1
		SE	*14*	*1*	

Rx = Treatment D.Fir/Larch = Douglas-fir and Larch P. Pine = Ponderosa Pine White Woods = All other species

SE = Standard Error (+/-)

Note: Blanks indicate no harvested volume.

G.2 Average Percent of Volume of Utilized Trees by Species of Utilized Logs for Ponderosa Pine Forest Type in Montana.

Western Montana, Forest Service Ownership

Gentle Slope - Low Hazard

Year: **2030**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.	0	86	14
SE			*50*	*8*
Mean	50%	16	79	5
SE		*7*	*35*	*2*

Year: **2060**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	11	88	0
SE		*5*	*36*	

Year: **2090**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	0	100	0
SE			*41*	

Steep Slope - Low Hazard

Year: **2030**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.	68	32	0
SE		*48*	*23*	
Mean	50%	35	65	0
SE		*14*	*27*	

Year: **2060**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	36	64	0
SE		*14*	*24*	

Year: **2090**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	35	65	0
SE		*13*	*25*	

Gentle Slope - High Hazard

Year: **2000**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.	40	60	0
SE		*23*	*35*	
Mean	50%	34	66	0
SE		*14*	*27*	

Year: **2030**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	27	73	0
SE		*9*	*24*	

Year: **2060**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	13	87	1
SE		*4*	*27*	

Year: **2090**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	11	87	2
SE		*3*	*28*	*1*

Steep Slope - High Hazard

Year: **2000**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.	39	25	36
SE		*22*	*14*	*21*
Mean	50%	39	48	13
SE		*13*	*16*	*4*

Year: **2030**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	26	74	0
SE		*8*	*24*	

Year: **2060**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	19	81	0
SE		*6*	*26*	

Year: **2090**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	18	82	0
SE		*5*	*25*	

Rx = Treatment D.Fir/Larch = Douglas-fir and Larch P. Pine = Ponderosa Pine White Woods = All other species

SE = Standard Error (+/-)

Note: Blanks indicate no harvested volume.

G.2 Average Percent of Volume of Utilized Trees by Species of Utilized Logs for Ponderosa Pine Forest Type in Montana.

Western Montana, Non - Forest Service Ownership

Gentle Slope - Low Hazard

Year: **2030**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	5	95	0
SE		*2*	*29*	
Year: 2060	**Rx**	**D.Fir/Larch**	**P. Pine**	**White Woods**
Mean	9 in.			
SE				
Mean	50%	21	79	0
SE		*5*	*20*	
Year: 2090	**Rx**	**D.Fir/Larch**	**P. Pine**	**White Woods**
Mean	9 in.			
SE				
Mean	50%	18	82	0
SE		*4*	*21*	

Gentle Slope - High Hazard

Year: **2000**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.	28	69	3
SE		*6*	*14*	*1*
Mean	50%	27	71	1
SE		*6*	*15*	
Year: 2030	**Rx**	**D.Fir/Larch**	**P. Pine**	**White Woods**
Mean	9 in.			
SE				
Mean	50%	20	78	2
SE		*4*	*14*	
Year: 2060	**Rx**	**D.Fir/Larch**	**P. Pine**	**White Woods**
Mean	9 in.			
SE				
Mean	50%	14	85	1
SE		*3*	*15*	
Year: 2090	**Rx**	**D.Fir/Larch**	**P. Pine**	**White Woods**
Mean	9 in.			
SE				
Mean	50%	17	83	0
SE		*3*	*15*	

Steep Slope - Low Hazard

Year: **2030**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	18	82	0
SE		*6*	*26*	
Year: 2060	**Rx**	**D.Fir/Larch**	**P. Pine**	**White Woods**
Mean	9 in.			
SE				
Mean	50%	29	71	0
SE		*9*	*21*	
Year: 2090	**Rx**	**D.Fir/Larch**	**P. Pine**	**White Woods**
Mean	9 in.			
SE				
Mean	50%	23	77	0
SE		*7*	*23*	

Steep Slope - High Hazard

Year: **2000**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%			
SE				
Year: 2030	**Rx**	**D.Fir/Larch**	**P. Pine**	**White Woods**
Mean	9 in.			
SE				
Mean	50%			
SE				
Year: 2060	**Rx**	**D.Fir/Larch**	**P. Pine**	**White Woods**
Mean	9 in.			
SE				
Mean	50%			
SE				
Year: 2090	**Rx**	**D.Fir/Larch**	**P. Pine**	**White Woods**
Mean	9 in.			
SE				
Mean	50%			
SE				

Rx = Treatment D.Fir/Larch = Douglas-fir and Larch P. Pine = Ponderosa Pine White Woods = All other species

SE = Standard Error (+/-)

Note: Blanks indicate no harvested volume.

G.2 Average Percent of Volume of Utilized Trees by Species of Utilized Logs for Ponderosa Pine Forest Type in Montana.

Eastern Montana, Forest Service Ownership

Gentle Slope - Low Hazard

Year: **2030**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%			
SE				

Year: **2060**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%			
SE				

Year: **2090**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%			
SE				

Steep Slope - Low Hazard

Year: **2030**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%			
SE				

Year: **2060**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%			
SE				

Year: **2090**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%			
SE				

Gentle Slope - High Hazard

Year: **2000**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.	17	83	0
SE		*4*	*21*	
Mean	50%	8	92	0
SE		*2*	*21*	

Year: **2030**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	9	91	0
SE		*2*	*20*	

Year: **2060**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.	18	76	7
SE		*10*	*44*	*4*
Mean	50%	2	97	1
SE			*19*	

Year: **2090**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.	0	53	47
SE			*53*	*47*
Mean	50%	4	95	1
SE		*1*	*18*	

Steep Slope - High Hazard

Year: **2000**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.	0	100	0
SE			*71*	
Mean	50%	21	79	0
SE		*11*	*39*	

Year: **2030**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.	12	88	0
SE		*4*	*27*	
Mean	50%	8	92	0
SE		*2*	*27*	

Year: **2060**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.	8	80	12
SE		*3*	*28*	*4*
Mean	50%	0	100	0
SE			*29*	

Year: **2090**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.	19	66	15
SE		*8*	*27*	*6*
Mean	50%	2	98	0
SE		*1*	*28*	

Rx = Treatment D.Fir/Larch = Douglas-fir and Larch P. Pine = Ponderosa Pine White Woods = All other species

SE = Standard Error (+/-)

Note: Blanks indicate no harvested volume.

G.2 Average Percent of Volume of Utilized Trees by Species of Utilized Logs for Ponderosa Pine Forest Type in Montana.

Eastern Montana, Non - Forest Service Ownership

Gentle Slope - Low Hazard

Year: **2030**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	1	99	0
SE			*19*	

Year: **2060**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	1	99	0
SE			*18*	

Year: **2090**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	2	98	1
SE			*16*	

Steep Slope - Low Hazard

Year: **2030**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	4	96	0
SE		*1*	*24*	

Year: **2060**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	0	100	0
SE			*23*	

Year: **2090**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	4	95	1
SE		*1*	*20*	

Gentle Slope - High Hazard

Year: **2000**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.	4	96	0
SE		*1*	*17*	
Mean	50%	4	96	0
SE		*1*	*16*	

Year: **2030**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	3	97	0
SE			*15*	

Year: **2060**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	2	98	0
SE			*15*	

Year: **2090**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	4	96	0
SE		*1*	*14*	

Steep Slope - High Hazard

Year: **2000**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.	4	96	0
SE		*1*	*19*	
Mean	50%	5	95	0
SE		*1*	*18*	

Year: **2030**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	5	95	0
SE		*1*	*19*	

Year: **2060**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	9	90	0
SE		*2*	*16*	

Year: **2090**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	50%	3	96	0
SE		*1*	*17*	

Rx = Treatment   D.Fir/Larch = Douglas-fir and Larch   P. Pine = Ponderosa Pine   White Woods = All other species

SE = Standard Error (+/-)

Note: Blanks indicate no harvested volume.

G.3 Average Percent of Volume of Utilized Trees by Species of Utilized Logs for Dry Mixed Conifer Forest Type in New Mexico

New Mexico, Forest Service Ownership

Gentle Slope - Low Hazard

Year	Rx	D.Fir/Larch	P. Pine	White Woods
Year: 2030	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in	51	49	0
SE		*21*	*20*	
Year: 2060	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				
Year: 2090	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				

Steep Slope - Low Hazard

Year	Rx	D.Fir/Larch	P. Pine	White Woods
Year: 2030	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in	40	49	11
SE		*18*	*22*	*5*
Year: 2060	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				
Year: 2090	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				

Gentle Slope - High Hazard

Year	Rx	D.Fir/Larch	P. Pine	White Woods
Year: 2000	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				
Year: 2030	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				
Year: 2060	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				
Year: 2090	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				

Steep Slope - High Hazard

Year	Rx	D.Fir/Larch	P. Pine	White Woods
Year: 2000	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				
Year: 2030	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				
Year: 2060	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				
Year: 2090	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				

Rx = Treatment D.Fir/Larch = Douglas-fir and Larch P. Pine = Ponderosa Pine White Woods = All other species

SE = Standard Error (+/-)

Note: Blanks indicate no harvested volume.

G.3 Average Percent of Volume of Utilized Trees by Species of Utilized Logs for Dry Mixed Conifer Forest Type in New Mexico

New Mexico, Non - Forest Service Ownership

Gentle Slope - Low Hazard

Year: **2030**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in	25	40	35
SE		*11*	*18*	*16*
Year: **2060**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				
Year: **2090**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				

Steep Slope - Low Hazard

Year: **2030**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				
Year: **2060**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				
Year: **2090**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				

Gentle Slope - High Hazard

Year: **2000**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				
Year: **2030**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				
Year: **2060**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				
Year: **2090**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				

Steep Slope - High Hazard

Year: **2000**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				
Year: **2030**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in	99	0	1
SE				
Year: **2060**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				
Year: **2090**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				

Rx = Treatment D.Fir/Larch = Douglas-fir and Larch P. Pine = Ponderosa Pine White Woods = All other species

SE = Standard Error (+/-)

Note: Blanks indicate no harvested volume.

G.4 Average Percent of Volume of Utilized Trees by Species of Utilized Logs for Ponderosa Pine Forest Type in New Mexico

New Mexico, Forest Service Ownership

Gentle Slope - Low Hazard

Year: **2030**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				

Year: **2060**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				

Year: **2090**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				

Gentle Slope - High Hazard

Year: **2000**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				

Year: **2030**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				

Year: **2060**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				

Year: **2090**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				

Steep Slope - Low Hazard

Year: **2030**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in	6	76	18
SE		*2*	*31*	*7*

Year: **2060**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				

Year: **2090**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				

Steep Slope - High Hazard

Year: **2000**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				

Year: **2030**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				

Year: **2060**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				

Year: **2090**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				

Rx = Treatment   D.Fir/Larch = Douglas-fir and Larch   P. Pine = Ponderosa Pine   White Woods = All other species

SE = Standard Error (+/-)

Note: Blanks indicate no harvested volume.

G.4 Average Percent of Volume of Utilized Trees by Species of Utilized Logs for Ponderosa Pine Forest Type in New Mexico

New Mexico, Non - Forest Service Ownership

Gentle Slope - Low Hazard

Year: **2030**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in	1	91	8
SE			*19*	*2*

Year: **2060**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				

Year: **2090**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				

Steep Slope - Low Hazard

Year: **2030**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				

Year: **2060**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				

Year: **2090**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				

Gentle Slope - High Hazard

Year: **2000**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				

Year: **2030**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				

Year: **2060**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				

Year: **2090**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				

Steep Slope - High Hazard

Year: **2000**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				

Year: **2030**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				

Year: **2060**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				

Year: **2090**	Rx	D.Fir/Larch	P. Pine	White Woods
Mean	9 in.			
SE				
Mean	16 in			
SE				

Rx = Treatment D.Fir/Larch = Douglas-fir and Larch P. Pine = Ponderosa Pine White Woods = All other species

SE = Standard Error (+/-)

Note: Blanks indicate no harvested volume.

APPENDIX H

Cost and Log Price Assumptions

Cost assumptions for harvesting, hauling, and treating unutilized trees are the same for both states. Ground-based harvesting systems are assumed for gentle slopes (<35% in Montana and <40% in New Mexico). Cable systems are assumed for steep slopes, although cable systems are not expected to be used in New Mexico and little harvesting is expected on steep slopes there. Harvesting costs used vary by tree size and volume per acre that is harvested. An average hauling cost of $28/ccf was used for all cases. Log prices used are for a relatively good market. Because of the tendency for high-cost wood to be the last supply to enter the market in good times and the first supply to leave the market in bad times, there are bound to be periods of lower prices where net revenues will be significantly less favorable than we report.

H.1 Harvesting Costs

Harvesting Costs for Gentle Slope ($/CCF)

Tree Size	CCF Cut per Acre			
DBH/Cut Tree	**4**	**7**	**10**	**15**
6	83	81	79	76
8	74	72	71	68
10	66	64	62	59
12	57	55	53	50
14	48	46	44	41
16	48	46	44	41

Harvesting Cost for Steep Slope ($/CCF)

Tree Size	CCF Cut per Acre			
DBH/Cut Tree	**4**	**7**	**10**	**15**
6	172	134	123	114
8	162	125	113	104
10	153	115	104	95
12	143	109	94	85
14	136	106	89	82
16	134	103	86	78

H.2 Cost for Treating Unutilized Trees

Cost of Slashing and Treating Trees <4 Inches DBH

Number of trees	$/Acre
<300	105
300-1000	225
1000-2000	250
>2000	280

Cost of Skidding/Yarding Unutilized Trees >4 Inches DBH

Slope	$/CCF
Gentle	80
Steep	130

H.3 Log Prices

Log Prices for Montana ($/CCF)

Small End Diameter	**DF & Larch**	**Hem & Fir**	**Ponderosa**	**Lodgepole**
7	169	132	132	143
8	189	147	189	161
10	227	178	227	197
12	265	208	265	233
14	304	238	304	268
16	342	269	342	280
17	360	284	361	280
18	360	290	370	280

Log Prices for New Mexico ($/CCF)

Small End Diameter	**Douglas-fir**	**White Fir**	**Ponderosa Pine**
9.6	112	109	112
12.6	165	159	167
16.6	226	226	240

APPENDIX I
Average Proportion of Stands by Net Value Category

Data presented in this appendix provide information about the extent to which the thinning treatments have sufficient value to be self-financing as timber sales. The net value estimates are based on a good market for logs and a market for chip logs (only in Montana). Because of this these results should be regarded as an optimistic estimate of the ability to pay for these treatments via timber sales. Of more importance is the range of net value and the recognition that there are many stands that will not have a positive net value from thinning under any foreseeable circumstances. Because these results involve calculations involving economic assumptions for which standard errors are unknown, standard errors are also unknown for these results and therefore none are reported.

I.1 Average Proportion of Stands by Net Value Category for Douglas-fir Forest Type in Montana

Western Montana, Forest Service Ownership

Gentle Slope - Low Hazard

RX	<-100$	-100$ to 100$	100$ to 500$	500$ to 1000$	>1000$
Year: 2030					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.23	0.05	0.23	0.18	0.32
Year: 2060					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.08	0.04	0.17	0.21	0.50
Year: 2090					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.07	0.07	0.15	0.19	0.52

Gentle Slope - High Hazard

RX	<-100$	-100$ to 100$	100$ to 500$	500$ to 1000$	>1000$
Year: 2000					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.68	0.10	0.20	0.02	0.00
Year: 2030					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.30	0.11	0.30	0.20	0.09
Year: 2060					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.16	0.10	0.29	0.37	0.08
Year: 2090					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.02	0.06	0.24	0.53	0.14

Steep Slope - Low Hazard

RX	<-100$	-100$ to 100$	100$ to 500$	500$ to 1000$	>1000$
Year: 2030					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.47	0.06	0.16	0.22	0.09
Year: 2060					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.20	0.15	0.29	0.15	0.22
Year: 2090					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.11	0.04	0.30	0.39	0.15

Steep Slope - High Hazard

RX	<-100$	-100$ to 100$	100$ to 500$	500$ to 1000$	>1000$
Year: 2000					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.81	0.00	0.07	0.05	0.07
Year: 2030					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.10	0.12	0.29	0.29	0.20
Year: 2060					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.05	0.07	0.14	0.53	0.21
Year: 2090					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.07	0.02	0.09	0.70	0.13

Rx = Treatment **Proportion = the proportion of stands in net value catagories within each type, year and treatment**

I.1 Average Proportion of Stands by Net Value Category for Douglas-fir Forest Type in Montana

Western Montana, Non-Forest Service Ownership

Gentle Slope - Low Hazard

RX	<-100$	-100$ to 100$	100$ to 500$	500$ to 1000$	>1000$
Year: **2030**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.27	0.07	0.17	0.00	0.50
Year: **2060**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.08	0.14	0.14	0.17	0.47
Year: **2090**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.05	0.05	0.07	0.34	0.49

Gentle Slope - High Hazard

RX	<-100$	-100$ to 100$	100$ to 500$	500$ to 1000$	>1000$
Year: **2000**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.76	0.07	0.07	0.04	0.07
Year: **2030**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.25	0.11	0.42	0.14	0.08
Year: **2060**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.12	0.14	0.30	0.23	0.21
Year: **2090**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.13	0.06	0.25	0.23	0.33

Steep Slope - Low Hazard

RX	<-100$	-100$ to 100$	100$ to 500$	500$ to 1000$	>1000$
Year: **2030**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.54	0.08	0.11	0.11	0.16
Year: **2060**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.05	0.29	0.32	0.13	0.21
Year: **2090**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.07	0.09	0.34	0.39	0.11

Steep Slope - High Hazard

RX	<-100$	-100$ to 100$	100$ to 500$	500$ to 1000$	>1000$
Year: **2000**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.93	0.04	0.00	0.02	0.00
Year: **2030**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.60	0.06	0.06	0.14	0.14
Year: **2060**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.23	0.25	0.15	0.28	0.10
Year: **2090**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.07	0.07	0.45	0.33	0.07

Rx = Treatment **Proportion = the proportion of stands in net value catagories within each type, year and treatment**

I.1 Average Proportion of Stands by Net Value Category for Douglas-fir Forest Type in Montana

Eastern Montana, Forest Service Ownership

Gentle Slope - Low Hazard

RX	<-100$	-100$ to 100$	100$ to 500$	500$ to 1000$	>1000$
Year: **2030**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.43	0.09	0.26	0.13	0.09
Year: **2060**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.17	0.09	0.39	0.17	0.17
Year: **2090**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.04	0.08	0.63	0.21	0.04

Gentle Slope - High Hazard

RX	<-100$	-100$ to 100$	100$ to 500$	500$ to 1000$	>1000$
Year: **2000**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.59	0.04	0.07	0.13	0.17
Year: **2030**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.07	0.26	0.33	0.02	0.31
Year: **2060**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.07	0.26	0.38	0.24	0.05
Year: **2090**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.09	0.12	0.47	0.26	0.07

Steep Slope - Low Hazard

RX	<-100$	-100$ to 100$	100$ to 500$	500$ to 1000$	>1000$
Year: **2030**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.47	0.24	0.06	0.00	0.24
Year: **2060**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.28	0.17	0.50	0.06	0.00
Year: **2090**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.19	0.24	0.52	0.05	0.00

Steep Slope - High Hazard

RX	<-100$	-100$ to 100$	100$ to 500$	500$ to 1000$	>1000$
Year: **2000**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.80	0.08	0.05	0.03	0.05
Year: **2030**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.35	0.30	0.13	0.04	0.17
Year: **2060**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.32	0.39	0.25	0.00	0.04
Year: **2090**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.09	0.58	0.30	0.00	0.03

Rx = Treatment   **Proportion = the proportion of stands in net value catagories within each type, year and treatment**

I.1 Average Proportion of Stands by Net Value Category for Douglas-fir Forest Type in Montana

Eastern Montana, Non-Forest Service Ownership

Gentle Slope - Low Hazard

RX	<-100$	-100$ to 100$	100$ to 500$	500$ to 1000$	>1000$
Year: **2030**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.15	0.19	0.23	0.12	0.31
Year: **2060**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.00	0.20	0.46	0.26	0.09
Year: **2090**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.03	0.05	0.41	0.35	0.16

Gentle Slope - High Hazard

RX	<-100$	-100$ to 100$	100$ to 500$	500$ to 1000$	>1000$
Year: **2000**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.61	0.12	0.10	0.06	0.10
Year: **2030**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.11	0.17	0.30	0.17	0.26
Year: **2060**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.06	0.04	0.33	0.23	0.33
Year: **2090**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.06	0.06	0.24	0.30	0.34

Steep Slope - Low Hazard

RX	<-100$	-100$ to 100$	100$ to 500$	500$ to 1000$	>1000$
Year: **2030**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.43	0.29	0.00	0.00	0.29
Year: **2060**					
9 in.	0.00	0.00	0.00	0.00	0.00
50%	0.14	0.14	0.43	0.14	0.14
Year: **2090**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.00	0.00	0.71	0.29	0.00

Steep Slope - High Hazard

RX	<-100$	-100$ to 100$	100$ to 500$	500$ to 1000$	>1000$
Year: **2000**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.90	0.02	0.08	0.00	0.00
Year: **2030**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.43	0.30	0.22	0.03	0.03
Year: **2060**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.17	0.24	0.38	0.17	0.05
Year: **2090**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.07	0.07	0.44	0.35	0.07

Rx = Treatment **Proportion = the proportion of stands in net value catagories within each type, year and treatment**

I.2 Average Proportion of Stands by Net Value Category for Ponderosa Pine Forest Type in Montana

Western Montana, Forest Service Ownership

Gentle Slope - Low Hazard

RX	<-100$	-100$ to 100$	100$ to 500$	500$ to 1000$	>1000$
Year: **2030**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.43	0.14	0.00	0.29	0.14
Year: **2060**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.00	0.00	0.29	0.43	0.29
Year: **2090**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.00	0.00	0.14	0.57	0.29

Gentle Slope - High Hazard

RX	<-100$	-100$ to 100$	100$ to 500$	500$ to 1000$	>1000$
Year: **2000**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.70	0.10	0.00	0.10	0.10
Year: **2030**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.18	0.18	0.00	0.36	0.27
Year: **2060**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.00	0.00	0.27	0.45	0.27
Year: **2090**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.00	0.00	0.18	0.55	0.27

Steep Slope - Low Hazard

RX	<-100$	-100$ to 100$	100$ to 500$	500$ to 1000$	>1000$
Year: **2030**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.43	0.14	0.00	0.29	0.14
Year: **2060**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.38	0.13	0.38	0.13	0.00
Year: **2090**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.00	0.25	0.50	0.25	0.00

Steep Slope - High Hazard

RX	<-100$	-100$ to 100$	100$ to 500$	500$ to 1000$	>1000$
Year: **2000**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.58	0.08	0.08	0.17	0.08
Year: **2030**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.36	0.09	0.27	0.09	0.18
Year: **2060**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.00	0.36	0.55	0.09	0.00
Year: **2090**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.08	0.25	0.58	0.08	0.00

Rx = Treatment   Proportion = the proportion of stands in net value catagories within each type, year and treatment

I.2 Average Proportion of Stands by Net Value Category for Ponderosa Pine Forest Type in Montana

Western Montana, Non-Forest Service Ownership

Gentle Slope - Low Hazard

RX	<-100$	-100$ to 100$	100$ to 500$	500$ to 1000$	>1000$
Year: 2030					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.23	0.08	0.08	0.08	0.54
Year: 2060					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.06	0.11	0.11	0.28	0.44
Year: 2090					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.16	0.05	0.00	0.42	0.37

Gentle Slope - High Hazard

RX	<-100$	-100$ to 100$	100$ to 500$	500$ to 1000$	>1000$
Year: 2000					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.67	0.10	0.10	0.07	0.07
Year: 2030					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.06	0.13	0.03	0.29	0.48
Year: 2060					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.00	0.00	0.10	0.26	0.65
Year: 2090					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.00	0.03	0.10	0.42	0.45

Steep Slope - Low Hazard

RX	<-100$	-100$ to 100$	100$ to 500$	500$ to 1000$	>1000$
Year: 2030					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.27	0.09	0.18	0.36	0.09
Year: 2060					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.08	0.00	0.50	0.25	0.17
Year: 2090					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.08	0.08	0.42	0.25	0.17

Steep Slope - High Hazard

RX	<-100$	-100$ to 100$	100$ to 500$	500$ to 1000$	>1000$
Year: 2000					
50%					
9 in.					
Year: 2030					
9 in.					
50%					
Year: 2060					
9 in.					
50%					
Year: 2090					
9 in.					
50%					

Rx = Treatment **Proportion = the proportion of stands in net value catagories within each type, year and treatment**

I.2 Average Proportion of Stands by Net Value Category for Ponderosa Pine Forest Type in Montana

Eastern Montana, Forest Service Ownership

Gentle Slope - Low Hazard

RX	<-100$	-100$ to 100$	100$ to 500$	500$ to 1000$	>1000$
Year: **2030**					
9 in.					
50%					
Year: **2060**					
9 in.					
50%					
Year: **2090**					
9 in.					
50%					

Gentle Slope - High Hazard

RX	<-100$	-100$ to 100$	100$ to 500$	500$ to 1000$	>1000$
Year: **2000**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.82	0.09	0.05	0.05	0.00
Year: **2030**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.16	0.20	0.28	0.20	0.16
Year: **2060**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.24	0.38	0.24	0.03	0.10
Year: **2090**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.33	0.27	0.33	0.03	0.03

Steep Slope - Low Hazard

RX	<-100$	-100$ to 100$	100$ to 500$	500$ to 1000$	>1000$
Year: **2030**					
9 in.					
50%					
Year: **2060**					
9 in.					
50%					
Year: **2090**					
9 in.					
50%					

Steep Slope - High Hazard

RX	<-100$	-100$ to 100$	100$ to 500$	500$ to 1000$	>1000$
Year: **2000**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	1.00	0.00	0.00	0.00	0.00
Year: **2030**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.31	0.23	0.23	0.23	0.00
Year: **2060**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.00	0.00	0.38	0.23	0.38
Year: **2090**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.08	0.08	0.31	0.46	0.08

Rx = Treatment **Proportion = the proportion of stands in net value catagories within each type, year and treatment**

I.2 Average Proportion of Stands by Net Value Category for Ponderosa Pine Forest Type in Montana

Eastern Montana, Non-Forest Service Ownership

Gentle Slope - Low Hazard

RX	<-100$	-100$ to 100$	100$ to 500$	500$ to 1000$	>1000$
Year: **2030**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.39	0.36	0.18	0.06	0.00
Year: **2060**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.39	0.39	0.17	0.06	0.00
Year: **2090**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.44	0.49	0.05	0.03	0.00

Gentle Slope - High Hazard

RX	<-100$	-100$ to 100$	100$ to 500$	500$ to 1000$	>1000$
Year: **2000**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.87	0.04	0.04	0.02	0.02
Year: **2030**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.28	0.30	0.21	0.09	0.12
Year: **2060**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.20	0.46	0.22	0.09	0.04
Year: **2090**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.30	0.52	0.13	0.02	0.02

Steep Slope - Low Hazard

RX	<-100$	-100$ to 100$	100$ to 500$	500$ to 1000$	>1000$
Year: **2030**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.71	0.19	0.10	0.00	0.00
Year: **2060**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.50	0.41	0.09	0.00	0.00
Year: **2090**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.44	0.52	0.04	0.00	0.00

Steep Slope - High Hazard

RX	<-100$	-100$ to 100$	100$ to 500$	500$ to 1000$	>1000$
Year: **2000**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.97	0.00	0.03	0.00	0.00
Year: **2030**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.29	0.16	0.16	0.19	0.19
Year: **2060**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.16	0.13	0.25	0.31	0.16
Year: **2090**					
9 in.	1.00	0.00	0.00	0.00	0.00
50%	0.13	0.16	0.59	0.09	0.03

Rx = Treatment   Proportion = the proportion of stands in net value catagories within each type, year and treatment

I.3 Average Proportion of Stands by Net Value Catergory for Dry Mixed Conifer Forest Type in New Mexico

New Mexico, Forest Service Ownership

Gentle Slope - Low Hazard

RX	<-1000	-1000$ to -500$	-500$ to -100$	-100$ to 100$	100$to500$
Year: 2030					
9 in.	0.00	0.08	0.92	0.00	0.00
16 in.	0.00	0.08	0.76	0.16	0.00
Year: 2060					
9 in.	0.00	0.00	1.00	0.00	0.00
16 in.	0.00	0.00	1.00	0.00	0.00
Year: 2090					
9 in.	0.00	0.00	1.00	0.00	0.00
16 in.	0.00	0.00	1.00	0.00	0.00

Gentle Slope - High Hazard

RX	<-1000	-1000$ to -500$	-500$ to -100$	-100$ to 100$	100$to500$
Year: 2000					
9 in.	0.00	0.06	0.94	0.00	0.00
16 in.	0.00	0.06	0.89	0.05	0.00
Year: 2030					
9 in.	0.00	0.00	1.00	0.00	0.00
16 in.	0.00	0.00	1.00	0.00	0.00
Year: 2060					
9 in.					
16 in.	0.00	0.00	1.00	0.00	0.00
Year: 2090					
9 in.	0.00	0.00	1.00	0.00	0.00
16 in.	0.00	0.00	1.00	0.00	0.00

Steep Slope - Low Hazard

RX	<-1000	-1000$ to -500$	-500$ to -100$	-100$ to 100$	100$to500
Year: 2030					
9 in.	0.00	0.20	0.80	0.00	0.00
16 in.	0.08	0.23	0.70	0.00	0.00
Year: 2060					
9 in.	0.00	0.00	1.00	0.00	0.00
16 in.	0.00	0.00	1.00	0.00	0.00
Year: 2090					
9 in.	0.00	0.00	1.00	0.00	0.00
16 in.	0.00	0.00	1.00	0.00	0.00

Steep Slope - High Hazard

RX	<-1000	-1000$ to -500$	-500$ to -100$	-100$ to 100$	100$to500
Year: 2000					
9 in.	0.02	0.04	0.94	0.00	0.00
16 in.	0.02	0.04	0.94	0.00	0.00
Year: 2030					
9 in.	0.00	0.00	1.00	0.00	0.00
16 in.	0.00	0.00	1.00	0.00	0.00
Year: 2060					
9 in.	0.00	0.00	1.00	0.00	0.00
16 in.	0.00	0.00	1.00	0.00	0.00
Year: 2090					
9 in.	0.00	0.00	1.00	0.00	0.00
16 in.	0.00	0.00	1.00	0.00	0.00

Rx = Treatment **Proportion = the proportion of stands in net value catagories within each type, year and treatment**

I.3 Average Proportion of Stands by Net Value Catergory for Dry Mixed Conifer Forest Type in New Mexico

New Mexico, Non-Forest Service Ownership

Gentle Slope - Low Hazard

RX	<-1000	-1000$ to -500$	-500$ to -100$	-100$ to 100$	100$to500$
Year: **2030**					
9 in.					
16 in.	0.00	0.00	0.68	0.32	0.00
Year: **2060**					
9 in.	0.00	0.00	1.00	0.00	0.00
16 in.	0.00	0.00	1.00	0.00	0.00
Year: **2090**					
9 in.	0.00	0.00	1.00	0.00	0.00
16 in.	0.00	0.00	1.00	0.00	0.00

Gentle Slope - High Hazard

RX	<-1000	-1000$ to -500$	-500$ to -100$	-100$ to 100$	100$to500$
Year: **2000**					
9 in.	0.00	0.24	0.76	0.00	0.00
16 in.	0.00	0.23	0.76	0.00	0.00
Year: **2030**					
9 in.	0.00	0.00	1.00	0.00	0.00
16 in.	0.00	0.00	0.86	0.14	0.00
Year: **2060**					
9 in.	0.00	0.00	1.00	0.00	0.00
16 in.	0.00	0.00	1.00	0.00	0.00
Year: **2090**					
9 in.	0.00	0.00	1.00	0.00	0.00
16 in.	0.00	0.00	0.91	0.09	0.00

Gentle Slope - Low Hazard

RX	<-1000	-1000$ to -500$	-500$ to -100$	-100$ to 100$	100$to500
Year: **2030**					
9 in.					
16 in.					
Year: **2060**					
9 in.					
16 in.					
Year: **2090**					
9 in.					
16 in.					

Steep Slope - High Hazard

RX	<-1000	-1000$ to -500$	-500$ to -100$	-100$ to 100$	100$to500
Year: **2000**					
9 in.	0.00	0.33	0.67	0.00	0.00
16 in.	0.01	0.35	0.64	0.00	0.00
Year: **2030**					
9 in.	0.00	0.00	1.00	0.00	0.00
16 in.	0.00	0.00	1.00	0.00	0.00
Year: **2060**					
9 in.	0.00	0.00	1.00	0.00	0.00
16 in.					
Year: **2090**					
9 in.	0.00	0.00	1.00	0.00	0.00
16 in.	0.00	0.00	1.00	0.00	0.00

Rx = Treatment **Proportion = the proportion of stands in net value catagories within each type, year and treatment**

I.4 Average Proportion of Stands by Net Value Category for Ponderosa Pine Forest Type in New Mexico

New Mexico, Forest Service Ownership

Gentle Slope - Low Hazard

RX	<-1000	-1000$ to -500$	-500$ to -100$	-100$ to 100$	100$to500$
Year: **2030**					
9 in.	0.05	0.19	0.76	0.00	0.00
16 in.	0.05	0.19	0.71	0.05	0.00
Year: **2060**					
9 in.	0.00	0.00	1.00	0.00	0.00
16 in.	0.00	0.00	1.00	0.00	0.00
Year: **2090**					
9 in.	0.00	0.00	1.00	0.00	0.00
16 in.	0.00	0.00	1.00	0.00	0.00

Gentle Slope - High Hazard

RX	<-1000	-1000$ to -500$	-500$ to -100$	-100$ to 100$	100$to500$
Year: **2000**					
9 in.	0.00	0.15	0.85	0.00	0.00
16 in.	0.00	0.15	0.85	0.00	0.00
Year: **2030**					
9 in.	0.00	0.00	1.00	0.00	0.00
16 in.	0.00	0.00	1.00	0.00	0.00
Year: **2060**					
9 in.					
16 in.	0.00	0.00	1.00	0.00	0.00
Year: **2090**					
9 in.	0.00	0.00	1.00	0.00	0.00
16 in.	0.00	0.00	1.00	0.00	0.00

Steep Slope - Low Hazard

RX	<-1000	-1000$ to -500$	-500$ to -100$	-100$ to 100$	100$to500
Year: **2030**					
9 in.	0.00	0.00	1.00	0.00	0.00
16 in.	0.00	0.00	1.00	0.00	0.00
Year: **2060**					
9 in.	0.00	0.00	1.00	0.00	0.00
16 in.					
Year: **2090**					
9 in.	0.00	0.00	1.00	0.00	0.00
16 in.					

Steep Slope - High Hazard

RX	<-1000	-1000$ to -500$	-500$ to -100$	-100$ to 100$	100$to500
Year: **2000**					
9 in.	0.00	0.25	0.75	0.00	0.00
16 in.	0.00	0.30	0.70	0.00	0.00
Year: **2030**					
9 in.	0.00	0.00	1.00	0.00	0.00
16 in.	0.00	0.00	1.00	0.00	0.00
Year: **2060**					
9 in.	0.00	0.00	1.00	0.00	0.00
16 in.	0.00	0.00	1.00	0.00	0.00
Year: **2090**					
9 in.	0.00	0.00	1.00	0.00	0.00
16 in.	0.00	0.00	1.00	0.00	0.00

Rx = Treatment **Proportion = the proportion of stands in net value catagories within each type, year and treatment**

I.4 Average Proportion of Stands by Net Value Category for Ponderosa Pine Forest Type in New Mexico

New Mexico, Non - Forest Service Ownership

Gentle Slope - Low Hazard

RX	<-1000	-1000$ to -500$	-500$ to -100$	-100$ to 100$	100$to500$
Year: **2030**					
9 in.	0.00	0.00	1.00	0.00	0.00
16 in.	0.00	0.00	0.61	0.39	0.00
Year: **2060**					
9 in.	0.00	0.00	1.00	0.00	0.00
16 in.	0.00	0.00	1.00	0.00	0.00
Year: **2090**					
9 in.	0.00	0.00	1.00	0.00	0.00
16 in.	0.00	0.00	1.00	0.00	0.00

Gentle Slope - High Hazard

RX	<-1000	-1000$ to -500$	-500$ to -100$	-100$ to 100$	100$to500$
Year: **2000**					
9 in.	0.00	0.21	0.79	0.00	0.00
16 in.	0.00	0.21	0.79	0.00	0.00
Year: **2030**					
9 in.	0.00	0.00	1.00	0.00	0.00
16 in.	0.00	0.00	1.00	0.00	0.00
Year: **2060**					
9 in.	0.00	0.00	1.00	0.00	0.00
16 in.	0.00	0.00	1.00	0.00	0.00
Year: **2090**					
9 in.	0.00	0.00	1.00	0.00	0.00
16 in.	0.00	0.00	1.00	0.00	0.00

Steep Slope - Low Hazard

RX	<-1000	-1000$ to -500$	-500$ to -100$	-100$ to 100$	100$to500
Year: **2030**					
9 in.					
16 in.					
Year: **2060**					
9 in.					
16 in.					
Year: **2090**					
9 in.					
16 in.					

Steep Slope - High Hazard

RX	<-1000	-1000$ to -500$	-500$ to -100$	-100$ to 100$	100$to500
Year: **2000**					
9 in.					
16 in.					
Year: **2030**					
9 in.					
16 in.					
Year: **2060**					
9 in.					
16 in.					
Year: **2090**					
9 in.					
16 in.					

Rx = Treatment   Proportion = the proportion of stands in net value catagories within each type, year and treatment