**Colville Plan Revision**
**Meeting with the Northeast WA Forestry Coalition**
**March 31, 2016**

**Subject**: Request for clarification on vegetation modeling

**Participants**:

Maurice Williamson, Matt Scott, and Mike Petersen, NEWFC
Amy Dillon, Forest Plan Revision Team Lead, Jon Day, Forest Silviculturist, and Marcy Rumelhart (notes)

Meeting start time: 10:00 am, Williamson Consulting Office, Colville, WA.

This meeting was requested by NEWFC for purpose of receiving clarification on vegetation modelling done for the forest plan revision. Jon Day provided three documents to the meeting participants - alternative graphs, volume estimates by alternative, and modeling assumptions. The following questions were provided by Maurice Williamson to Amy Dillon prior to the meeting, and were discussed by the group.

- What assumptions were made regarding silvicultural treatments (Pct, planting, etc) in terms of timing and extent within the various alternatives and management areas?
- How was the Joint Chief's and CFLRP $'s factored into the capacity of the veg. management budget?
    - Jon discussed modeling and budget assumptions in the document he provided. The CFLRP treatment area wasn't included in the modeling.
- What is the assumed annual growth increments by management area?
- Under what congressional direction (statute? not FS policy) is there a mandate to submit a Revised Forest Plan based on expected budget vs the need of activities on the forest to achieved goals and objectives in an efficient timeframe?
    - Jon - The only timber number based on budget is the predicted wood sale quantity (PWSQ). Allowable Sale Quantity (ASQ) and Long Term Sustained Yield (LTSY) are computed without regard to budget (unconstrained model). Determining the PWSQ is required by the 2012 planning rule and is regional direction to include. ASQ and LTSY are part of the 1982 planning rule. The PWSQ is what the Forest thinks we can do, based on budget. Some of the budget assumptions in the effects analysis are based on an estimate of staffing needs and treating 5000 acres per year of timber harvest, burning, and precommercial thinning (15,000 ac total of various treatments). They are just assumptions for modeling. Assumptions have to be made to determine effects and provide comparable types of outputs for each of the alternatives. The ASQ number for Alternative P is based on the maximum amount of timber harvest allowed to meet desired conditions, not budget.

      Mike asked why the ASQ number wouldn't start higher.

Jon – the main constraint is tree size which means time is required for trees to grow large enough. The LTSY number considers if the forest is already meeting the desired conditions, then it would be a higher volume number per year.

- Under what congressional direction (statute? not FS policy) is there a mandate to set production amounts based on even-flow sustained yield vs periodic sustained yield?
    - Jon – this is comes from the Multiple Use Sustained Yield act, the National Forest Management Act, and the 1982 planning rule. There is a departure schedule allowed to be developed under the 1982 rule, but we did not pursue this since the biggest factor in meeting desired conditions is tree size, and hence time. Departing the sustained yield doesn't result in meeting desired conditions faster.
- NEWFC is confused as to the reasons the FS saleable quantities are much less than previous projections by Derrick Churchill. What are the reasons for this difference? Note that Churchill's calculations were for NEWFC's "active management area" which amounted to about 400,000 acres vs the "suitable" acres used by the FS. Furthermore, please note that the volumes derived were based on a projected 20 year "cutting budget" on those 400,000 acres over a 20 year period to accomplish a "regulated" forest, minimizing insect, disease, and uncharacteristic fires.
    - Jon - a regulated forest is not the desired condition. The desired condition is a range of structure types based on the concept of HRV. See modeling assumptions document for background on modeling. Forest Vegetation Simulator (FVS) bare ground runs also show what is attainable from a purely biological standpoint. We can't comment on what Churchill did.

      Jon explained the Eastside Screens (retained under Alternative B) have too many constraints to meet desired conditions which results in a lower number. Even if the forest was meeting desired conditions, there would still be more constraints (under the screens) to harvesting trees greater than 21 inches. With the diameter limit under the Eastside Screens, maintaining late and old structure is generally not possible. No alternative gets us to the historical range of variability in the modelled vegetation types. Because some vegetation types are in areas we can't treat anyway, like wilderness or inventoried roadless areas. The bare ground model is based on the biological capacity of the land, on areas suitable for timber production. We don't know what modeling Derek did, but he requested to review our data. The screens inhibit reaching the desired condition in the alternatives where that direction is retained.
- Should there be mention of potential innovative approaches to "increasing the restoration footprint" such as A-Z to avoid accusations of exceeding ASQ in the revised plan?
    - Jon – ASQ is a decadal average that is allowed in order to move toward desired conditions. Once desired conditions are reached, the LTSY represents total timber output. The PWSQ is not the maximum number, just an estimate, used across all alternatives. It is a more realistic number.

<u>General discussion</u>

Mike – if congress provided the Forest Service with more resources and wanted ASQ, how hard would it be to do an impacts analysis on that?

Amy – if it was long-term and the forest received more than one year of funding, an analysis would need to be done to see if a forest plan amendment would be needed (if happened after ROD was signed for a

new forest plan). If that analysis was included for the final EIS during the plan revision process, it would need to be done for each alternative. If the forest maintains an average (ASQ) over a 10 year period, then it still meets the intent in the forest plan. If the average is way less, then an analysis might be needed to see if there is a need to do a forest plan amendment (is the forest still moving toward desired conditions?).

Maurice – would be concerned about having to do an amendment if the forest exceeds what was modeled, would you have to do more effects analysis?

Amy/Jon – effects analysis is flexible enough to account for some fluctuation. If moving toward desired conditions, we are still within the effects determination. Analyzing at this level (i.e., plan revision analysis of alternatives) requires making assumptions.

Maurice stated that although the Forest Service's interpretation of the NEWFC blueprint wasn't exactly how they thought it would be, NEWFC has been discussing changes they want to make regarding restoration areas and roads. They are considering coming back to the Forest Service with a suggestion for bringing Alternatives P and B together. NEWFC wants to be tied to adaptive management concept and wants to try to help the Forest understand their interpretation of Alternative B.

Amy clarified that Alternative B was a product of the collaborative public meetings held between 2006 and 2008, and discussions with Rick Brazell. If Alternative B is modified, NEWFC would need to articulate very clearly what they want to see and send that information to Rodney.

Mike thought it was very useful to have the Forest Service explain the modeling.

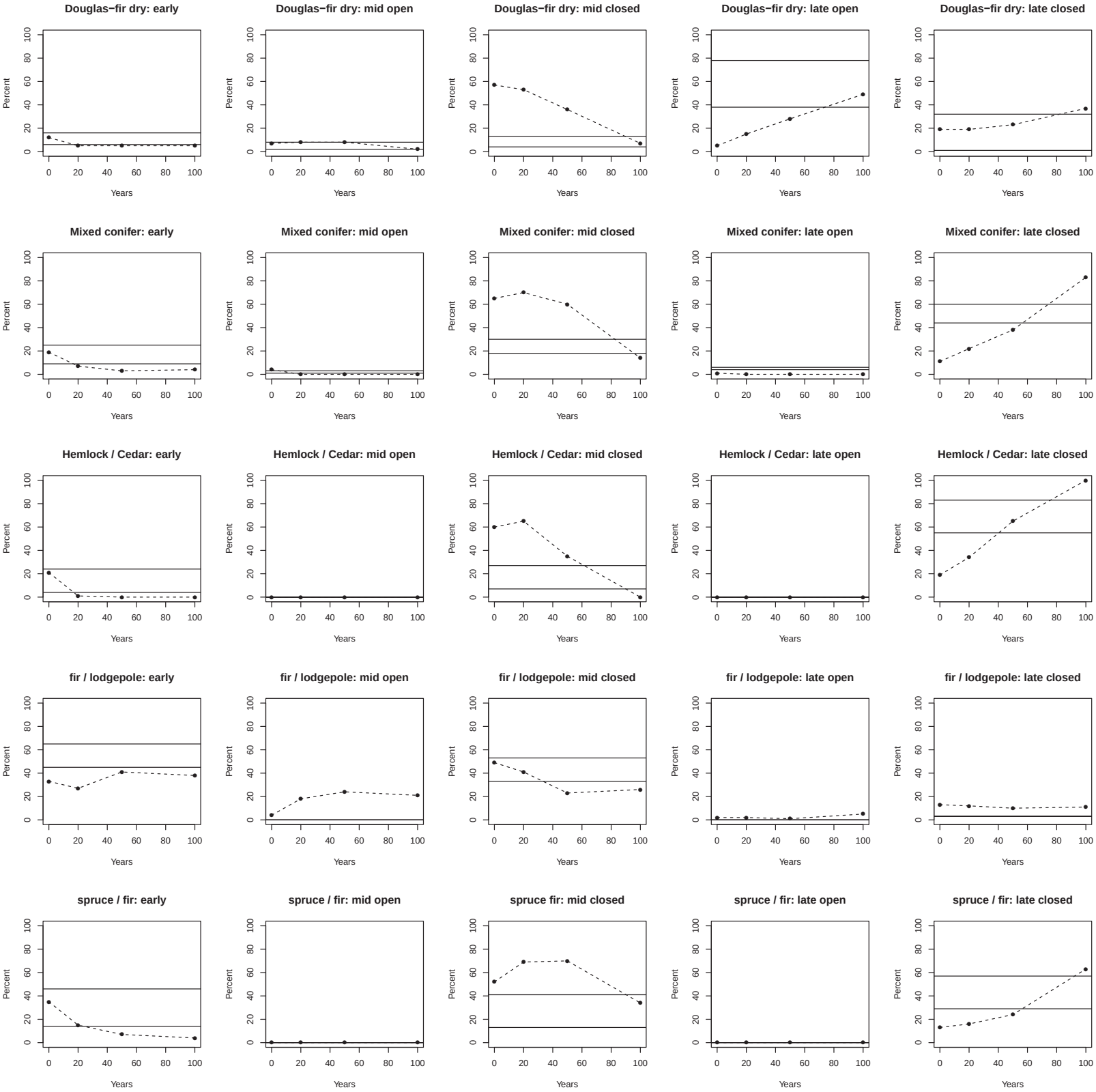
Maurice requested another meeting with NEWFC members to discuss roads and soils. That meeting was scheduled for **April 21 at 1:30**, at the Williamson Consulting office.

Additional information requested at the meeting:

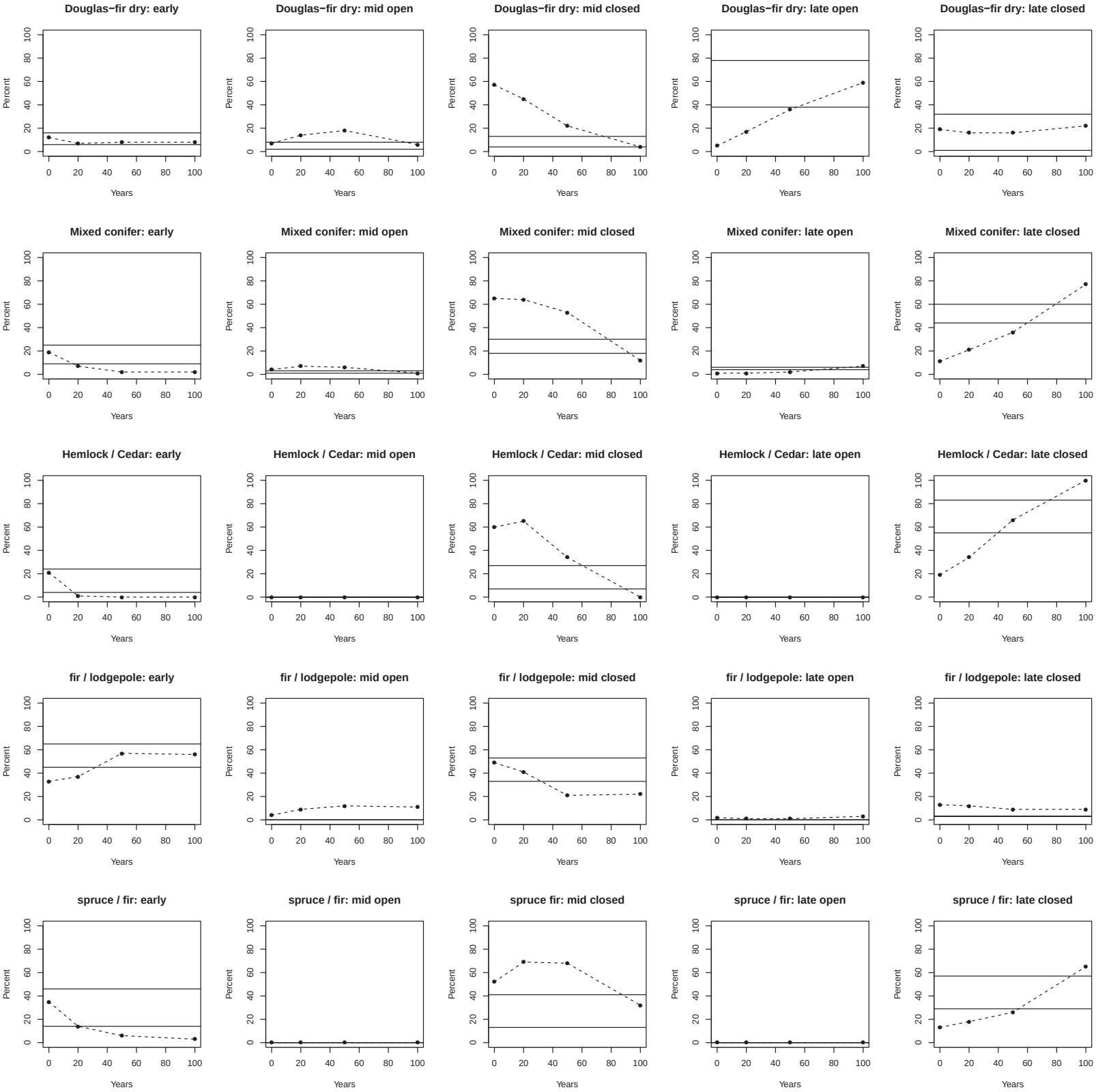
- ✓ Some specialist reports were requested, all reports can be found on the Colville Forest Plan Revision web page: http://www.fs.usda.gov/detail/colville/landmanagement/planning/?cid=fseprd490128
- ✓ A list of acronyms used in the meeting discussion can also be found on the Colville Forest Plan Revision web page: http://www.fs.usda.gov/detail/colville/landmanagement/planning/?cid=stelprd3824594

Meeting ended at approximately 11:15.

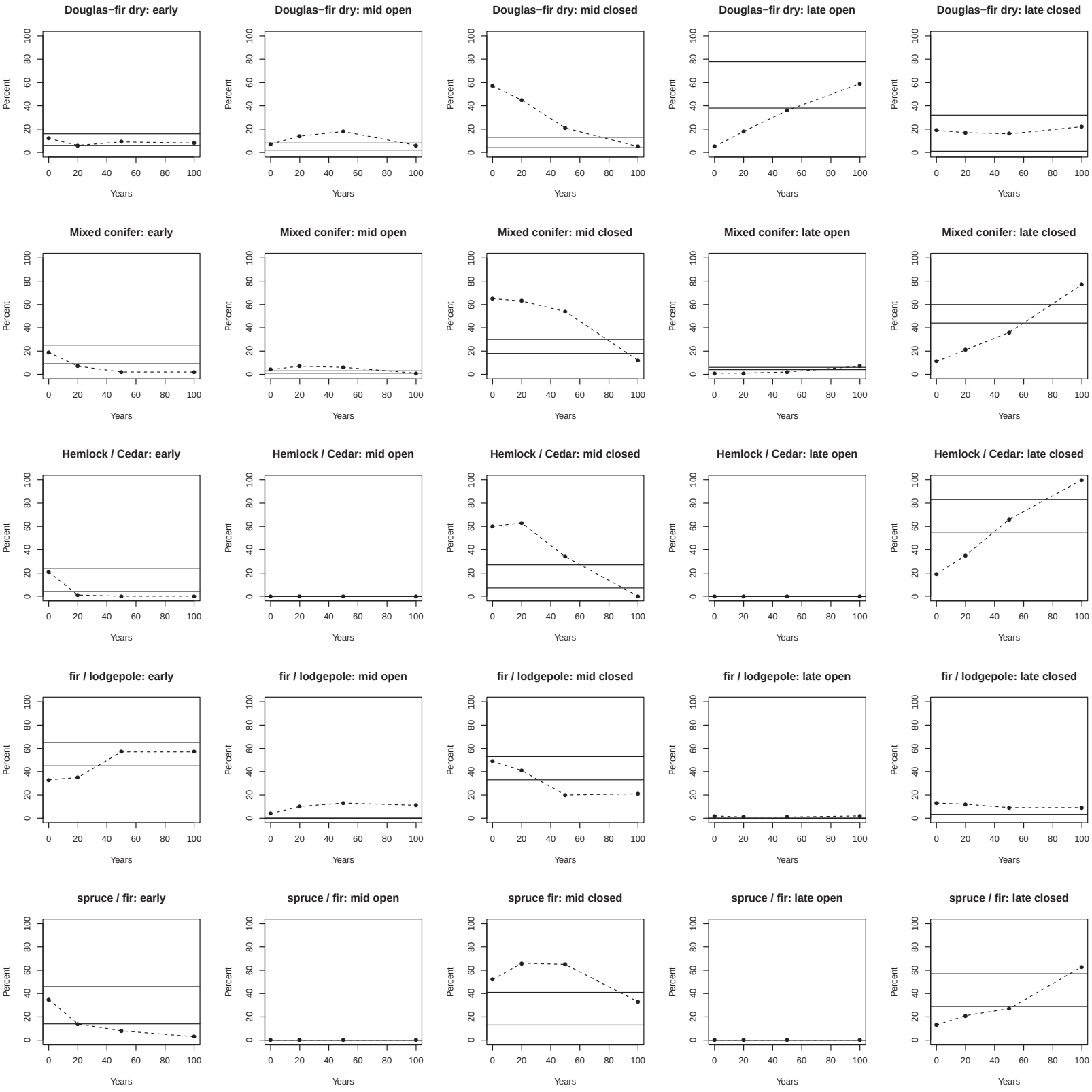
# No Action Alternative



# Proposed Action Alternative



# P Alternative



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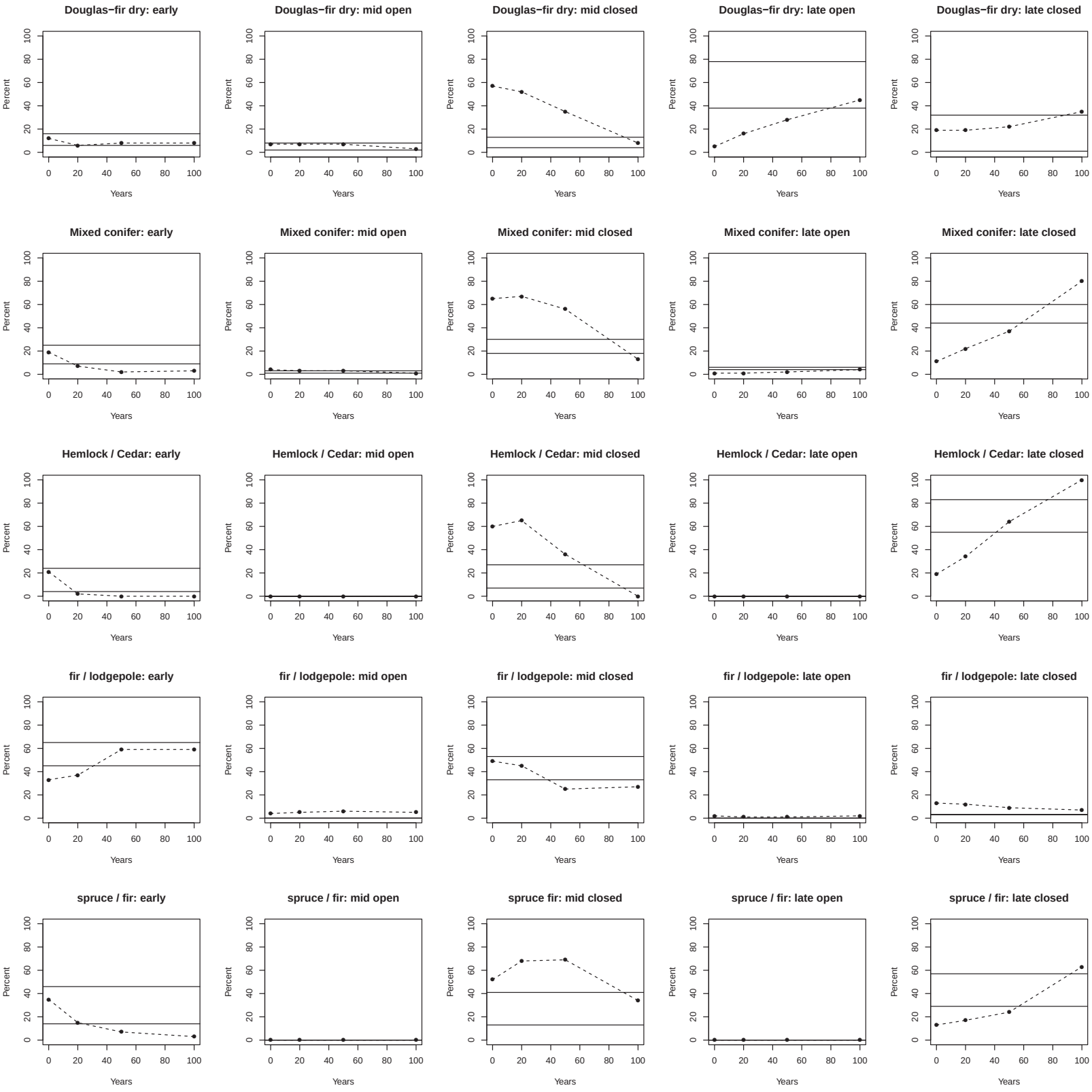

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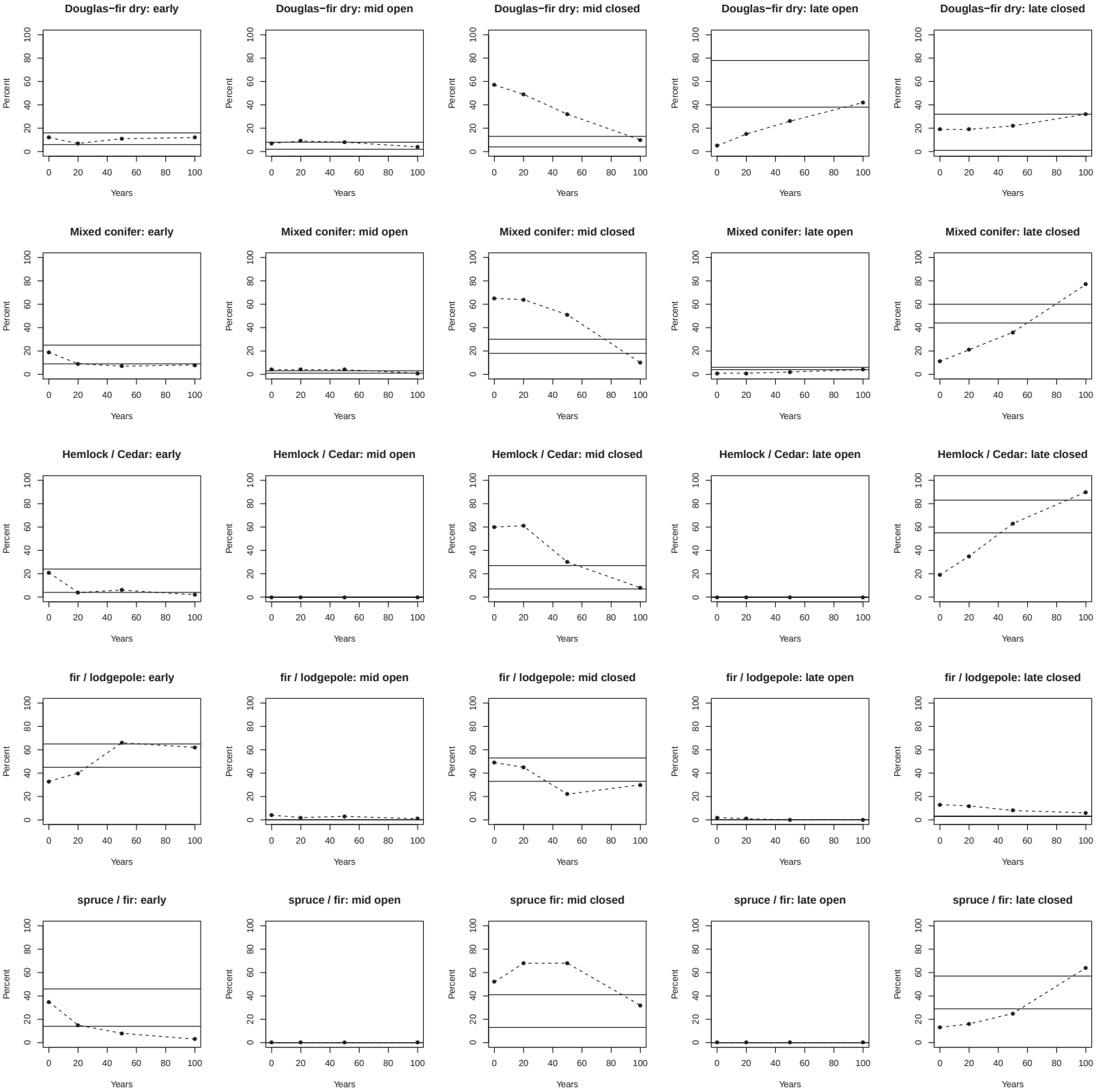
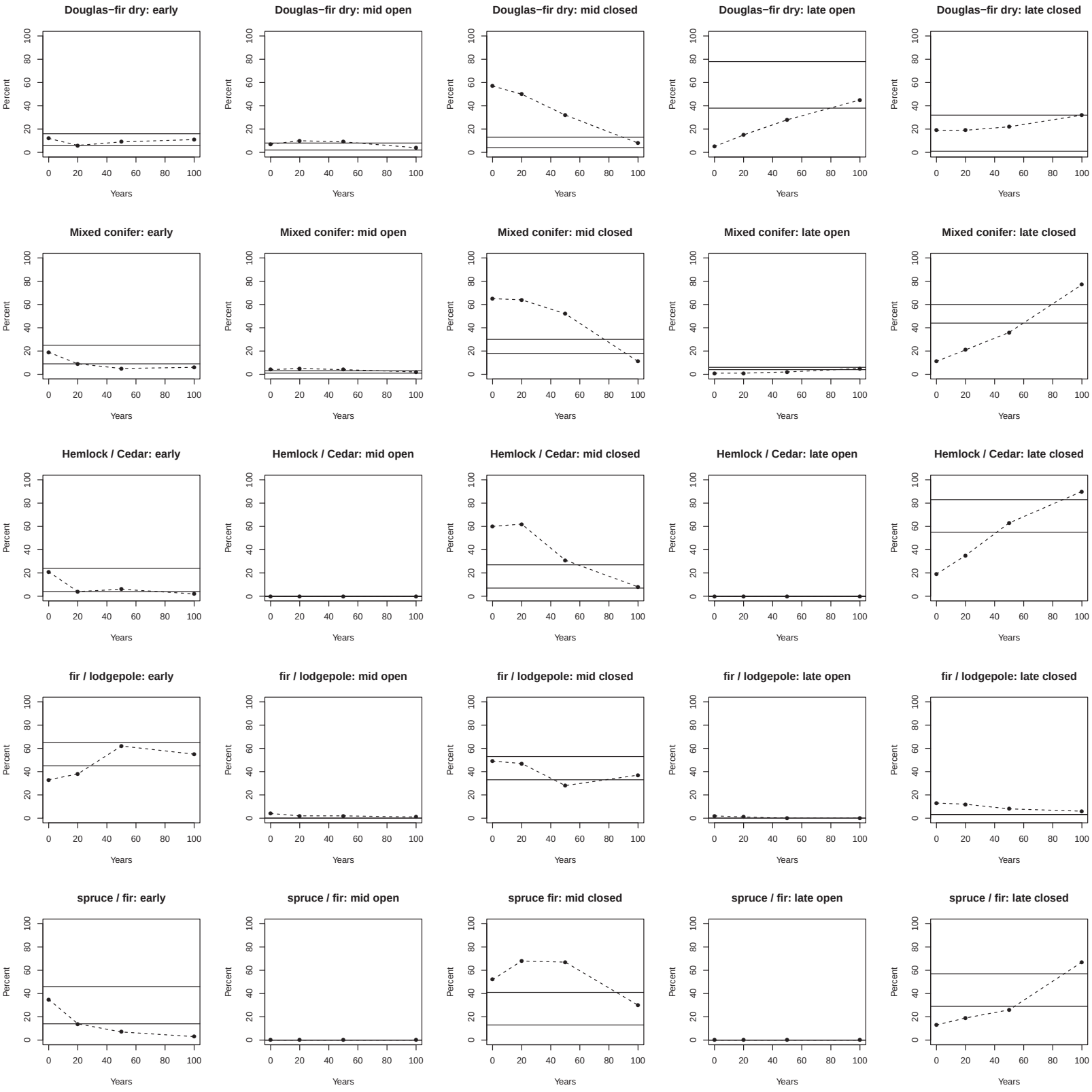


# O Alternative



| FVS Bareground Growth and Yield Modeling Results by Vegetation Type | | | | | |
|---|---|---|---|---|---|
| | **Harvests** | | **Accretion** | | |
| **Dry Douglas-fir Veg Type - FVS Veg Code CDS633** | BdFt/Acre | BdFt/Acre/Yr | CuFt/Acre/10 Yr | BdFt/Acre/10 Year | BdFt/Acre/Yr |
| No Management | 0 | 0 | 72 | 864 | 86 |
| Clearcut every 80 years. No intermediate treatments. | 26656 | 333 | 78 | 936 | 94 |
| 100 Year Rotation. Thin to 70% of BA at 30 years, Clearcut at 100 years. | 32166 | 322 | 72 | 864 | 86 |
| 150 Year Rotation. Thin to 40% of BA at 80 years, clearcut at 150 years. | 25533 | 170 | 80 | 960 | 96 |
| 100 Year Rotation. Thin to 40% of BA at 50 years, Clearcut at 100. | 24905 | 249 | 58 | 696 | 70 |
| 100 Year Rotation. Shelterwood with reserves (20 tpa), no prep cut. | 6235 | 62 | 68 | 816 | 82 |
| | | | | | |
| **Northern Rocky Mountain Mixed Conifer - FVS Veg Code CCF221** | | | | | |
| No Management | 0 | 0 | 105 | 1260 | 126 |
| 80 Year Rotation. Clearcut every 80 years, no intermediate treatment | 24096 | 301 | 103 | 1236 | 124 |
| 100 Year Rotation. Thin to 70% of BA at 30 years, clearcut at 100 years. | 32529 | 325 | 101 | 1212 | 121 |
| 150 Year Rotation. Thin to 40% of BA at 80 years, clearcut at 150 years. | 44272 | 295 | 96 | 1152 | 115 |
| 90 Year Rotation. Thin to 70% BA at 30 years, clearcut at 90. | 28879 | 321 | 96 | 1152 | 115 |
| 90 Year Rotation. No intermediate treatment. | 26784 | 298 | 105 | 1260 | 126 |
| 100 Year Rotation. Shelterwood with reserves (20 tpa left, 7" min cut). Prep cut at 50 years to 30% of MaxSDI. | 16956 | 170 | 101 | 1212 | 121 |
| | | | | | |
| **Western Hemlock / Western Redcedar - FVS Veg Code CHF311** | | | | | |
| No Management | 0 | 0 | 124 | 1488 | 149 |
| 80 Year Rotation. Clearcut at 80 years, no intermediate treatment. | 31173 | 390 | 124 | 1488 | 149 |
| 100 Year Rotation. Thin to 70% of BA at 30 years, clearcut at 100 years. | 44054 | 441 | 125 | 1500 | 150 |
| 150 Year Rotation. Thin to 40% of BA at 80 years, clearcut at 150 years. | 58660 | 391 | 127 | 1524 | 152 |
| Thin from below to 30% of MaxSDI when stand reaches 55% of MaxSDI. Initial clearcut at 120 years and then every 100 years. | 45646 | 415 | 112 | 1344 | 134 |
| 110 Year Rotation. Thin to 70% of BA at 30 years, clearcut at 110 years. | 50492 | 459 | 124 | 1488 | 149 |
| 110 Year Rotation. Thin to 70% of BA at 50 years, clearcut at 110 years. | 50906 | 463 | 126 | 1512 | 151 |
| 120 Year Rotation. Shelterwood with reserves (30 tpa, 7" min cut). Prep cut at 60 years to 30% of MaxSDI. | 22038 | 184 | 113 | 1356 | 136 |
| | | | | | |
| **Subalpine Fir / Lodgepole Pine - FVS Veg Type CEF211** | | | | | |
| No Management | 0 | 0 | 66 | 792 | 79 |
| 80 Year Rotation. Clearcut at 80 years, no intermediate treatment. | 14364 | 180 | 69 | 828 | 83 |
| 100 Year Rotation. Thin to 70% of BA at 30 years, clearcut at 100 years. | 17235 | 172 | 63 | 756 | 76 |
| 150 Year Rotation. Thin to 40% of BA at 80 years, clearcut at 150 years. | 19713 | 131 | 61 | 732 | 73 |
| 60 Year Rotation. No intermediate treatment, clearcut at 60. | 9930 | 166 | 53 | 636 | 64 |
| 70 Year Rotation | 12640 | 181 | 57 | 684 | 68 |
| 100 Year Rotation. No intermediate treatment. | 17402 | 174 | 74 | 888 | 89 |
| 80 Year Rotation. Shelterwood down to 0" dbh with 15 tpa remaining. | 6335 | 79 | 58 | 696 | 70 |
| | | | | | |
| **Spruce / Subalpine Fir - FVS Veg Code CEF423** | | | | | |
| No Management | 0 | 0 | 91 | 1092 | 109 |
| 90 Year Rotation. Clearcut at 90 years, no intermediate treatment. | 26838 | 298 | 89 | 1068 | 107 |
| 100 Year Rotation. Thin to 70% of BA at 30 years, clearcut at 100 years. | 29653 | 297 | 82 | 984 | 98 |
| 150 Year Rotation. Thin to 40% of BA at 80 years, clearcut at 150 years. | 39489 | 263 | 87 | 1044 | 104 |
| 100 Year Rotation. Shelterwood with reserves (20 tpa left, 7" min cut). Prep cut at 50 years to 30% of MaxSDI. | 16918 | 169 | 91 | 1092 | 109 |

**Volume results from FVS bareground model runs**

| | | Entire Forest Area (no regards to suitability) | | | Only Acres Suitable for Timber Production | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | NA | | PA | | P | | R | | B | | O | |
| **Model Type** | **Total Modeled Acres** | **Max BdFt Accretion/ Acre/Year** | **Total BdFt/Year** | **MMBF/Year** | **Acres** | **MMBF** | **Acres** | **MMBF** | **Acres** | **MMBF** | **Acres** | **MMBF** | **Acres** | **MMBF** | **Acres** | **MMBF** |
| Douglas-Fir Dry | 395,250 | 96 | 37944000 | 38 | 170076 | 16 | 253197 | 24 | 257901 | 25 | 101381 | 10 | 184384 | 18 | 153436 | 15 |
| Northern Rocky Mountain Mixed Conifer | 309,500 | 126 | 38997000 | 39 | 197647 | 25 | 224542 | 28 | 224016 | 28 | 63355 | 8 | 124945 | 16 | 121974 | 15 |
| Spruce/Subalpine Fir | 23,506 | 109 | 2562154 | 3 | 10516 | 1 | 8596 | 1 | 8916 | 1 | 3200 | 0 | 2410 | 0 | 3413 | 0 |
| Subalpine Fir/Lodgepole pine | 189,794 | 83 | 15752902 | 16 | 103280 | 9 | 90162 | 7 | 89906 | 7 | 40569 | 3 | 32550 | 3 | 31995 | 3 |
| Western Redcedar/Western Hemlock | 99,200 | 152 | 15078400 | 15 | 44481 | 7 | 59927 | 9 | 58647 | 9 | 15634 | 2 | 32012 | 5 | 28966 | 4 |
| | | | **110334456** | **110** | **526000** | **58** | **636424** | **70** | **639386** | **70** | **224139** | **24** | **376301** | **41** | **339784** | **38** |

# Vegetation Modeling Assumptions for the Colville Forest Planning Effort

*Prepared by Maximillian Wahlberg, Regional Analyst*

## Background:

The following documentation represents model parameters and assumptions used in the modeling of Forest Plan Alternatives in the Colville National Forest revision effort. This document specifically refers to the model runs and results provided to Colville Interdisciplinary Team (IDT) members in February 2015.

### Software

State and transition simulation modeling (STSM) was conducted using the St-Sim module of SyncroSim, version 2.3.8. For a full description of St-Sim the reader is referred to ApexRMS and online documentation at http://wiki.syncrosim.com/index.php?title=Main_Page.

### Model origins

The models used in this effort were adapted from models received from Mark Loewen (NEWz Vegetation Specialist, now retired). These base models were evaluated for potential flaws (with fixes applied as necessary) and reworked through a workshop process. Model workshops were conducted in Wenatchee, WA with key specialists' involvement in July of 2014. Further refinement of the models was done based on feedback received from Colville NF specialists in August of 2014. Final modifications were made in consultation with Jonathan Day, Colville Plan Revision Vegetation Specialist between August and November of 2014.

### Stratifications

The model space is stratified by two primary components, 1) Potential Vegetation Type, and 2) Modeling Zone.

### Model Types

The Potential Vegetation Type is derived from plant association group (PAG) crosswalks combining like PAGs into functional groupings based on similar vegetation potential and disturbance response.

**Table 1 - Model Types**

| ***Model Type*** | ***Code*** | ***Total Modeled Acres*** |
|---|---|---|
| Douglas-Fir Dry | FDD | 395,250 |
| Northern Rocky Mountain Mixed Conifer | FCM | 309,500 |
| Spruce/Subalpine Fir | FCD_LPWL | 23,506 |
| Subalpine Fir/Lodgepole pine | FCD_DFmx | 189,794 |
| Western Redcedar/Western Hemlock | FRN | 99,200 |

Geospatial representation of the PAGs comes from the 2012 Henderson PAG layer. Table 2 includes a crosswalk between PAGs and Model Types.

Table 2 - Plant Association Group to Forest Plan Model Type Crosswalk

| PAG NAME | MAP CODE | PVG | FOREST PLAN MODEL |
|---|---|---|---|
| PIAL/VASC-LUHI-CARU | 2501 | Cold | Subalpine Fir/Lodgepole pine (fcd) |
| SAF/CARU-PAMY | 2502 | Cold | Subalpine Fir/Lodgepole pine (fcd) |
| SAF/VASC-VACA-VAME-LIBOL | 2503 | Cold | Subalpine Fir/Lodgepole pine (fcd) |
| SAF/RHAL-XETE-ARLA-POPU | 2505 | Cold | Subalpine Fir/Lodgepole pine (fcd) |
| SAF/TRCA3-ATFI-GYDR-STAM-riparian | 2507 | Cold | Spruce/Subalpine fir (fcd?) |
| PP/AGSP-PUTR dry shrub-grass | 1001 | Dry | Douglas-fir dry (fdd) |
| DF-PP/AGSP-PUTR-FEID-ARUV | 1401 | Dry | Douglas-fir dry (fdd) |
| DF/CARU-SPBE-PAMY-ARUV-SYOR | 1403 | Dry | Douglas-fir dry (fdd) |
| DF/SYAL-PHMA | 1404 | Dry | Douglas-fir dry (fdd) |
| DF/VACA-VAME-VAMY | 1405 | Dry | Douglas-fir dry (fdd) |
| WH/GASH-XETE-VAME-HODI-ARNE | 1901 | Mesic | Northern Rocky Mountain Mixed Conifer (fcm) |
| WH/GASH-BENE-RHMA-PAMY-CLUN | 1903 | Mesic | Northern Rocky Mountain Mixed Conifer (fcm) |
| WH/ACCI-GASH-BENE-ACTR-POMU | 1906 | Mesic | Northern Rocky Mountain Mixed Conifer (fcm) |
| WH/POMU-TIUN-OXOR-ARNU3 | 1907 | Mesic | Western redcedar/western hemlock (frn) |
| WH/OPHO-ATFI-LYAM | 1910 | Mesic | Western redcedar/western hemlock (frn) |
| WH/MEFE-XETE-RUPE | 1912 | Mesic | Western redcedar/western hemlock (frn) |
| Northern Artemesia-Agropyron steppe | 501 | Non-Forest | |
| Non-Forest Dry | 1071 | Non-Forest | |
| Non-Forest Dry | 1471 | Non-Forest | |
| Non-Forest Dry | 1971 | Non-Forest | |
| Non-Forest Dry | 2571 | Non-Forest | |
| Dry Continental PKL | 3201 | Non-Forest | |
| Alpine | 3301 | Non-Forest | |
| DF-ES/riparian | 1409 | Riparian | |

## Model zones

The second strata applied to this modeling effort are "Model Zones". Four primary model zones were created to capture different management emphasis on lands with different designations under each alternative[1]. These model zones allow a certain number of model "cells" to receive different transitions and probabilities than other model cells of the same state. In this way, model cells that reflect designated Wilderness, for example, can be programed to receive fire transitions but not mechanical treatments. In the St-Sim database, these areas are referred to as "Planning Zones". A list of the model zones is contained in Table 3.

Table 3 - Model Zones

| *Planning Zone* | *ST-Sim Description* |
|---|---|
| Reserve | Reserve lands |

[1] While the models themselves are not run spatially (the outcome in a given model cell is not informed by the outcomes of "adjacent" cells), model initial conditions are set based on acres of each model state in each model zone based on GIS queries.

| | |
|---|---|
| Restoration | Whole Landscape Approach and Restoration Zones |
| TimbProd | Active Timber Production Zones |
| WildOther | Wilderness, PARW and other |

Model zones are based on and tier to categories developed by Jon Day, Planning Team Vegetation Specialist as part of the timber suitability analysis.

## Parameters

### Alternatives

Individual model runs were completed for each vegetation/model type[2], and for each alternative. Transitions for each alternative were developed and refined through a workshop process and based on local expertise and the interdisciplinary team's understanding of the alternatives. A full description of the model assumptions for each alternative can be found in the section Model Assumptions by Alternative.

### Non-spatial

All models are run as non-spatial models. However, existing (initial) conditions are populated based on spatial analysis of model state distribution across modeling zones. See the Modeling Zoned and Existing Conditions sections for a detailed description of the spatial data that feeds the initial conditions in these model runs.

## Existing conditions

### Source

Existing conditions were calculated using the following data sources:
2012 Gradient Nearest Neighbor (GNN) Structure Data produced by the Landscape Ecology, Modeling, Mapping and Analysis group (LEMMA). GNN structure data can be obtained from the following link: *http://lemma.forestry.oregonstate.edu/data/structure-maps*

- 2012 Plant Association Group (PAG) map developed and updated by Jan Henderson. A description of this product can be found in the document: "FINAL REPORT for CONTRACT AG-05H7-P-10-0029 - Revise and update the PAG map and model for the Okanogan, Wenatchee and Colville National Forests.
- Model Zones (discussed above)

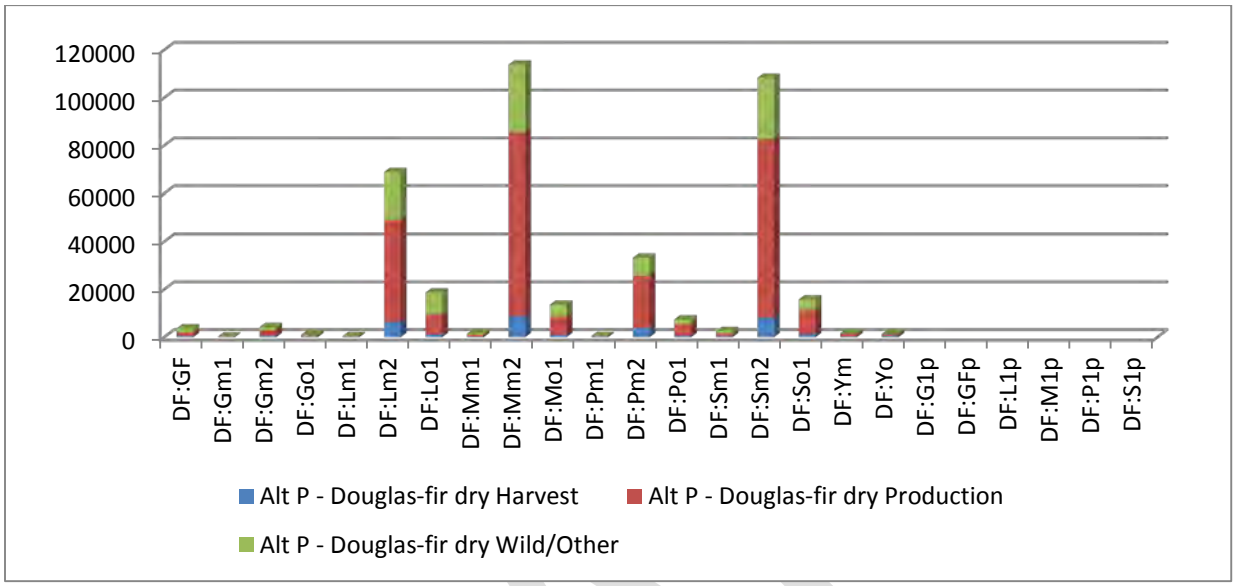
To develop datasets for imputation into the St-Sim modeling database, both datasets were classified into model groupings. The PAG data were classified and cross walked into model vegetation types as displayed in Table 2. GNN data were classified into structural groupings based on canopy cover, size class and storiedness. These structural groupings represent the structural components of the model states[3] in each state and transition simulation model.

[2] The one exception to this was the FCD model, which was run as one model, but represents two different model types (Spruce/Subalpine Fir & Subalpine Fir/Lodgepole Pine). However, there are no transition pathways between the two model types contained in this model, therefore they essentially function as separate models run concurrently. This was done to expedite modeling as the base models contained linkages between these two model types that were removed as a result of model workshops based on local understanding of the ecology inherent to these systems.
[3] The model states are not synonymous with the Colville Structure Groupings used for final reporting in the Vegetation Specialist's Report. These structural groupings represent a finer delineation of structural characteristics

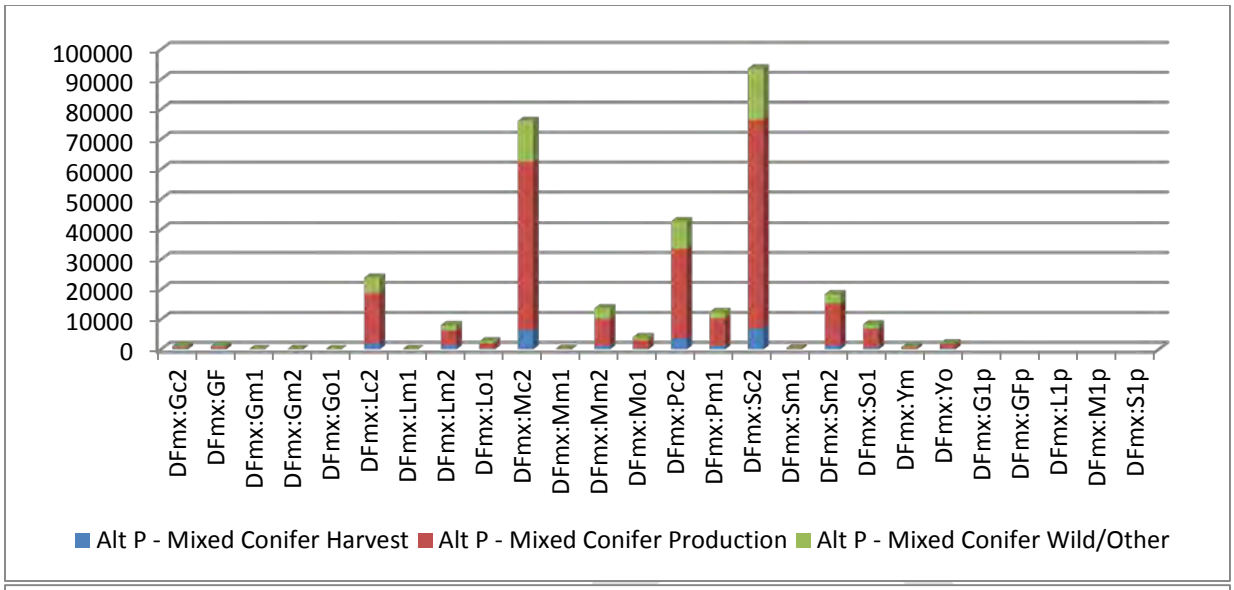
## Values

Full existing condition values by model state and model zone are included in the St-SIM database. The following summaries show existing conditions by model state and model zone in graphical format.

### *Alternative P*




(e.g. storiedness) than the Colville Structural Groupings. A crosswalk between modeled structure states and the Colville Structure Groupings can be found in Appendix 2.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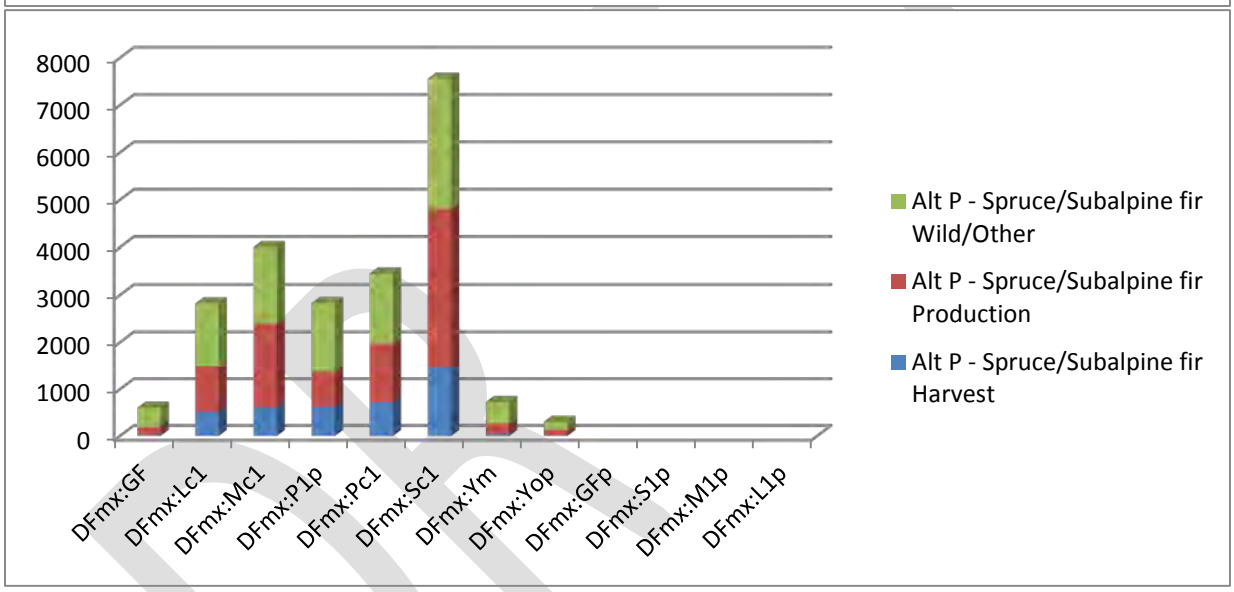
Alt P - Mixed Conifer Harvest
Alt P - Mixed Conifer Production
Alt P - Mixed Conifer Wild/Other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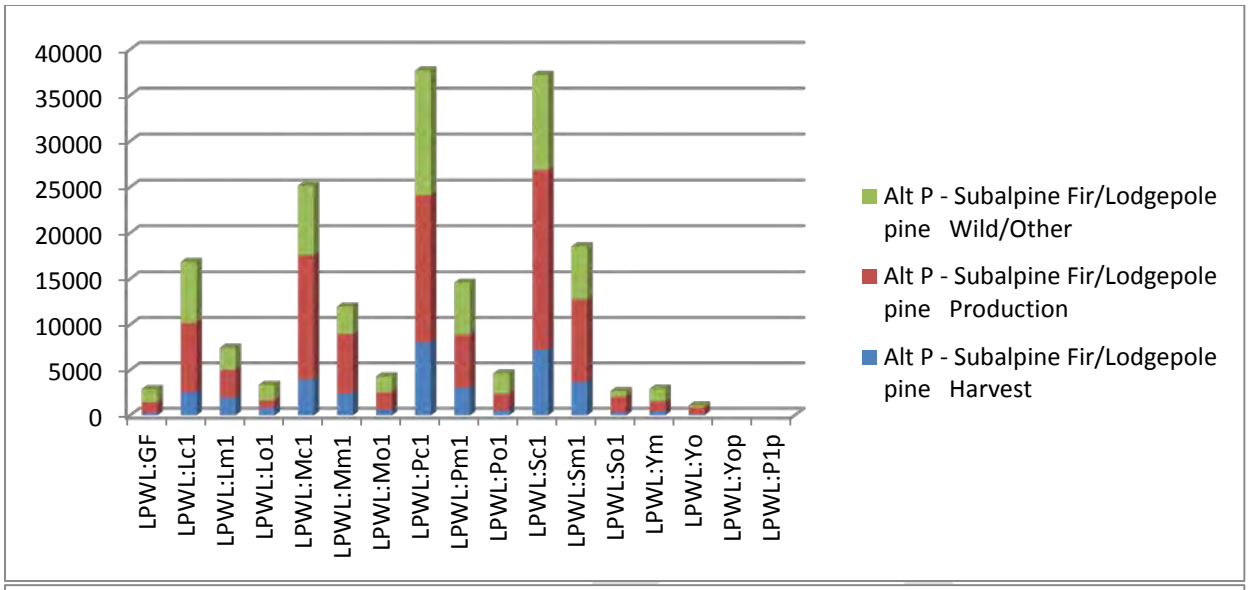
Alt P - Spruce/Subalpine fir Production
Alt P - Spruce/Subalpine fir Harvest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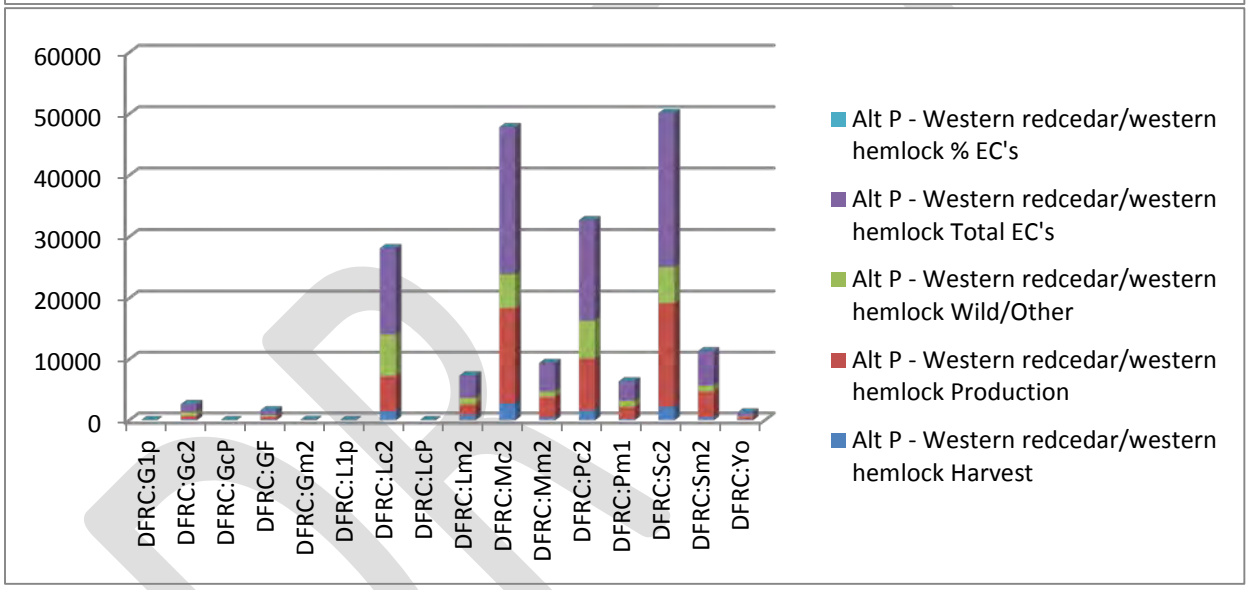
Alt P - Subalpine Fir/Lodgepole pine Production
Alt P - Subalpine Fir/Lodgepole pine Harvest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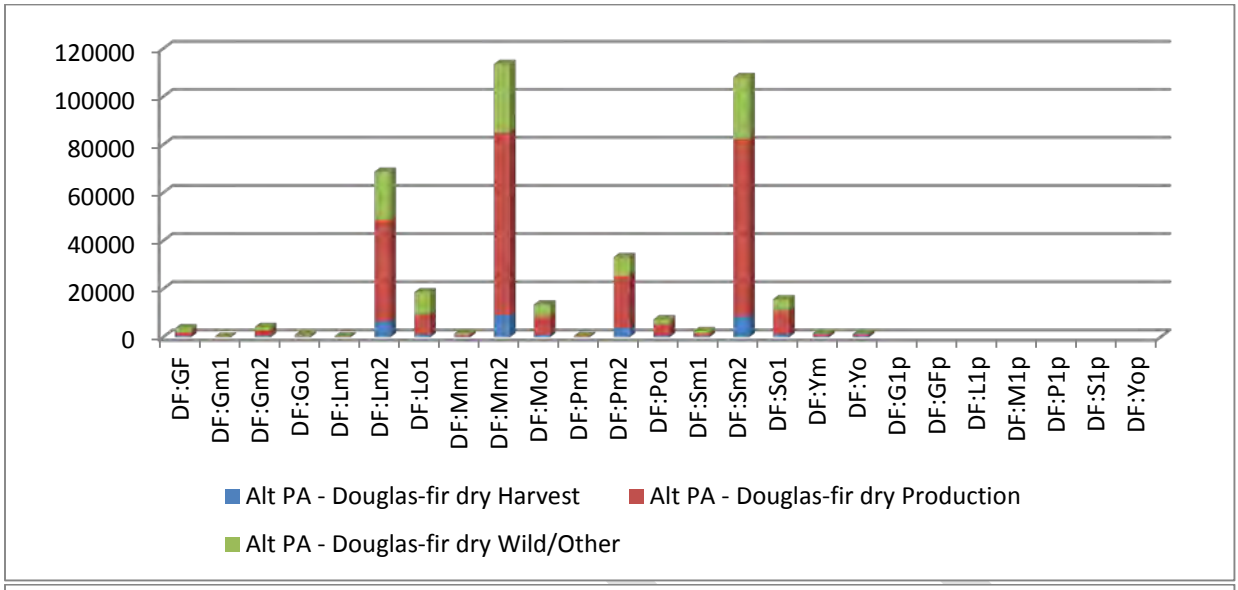
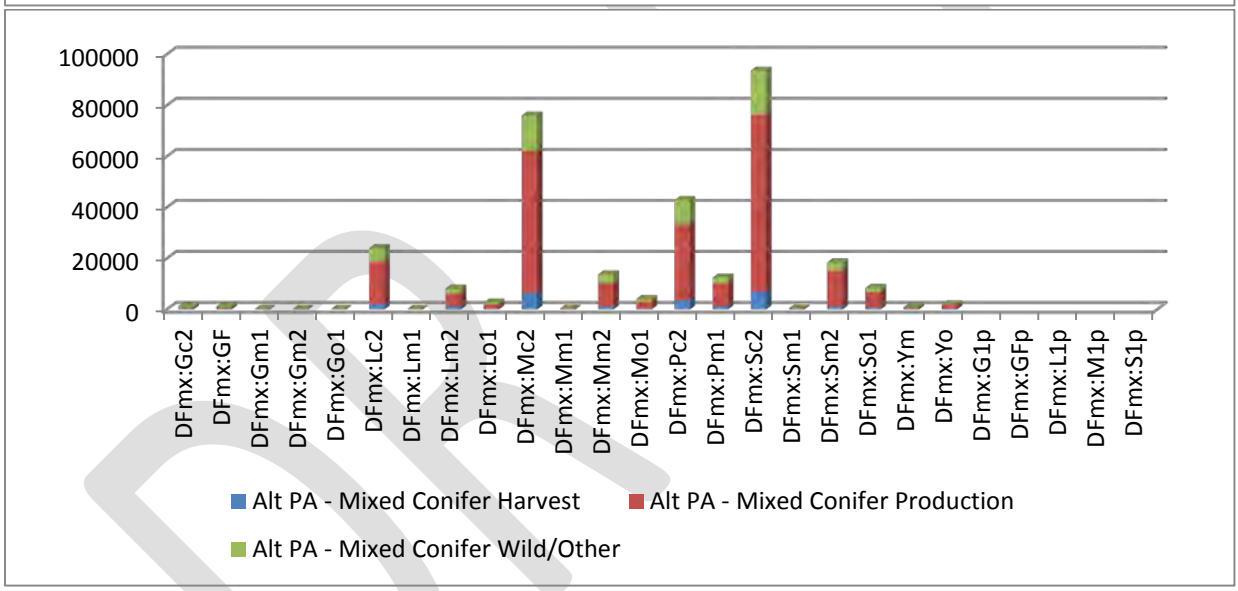
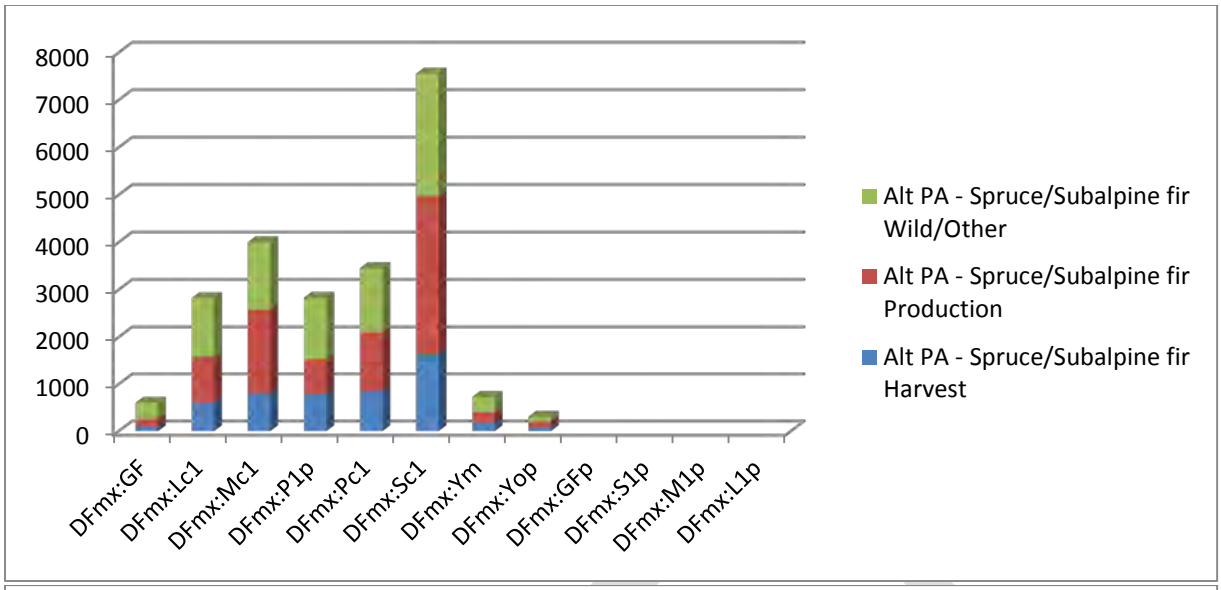
DFRC:LcP
DFRC:Lm2
DFRC:Mc2
DFRC:Mm2
DFRC:Pc2
DFRC:Pm1
DFRC:Sc2
DFRC:Sm2
DFRC:Yo
Alt P - Western redcedar/western hemlock % EC's
Alt P - Western redcedar/western hemlock Total EC's
Alt P - Western redcedar/western hemlock Wild/Other
Alt P - Western redcedar/western hemlock Production
Alt P - Western redcedar/western hemlock Harvest

## *Alternative PA*

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DFmx:Ym
DFmx:Yop
DFmx:GFp
DFmx:S1p
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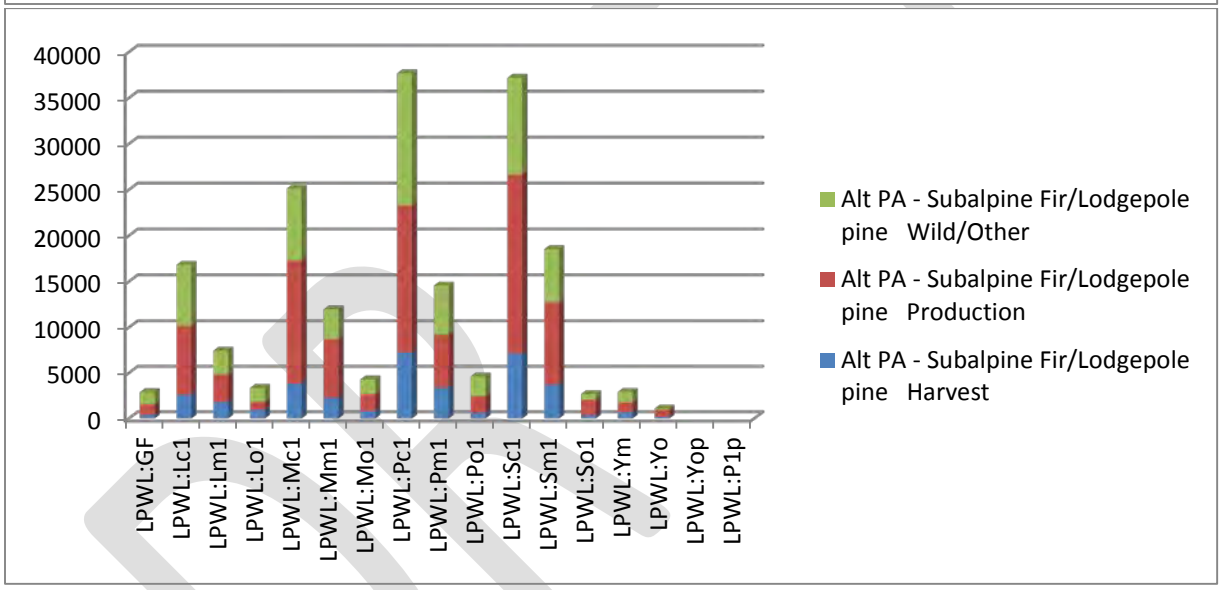
Alt PA - Spruce/Subalpine fir Wild/Other
Alt PA - Spruce/Subalpine fir Production
Alt PA - Spruce/Subalpine fir Harvest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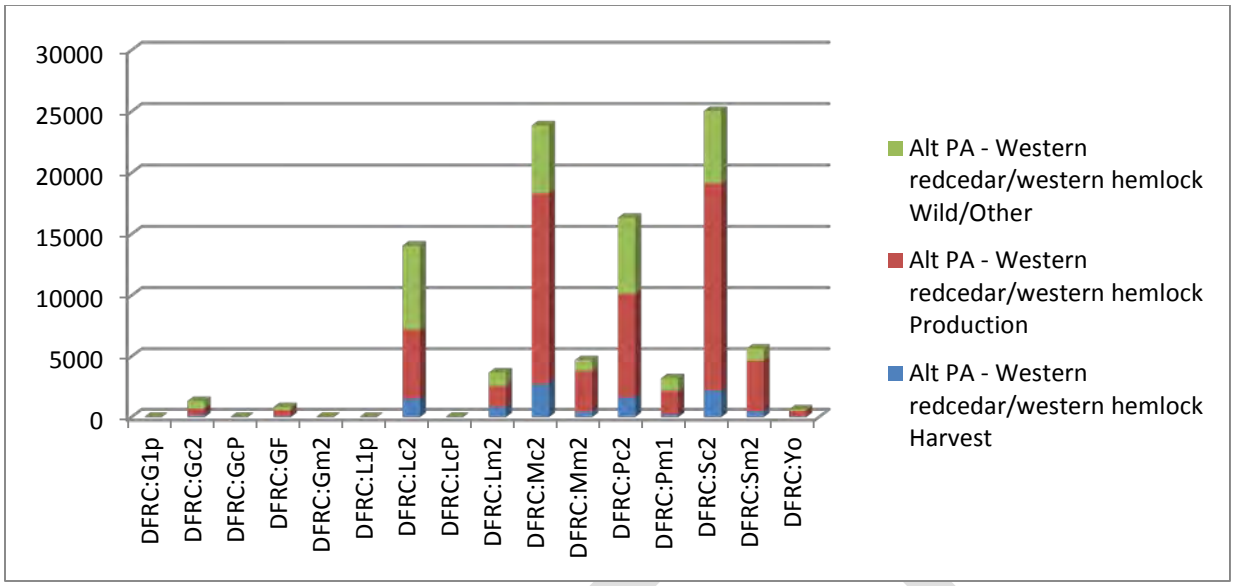
LPWL:Mo1
LPWL:Pc1
LPWL:Pm1
LPWL:Po1
LPWL:Sc1
LPWL:Sm1
LPWL:So1
LPWL:Ym
LPWL:Yo
LPWL:Yop
LPWL:P1p
Alt PA - Subalpine Fir/Lodgepole pine Wild/Other
Alt PA - Subalpine Fir/Lodgepole pine Production
Alt PA - Subalpine Fir/Lodgepole pine Harvest

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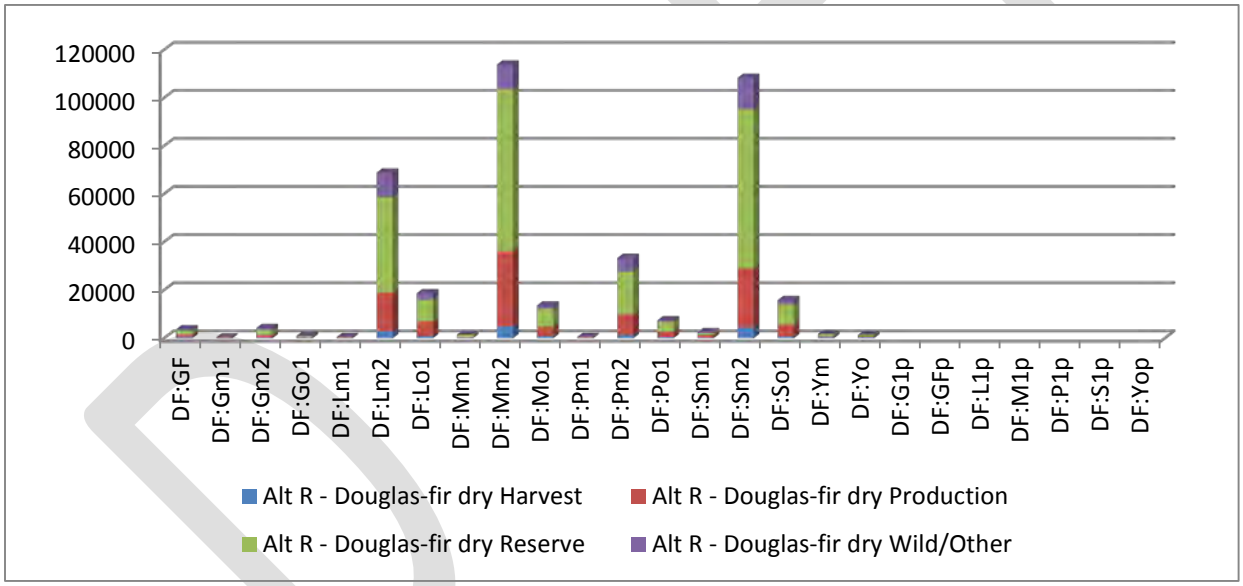

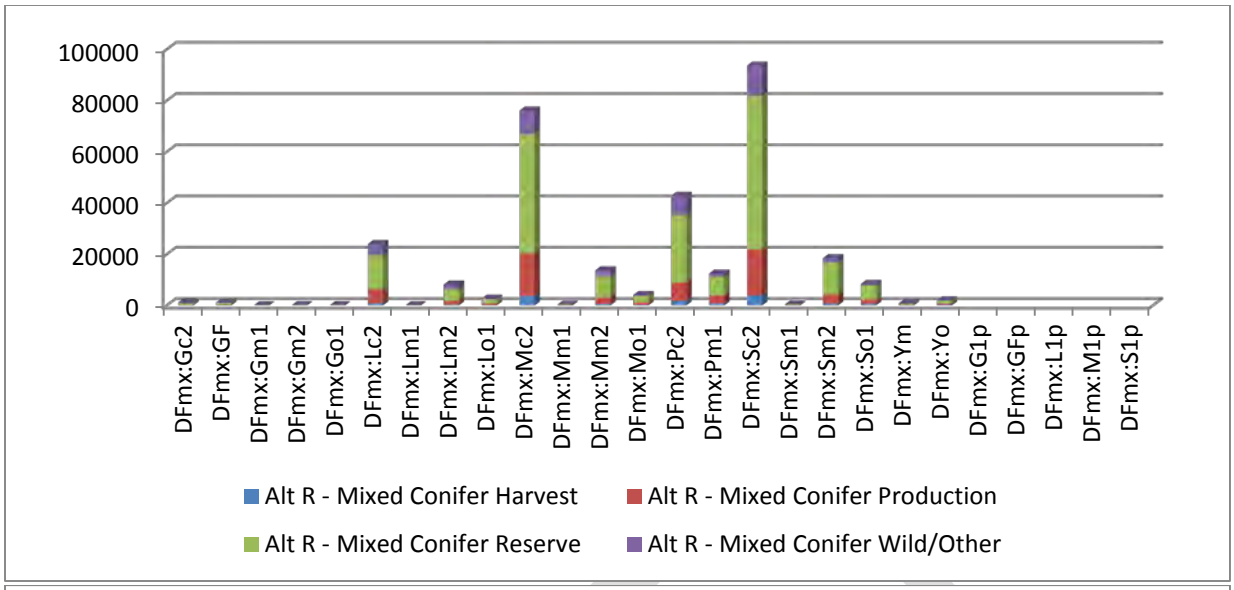
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DFmx:Lm2
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DFmx:Mc2
DFmx:Mm1
DFmx:Mm2
DFmx:Mo1
DFmx:Pc2
DFmx:Pm1
DFmx:Sc2
DFmx:Sm1
DFmx:Sm2
DFmx:So1
DFmx:Ym
DFmx:Yo
DFmx:G1p
DFmx:GFp
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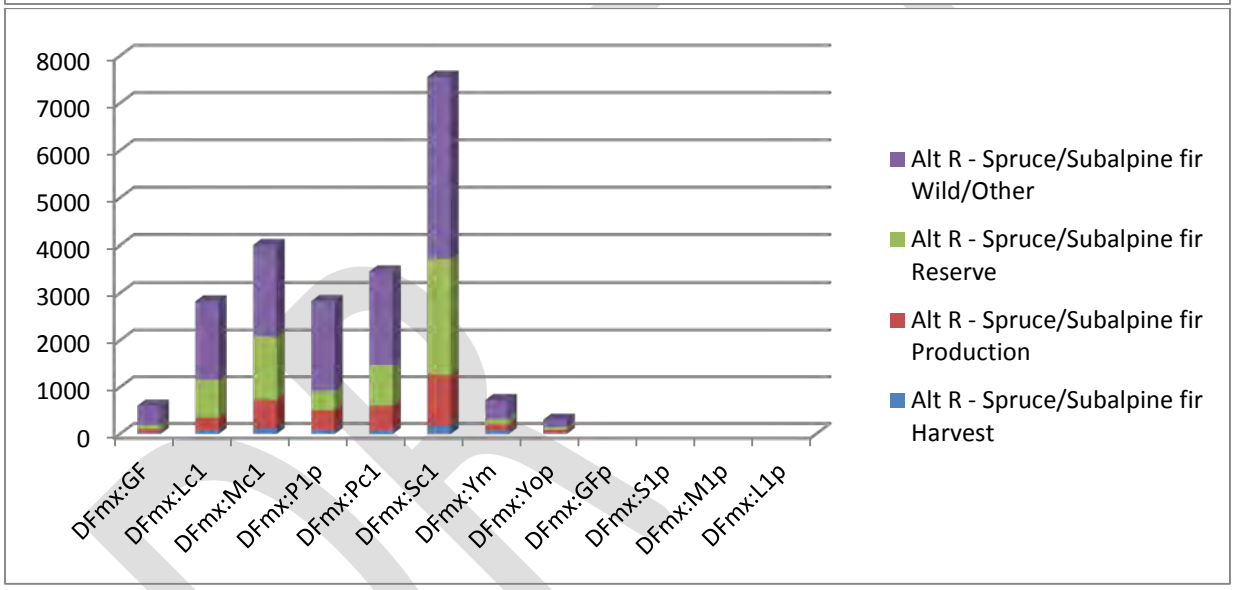
DFmx:S1p
Alt R - Mixed Conifer Harvest
Alt R - Mixed Conifer Production
Alt R - Mixed Conifer Reserve
Alt R - Mixed Conifer Wild/Other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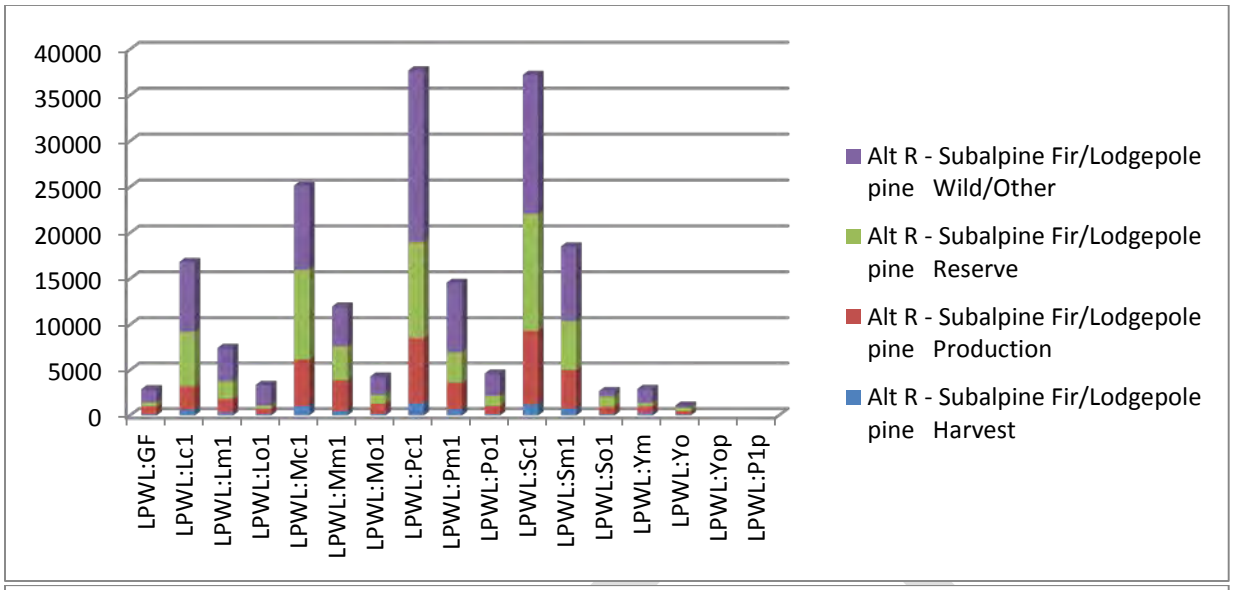
DFmx:Ym
DFmx:Yop
DFmx:GFp
DFmx:S1p
DFmx:M1p
DFmx:L1p
Alt R - Spruce/Subalpine fir Wild/Other
Alt R - Spruce/Subalpine fir Reserve
Alt R - Spruce/Subalpine fir Production
Alt R - Spruce/Subalpine fir Harvest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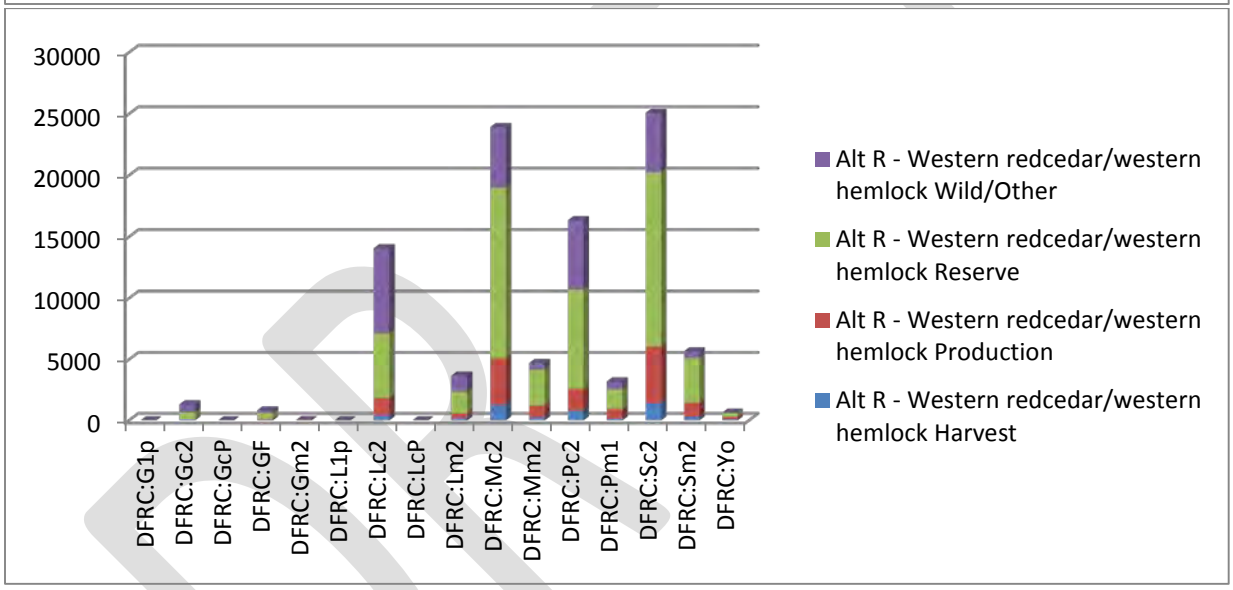
LPWL:Mm1
LPWL:Mo1
LPWL:Pc1
LPWL:Pm1
LPWL:Po1
LPWL:Sc1
LPWL:Sm1
LPWL:So1
LPWL:Ym
LPWL:Yo
LPWL:Yop
LPWL:P1p
Alt R - Subalpine Fir/Lodgepole pine Wild/Other
Alt R - Subalpine Fir/Lodgepole pine Reserve
Alt R - Subalpine Fir/Lodgepole pine Production
Alt R - Subalpine Fir/Lodgepole pine Harvest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DFRC:L1p
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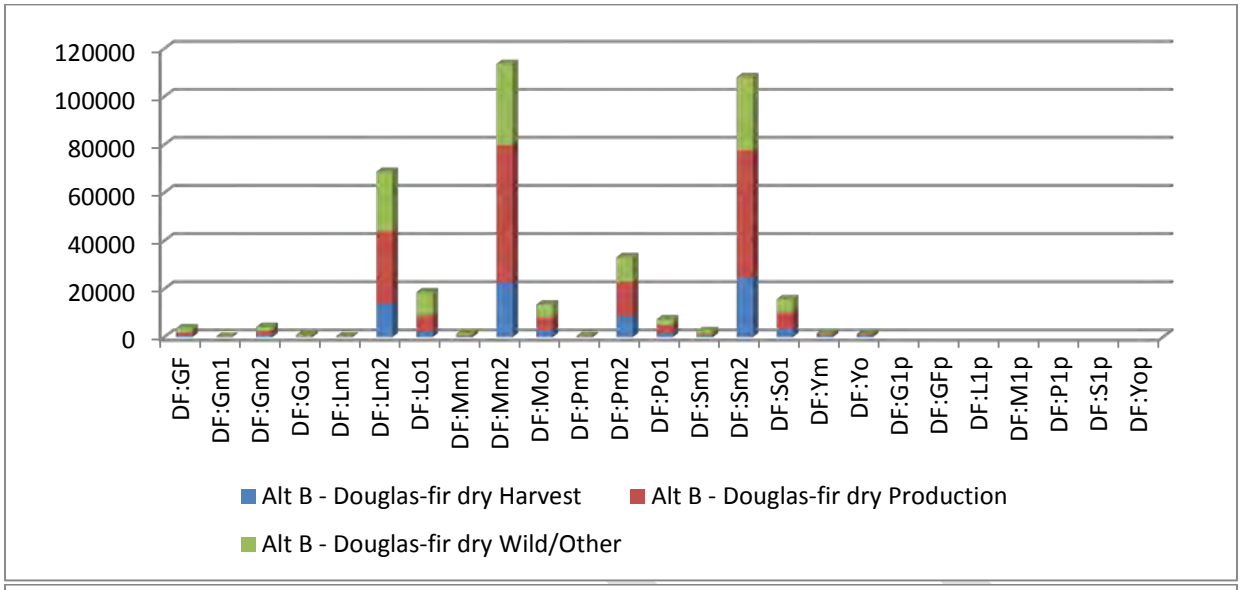
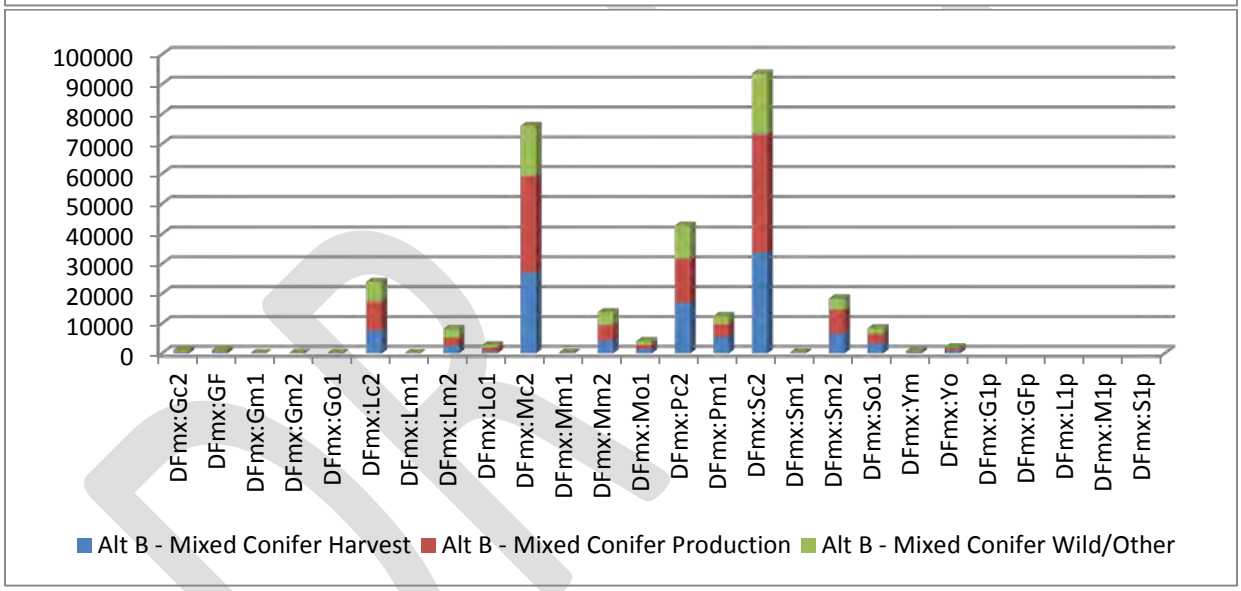
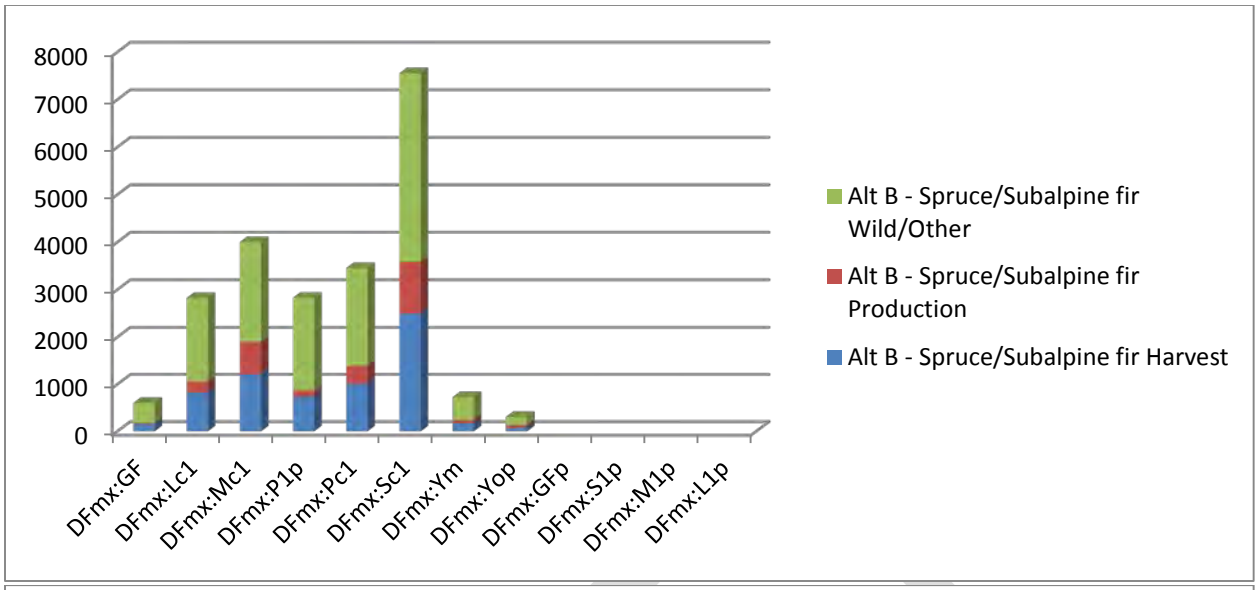
DFRC:LcP
DFRC:Lm2
DFRC:Mc2
DFRC:Mm2
DFRC:Pc2
DFRC:Pm1
DFRC:Sc2
DFRC:Sm2
DFRC:Yo
Alt R - Western redcedar/western hemlock Wild/Other
Alt R - Western redcedar/western hemlock Reserve
Alt R - Western redcedar/western hemlock Production
Alt R - Western redcedar/western hemlock Harvest

### *Alternative B*

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DFmx:Ym
DFmx:Yop
DFmx:GFp
DFmx:S1p
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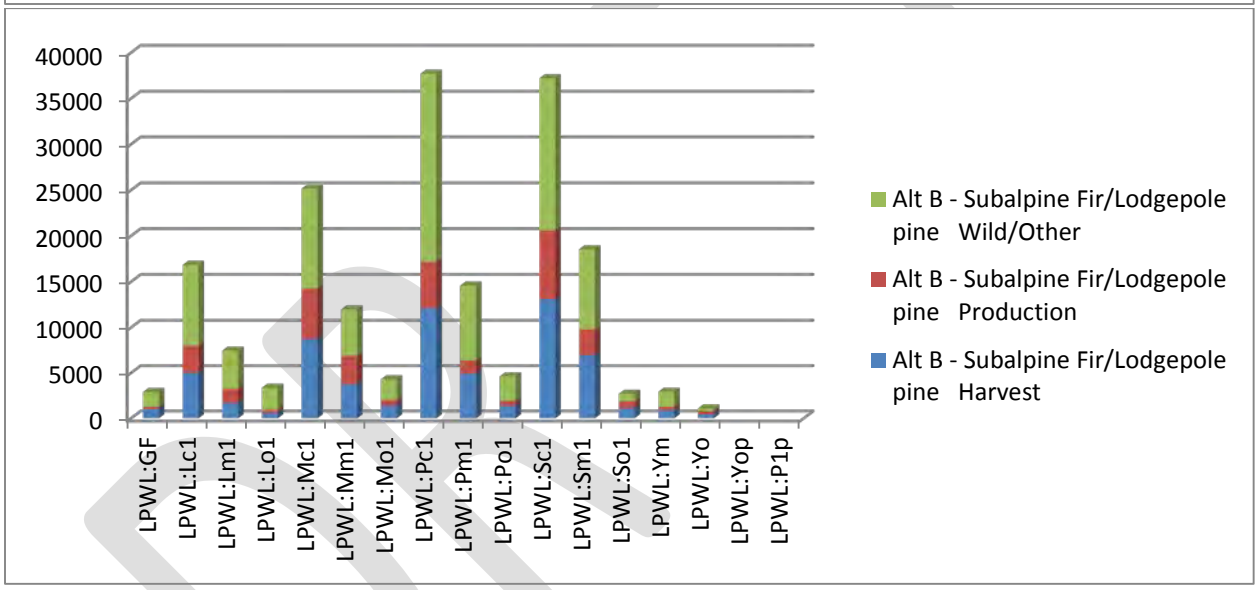
DFmx:L1p
Alt B - Spruce/Subalpine fir Wild/Other
Alt B - Spruce/Subalpine fir Production
Alt B - Spruce/Subalpine fir Harvest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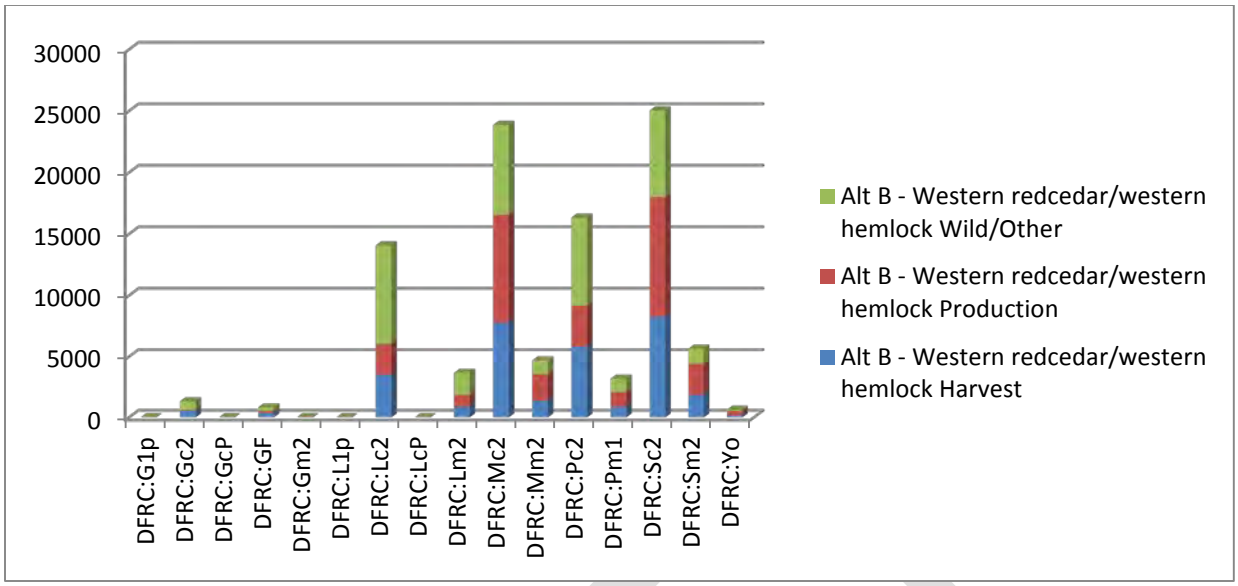
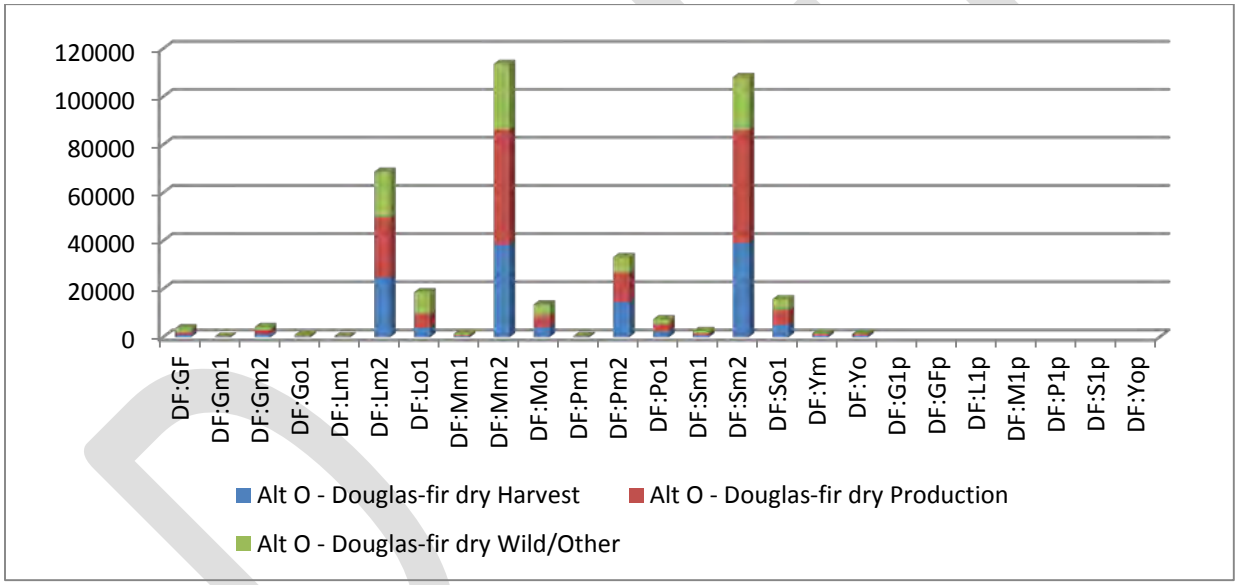
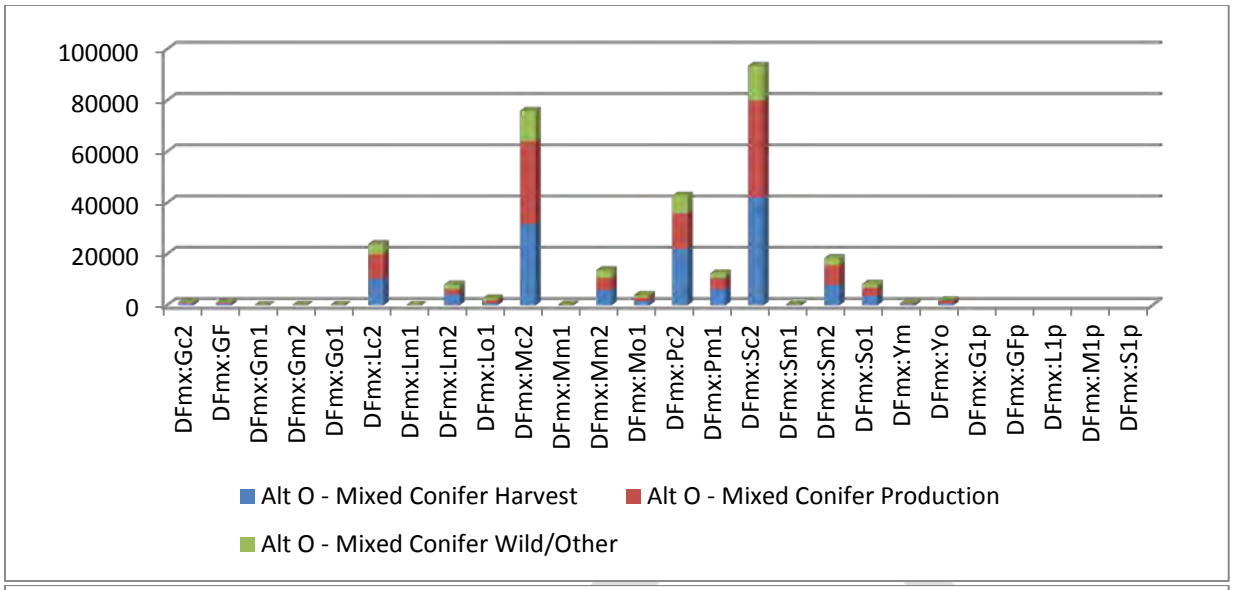
LPWL:Mo1
LPWL:Pc1
LPWL:Pm1
LPWL:Po1
LPWL:Sc1
LPWL:Sm1
LPWL:So1
LPWL:Ym
LPWL:Yo
LPWL:Yop
LPWL:P1p
Alt B - Subalpine Fir/Lodgepole pine Wild/Other
Alt B - Subalpine Fir/Lodgepole pine Production
Alt B - Subalpine Fir/Lodgepole pine Harvest




### *Alternative O*

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DFmx:Yo
DFmx:G1p
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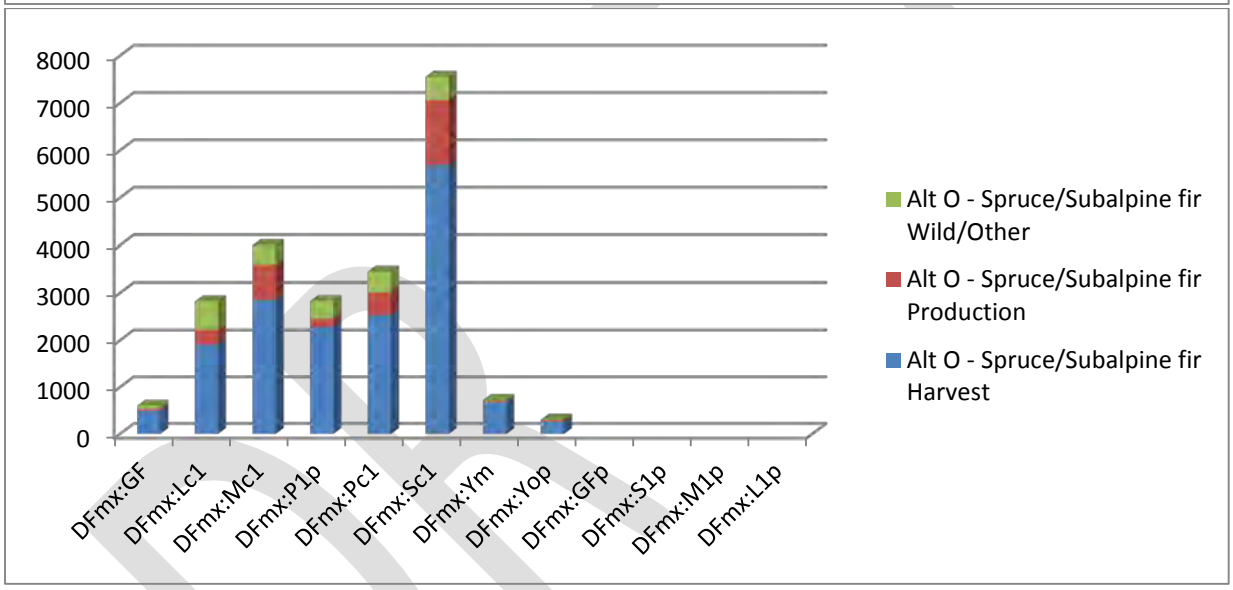
DFmx:S1p
Alt O - Mixed Conifer Harvest
Alt O - Mixed Conifer Production
Alt O - Mixed Conifer Wild/Other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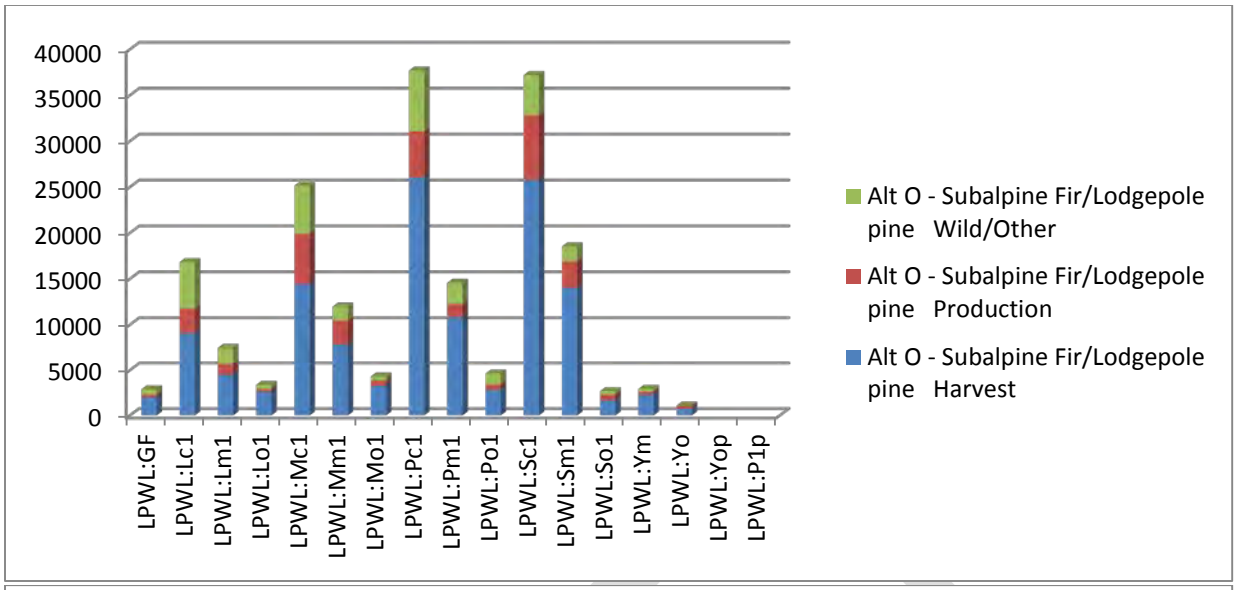
DFmx:Ym
DFmx:Yop
DFmx:GFp
DFmx:S1p
DFmx:M1p
DFmx:L1p
Alt O - Spruce/Subalpine fir Wild/Other
Alt O - Spruce/Subalpine fir Production
Alt O - Spruce/Subalpine fir Harvest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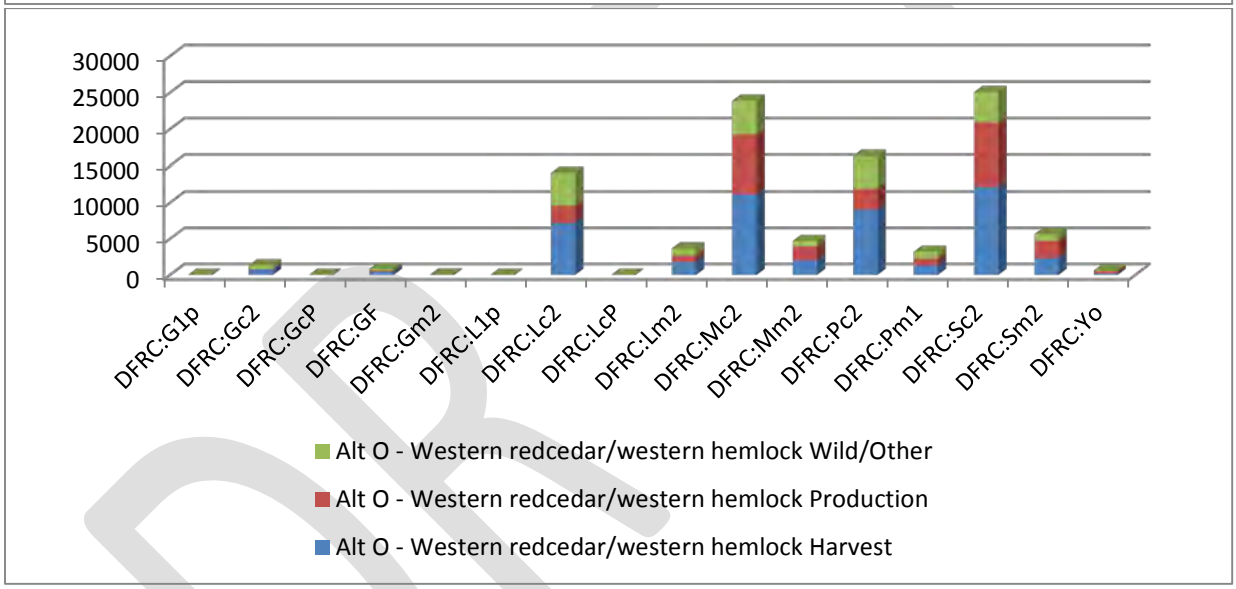
LPWL:Sc1
LPWL:Sm1
LPWL:So1
LPWL:Ym
LPWL:Yo
LPWL:Yop
LPWL:P1p
Alt O - Subalpine Fir/Lodgepole pine Wild/Other
Alt O - Subalpine Fir/Lodgepole pine Production
Alt O - Subalpine Fir/Lodgepole pine Harvest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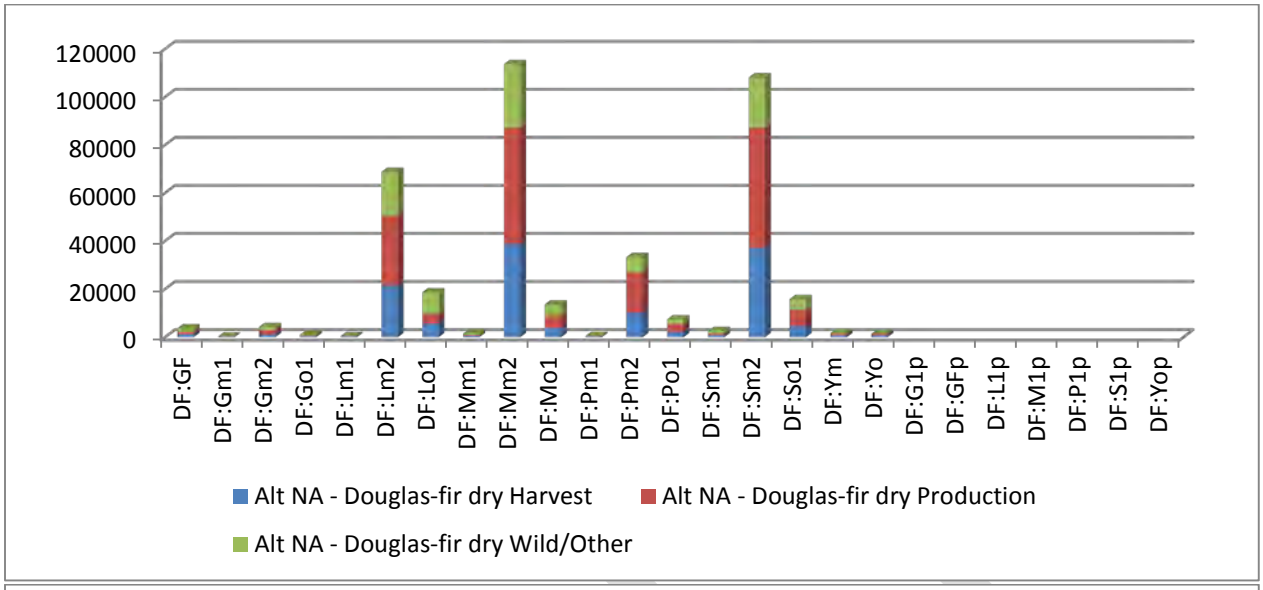
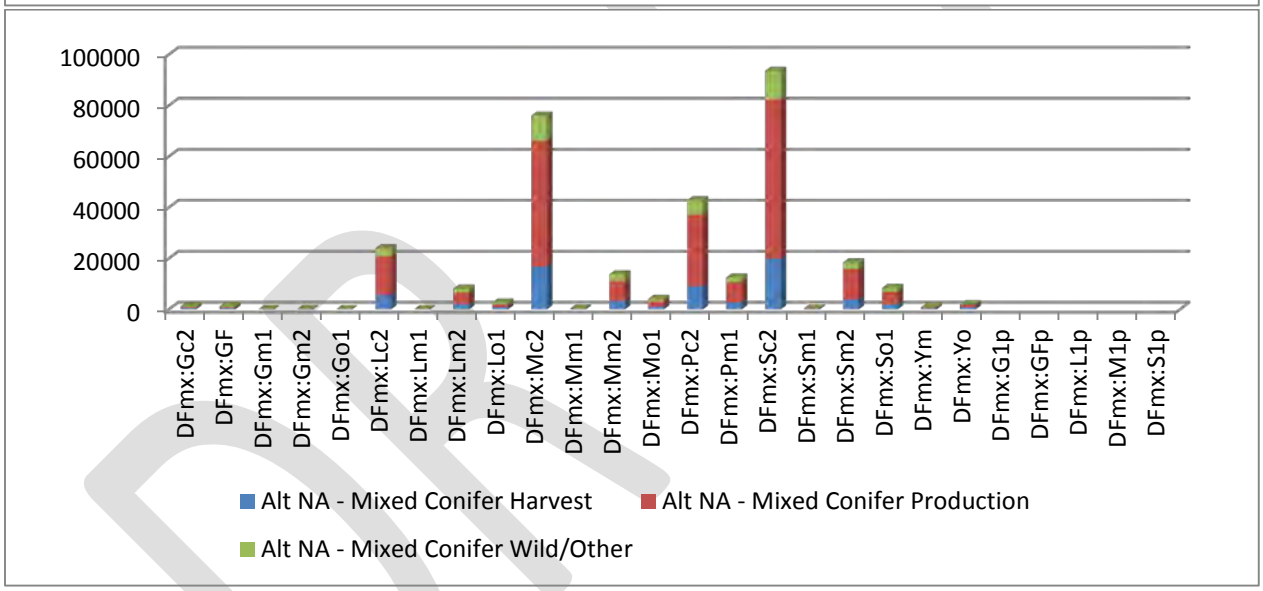
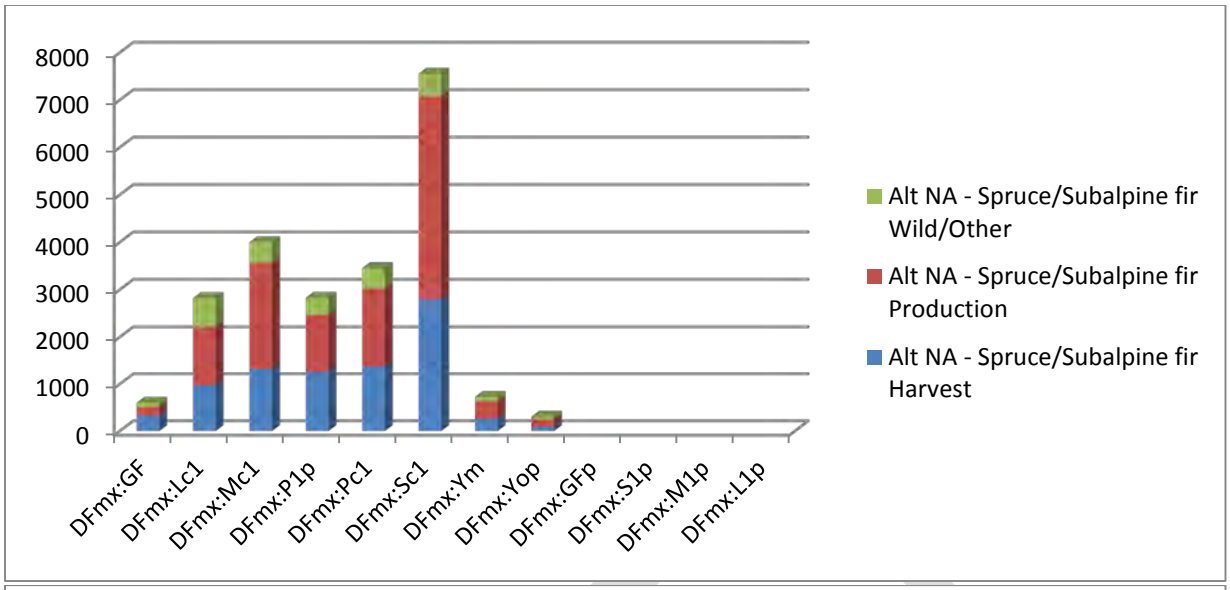
DFRC:GcP
DFRC:GF
DFRC:Gm2
DFRC:L1p
DFRC:Lc2
DFRC:LcP
DFRC:Lm2
DFRC:Mc2
DFRC:Mm2
DFRC:Pc2
DFRC:Pm1
DFRC:Sc2
DFRC:Sm2
DFRC:Yo
Alt O - Western redcedar/western hemlock Wild/Other
Alt O - Western redcedar/western hemlock Production
Alt O - Western redcedar/western hemlock Harvest

### *No Action Alternative*

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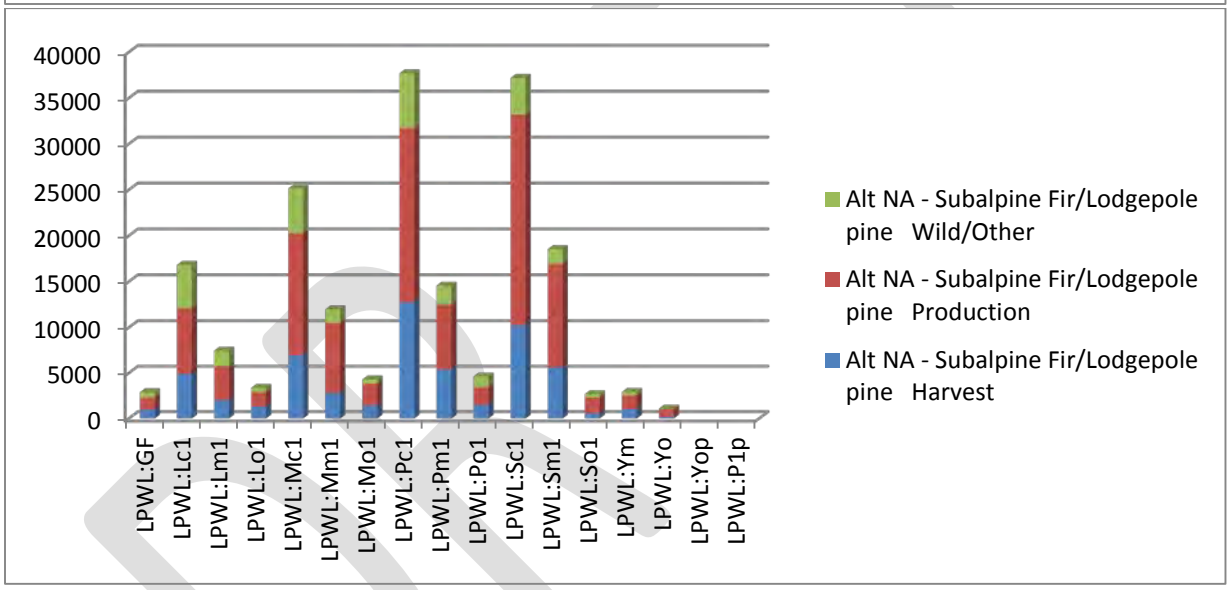
DFmx:Ym
DFmx:Yop
DFmx:GFp
DFmx:S1p
DFmx:M1p
DFmx:L1p
Alt NA - Spruce/Subalpine fir Wild/Other
Alt NA - Spruce/Subalpine fir Production
Alt NA - Spruce/Subalpine fir Harvest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LPWL:Pc1
LPWL:Pm1
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LPWL:Sc1
LPWL:Sm1
LPWL:So1
LPWL:Ym
LPWL:Yo
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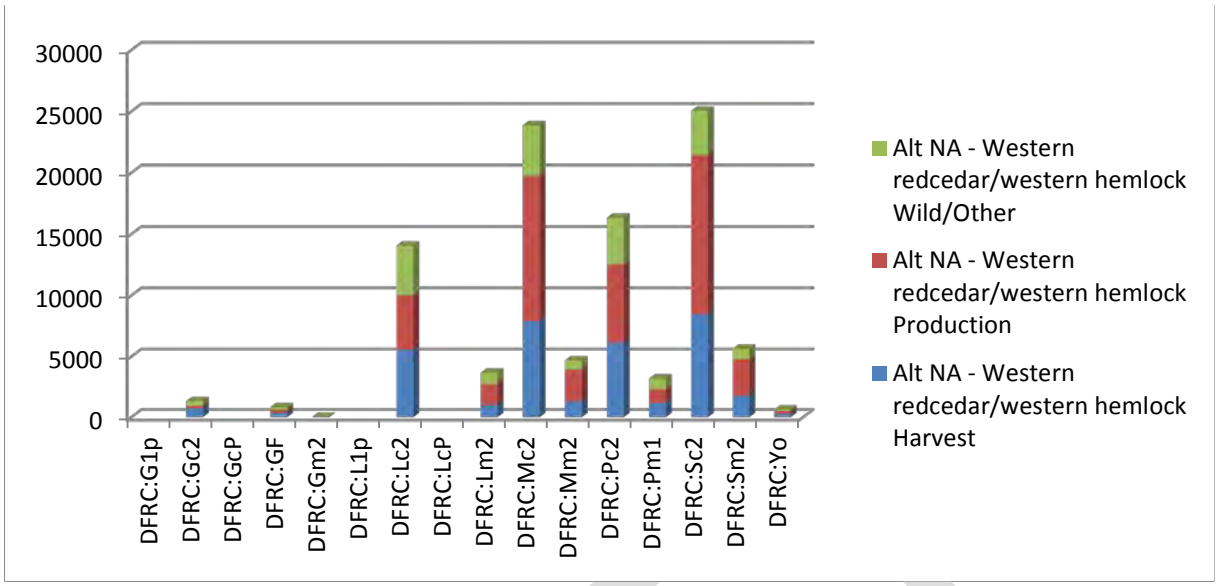
Alt NA - Subalpine Fir/Lodgepole pine Wild/Other
Alt NA - Subalpine Fir/Lodgepole pine Production
Alt NA - Subalpine Fir/Lodgepole pine Harvest




## Attributes

Two types of attributes were developed and tracked into the St-Sim model database. State Attributes are used to link model states with a given attribute and track relative abundance over time. State attributes are used in this effort to track wildlife habitat and structure groups. Transition Attributes are used to track values associated with given model transitions, and are used in this effort to track timber volume removed through mechanical treatments.

## Wildlife Habitat

Attribute tables were developed and loaded into the St-Sim model database containing crosswalks between model states and wildlife habitat for specific species. This facilitates the tracking of trend in attributes such as wildlife habitat through a model run. For wildlife attributes, the unit of measure that is tracked is acreage.

| Model Type | Model State | Primary Black Backed Woodpecker | Secondary Black Backed Woodpecker | Goshawk | Primary Lewis's Woodpecker | Secondary Lewis's Woodpecker | American Marten | Pileated Woodpecker | White-headed Woodpecker |
|---|---|---|---|---|---|---|---|---|---|
| Douglas-fir dry | DF:G1p | | X | | | | | | |
| | DF:GFp | X | | | X | | | | |
| | DF:Gm1 | | | X | | | | X | |
| | DF:Gm2 | | | X | | | | X | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | DF:Go1 | | | | | X | | | X |
| | DF:L1p | | X | | | | | | |
| | DF:Lm1 | | X | X | | | | | |
| | DF:Lm2 | | X | X | | | | X | |
| | DF:Lo1 | | | | | X | | | X |
| | DF:M1p | | X | | | | | | |
| | DF:Mm1 | | X | X | | | | | |
| | DF:Mm2 | | X | X | | | | | |
| Northern Rocky Mountain Mixed Conifer | DFmx:G1p | | X | | | | | | |
| | DFmx:Gc2 | | X | X | | | X | X | |
| | DFmx:GFp | X | | | | | | | |
| | DFmx:Gm1 | | X | X | | | X | X | |
| | DFmx:Gm2 | | X | X | | | X | X | |
| | DFmx:L1p | | X | | | | | | |
| | DFmx:Lc2 | | X | X | | | X | X | |
| | DFmx:Lm1 | | X | X | | | X | X | |
| | DFmx:Lm2 | | X | X | | | X | X | |
| | DFmx:M1p | | X | | | | | | |
| | DFmx:Mc2 | | X | X | | | X | | |
| | DFmx:Mm1 | | X | X | | | | | |
| | DFmx:Mm2 | | X | X | | | | | |
| Spruce/ Subalpine fir | DFmx:GFp | X | | | | | | | |
| | DFmx:L1p | | X | | | | | | |
| | DFmx:Lc1 | | X | X | | | X | X | |
| | DFmx:M1p | | X | | | | | | |
| | DFmx:Mc1 | | X | X | | | X | | |
| Subalpine Fir/Lodgepole pine | LPWL:GFp | X | | | | | | | |
| | LPWL:L1p | | X | | | | | | |
| | LPWL:Lc1 | | X | X | | | X | X | |
| | LPWL:Lm1 | | X | X | | | X | X | |
| | LPWL:M1p | | X | | | | | | |
| | LPWL:Mc1 | | X | X | | | X | | |
| | LPWL:Mm1 | | X | X | | | | | |
| Western redcedar/western hemlock | DFRC:G1p | | X | | | | | | |
| | DFRC:Gc2 | | X | X | | | X | X | |
| | DFRC:Gm2 | | X | X | | | X | X | |
| | DFRC:L1p | | X | | | | | | |
| | DFRC:Lc2 | | X | X | | | X | X | |
| | DFRC:LcP | | X | | | | | | |
| | DFRC:Lm2 | | X | X | | | | | |

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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | DFRC:Mc2 | | X | X | | | | | |
| | DFRC:Mm2 | | X | | | | | | |

## Timber volumes

Timber volumes are tracked in the modeling process based on transition attributes. For each transition type pertaining to mechanical harvest, a harvest volume coefficient is developed based on the model state that the harvest occurs in. To develop harvest coefficients it was first necessary to designate standing timber for each model state. Initial standing volume values were developed based on Zhou and Hemstrom 2010[4] and were inherited with the original models developed for the NEWz co-planning effort. As part of the Colville model development process, some model states did not have standing volume estimates. In these cases, the most similar ancillary model state for which data was available was chosen to approximate standing volume. However, if the most similar ancillary model state was determined to not be a close approximation for the missing value, proportional values were assigned using proportional calculations tied to relative canopy closure and associated states for which data were available. Volume removals were calculated by determining the difference in standing volume for a given state before a transition and after a transition. Some modeled transitions (e.g. Variable Density Thinning) have multiple destination states; in these cases, volume removals were calculated using proportional coefficients identical to those applied in the model destination probabilities. In this way, one volume removal value is assigned for each starting model state / harvest type for a given volume attribute.

The volume estimates are provided below and represent volume removals *per acre*.

| Model Type | Treatment Code | Model State | cfsawvol | bfvsaw |
|---|---|---|---|---|
| Douglas-fir dry | VDT | DF:Gm1 | 319 | 1,065 |
| | VDT_2 | DF:Gm1 | 319 | 1,065 |
| | VDT | DF:Gm2 | 1,041 | 5,975 |
| | VDT_2 | DF:Gm2 | 1,041 | 5,975 |
| | VDT | DF:Lm1 | 2,764 | 17,438 |
| | VDT | DF:Lm2 | 2,346 | 12,555 |
| | NAharv | DF:Mm1 | 1,760 | 9,032 |
| | RegHar | DF:Mm1 | 4,351 | 22,071 |
| | VDT | DF:Mm1 | 3,293 | 16,859 |
| | NAharv | DF:Mm2 | 838 | 4,129 |
| | RegHar | DF:Mm2 | 2,507 | 12,265 |
| | VDT | DF:Mm2 | 1,634 | 8,034 |
| | RegHar | DF:Mo1 | 830 | 4,005 |
| | PH.poles | DF:Pm1 | 499 | 2,440 |
| | PH.poles | DF:Pm2 | 249 | 1,220 |
| | NAharv | DF:Sm1 | 555 | 2,369 |
| | VDT | DF:Sm1 | 1,154 | 5,064 |

[4] Zhou, Xiaoping; Hemstrom, Miles A. 2010. Gen. Tech. Rep. PNW-GTR-819. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 31 p
Available online at: http://www.fs.fed.us/pnw/pubs/pnw_gtr819.pdf

| | | | | |
|---|---|---|---|---|
| | NAharv | DF:Sm2 | 272 | 1,159 |
| | VDT | DF:Sm2 | 645 | 2,885 |

| Model Type | Treatment Code | Model State | cfsawvol | bfvsaw |
|---|---|---|---|---|
| Northern Rocky Mountain Mixed Conifer | VDT | DFmx:Gc2 | 1,004 | 5,887 |
| | VDT_2 | DFmx:Gc2 | 1,004 | 5,887 |
| | VDT | DFmx:Lc2 | 1,167 | 5,689 |
| | VDT_2 | DFmx:Lc2 | 1,167 | 5,689 |
| | NAharv | DFmx:Mc2 | 1,141 | 5,296 |
| | VDT | DFmx:Mc2 | 2,415 | 11,860 |
| | NAharv | DFmx:Mm2 | 4,810 | 23,621 |
| | NAharv | DFmx:Sc2 | 1,141 | 5,296 |
| | RegHar | DFmx:Sc2 | 3,381 | 15,628 |
| | VDT | DFmx:Sc2 | 2,355 | 10,909 |
| | RegHar | DFmx:Sm1 | 2,240 | 10,332 |
| | NAharv | DFmx:Sm2 | 1,098 | 5,035 |
| | RegHar | DFmx:Sm2 | 1,098 | 5,035 |
| | RegHar | DFmx:So1 | 551 | 2,527 |

| Model Type | Treatment Code | Model State | cfsawvol | bfvsaw |
|---|---|---|---|---|
| Western redcedar/western hemlock | RegHar | DFRC:Mc2 | 2,933 | 15,610 |
| | RegHar | DFRC:Mm2 | 2,933 | 15,610 |
| | VDT | DFRC:Sc2 | 721 | 3,442 |

| Model Type | Treatment Code | Model State | cfsawvol | bfvsaw |
|---|---|---|---|---|
| Subalpine Fir/Lodgepole pine | RegHar | LPWL:Mc1 | 3,606 | 17,346 |
| | RegHar2 | LPWL:Mc1 | 3,426 | 16,476 |
| | RegHar | LPWL:Mm1 | 3,606 | 17,346 |
| | RegHar | LPWL:Sc1 | 2,809 | 13,087 |
| | RegHar2 | LPWL:Sc1 | 2,668 | 12,431 |
| | RegHar | LPWL:Sm1 | 2,809 | 13,087 |

# Modeled Alternatives

## Model Coefficients Common to All Alternatives

While management prescriptions vary from one alternative to another, natural growth rates, wildfire probability and insect and disease probabilities generally do not.

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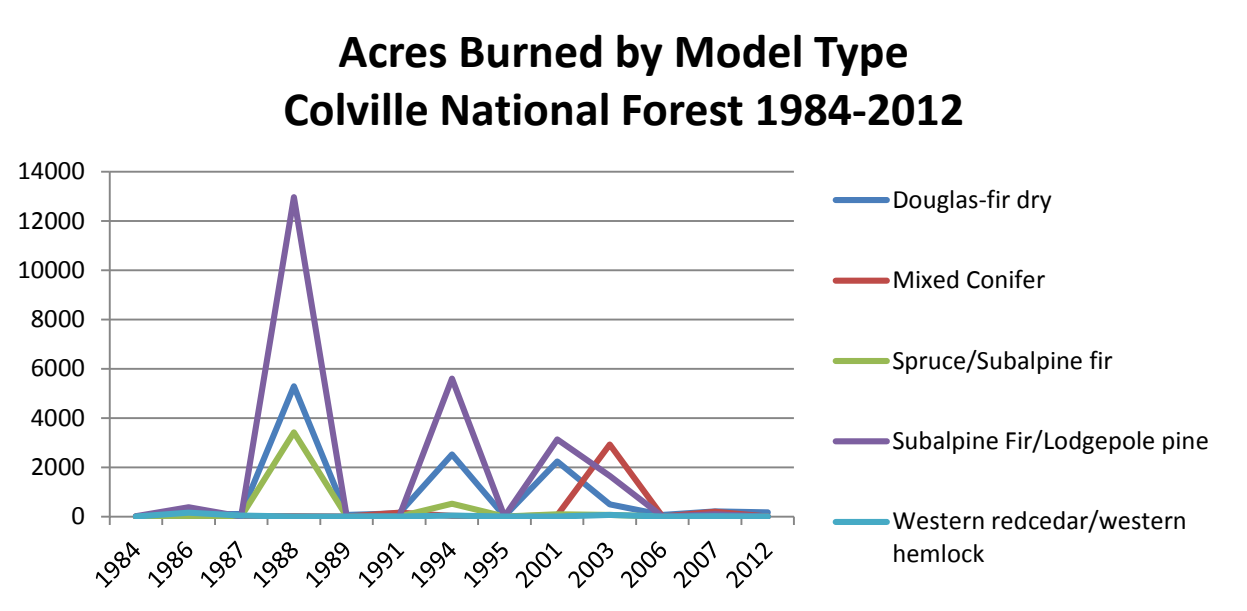
## Wildfire

Wildfire coeficients were developed based on fire history for the Colville national forest. Fire history polygons were intersected with the PAG derived model types layer to calculate acres burned by model type by year. To assign burn severity, the ILAP derived burn severity (based on MTBS data) were queried to determine percentage of burned are by severity class for each model type. These model type specific proportions were then applied to total burned acres to determine area burned by burn severity. The period of 1985-2012 was used to reflect the contemporary period for fire occurrence on the Colville and develop wildfire probability coeficients.




The following table displays the annual wildfire probability coefficients applied to each model type by burn severity.

| | ***Douglas-fir dry*** | ***Mixed Conifer*** | ***Spruce/Subalpine fir*** | ***Subalpine Fir/Lodgepole pine*** | ***Western redcedar/western hemlock*** |
|---|---|---|---|---|---|
| ***1985-2012 avg. annual acres burned*** | 408 | 122 | 147 | 851 | 11 |
| ***Total Acres / PAG*** | 616,503 | 394,482 | 21,040 | 183,765 | 125,207 |
| ***Calc Total Fire Prob:*** | 0.0007 | 0.0003 | 0.0070 | 0.0046 | 0.0001 |
| ***Calc Total MFRI (in years)*** | 1,513 | 3,235 | 143 | 216 | 11,222 |
| ***Annual Probability (Non Lethal - WFNL)*** | 0.000351 | 0.000128 | 0.002214 | 0.001466 | 0.000037 |
| ***Annual Probability (Mixed Severity - WFMS)*** | 0.000173 | 0.000070 | 0.001521 | 0.001007 | 0.000020 |
| ***Annual Probability (Stand Replacing - WFSR)*** | 0.000137 | 0.000110 | 0.003260 | 0.002159 | 0.000032 |

## Insect and Disease

Insect and disease coefficients were developed by intersecting Aerial Detection Survey GIS with PAG / Model Types. For polygons with multiple agents in the same year, only the primary agent was used to calculate a coefficient. Aerial detection data from 1985-2012 was used to develop contemporary I&D rates and coefficients. These resulting summary values are contained in Table 4. Full data used to create the values, as well as aerial detection survey values going back to 1970 are included in the project spreadsheet 1970_2012_InD_Colville_Coeffifient.xlsx.

**Table 4 - Modeled Insect and Disease Values**

| *Model Type* | *Transition Type* | *Prob. Coefficient* | *Eq. Return Interval (yrs)* |
|---|---|---|---|
| Subalpine Fir / Lodgepole | MPB | 0.0250 | 40 |
| Spruce / Subalpine Fir | SAFMort | 0.0002 | 4,043 |
| Spruce / Subalpine Fir | SPB | 0.0004 | 2,561 |
| Northern Rocky Mountain Mixed Conifer | DFB | 0.0053 | 189 |
| Northern Rocky Mountain Mixed Conifer | FE | 0.0076 | 131 |
| Northern Rocky Mountain Mixed Conifer | RDBT | 0.0100 | 100 |
| Northern Rocky Mountain Mixed Conifer | SBWobk | 0.0022 | 451 |
| Northern Rocky Mountain Mixed Conifer | SPB | 0.0001 | 12,194 |
| Douglas-Fir Dry | DFB | 0.0060 | 167 |
| Douglas-Fir Dry | FE | 0.0061 | 163 |
| Douglas-Fir Dry | MPB | 0.0091 | 109 |
| Douglas-Fir Dry | RDBT | 0.0100 | 100 |
| Douglas-Fir Dry | SBW | 0.0225 | 45 |
| Western Redcedar/Western Hemlock | DFB | 0.0048 | 210 |
| Western Redcedar/Western Hemlock | RDBT | 0.0200 | 50 |

## Stochastic Variation

Transition multipliers (in the form of Monte Carlo Multipliers or MCMs) are used in the model to create stochasticity. The MCMs vary the probability of certain natural transitions (fire and other natural mortality) to better reflect the variance in these disturbance agents. In this way, some model "years" have higher probability of stand replacing fire than other years for example. All MCM values are contained in the ST-Sim database. Figure 1 displays the probability multipliers for stand replacing fire for years 1-300 of the model run.

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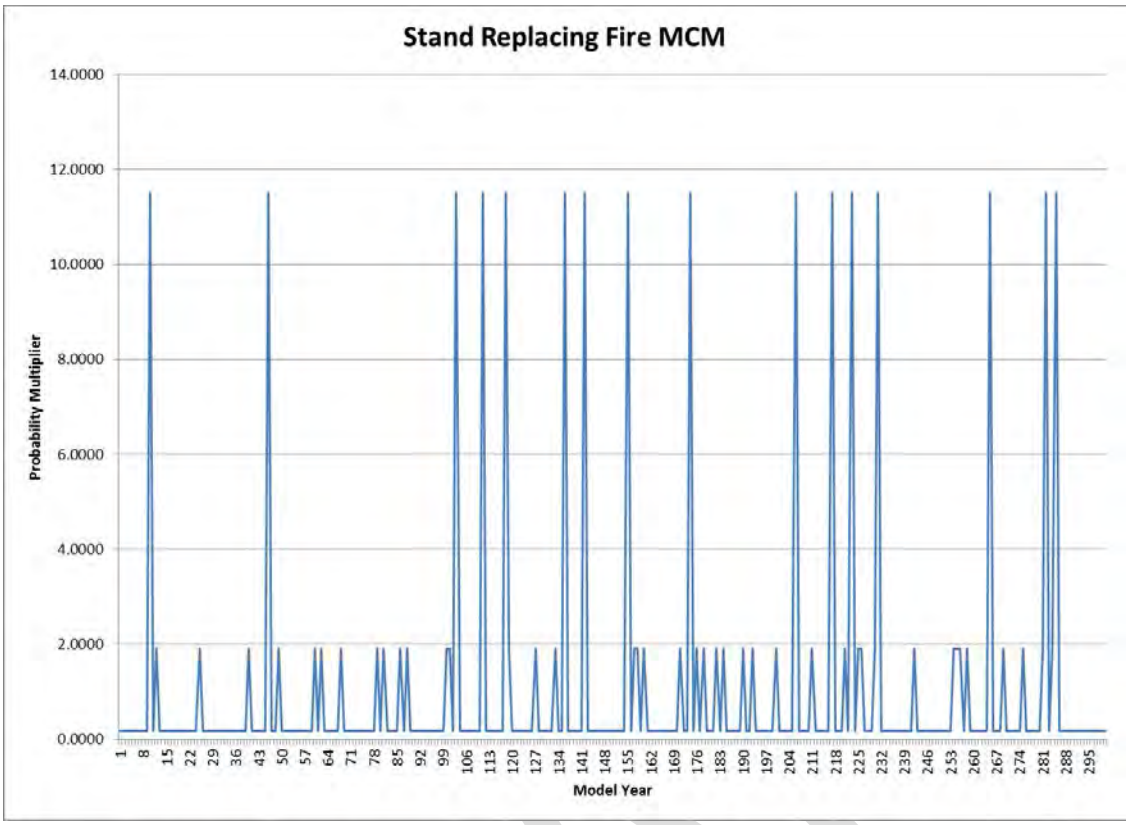


**Figure 1 - Stochastic Variation Example: MCM values for Stand Replacing Fire**

## Model Assumptions by Alternative

### Alternative PA & P

Note: the following descriptions for modeled assumptions are combined for the P and PA alternatives. This is *not* intended to imply that the two are identical. Rather, the *types* of prescriptions applied in the models are identical for the P and PA alternatives. However, the *locations* of treatments vary between the two alternatives based on suited land designations.

#### *Douglas-Fir Dry*

##### Restoration Zone[5]

**Variable Density Thinning** (VDT) is prescribed in Small, Medium, and Large model states with closed canopies (>40% CC). Once desired conditions are attained (~60 years) VDT is applied in Giant states. Variable density thinning results in proportional transitions to destination states as follows:

[5] The "restoration zone" in the P and PA alternatives include both Suitable and Non-Suitable timber lands. To account for treatment and harvest volumes on suitable lands separately, the model is programmed to include a "timber production" zone. However, this timber production zone simply represents the suitable timber lands, and receives the exact same treatments and probabilities as the unsuitable restoration zone lands *that are outside the wilderness/other category*. As a result, raw model outputs for the P and PA alternatives show values for timber production zones, which is not to imply that there is a primary timber emphasis for these areas or that they would receive different treatments.

- 75% transitions to an open canopied (10-39% canopy cover) system of the same size class with an increased model age of 5 years (to account for increased overall age of unharvested trees)
- 10% remains in the closed canopy state and does not transition to another state
- 15% reverts to the Grass/Forb state with less than 10% total tree canopy cover

**Pre-commercial thinning** (PCT) is prescribed for Seed/Sap (<5" DBH) classes and open canopied classes of all sizes.

- PCT results in transitions to or maintains states with open canopies (10-39% canopy cover)

**Partial Harvest of Poles** (PH.Poles) is prescribed in pole states with canopy cover >40%.

- Partial Harvest of Poles results in transitions to pole stands with open canopies (10-39% canopy cover)

**Prescribed Fire** is applied to open canopied states only (10-39% canopy cover). Rx fire maintains open canopied states and prevents canopy infill (GROWCAN) transitions to closed states.

### Wild / Other Zone

**No Mechanical** prescriptions are modeled in this model zone.

**Prescribed Fire** is applied to open canopied states only (10-39% canopy cover). Rx fire maintains open canopied states and prevents canopy infill (GROWCAN) transitions to closed states.

## *Northern Rocky Mountain Mixed Conifer*

### Restoration Zone

**Variable Density Thinning** (VDT) is prescribed in Small & Medium model states with closed canopies (>60% CC). Once desired conditions are attained (~60 years) VDT is applied in Large & Giant states. Variable density thinning results in proportional transitions to destination states that mimic the effects of mixed severity fire[6] as follows:

- 58% transitions to an open canopied (10-39% canopy cover) system of the same size class
- 21% transitions to a mid-canopied (40-60% canopy cover) multi-storied state of the same size class
- 21% transitions to a mid-canopied (40-60% canopy cover) single-storied state of the same size class
- 6% remains in the closed canopied state and does not transition to another state

**Prescribed Fire** is applied to mimic natural mixed severity fire occurring in closed canopied (>60% CC) states with multiple stories that are small-giant in size. Prescribed

[6] Fire transition proportions were derived from equal probability cover-severity tables. Cover-Severity proportions are provided in Appendix 1.

mixed severity fire results in proportional transitions to destination states that mimic the effects of mixed severity fire[7] as follows:

- 58% transitions to an open canopied (10-39% canopy cover) system of the same size class
- 21% transitions to a mid-canopied (40-60% canopy cover) multi-storied state of the same size class
- 21% transitions to a mid-canopied (40-60% canopy cover) single-storied state of the same size class
- 6% remains in the closed canopied state and does not transition to another state

### Wild / Other Zone

**No Mechanical** prescriptions are modeled in this model zone.

**No Prescribed Fire** is not applied in this model zone[8].

## *Spruce/Subalpine Fir*

No activity is modeled in this vegetation type. Wildfire and insect/disease agents; all alternatives are the same for all model zones.

## *Subalpine Fir/Lodgepole pine*

### Restoration Zone

**Shelterwood harvest** [RegHar] is prescribed in small and medium sized states with closed canopies (>60% CC) beginning at 80 years of age. Resulting transitions are proportional as follows:

- 90% reverts to the Grass/Forb state with less than 10% total tree canopy cover
- 10% transitions to an open canopied state of the same size class

**Prescribed Stand Replacing Fire** is applied at 80-100 years of age in small size class and larger states with a transition to a Grass/Forb state with less than 10% canopy cover retaining residual fuel loading. It is also applied to Seed/Sap and Pole states (only those with residual fuels from previous burns) and transitions to a Grass/Forb state with less than 10% canopy cover from trees.

### Wild / Other Zone

**No Mechanical** prescriptions are modeled in this model zone.

**Prescribed Stand Replacing Fire** is applied at 80-100 years of age in small size class and larger states with a transition to a Grass/Forb state with less than 10% canopy cover retaining residual fuel loading. It is also applied to Seed/Sap and Pole states (only those with residual fuels from previous burns) and transitions to a Grass/Forb state with less than 10% canopy cover from trees.

[7] Fire transition proportions were derived from equal probability cover-severity tables. Cover-Severity proportions are provided in Appendix 1.

[8] This is not to imply that natural fire is excluded from this model zone, but Rx fire is not included for this model zone.



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### *Western Redcedar/Western Hemlock*

*Reserve Zone*
**No Mechanical** prescriptions are modeled in this model zone.
**No Prescribed Fire** is not applied in this model zone

*Restoration Zone*
**No Mechanical** prescriptions are modeled in this model zone.
**No Prescribed Fire** is not applied in this model zone

*Timber Production Zone*
**No Mechanical** prescriptions are modeled in this model zone.
**No Prescribed Fire** is not applied in this model zone

*Wild / Other Zone*
**No Mechanical** prescriptions are modeled in this model zone.
**No Prescribed Fire** is not applied in this model zone

## Alternative R

### *Douglas-Fir Dry*

Reserve Zone
**Pre-Commercial Thinning** (PCT) is prescribed in Seed/Sap (>40% CC) states maintaining the state class.
**Partial Harvest of Poles** (PH.Poles) is prescribed in Pole size states with closed canopies (>40% CC) with transitions to open canopied pole states (10-40% CC).
**Partial Harvest** of small closed canopied states (>40% CC) with transitions similar to those prescribed for partial harvest in the No Action alternative[9]:

- 30% transitions to an open canopied state of the same size class
- 20% transitions to an open canopied state of medium size class (to reflect retention of larger trees)
- 50% maintains closed canopy of the same state class (>40%)

**Partial Harvest** of medium closed canopied states (>40% CC) with transitions similar to those prescribed for partial harvest in the No Action alternative[10]:

- 50% transitions to an open canopied state of the same size class
- 50% maintains closed canopy of the same state class (>40%)

**Prescribed Fire** (non-lethal) is applied to open canopied model states of Seed/Sap, Pole, and Small size classes to maintain open canopies and prevent canopy infill (GROWCAN).

[9] Because the referenced transition mechanics are identical here to the No Action harvest in this type, the model database uses the nomenclature (NAharv) to represent this transition.
[10] Because the referenced transition mechanics are identical here to the No Action harvest in this type, the model database uses the nomenclature (NAharv) to represent this transition.

## Restoration Zone

*(The following are the same as the restoration zone assumptions for the PA and P alternatives)*

**Variable Density Thinning** (VDT) is prescribed in Small and Medium model states with closed canopies (>40% CC). Variable density thinning results in proportional transitions to destination states as follows:

- 75% transitions to an open canopied (10-39% canopy cover) system of the same size class with an increased model age of 5 years (to account for increased overall age of unharvested trees)
- 10% remains in the closed canopy state and does not transition to another state
- 15% reverts to the Grass/Forb state with less than 10% total tree canopy cover

**Pre-commercial thinning** (PCT) is prescribed for Seed/Sap (<5" DBH) classes with canopy cover > 40%.

- PCT results in transitions to Seed/Sap stands with open canopies (10-39% canopy cover)

**Partial Harvest of Poles** (PH.Poles) is prescribed in pole states with canopy cover >40%.

- Partial Harvest of Poles results in transitions to pole stands with open canopies (10-39% canopy cover)

**Prescribed Fire** is applied to open canopied states only (10-39% canopy cover). Rx fire maintains open canopied states and prevents canopy infill (GROWCAN) transitions to closed states.

## Timber Production Zone

**Shelterwood Harvest** is prescribed at 120 years of age (modeled as regeneration harvest [RegHar]) medium size class only[11]. Retention of ~15 trees per acre is assumed to transition to the Grass/Forb state with <10% residual tree cover.

**Salvage** is prescribed for states burned with stand replacing fire, transitioning from Grass/Forb with standing dead to Grass/Forb state

**Pre-commercial thinning** (PCT) is prescribed for Seed/Sap (<5" DBH) classes with canopy cover > 40%.

- PCT results in transitions to Seed/Sap stands with open canopies (10-39% canopy cover)

**Partial Harvest of Poles** (PH.Poles) is prescribed in pole states with canopy cover >40%.

- Partial Harvest of Poles results in transitions to pole stands with open canopies (10-39% canopy cover)

**No Prescribed Fire** is not applied in this model zone.

## Wild / Other Zone

**No Mechanical** prescriptions are modeled in this model zone.

[11] Previous modeling included RegHar for the R alternative in the Timber Production Zone for states larger than medium. This was changed to reflect IDT wishes communicated on 1/30/2015.

**Prescribed Fire** is applied to open canopied states only (10-39% canopy cover). Rx fire maintains open canopied states and prevents canopy infill (GROWCAN) transitions to closed states.

### *Northern Rocky Mountain Mixed Conifer*

#### Reserve Zone

**No Mechanical** prescriptions are modeled in this model zone.
**Prescribed Fire** is applied to mimic natural mixed severity fire occurring in closed canopied (>60% CC) states with multiple stories that are small-giant in size. Prescribed mixed severity fire results in proportional transitions to destination states that mimic the effects of mixed severity fire[12] as follows:

- 58% transitions to an open canopied (10-39% canopy cover) system of the same size class
- 21% transitions to a mid-canopied (40-60% canopy cover) multi-storied state of the same size class
- 21% transitions to a mid-canopied (40-60% canopy cover) single-storied state of the same size class
- 6% remains in the closed canopied state and does not transition to another state

#### Restoration Zone

**Variable Density Thinning** (VDT) is prescribed in Small & Medium model states with closed canopies (>60% CC). Variable density thinning results in proportional transitions to destination states that mimic the effects of mixed severity fire[13] as follows:

- 58% transitions to an open canopied (10-39% canopy cover) system of the same size class
- 21% transitions to a mid-canopied (40-60% canopy cover) multi-storied state of the same size class
- 21% transitions to a mid-canopied (40-60% canopy cover) single-storied state of the same size class
- 6% remains in the closed canopied state and does not transition to another state

**Prescribed Fire** is applied to mimic natural mixed severity fire occurring in closed canopied (>60% CC) states with multiple stories that are small-giant in size. Prescribed mixed severity fire results in proportional transitions to destination states that mimic the effects of mixed severity fire as follows:

- 58% transitions to an open canopied (10-39% canopy cover) system of the same size class

[12] Fire transition proportions were derived from equal probability cover-severity tables. Cover-Severity proportions are provided in Appendix 1.

- 21% transitions to a mid-canopied (40-60% canopy cover) multi-storied state of the same size class
- 21% transitions to a mid-canopied (40-60% canopy cover) single-storied state of the same size class
- 6% remains in the closed canopied state and does not transition to another state

### Timber Production Zone

**Variable Density Thinning** (VDT) is prescribed in Small & Medium model states with closed canopies (>60% CC). Variable density thinning results in proportional transitions to destination states that mimic the effects of mixed severity fire as follows:

- 58% transitions to an open canopied (10-39% canopy cover) system of the same size class
- 21% transitions to a mid-canopied (40-60% canopy cover) multi-storied state of the same size class
- 21% transitions to a mid-canopied (40-60% canopy cover) single-storied state of the same size class
- 6% remains in the closed canopied state and does not transition to another state

**Prescribed Fire** is applied to mimic natural mixed severity fire occurring in closed canopied (>60% CC) states with multiple stories that are small-giant in size. Prescribed mixed severity fire results in proportional transitions to destination states that mimic the effects of mixed severity fire[14] as follows:

- 58% transitions to an open canopied (10-39% canopy cover) system of the same size class
- 21% transitions to a mid-canopied (40-60% canopy cover) multi-storied state of the same size class
- 21% transitions to a mid-canopied (40-60% canopy cover) single-storied state of the same size class
- 6% remains in the closed canopied state and does not transition to another state

### Wild / Other Zone

**No Mechanical** prescriptions are modeled in this model zone.
**No Prescribed Fire** is not applied in this model zone

### *Spruce/Subalpine Fir*

No activity is modeled in this vegetation type. Wildfire and insect/disease agents; all alternatives are the same for all model zones.

### *Subalpine Fir/Lodgepole pine*

#### Reserve Zone

**No Mechanical** prescriptions are modeled in this model zone.
**Prescribed Stand Replacing Fire** is applied at 80-100 years of age in small size class and larger states with a transition to a Grass/Forb state with less than 10% canopy cover retaining residual fuel loading. It is also applied to Seed/Sap and Pole states (only those with residual fuels from previous burns) and transitions to a Grass/Forb state with less than 10% canopy cover from trees.

#### Restoration Zone

**Shelterwood harvest** is prescribed in small and medium sized states with closed canopies (>60% CC) beginning at 80 years of age. Resulting transitions are proportional as follows:

- 90% reverts to the Grass/Forb state with less than 10% total tree canopy cover
- 10% transitions to an open canopied state of the same size class

**Prescribed Stand Replacing Fire** is applied at 80-100 years of age in small size class and larger states with a transition to a Grass/Forb state with less than 10% canopy cover retaining residual fuel loading. It is also applied to Seed/Sap and Pole states (only those with residual fuels from previous burns) and transitions to a Grass/Forb state with less than 10% canopy cover from trees.

#### Timber Production Zone

**Shelterwood harvest** is prescribed in small and medium sized states with closed canopies (>60% CC) beginning at 80 years of age. Resulting transitions are proportional as follows:

- 90% reverts to the Grass/Forb state with less than 10% total tree canopy cover
- 10% transitions to an open canopied state of the same size class

**Prescribed Stand Replacing Fire** is applied at 80-100 years of age in small size class and larger states with a transition to a Grass/Forb state with less than 10% canopy cover retaining residual fuel loading. It is also applied to Seed/Sap and Pole states (only those with residual fuels from previous burns) and transitions to a Grass/Forb state with less than 10% canopy cover from trees.

#### Wild / Other Zone

**No Mechanical** prescriptions are modeled in this model zone.
**Prescribed Stand Replacing Fire** is applied at 80-100 years of age in small size class and larger states with a transition to a Grass/Forb state with less than 10% canopy cover retaining residual fuel loading. It is also applied to Seed/Sap and Pole states (only those with residual fuels from previous burns) and transitions to a Grass/Forb state with less than 10% canopy cover from trees.

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### *Western Redcedar/Western Hemlock*

*Reserve Zone*
**No Mechanical** prescriptions are modeled in this model zone.
**No Prescribed Fire** is not applied in this model zone

*Restoration Zone*
**No Mechanical** prescriptions are modeled in this model zone.
**No Prescribed Fire** is not applied in this model zone

*Timber Production Zone*
**No Mechanical** prescriptions are modeled in this model zone.
**No Prescribed Fire** is not applied in this model zone

*Wild / Other Zone*
**No Mechanical** prescriptions are modeled in this model zone.
**No Prescribed Fire** is not applied in this model zone

## Alternative B

### *Douglas-Fir Dry*

Timber Production Zone
**Pre-commercial thinning** (PCT) is prescribed for Seed/Sap (<5" DBH) classes with canopy cover > 40%.

- PCT results in transitions to Seed/Sap stands with open canopies (10-39% canopy cover)

**Partial Harvest of Poles** (PH.Poles) is prescribed in pole states with canopy cover >40%.

- Partial Harvest of Poles results in transitions to pole stands with open canopies (10-39% canopy cover)

- **Shelterwood Harvest** is prescribed at ~120 years of age (modeled as regeneration harvest [RegHar]) medium size class only[15]). Retention of ~15 trees per acre is assumed to transition to the Grass/Forb state with <10% residual tree cover.
- **Salvage** is prescribed for states burned with stand replacing fire, transitioning from Grass/Forb with standing dead to Grass/Forb state
  **No Prescribed Fire** is not applied in this model zone

Restoration Zone
**Variable Density Thinning** (VDT) is prescribed in Small and Medium[16] model states with closed canopies (>40% CC). Variable density thinning results in proportional transitions to destination states as follows:

[15] This reflects models as re-run and delivered in February 2015. This change was made after the November 2014 model runs to deal with constraints in this alternative relative to "Eastside Screens".
[16] VDT in the large state was removed to reflect *no mechanical* harvest in large or giant dominated stands to deal with constraints in this alternative relative to "Eastside Screens".

- 75% transitions to an open canopied (10-39% canopy cover) system of the same size class with an increased model age of 5 years (to account for increased overall age of unharvested trees)
- 10% remains in the closed canopy state and does not transition to another state
- 15% reverts to the Grass/Forb state with less than 10% total tree canopy cover

**Pre-commercial thinning** (PCT) is prescribed for Seed/Sap (<5" DBH) classes with canopy cover > 40%.

- PCT results in transitions to Seed/Sap stands with open canopies (10-39% canopy cover)

**Partial Harvest of Poles** (PH.Poles) is prescribed in pole states with canopy cover >40%.

- Partial Harvest of Poles results in transitions to pole stands with open canopies (10-39% canopy cover)

**Prescribed Fire** is applied to open canopied states only (10-39% canopy cover). Rx fire maintains open canopied states and prevents canopy infill (GROWCAN) transitions to closed states.

### Wild / Other Zone

**No Mechanical** prescriptions are modeled in this model zone.

**Prescribed Fire** is applied to open canopied states only (10-39% canopy cover). Rx fire maintains open canopied states and prevents canopy infill (GROWCAN) transitions to closed states.

## *Northern Rocky Mountain Mixed Conifer*

### Timber Production Zone

**Pre-commercial thinning** (PCT) is prescribed for Seed/Sap (<5" DBH) classes with canopy cover > 40%.

- PCT results in transitions to Seed/Sap stands with open canopies (10-39% canopy cover)

**Regeneration Harvest with Reserves** [RegHar] is prescribed at ~80 years (small size class) with transition to the Grass/Forb state (<10% tree CC).

**No Prescribed Fire** is not applied in this model zone

### Restoration Zone

**Variable Density Thinning** (VDT) is prescribed in Small & Medium model states with closed canopies (>60% CC). Variable density thinning results in proportional transitions to destination states that mimic the effects of mixed severity fire[17] as follows:

- 58% transitions to an open canopied (10-39% canopy cover) system of the same size class
- 21% transitions to a mid-canopied (40-60% canopy cover) multi-storied state of the same size class

[17] Fire transition proportions were derived from equal probability cover-severity tables. Cover-Severity proportions are provided in Appendix 1.

- 21% transitions to a mid-canopied (40-60% canopy cover) single-storied state of the same size class
- 6% remains in the closed canopied state and does not transition to another state

**Prescribed Fire** is applied to mimic natural mixed severity fire occurring in closed canopied (>60% CC) states with multiple stories that are small-giant in size. Prescribed mixed severity fire results in proportional transitions to destination states that mimic the effects of mixed severity fire[18] as follows:

- 58% transitions to an open canopied (10-39% canopy cover) system of the same size class
- 21% transitions to a mid-canopied (40-60% canopy cover) multi-storied state of the same size class
- 21% transitions to a mid-canopied (40-60% canopy cover) single-storied state of the same size class
- 6% remains in the closed canopied state and does not transition to another state

### Wild / Other Zone

**No Mechanical** prescriptions are modeled in this model zone.

**No Prescribed Fire** is applied in this model zone

## *Spruce/Subalpine Fir*

No activity is modeled in this vegetation type. Wildfire and insect/disease agents; all alternatives are the same for all model zones.

## *Subalpine Fir/Lodgepole pine*

### Timber Production Zone

**Regeneration Harvest with Reserves** is prescribed at 80-120 years (small & medium size class) with transition to the Grass/Forb state (<10% tree CC).
**No Prescribed Fire** is applied in this model zone

### Restoration Zone

**Shelterwood harvest** is prescribed in small and medium sized states with closed canopies (>60% CC) beginning at 80 years of age. Resulting transitions are proportional as follows:

- 90% reverts to the Grass/Forb state with less than 10% total tree canopy cover
- 10% transitions to an open canopied state of the same size class

**No Prescribed Fire** is applied in this model zone

[18] Fire transition proportions were derived from equal probability cover-severity tables. Cover-Severity proportions are provided in Appendix 1.



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### Wild / Other Zone

**No Mechanical** prescriptions are modeled in this model zone.
**Prescribed Stand Replacing Fire** is applied at 80-100 years of age in small size class and larger states with a transition to a Grass/Forb state with less than 10% canopy cover retaining residual fuel loading. It is also applied to Seed/Sap and Pole states (only those with residual fuels from previous burns) and transitions to a Grass/Forb state with less than 10% canopy cover from trees.

#### *Western Redcedar/Western Hemlock*

### Timber Production Zone

**Partial Harvest** (PH.small) is prescribed in small states with mid-canopy closure (40-60% CC) maintaining the state class and preventing canopy infill (GROWCAN).
**Regeneration Harvest with Reserves** is prescribed at ~80 years (medium size class) with transition to the Grass/Forb state (<10% tree CC).
**No Prescribed Fire** is not applied in this model zone.

### Restoration Zone

**Variable Density Thinning** (VDT) is prescribed in Small model states with closed canopies (>60% CC). Variable density thinning results in proportional transitions to destination states as follows:

- 72% transitions to a mid-canopied state
- 14% remains in a closed canopied state
- 14% reverts to a grass/forb state

**No Prescribed Fire** is not applied in this model zone

### Wild / Other Zone

**No Mechanical** prescriptions are modeled in this model zone.
**No Prescribed Fire** is not applied in this model zone.

### Reserve Zone

**No Mechanical** prescriptions are modeled in this model zone.
**No Prescribed Fire** is not applied in this model zone

## Alternative O

#### *Douglas-Fir Dry*

### Timber Production Zone

**Pre-commercial thinning** (PCT) is prescribed for Seed/Sap (<5” DBH) classes with canopy cover > 40%.

- PCT results in transitions to Seed/Sap stands with open canopies (10-39% canopy cover)

**Partial Harvest of Poles** (PH.Poles) is prescribed in pole states with canopy cover >40%.

- Partial Harvest of Poles results in transitions to pole stands with open canopies (10-39% canopy cover)
- **Shelterwood Harvest** is prescribed at ~120 years of age (modeled as regeneration harvest [RegHar]) medium size class only[19]). Retention of ~15 trees per acre is assumed to transition to the Grass/Forb state with <10% residual tree cover.
- **Salvage** is prescribed for states burned with stand replacing fire, transitioning from Grass/Forb with standing dead to Grass/Forb state
  **No Prescribed Fire** is not applied in this model zone

### Restoration Zone

**Variable Density Thinning** (VDT) is prescribed in Small and Medium[20] model states with closed canopies (>40% CC). Variable density thinning results in proportional transitions to destination states as follows:

- 75% transitions to an open canopied (10-39% canopy cover) system of the same size class with an increased model age of 5 years (to account for increased overall age of unharvested trees)
- 10% remains in the closed canopy state and does not transition to another state
- 15% reverts to the Grass/Forb state with less than 10% total tree canopy cover

**Pre-commercial thinning** (PCT) is prescribed for Seed/Sap (<5" DBH) classes with canopy cover > 40%.

- PCT results in transitions to Seed/Sap stands with open canopies (10-39% canopy cover)

**Partial Harvest of Poles** (PH.Poles) is prescribed in pole states with canopy cover >40%.

- Partial Harvest of Poles results in transitions to pole stands with open canopies (10-39% canopy cover)

**Prescribed Fire** is applied to open canopied states only (10-39% canopy cover). Rx fire maintains open canopied states and prevents canopy infill (GROWCAN) transitions to closed states.

### Wild / Other Zone

**No Mechanical** prescriptions are modeled in this model zone.

**Prescribed Fire** is applied to open canopied states only (10-39% canopy cover). Rx fire maintains open canopied states and prevents canopy infill (GROWCAN) transitions to closed states.

## *Northern Rocky Mountain Mixed Conifer*

### Timber Production Zone

**Pre-commercial thinning** (PCT) is prescribed for Seed/Sap (<5" DBH) classes with canopy cover > 40%.

[19] This reflects models as re-run and delivered in February 2015. This change was made after the November 2014 model runs to deal with constraints in this alternative relative to "Eastside Screens".
[20] VDT in the large state was removed to reflect *no mechanical* harvest in large or giant dominated stands to deal with constraints in this alternative relative to "Eastside Screens".

- PCT results in transitions to Seed/Sap stands with open canopies (10-39% canopy cover)

**Regeneration Harvest with Reserves** is prescribed at ~80 years (small size class) with transition to the Grass/Forb state (<10% tree CC).
**No Prescribed Fire** is not applied in this model zone

### Restoration Zone

**Variable Density Thinning** (VDT) is prescribed in Small & Medium model states with closed canopies (>60% CC). Variable density thinning results in proportional transitions to destination states that mimic the effects of mixed severity fire[21] as follows:

- 58% transitions to an open canopied (10-39% canopy cover) system of the same size class
- 21% transitions to a mid-canopied (40-60% canopy cover) multi-storied state of the same size class
- 21% transitions to a mid-canopied (40-60% canopy cover) single-storied state of the same size class
- 6% remains in the closed canopied state and does not transition to another state

**Prescribed Fire** is applied to mimic natural mixed severity fire occurring in closed canopied (>60% CC) states with multiple stories that are small-giant in size. Prescribed mixed severity fire results in proportional transitions to destination states that mimic the effects of mixed severity fire[22] as follows:

- 58% transitions to an open canopied (10-39% canopy cover) system of the same size class
- 21% transitions to a mid-canopied (40-60% canopy cover) multi-storied state of the same size class
- 21% transitions to a mid-canopied (40-60% canopy cover) single-storied state of the same size class
- 6% remains in the closed canopied state and does not transition to another state

### Wild / Other Zone

**No Mechanical** prescriptions are modeled in this model zone.

**No Prescribed Fire** is applied in this model zone

## *Spruce/Subalpine Fir*

No activity is modeled in this vegetation type. Wildfire and insect/disease agents; all alternatives are the same for all model zones.

[21] Fire transition proportions were derived from equal probability cover-severity tables. Cover-Severity proportions are provided in Appendix 1.
[22] Fire transition proportions were derived from equal probability cover-severity tables. Cover-Severity proportions are provided in Appendix 1.

### *Subalpine Fir/Lodgepole pine*

#### Timber Production Zone

**Regeneration Harvest with Reserves** is prescribed at 80-120 years (small & medium size class) with transition to the Grass/Forb state (<10% tree CC).
**No Prescribed Fire** is applied in this model zone

#### Restoration Zone

**Shelterwood harvest** is prescribed in small and medium sized states with closed canopies (>60% CC) beginning at 80 years of age. Resulting transitions are proportional as follows:

- 90% reverts to the Grass/Forb state with less than 10% total tree canopy cover
- 10% transitions to an open canopied state of the same size class

**No Prescribed Fire** is applied in this model zone

#### Wild / Other Zone

**No Mechanical** prescriptions are modeled in this model zone.
**Prescribed Stand Replacing Fire** is applied at 80-100 years of age in small size class and larger states with a transition to a Grass/Forb state with less than 10% canopy cover retaining residual fuel loading. It is also applied to Seed/Sap and Pole states (only those with residual fuels from previous burns) and transitions to a Grass/Forb state with less than 10% canopy cover from trees.

### *Western Redcedar/Western Hemlock*

#### Timber Production Zone

**Partial Harvest** (PH.small) is prescribed in small states with mid-canopy closure (40-60% CC) maintaining the state class and preventing canopy infill (GROWCAN).
**Regeneration Harvest with Reserves** is prescribed at ~80 years (medium size class) with transition to the Grass/Forb state (<10% tree CC).
**No Prescribed Fire** is not applied in this model zone.

#### Restoration Zone

**Variable Density Thinning** (VDT) is prescribed in Small model states with closed canopies (>60% CC). Variable density thinning results in proportional transitions to destination states as follows:

- 72% transitions to a mid-canopied state
- 14% remains in a closed canopied state
- 14% reverts to a grass/forb state

**No Prescribed Fire** is not applied in this model zone

#### Wild / Other Zone

**No Mechanical** prescriptions are modeled in this model zone.
**No Prescribed Fire** is not applied in this model zone.

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## No Action Alternative

### *Douglas-Fir Dry*

#### Restoration Zone[23]

**No Mechanical** prescriptions are modeled in this model zone.
**No Prescribed Fire** is not applied in this model zone.

#### Timber Production Zone

**Pre-Commercial Thinning** (PCT) is prescribed in Seed/Sap (>40% CC) states maintaining the state class.
**Partial Harvest** of small closed canopied states (>40% CC) with transitions similar to those prescribed for partial harvest in the No Action alternative:

- 30% transitions to an open canopied state of the same size class
- 20% transitions to an open canopied state of medium size class (to reflect retention of larger trees)
- 50% maintains closed canopy of the same state class (>40%)

**Partial Harvest** of medium closed canopied states (>40% CC) with transitions similar to those prescribed for partial harvest in the No Action alternative:

- 50% transitions to an open canopied state of the same size class
- 50% maintains closed canopy of the same state class (>40%)

**Prescribed Fire** is applied to open canopied states only (10-39% canopy cover). Rx fire maintains open canopied states and prevents canopy infill (GROWCAN) transitions to closed states.

#### Wild / Other Zone

**No Mechanical** prescriptions are modeled in this model zone.
**No Prescribed Fire** is not applied in this model zone.

### *Northern Rocky Mountain Mixed Conifer*

#### Restoration Zone[24]

**No Mechanical** prescriptions are modeled in this model zone.
**Prescribed Fire** is applied to small, medium, and large sized states with closed canopies. Resulting transitions are proportional as follows:

- 75% transitions to mid-closed canopy states with multiple-storied structure of the same size class.
- 25% transitions to mid-closed canopy states with single storied structure of the same size class.

[23] While the term restoration zone is used here, this term is not used in the NA or current plan. This represents acres in the "harvest" category of the suitability analysis for the NA alternative. The terminology of Restoration Zone is used here only because it corresponds to the terminology used in the model database.
[24] While the term restoration zone is used here, this term is not used in the NA or current plan. This represents acres in the "harvest" category of the suitability analysis for the NA alternative. The terminology of Restoration Zone is used here only because it corresponds to the terminology used in the model database.

### Timber Production Zone

**Thinning Harvest** [NaHarv] is prescribed in small and medium sized, closed canopied systems with transitions to mid-canopied states of the same size class.
**Regeneration Harvest** [RegHar] is prescribed in small and medium sized, mid-canopied systems with transitions to the Grass/Forb state.
**Prescribed Fire** is applied to small, medium, and large sized states with closed canopies. Resulting transitions are proportional as follows:

- 75% transitions to mid-closed canopy states with multiple-storied structure of the same size class.
- 25% transitions to mid-closed canopy states with single storied structure of the same size class.

### Wild / Other Zone

**No Mechanical** prescriptions are modeled in this model zone.
**No Prescribed Fire** is not applied in this model zone.

## *Spruce/Subalpine Fir*

No activity is modeled in this vegetation type. Wildfire and insect/disease agents; all alternatives are the same for all model zones.

## *Subalpine Fir/Lodgepole pine*

### Restoration Zone[25]

**Regeneration Harvest** is prescribed in small and medium sized states with closed canopies with transitions to the Grass/Forb state.
**No Prescribed Fire** is not applied in this model zone.

### Timber Production Zone

**Regeneration Harvest** is prescribed in small and medium sized states with closed canopies with transitions to the Grass/Forb state.
**No Prescribed Fire** is not applied in this model zone.

### Wild / Other Zone

**No Mechanical** prescriptions are modeled in this model zone.
**No Prescribed Fire** is not applied in this model zone.

## *Western Redcedar/Western Hemlock*

### Restoration Zone[26]

**No Mechanical** prescriptions are modeled in this model zone.
**No Prescribed Fire** is not applied in this model zone.

[25] While the term restoration zone is used here, this term is not used in the NA or current plan. This represents acres in the "harvest" category of the suitability analysis for the NA alternative. The terminology of Restoration Zone is used here only because it corresponds to the terminology used in the model database.
[26] While the term restoration zone is used here, this term is not used in the NA or current plan. This represents acres in the "harvest" category of the suitability analysis for the NA alternative. The terminology of Restoration Zone is used here only because it corresponds to the terminology used in the model database.

### Timber Production Zone

**No Mechanical** prescriptions are modeled in this model zone.
**No Prescribed Fire** is not applied in this model zone.

### Wild / Other Zone

**No Mechanical** prescriptions are modeled in this model zone.
**No Prescribed Fire** is not applied in this model zone.

## Constrained Model Runs

In order to better represent expected landscape trajectories, a set of model runs were developed using constraints based on budget assumptions. The assumed budget is based on existing performance reflecting recent budgets on the Colville National Forest. While it is recognized that budgets can and do fluctuate, this is intended to give a good approximation of what could be accomplished under current budgets. Further, it is acknowledged that particularly in the realm of prescribed fire, budget is not the only constraint; rather it is on equal footing with regulatory limitations and forest capacity. In other words, it is possible that an increased budget alone might not lead to an increase in prescribed fire treatments if regulatory constraints and forest capacity remain unchanged. Budget assumptions are translated into the model as acres of treatment per year. Cost per acre of treatment, by treatment type is not factored into this analysis.

### Budget assumptions

The original budget constrained runs used the following acre targets by model type. These values are based on an assumed 5,000 acre of total treatment per year for each of the three categories (Timber Management, Prescribed Fire, and Mechanical Fuels Treatment. The specific acres applied generally represent the approximate proportion of the landscape represented by each model type with some adjustments for resource objectives.
Budget constrained treatment acres for the each alternative are displayed in Table 5. For the B, O, R, and NA alternatives, the modeled values for constrained runs reflect further constraints associated with Non-Declining Flow for timber management transitions. See the section of this document on Timber Scheduling for a full description of the Allowable Sale Quantity, Long Term Sustained Yield, and Non-Declining Flow calculation process.

**Table 5 - Budget Constrained Treatment Values**

| Model Type | Transition Group | Alt P/PA Target Area (Acres) | Alt B/O Target Area (Acres) | Alt NA Target Area (Acres) | Alt R Target Area (Acres) |
|---|---|---|---|---|---|
| Subalpine Fir/Lodgepole pine | 5kFuelsMech | 0 | 0 | 0 | 0 |
| | 5kRxFire | 1040 | 1040 | 1040 | 1040 |
| | 5kTimber | 950 | 475 | 1900 | 475 |
| Northern Rocky Mountain Mixed Conifer | 5kFuelsMech | 1925 | 963 | 481 | 0 |
| | 5kRxFire | 1686 | 1686 | 1686 | 1686 |
| | 5kTimber | 1550 | 775 | 388 | 0 |
| Douglas-fir dry | 5kFuelsMech | 3074 | 1229 | 615 | 615 |
| | 5kRxFire | 2153 | 2153 | 2153 | 2153 |
| | 5kTimber | 2500 | 1000 | 500 | 500 |

| | | | | | |
|---|---|---|---|---|---|
| Western redcedar/western hemlock | 5kFuelsMech | 0 | 309 | 0 | 0 |
| | 5kRxFire | 0 | 0 | 0 | 0 |

For those alternatives where non-declining flow restricted number of acres treated for timber management below the 5,000 acre current values, transition targets were reduced/increased (within the 5,000ac cap).

### *Acres and probabilities*

To approximate the above discussed budget constraints, model transitions were grouped into three categories: 1) Timber Management, 2) Prescribed Fire, and 3) Fuels Mechanical. Transition area targets where then assigned to each model type and transition group based on the values provided in Table 5 above. The model then adjusts probabilities on the fly to approximate the entered amount of treatment by treatment group in a given year.

### Unconstrained

The original model runs produced in Nov. of 2014 included unconstrained model runs. These model runs allowed for much higher amounts of treatment acres in an attempt to see what an unlimited management budget could achieve under the management prescriptions for each alternative. However, these model runs were not consistent with the concept of non-declining flow for timber volume, and did not meet Long Term Sustained Yield (LTSY) objectives. Therefore they are not currently included in the modeling package. Instead, the LTSY and Allowable Sale Quantity (ASQ) runs now approximate the maximum harvest levels of an unlimited budget and associated resource impacts. See the Timber Scheduling section of this document for a description of the process used to model LTSY and ASQ.

## Timber Scheduling

To meet NFMA and 1982 planning rule requirements, model runs were completed to calculate Long Term Sustained Yield, Allowable Sale Quantity, and planned sale quantities reported as Planned Wood Sale Quantity & Planned Timber Sale Quantity. Model runs were developed to be consistent with R6 Timber Calculations Guidance[27].

### Calculation of Long Term Sustained Yield

The calculation of Long Term Sustained Yield (LTSY) assumes that the forest has already achieved desired conditions on the landscape, and computes the maximum volume that can be sustained in perpetuity while maintaining those desired conditions. To facilitate these runs, the model was first populated with initial conditions that reflect desired conditions. Because the stated desired conditions are based on the simplified Colville Structural Groupings[28], and not model states, values for initial conditions by model states were derived using outputs from the Natural Range of Variation model runs.

[27] The March 2011 document, "Determining Lands Suitable for Timber Production, and Long-Term Sustained Yield, Allowable Sale Quantity and Harvest Volume Estimates for Forest Plan Revisions Under Provisions of the 1982 Rule – Pacific Northwest Region" contains a full description of regional guidance on preforming timber calculations.

[28] See appendix 2 for a crosswalk between Colville Structural Groupings and Model States.

With initial conditions set, model runs were conducted with successively higher (and lower) transition targets (acres) for mechanical treatments (timber and fuels). Models were run with existing intensity (1x) as well as ¼, ½, ¾, 2x, 2.5x, 3x, 4x, 8x, 16x, and 32x management intensities. The outputs from each run were then compared to determine the maximum intensity of management possible for each model type that both conformed to the principle of non-declining flow and best approximated the maintenance of desired conditions.
Table 6 displays the selected LTSY intensity for each model type by alternative. As evidenced by this table, LTSY could not be calculated for alternatives B, O, R, or NA. This is because no intensity of management under the prescriptions developed for these alternatives led to a non-declining flow of timber or maintained desired conditions.

**Table 6 - LTSY management intensities relative to current management intensity**

| | LTSY Maximum Management Intensity by Alternative | | | | | |
|---|---|---|---|---|---|---|
| **Vegetation Type:** | **PA** | **P** | **B** | **O** | **R** | **NA** |
| ***FDD*** | 3x | 3x | * | * | * | * |
| ***FCM*** | 2.5x | 2.5x | * | * | * | * |
| ***FCD*** | 1x | 1x | * | * | * | * |
| ***FRN*** | 0x | 0x | * | * | * | * |

The selected LTSY management intensities resulted in the LTSY volumes presented in Table 8.

## Calculation of the Allowable Sale Quantity

The calculation of Allowable Sale Quantity (ASQ) follows the same general process as the LTSY calculation with the key distinction that model runs use initial conditions reflecting current conditions on the forest (see the Existing Conditions section of this document for a full description of how these values were calculated). ASQ model runs were conducted with successively higher (and lower) transition targets (acres) for mechanical treatments (timber and fuels). Models were run with existing intensity (1x) as well as ¼, ½, ¾, 2x, 2.5x, 3x, 4x, 8x, 16x, and 32x management intensities. The outputs from each run were then compared to determine the maximum intensity of management possible for each model type that conformed to the principle of non-declining flow while moving towards desired conditions.

## Calculation of Non-Declining Flow

A true ASQ value could not be calculated for the B, O, R or NA alternative because no intensity of management under the prescriptions developed for these alternatives led to desired conditions. However, non-declining flow rates were developed for these alternatives and are reported in Table 7.

**Table 7- Non-Declining Flow management intensities relative to current management intensity**

| | Non-Declining Flow Maximum Management Intensity by Alternative | | | | | |
|---|---|---|---|---|---|---|
| **Vegetation Type:** | **PA** | **P** | **B** | **O** | **R** | **NA** |
| ***Douglas-fir dry*** | 2x | 2x | 1/2* | 1/2* | <1/4* | <1/4* |
| ***Northern Rocky Mountain Mixed Conifer*** | 2x | 2x | 1/2* | 1/2* | 0x | <1/4* |
| ***Subalpine Fir/Lodgepole pine*** | 1x | 1x | 1/2* | 1/2* | 1/2x | 2x |

| | | | | | | |
|---|---|---|---|---|---|---|
| ***Western redcedar/western hemlock*** | 0x | 0x | 1/2* | 1/2* | 0x | 0x |

## Calculation of the Planned Sale Quantities

Planned sale quantities were developed using the budget constrained transition targets for mechanical treatments. Modeled volumes for both Planned Wood Sale Quantity (PWSQ) and Planned Timber Sale Quantity (PTSQ) are included in Table 8. Values below do not reflect additional contributions to PWSQ from other non-chargeable volume including fuelwood.

**Table 8- Modeled Timber Volumes by Alternative**

| | | Alternative | | | | | |
|---|---|---|---|---|---|---|---|
| Value | | **PA** | **P** | **B** | **O** | **R** | **NA** |
| LTSY | *MMBF* | 97.5 | 97.4 | * | * | * | * |
| | *CCF* | 191,094 | 186,418 | * | * | * | * |
| ASQ | *MMBF* | 67.6 | 67 | * | * | * | * |
| | *CCF* | 139,416 | 138,041 | * | * | * | * |
| NDF | *MMBF* | 67.6 | 67 | 13.9 | 12.2 | 7.5 | 18.3 |
| | *CCF* | 139,416 | 138,041 | 29,132 | 26,525 | 15,576 | 38,397 |
| PWSQ | *MMBF* | *62.07* | *61.77* | *37.37* | *37.47* | *14.26* | *40.57* |
| | *CCF* | *125,866* | *125,379* | *75,843* | *77,067* | *28,849* | *82,758* |
| PTSQ | *MMBF* | 40.8 | 41.2 | 13.9 | 12.2 | 7.5 | 18.3 |
| | *CCF* | 83,992 | 84,902 | 29,132 | 26,525 | 15,576 | 38,397 |

* LTSY and ASQ cannot be calculated for these alternatives as the associated management prescriptions do not represent non-declining flow nor do they move toward or sustain the stated desired conditions.

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## Appendix 1 – Cover Severity Tables

| Non-Lethal in OPEN<br>**POST-FIRE CONDITION**<br>CANOPY COVER CLASS | COUNT | % |
|---|---|---|
| CANOPY COVER CLASS | COUNT | % |
| 1 (non-forested; <10% tree cover) | 48 | 6.4 |
| 2 (open; 10-39.9% tree cover) | 702 | 93.6 |
| 3 (closed; 40%+) | 0 | 0.0 |

| Non-Lethal in mid-canopy<br>**POST-FIRE CONDITION** | | |
|---|---|---|
| 1 (non-forested; <10% tree cover) | 0 | 0.0 |
| 2 (open; 10-39.9% tree cover) | 157 | 31.4 |
| 3 (closed; 40%+) | 343 | 68.6 |

| Mixed Severity in OPEN<br>**POST-FIRE CONDITION** | COUNT | % |
|---|---|---|
| 1 (non-forested; <10% tree cover) | 610 | 40.7 |
| 2 (open; 10-39.9% tree cover) | 890 | 59.3 |
| 3 (closed; 40%+) | 0 | 0.0 |

| Mixed Severity in mid-canopy<br>**POST-FIRE CONDITION** | | |
|---|---|---|
| 1 (non-forested; <10% tree cover) | 418 | 80.4 |
| 2 (open; 10-39.9% tree cover) | 102 | 19.6 |
| 3 (mid-closed; 40-60%) | 0 | 0.0 |

| Stand replacing in OPEN<br>**POST-FIRE CONDITION** | | |
|---|---|---|
| 1 (non-forested; <10% tree cover) | 780 | 1.0 |
| 2 (open; 10-39.9% tree cover) | 0 | 0.0 |
| 3 (mid-closed; 40-60%) | 0 | 0.0 |

| Stand Replacing in mid-canopy<br>**POST-FIRE CONDITION** | | |
|---|---|---|
| 1 (non-forested; <10% tree cover) | 418 | 80.4 |
| 2 (open; 10-29.9% tree cover) | 102 | 19.6 |

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| | | |
|---|---|---|
| 3 (mid-closed; 40-60%) | 0 | 0.0 |

| Stand Replacing in closed Canopy (>60%) **POST-FIRE CONDITION** | | |
|---|---|---|
| | COUNT | % |
| 1 (non-forested; <10% tree cover) | 544 | 51.0 |
| 2 (open; 10-29.9% tree cover) | 522 | 49.0 |
| 3 (mid-closed; 40-60%) | 0 | 0.0 |

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## Appendix 2 – Colville Structure Groupings Crosswalk

| Model Type | Model State Code | Size Class | Cover Class | Storiedness | Colville Grouping |
|---|---|---|---|---|---|
| Douglas-fir dry | DF:Yo | seed/sap <5" | Open 10-40% | | A - Early |
| | DF:Po1 | pole 5-10" | Open 10-40% | Single | |
| | DF:Ym | seed/sap <5" | Mid CC 40-60% | | |
| | DF:Pm2 | pole 5-10" | Mid CC 40-60% | Multi | |
| | DF:Pm1 | pole 5-10" | Mid CC 40-60% | Single | |
| | DF:G1p | GFB (w/ snags) | <10% | | |
| | DF:L1p | GFB (w/ snags) | <10% | | |
| | DF:M1p | GFB (w/ snags) | <10% | | |
| | DF:P1p | GFB (w/ snags) | <10% | | |
| | DF:S1p | GFB (w/ snags) | <10% | | |
| | DF:Yop | GFB (w/ snags) | <10% | | |
| | DF:GF | GFB | <10% | | |
| | DF:So1 | small 10-15" | Open 10-40% | Single | B - Mid Open |
| | DF:Mo1 | medium 15-20" | Open 10-40% | Single | |
| | DF:Sm2 | small 10-15" | Mid CC 40-60% | Multi | C - Mid Closed |
| | DF:Sm1 | small 10-15" | Mid CC 40-60% | Single | |
| | DF:Mm2 | medium 15-20" | Mid CC 40-60% | Multi | |
| | DF:Mm1 | medium 15-20" | Mid CC 40-60% | Single | |
| | DF:Lo1 | large 20-30" | Open 10-40% | Single | D - Late Open |
| | DF:Go1 | giant >30" | Open 10-40% | Single | |
| | DF:Lm2 | large 20-30" | Mid CC 40-60% | Multi | E - Late Closed |
| | DF:Lm1 | large 20-30" | Mid CC 40-60% | Single | |
| | DF:Gm2 | giant >30" | Mid CC 40-60% | Multi | |
| | DF:Gm1 | giant >30" | Mid CC 40-60% | Single | |

| Model Type | Model State Code | Size Class | Cover Class | Storiedness | Colville Grouping |
|---|---|---|---|---|---|
| Northern Rocky Mountain Mixed Conifer | DFmx:Yo | seed/sap <5" | Open 10-40% | | A - Early |
| | DFmx:Pm1 | pole 5-10" | Mid CC 40-60% | Single | |
| | DFmx:Pc2 | pole 5-10" | Closed >60% | Multi | |
| | DFmx:S1p | GFB (w/ snags) | <10% | | |
| | DFmx:M1p | GFB (w/ snags) | <10% | | |
| | DFmx:L1p | GFB (w/ snags) | <10% | | |
| | DFmx:G1p | GFB (w/ snags) | <10% | | |
| | DFmx:So1 | small 10-15” | Open 10-40% | Single | B - Mid Open |
| | DFmx:Mo1 | medium 15-20" | Open 10-40% | Single | |
| | DFmx:Sm2 | small 10-15” | Mid CC 40-60% | Multi | C - Mid Closed |
| | DFmx:Sm1 | small 10-15” | Mid CC 40-60% | Single | |

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| | | | | | |
|---|---|---|---|---|---|
| | DFmx:Mm2 | medium 15-20" | Mid CC 40-60% | Multi | |
| | DFmx:Mm1 | medium 15-20" | Mid CC 40-60% | Single | |
| | DFmx:Sc2 | small 10-15” | Closed >60% | Multi | |
| | DFmx:Mc2 | medium 15-20" | Closed >60% | Multi | |
| | DFmx:Lo1 | large 20-30" | Open 10-40% | Single | D - Late Open |
| | DFmx:Go1 | giant >30" | Open 10-40% | Single | |
| | DFmx:Lm2 | large 20-30" | Mid CC 40-60% | Multi | E - Late Closed |
| | DFmx:Lm1 | large 20-30" | Mid CC 40-60% | Single | |
| | DFmx:Gm2 | giant >30" | Mid CC 40-60% | Multi | |
| | DFmx:Gm1 | giant >30" | Mid CC 40-60% | Single | |
| | DFmx:Lc2 | large 20-30" | Closed >60% | Multi | |
| | DFmx:Gc2 | giant >30" | Closed >60% | Multi | |

| Model Type | Model State Code | Size Class | Cover Class | Storiedness | Colville Grouping |
|---|---|---|---|---|---|
| Spruce/Subalpine fir | DFmx:GFp | seed/sap <5" | Open 10-40% | | A - Early |
| | DFmx:Ym | seed/sap <5" | Mid CC 40-60% | | |
| | DFmx:Pc1 | pole 5-10" | Closed >60% | | |
| | DFmx:Yop | GFB (w/ snags) | <10% | | |
| | DFmx:P1p | GFB (w/ snags) | <10% | | |
| | DFmx:S1p | GFB (w/ snags) | <10% | | |
| | DFmx:M1p | GFB (w/ snags) | <10% | | |
| | DFmx:L1p | GFB (w/ snags) | <10% | | |
| | DFmx:Sc1 | small 10-15” | Closed >60% | | C - Mid Closed |
| | DFmx:Mc1 | medium 15-20" | Closed >60% | | |
| | DFmx:Lc1 | large 20-30" | Closed >60% | | E - Late Closed |

| Model Type | Model State Code | Size Class | Cover Class | Storiedness | Colville Grouping |
|---|---|---|---|---|---|
| Subalpine Fir/Lodgepole pine | LPWL:Yo | seed/sap <5" | Open 10-40% | | A - Early |
| | LPWL:GFp | seed/sap <5" | Open 10-40% | | |
| | LPWL:Ym | seed/sap <5" | Mid CC 40-60% | | |
| | LPWL:Pc1 | pole 5-10" | Closed >60% | | |
| | LPWL:Yop | GFB (w/ snags) | <10% | | |
| | LPWL:P1p | GFB (w/ snags) | <10% | | |
| | LPWL:S1p | GFB (w/ snags) | <10% | | |
| | LPWL:M1p | GFB (w/ snags) | <10% | | |
| | LPWL:L1p | GFB (w/ snags) | <10% | | |
| | LPWL:Sm1 | small 10-15” | Mid CC 40-60% | | C - Mid Closed |
| | LPWL:Sc1 | small 10-15” | Closed >60% | | |
| | LPWL:Mc1 | medium 15-20" | Closed >60% | | |
| | LPWL:Lc1 | large 20-30" | Closed >60% | | E - Late Closed |

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| Model Type | Model State Code | Size Class | Cover Class | Storiedness | Colville Grouping |
|---|---|---|---|---|---|
| Western redcedar/western hemlock | DFRC:Yo | seed/sap <5" | Open 10-40% | | A - Early |
| | DFRC:LcP | seed/sap <5" | Open 10-40% | | |
| | DFRC:GcP | seed/sap <5" | Open 10-40% | | |
| | DFRC:Pm1 | pole 5-10" | Mid CC 40-60% | Single | |
| | DFRC:G1p | GFB (w/ snags) | <10% | | |
| | DFRC:L1p | GFB (w/ snags) | <10% | | |
| | DFRC:GF | GFB | <10% | | |
| | DFRC:Sm2 | small 10-15” | Mid CC 40-60% | Multi | C - Mid Closed |
| | DFRC:Mm2 | medium 15-20" | Mid CC 40-60% | Multi | |
| | DFRC:Sc2 | small 10-15” | Closed >60% | Multi | |
| | DFRC:Mc2 | medium 15-20" | Closed >60% | Multi | |
| | DFRC:Lm2 | large 20-30" | Mid CC 40-60% | Multi | E - Late Closed |
| | DFRC:Gm2 | giant >30" | Mid CC 40-60% | Multi | |
| | DFRC:Lc2 | large 20-30" | Closed >60% | Multi | |
| | DFRC:Gc2 | giant >30" | Closed >60% | Multi | |

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