Section VII. R.

Wall Watershed Ecosystem Analysis
Study of Forested Vegetation Historic Range of Variability in Relation to Existing Conditions

Prepared by Charlene Bucha
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I. INTRODUCTION

A. Overview

Elements and processes within ecosystems are naturally dynamic and the structures and species composition of plant communities change over time. This changing of elements and processes occurs within a range of variability. This potential or historic range of variability is a useful reference point that can be used to compare the current and historic vegetative state (Caraher 1992, Swanson et al. 1994, Agee 1994, Anon 1994, Johnson et al. 1994, and others). This approach assumes that when ecosystems are pushed outside the bounds of their historic range of variability, there is increased risk that ecological function will be lost. It is believed that by restoring the vegetative composition and structure to within its range of variability, watersheds will move toward a more sustainable ecological land condition.

This paper describes analysis methods used to examine current forest vegetation structure in relation to historical and natural conditions for the Wall watershed. Part of this team's effort was to learn what processes shaped the landscape, what the historic composition and structure of the vegetation were, and to compare the historic vegetation conditions to the existing condition. The historic range should be viewed as a guide to help detect vegetation species and structure composition potential over the landscape. Social and political values may cause a difference between historic conditions and the desired.

B. Historical Role of Disturbance in the Wall Watershed

The Wall area is one of many Eastern Oregon watersheds where fire exclusion and forest management over the past 90 years has resulted in some significant changes in forest species and structure (Gast 1991, Johnson et al. 1994). An ecological assessment by Shilsky (1994) characterizes the current condition of the forest vegetation as extensive stands of dead and dying trees, especially the older, dense fir stands on the drier sites. Historically, sites that were dominated by multi-age ponderosa pine were maintained by frequent, low-intensity ground fires. These sites have progressed along the successional spectrum due to changes in the natural disturbance regime and are now dominated by shade tolerant climax species like grand fir. In addition, selective harvest of large ponderosa pine has also altered age structure. It is well established that these conditions are the result of fire exclusion, grazing, and selective logging. To provide the reader with a perspective on the natural disturbance processes within the Wall area, existing knowledge regarding the historical role of fire, insects, and grazing as agents of disturbance is summarized below:

Fire. The Blue Mountains with its long, dry summers and frequent lightning storms has the potential to experience wildfires across vast acres of the landscape (Mutch 1993). On low to middle elevation dry sites, ponderosa pine was once a major forest component. Fires burned in the understory and perpetuated an open parklike structure dominated by ponderosa pine with a component of western larch on the wetter an open parklike structure dominated by ponderosa pine with a component of western larch on the wetter sites. In the higher elevations and moist sites at the middle elevations, the structure was a mosaic of burned and unburned areas with a composition of western larch, Douglas-fir, lodgepole pine, and grand fir.

By the 1950's, fire suppression successfully extinguished all fires of low and moderate intensity (Agee 1991). This ability to suppress fires led to an increase of fuels and regeneration of shade tolerant species. The process of fire has changed from one of maintaining open stands of fire resistant species to severe wildfire that may burn uncontrollably in heavy fuels (Mutch 1993). Fire suppression has resulted in the expanded distribution of Douglas-fir and grand fir which has caused stands to be more susceptible to insect infestation, disease epidemics, and catastrophic wildfires.

Current high fuel loads caused by decades of fire suppression and recent catastrophic tree mortality have resulted in a change in the range of fuel models for the Wall watershed. Historically, these fuel models ranged from NFFL 2 through NFFL 8. Currently these models now range from NNFL 2 to NFFL 12. This has created a situation where the risk of a catastrophic wildfire is significantly higher than in historical times.

Insects. Insects are always present in the forest and have a cyclic fluctuation. Typically, the effect of insects is probably one of creating gaps or small openings on the landscape, but recent sporadic outbreaks of defoliating insects have caused severe defoliation of grand fir and Douglas-fir, especially in the northeastern portion of the analysis area. In recent years, the concern has been that current outbreaks appear to be more severe and involve larger areas than in the past (Torgersen 1993). The greater distribution of grand fir and Douglas-fir on sites following fire exclusion may account for some of that perception. Insect populations cause declining tree vigor, reduced growth, top-kill, and eventually mortality.

Grazing. Sheep grazing within the Wall watershed is well documented back to the 1870's. Holding 1937 as our benchmark in time, be believe that the 70 years of intensive grazing prior to that point in time had significant impact upon the vegetative condition. Fire frequency and intensity, as well as species regeneration and density had been markedly altered. With the decline of the sheep market, grazing utilization changed to cattle throughout the 1920's and 30's and continues in that trend today.

Studies show that livestock grazing contributes to changes in forest species composition and structure through an increase in woody plants and shrubs (including larger plants such as pinyon, ponderosa pine, and juniper) across the western United States (Arnold 1950, Ellison 1960, Zimmerman and Neuenschwander 1984, and Bahre 1991). In addition, grazing has also been found to contribute to overstocking of trees by removing grasses which would otherwise prevent seedling establishment through competition (water, space, and nutrients). This removal of grasses and other fine fuels also acted to impede the progression of low-intensity ground fires (Rummel 1951, Cooper 1960, Jameson 1968, Rietveld 1975, Belsky 1995, and others).

II. METHODS

Overview

The basic process we used for the analysis of historic range of variability (HRV) was to compare the "potential" disturbance climax vegetation structure on the landscape (as defined below for the plant association groups) against the existing condition. The existing vegetation on the forest was classified according to a structural and species composition matrix for each of the disturbance-climax plant association groups (DCPAG's). Each forest stand was identified in terms of its structure (very early, early, early/middle, middle, and late/old), major species, and its species composition within the natural succession for that DCPAG. When existing vegetation is classified into the appropriate DCPAG and structural/species matrix within that PAG, the existing vegetation can be compared to what would have been sustained if natural disturbances had managed the landscape. Landscape structure parameters used in this project were identified using data from many sources, including memos from Regional Ecology staff, Forest Staff, regional guides (e.g. Hall 1973) and published literature (Johnson et al. 1994, Agee 1994), and local knowledge of the Wall watershed area. We have essentially integrated historical maps (1937), fire history data, interpretations by staff ecologists on the Forest, and working papers by Region 6 ecologists. Although much of the data on historic and natural conditions is sparse and not well developed, they are sufficient to identify gross changes in the landscape vegetation and structure that have resulted from anthropogenic activities.

B. Identification of Disturbance Climax Plant Association Groupings

The foundation for analyzing departures from potential or natural/historic conditions is the identification of the major plant association groups and associated disturbance regimes for the forested lands within the Wall watershed. The disturbance regime regulates the age, structure, and species composition of the plant association groups over the landscape. By identifying a disturbance regime we can determine the proportions of structural stages found in natural conditions for each disturbance-climax plant association group. Five different forested plant groupings (PAG), based on temperature/moisture regimes, were identified.

The five groups are identified by a dominant tree species, ranging from the coolest and wettest, lodgepole pine, to the warmest and driest, juniper. To better characterize the vegetation within the Wall area, we combined features of other plant association classifications (proposed by ecology staff, F. Hall and C. Johnson) and made some minor modifications. The five groupings are discussed below.

<u>Lodgepole Pine Group</u> - Lodgepole pine was included as a group because it is the dominant tree species under certain edaphic conditions. Specifically, the bottoms of cold air drainages or basins, and sites where no other species is reproducing with sufficient success to dominate. Lodgepole is generally tolerant to most insects and disease but is susceptible to mistletoe and bark beetle attack.

The fuel loading in this group ranges from 3 to 35 tons per acre (Maxwell and Ward, 1980). The fire disturbance regime is generally intense stand replacement fires occurring approximately every 80 to 120 years. In certain cases, lodgepole pine communities may require two stand replacement fire occurrences to complete a stand development cycle. The first fire would follow an outbreak of bark beetle attack in a decadent stand of lodgepole pine, this fire would kill the stand but would leave a large amount of standing material. After the standing dead has fallen over to create a continuous fuel bed, a second fire would consume the bulk of this fuel and reinitiate stand development. Such fire regimes also limit the species in the stands to lodgepole, and discriminate against less fire tolerant fir and spruce.

Lodgepole pine is the dominant species in this group. Presence by other tree species is minor. Dominant understory is pinegrass and grouse huckleberry with elk sedge. Prominent forbs are arnica, lupines, strawberries, and violets (Johnson and Clausnitzer, 1992). Lodgepole can be seral to subalpine fir and grand fir.

Cool Grand Fir Group - The cool, moist grand fir plant associations are stands where western larch, lodgepole pine, Douglas-fir, and ponderosa pine are the primary seral species and successional development would lead to climax stands of mixed conifers dominated by shade tolerant grand fir and/or Engelmann spruce. These stands are most susceptible to insect and disease infestations.

Fuel loading ranges from 11 to 43 tons per acre (Maxwell and Ward, 1980). The fire disturbance regime for this group is characterized by intense, stand replacement fires occurring every 150 to 300 years. Although low intensity fires do occur in this group, they usually do not spread and significantly alter the stand's succession.

Many forbs and shrubs can be found in this group as the successional stages develop. Common shrubs are big huckleberry, grouse huckleberry, snowberry, spirea, and pinemat manzanita. Forbs and grasses commonly found are heartleaf arnica, strawberries, pinegrass, and sedges.

Warm Grand Fir Group - The warm grand fir group also includes the Douglas-fir series plant associations. Historically, ponderosa pine would be the dominant seral tree species within this group. The dominance of ponderosa pine is due to a short return interval, low intensity fire regime that interrupts the successional pattern. This type of disturbance regime maintains fire resistant ponderosa pine, western larch, and Douglas-fir and discriminates against the less fire resistant grand fir. Insect and disease infestations are moderate because of the dominance of ponderosa pine and western larch. Larch dwarf mistletoe is found throughout most of the range of western larch and ponderosa pine is predisposed to attack by bark beetle.

Fuel loading ranges from 6 to 11 tons per acre (Maxwell and Ward 1980). The historic fire regime within this group that was low intensity with short return intervals has transitioned to a high to moderate fire intensity situation because of the increase in fuel loading due to the current condition of overstocked stands. Stand replacement fires are the result of these changes.

Common shrubs found within this group are big huckleberry, grouse huckleberry, spirea, snowberry, ninebark, and oceanspray. Forbs and grasses commonly found are pinegrass, sedges, bromes, and heartleaf arnica.

Ponderosa Pine Group - The ponderosa pine plant associations are the hottest and dryest of the forested plant associations analyzed. The stands in this group are tolerant of most diseases and insects, although dwarf mistletoe, P-type annosus, and bark beetles may play a significant role in stand dynamics. This group has a general appearance of a continuous open parklike ponderosa pine forest with small "cohort groups" of regenerated ponderosa pine. Juniper occurs in small numbers.

Fuel loading in this group ranges from less than 1 up to 48 tons per acre (Maxwell and Ward 1980). The fire regime associated with this group is one of low intensity and short return interval. This type of regime acted to reduce fuels and maintain stocking control within the stands by thinning the regeneration that would have occurred since the last fire. Fire in this group served more of a maintenance function that a stand disturbance/replacement function. Historically, insects were probably the initial agent of disturbance that created openings in this group. An example would be a small patch of bark beetle caused mortality surrounding a lightning strike or windthrow. As the overstory trees begin to break down and fall, fuel accumulates on the surface. When a surface fire reaches this patch of heavier fuels, the resulting fire is more intense within this small area and results in site preparation consisting of bare mineral soil with reduced grass competition to promote the initiation of new ponderosa pine seedlings. Additional low intensity surface fires will thin this regeneration and maintain an open forest structure.

Shrubs associated with this group may include snowberry, spirea, serviceberry, and bitterbrush. Grasses associated with this group are fescue, bluebunch wheatgrass, sandberg's bluegrass, pinegrass, and elk sedge.

Juniper Group - The Western Juniper series of plant associations is found on the Forest but offers little opportunity for management at this time. The primary purpose of analysis of this group was to determine the extent of juniper encroachment from historical (1937) to present conditions and to relate this to past and current management activities. No approximations have been derived regarding average patch size and expected range of structural classes. Further specifics on juniper encroachment can be found in the report on floristic biodiversity.

C. Assigning a Structural Stage to Existing Vegetation

Forested stands were classified into five structural stages. This information was obtained from the district's EVG layer from GIS and ignores species composition of the stand. Note: The EVG layer is all photo interpreted. Available stand exam information had not yet been incorporated into the EVG layer at the time of this analysis.

Very Early: Grass, forb, and shrub stage. Trees have not yet become the dominant plant type. This is the first seral stage following significant structural change in the stand due to severe fire, insect/disease, or other "natural disturbances." Generally expect to be years 0-10 of the stand's development. Note: District regeneration survival surveys and forest plan monitoring have indicated that many units on the Heppner R.D. have not developed within 10 years to the early structural stage as has been projected elsewhere on the Umatilla NF. Thus, the projected "age" of regeneration stand in the very early structural stage on a site specific basis may well be more than 10 years.

Early: Seedlings and trees less than 20 feet tall. Generally expect the stand to be in this stage from 11-30 years.

Early Middle: Saplings and trees between 20 feet tall and 7.9" DBH. Expect stand to remain in this stage during years 31-45.

Middle: Poles and small trees between 8.0 and 20.9" DBH. Stand reaches mature development in most cases. Generally expect stand to be in this class in years 46-100.

Late/Old: Small trees and trees equal to or greater than 21" DBH. Stand age is 100 years plus and may range as old as 350+ years in the case of "old growth" ponderosa pine stands. In accordance with the R6 old growth definitions (6/93), a minimum of 10 trees/acre are required for late/old structure in the ponderosa pine PAG. Our EVG data has canopy closure information, not trees/acre or basal area. Based on calculations, we determined that 10 trees/acre roughly equates to 10% canopy closure. Since structure was queried independent of species, R6 old growth definitions for Douglas-fir and grand fir may not be met.

Age to size relationship is not accurate for the lodgepole pine group.

D. Defining Appropriate Species Composition for the Structural Stages

To examine the existing vegetation in relation to historical conditions, it is necessary to classify stands as to whether they currently have an appropriate species mix. As an example, a stand in the warm grand fir plant association group would need to have trees between 8-20.9" DBH to be placed in the middle structural stage. These trees must also be of a specific species composition. If the species composition in a fire dominated warm grand fir stand is 51% ponderosa pine and 49% grand fir, then it would be difficult to classify that stand as being on a successional pathway for that disturbance-climax PAG.

Rules for assigning species composition are as follows:

1. <u>Ponderosa Pine Group</u>: 90% of the canopy closure should be derived from ponderosa pine or western larch, 10% from other species.

2. <u>Warm Grand Fir Group</u>: 80% of the canopy closure should be from ponderosa pine, western larch, and Douglas-fir, 20% from other species.

3. <u>Cool Grand Fir Group</u>: as much as 80% canopy closure from seral species in the early and early/middle structures, up to 50% in the middle structure, and no more than 20% in the late/old structure.

4. <u>Lodgepole Pine Group</u>: 90% of the canopy closure should be derived from lodgepole pine, 10% from other species.

E. Data used to Identify Plant Associations within Wall Watershed

The identification of the disturbance-climax PAG's used the following plant community codes from the Forest Datacell layer:

Lodgepole Pine: all CL plant associations; DD codes 33, 34, 35.

Cool Grand Fir: CW-F3-11 and CW-S2-11; DD codes 36, 37.

Warm Grand Fir: all CD plant associations, CW-G1-11, and CW-G1-12; DD codes 28-32.

Ponderosa Pine: all CP plant associations; DD codes 24, 25, 27.

Juniper: all CJ plant associations; DD codes 16, 17, 18.

F. Structural Stages and Their Historical Proportions for Plant Association Groups

Table 1 expresses what is believed to be the historical percentages by structure for each plant association group. These percentages were derived by the Umatilla National Forest (8/9/93). For the lodgepole group, Hall's writeup (7/30/93) on biophysical environments for vegetative screening was used. A very early stage was added to the lodgepole group since Hall's information began with the seedling/sapling stage.

Table 1. Historic Structural Stage Percentages by DCPAG

DCPAG	VE	E	EM	MID	L/O
Lodgepole	1-5%	10-25%	10-40%	20-40%	N/A
Cool Grand Fir	0-20%	5-20%	5-20%	20-50%	20-40%
Warm Grand Fir	1-5%	5-10%	5-10%	15-30%	40-70%
Ponderosa Pine	1-5%	5-10%	5-10%	15-30%	40-70%

Ponderosa pine and warm grand fir have the same percentages because ponderosa pine is considered the dominant species in both groups due to "fire climax."

Table 2. Average Patch-Size Acres by DCPAG

DCPAG	Avg. Patch Acres
Lodgepole Pine	40-1000
Cool Grand Fir	300-1500
Warm Grand Fir	150-1000
Ponderosa Pine	10-200

Table 3 describes the existing forest vegetation structural stages by PAG for the Wall Analysis area.

Table 3. Existing Structure by PAG (FS acres only)

Structure	PINE	Warm ABGR	Cool ABGR	LODGEPOLE	JUNIPER
Very Early	563	2,120	782	270	4,079
Early	79	212	6	15	571
Early/Mid	1,472	3,350	54	12	3,975
Middle	6,543	28,457	3,121	1,036	3,597
Late/Old	1,515	16,687	3,775	422	1,120
TOTALS	10,172	50,826	7,738	1,755	13,342

G. Assigning Prioritization for Examination for Silvicultural Treatment

Three priorities for examination for silvicultural treatment have been identified from lowest to highest as 1, 2, 3. The identification of priorities uses the following scheme. Assign priority 3 (high) to stands that have inappropriate species mix for the site (based on DCPAG), these stands would also have severe spruce budworm damage (rating of 3). Priority 2 (moderate) stands are those dominated by fir on the cool grand fir sites. The reasoning for this is that this type of stand is the most susceptible to disease/insects and fire, and stocking control is typically required to maintain stand health. Priority 2 was also assigned to stands that have spruce budworm damage of level 2 and otherwise were treatment priority 3. Priority 1 (low) stands are ones that need no immediate treatment but may need stocking control in the future to maintain species composition or appropriate structure. These priorities for management opportunities are viable if returning to a historic range of variability is the desired condition for the landscape.

H. 1937 Data

The purpose in analyzing the 1937 map is to have an historic "snapshot" in time against which to compare our existing condition and to determine any "deviations" that have occurred from "historic" conditions. The 1937 data describes existing vegetation on the site at that point in time and does not directly correlate to comparison with DCPAG acres. The interpretation of the 1937 landscape is presented in Table 4.

Table 4. Interpretation of 1937 vegetation mapping codes

Type Number	Type Description	Structure	Wall Analysis Area All Acres	Wall Analysis Area FS Acres	% FS Acres
01	Non-Forest		20,410	12,616	13.25%
03	Subalpine	No Structure	1,805	1,745	1.83%
04	Lodgepole Pine	No Structure	900	900	0.95%
05	Juniper	No Structure	471	471	0.50%
07	Douglas-fir, Large	Late/Old	739	739	0.78%
13	Ponderosa Pine, Large	Late/Old	9,972	8,896	9.35%
14	Pure Ponderosa Pine, Large	Late/Old	84,619	61,874	65.0%
15	Ponderosa Pine, Small	Middle	697	212	0.22%
16	Ponderosa Pine, Seedling, Sapling, Pole	Early/Mid	172	0	0.0%

Type Number	Type Description	Structure	Wall Analysis Area All Acres	Wall Analysis Area FS Acres	% FS Acres
17	Pine Mixture, Large	Middle	2,773	2390	2.50%
19	Fir Mixture, Large	Middle	4,131	4131	4.35%
25	Deforested Burns	Very Early	1,381	1,221	1.28%

According to this data, over 77% (73,372 acres) of the landscape (FS acres only) consisted of ponderosa pine of pine mixture, predominantly in the late/old structure. Table 5 shows the relationship of the existing vegetation in 1937 to the plant association groups (PAG's) derived from the forest datacell layer.

Table 5. 1937 Existing Vegetation by Plant Association Group (FS Acres only)

Type #	PINE	Warm ABGR	Cool ABGR	LODGEPOLE	JUNIPER	OTHER*
01	1,187	5,429	79	0	3,669	2,222
03	207	749	0	0	260	524
04	0	84	447	303	0	63
05	10	174	0	0	44	241
07	0	300	349	87	0	0
13	639	6,090	1,421	273	117	344
14	7,506	35,372	2,343	233	9,077	7,187
15	0	163	0	0	0	49
17	192	993	760	181	86	169
19	32	873	2,343	792	17	73
25	398	615	0	0	73	134
Total FS Wall Acres	10,171	50,842	7,742	1,869	13,343	11,006

*Other includes meadow, steppe, riverine, and rock.

I. Spruce Budworm Infestation

Information regarding the spruce budworm infestation is included in the fire hazards and fuel treatments section, therefore specifics are not included here.

J. Consideration of Non-Forest Land

We examined non-forest land to determine meadow encroachment by conifers. Groupings determined for non-forest land are meadow, steppe, riverine, and rock. Existing condition was derived from the plant association data in the forest datacell layer to determine number of acres in these non-forest groups. Historical condition was derived from the 1937 map simply under the category of non-forest. In 1937 there were 12,616 acres classified as non-forest, existing condition now shows 11,360 acres as non-forest. There are 1,201 acres that were forested in 1937 that today are less than 10% forested, of which 1,022 acres were described in 1937 as large, pure ponderosa pine.

K. Consideration of Private Land

Data from Pacific Meridian Resources (PMR) was used to determine existing condition land types (i.e. forested vs. non-forested) on private land within the Wall Watershed. However, due to time constraints and difficulty with the PMR data layer, we were unable to determine forest structural stages existing on adjacent private lands within the watershed. From observations in the field, aerial photographs, and discussion with industrial forest managers, it is known that the majority of the forested private land in the watershed has had one or more previous selection tree harvest entries and currently is stocked with trees in an early to middle structural stage. Within the Wall analysis area it was determined that there are 32,900 acres of non-National Forest lands with 21,200 acres having greater than or equal to 15% canopy closure or approximately 64.4% of that land base.

III. RESULTS

A. Comparison of Existing and Historic Condition

Existing and historic structural stage and species composition within the Wall analysis area were compared for four major subdrainages (Lower Wall, Upper Wall, Little Wall, and Skookum). This data (Tables 6, 7, 8 and 9) revealed the following conditions:

Lower Wall: This drainage is composed predominately of the warm grand fir PAG with a moderate component of Ponderosa Pine and a very small portion of cool grand fir and lodgepole PAG's. Overall, the structural component of this drainage is predominantly in the middle and late/old structure. Existing condition for the late/old, middle, and early structural stages are outside HRV, with late/old and early having less acres than historically and middle having more. An overall low priority for examination for silvicultural treatment exists in this drainage and indicates that species composition is generally appropriate for the plant association groups in this area. One exception is within the late/old structure where there are approximately 1,500 acres with a high priority rating. Recommend treatment of the late/old structure stands to enhance and promote the appropriate species mix for each PAG. Portions of the middle structure stands should be treated to promote continued growth toward the late/old structure and portions should be altered to promote the early structural stage.

Upper Wall: This drainage has the largest component of warm grand fir PAG in the analysis area, with moderate portions of ponderosa pine and cool grand fir PAG's. Both the middle and early structural stages are outside of HRV with the middle structure having considerably more acres than historically and the early structure having considerably less. Many of these stands are of high and moderate priority for treatment, especially in the late/old and middle structures. Recommend treatments that 1) alter the structure and/or 2) remove some components to improve species composition toward the desired seral species appropriate to each PAG while maintaining the existing structure. A preference toward the creation of some early structure is indicated.

Little Wall: The two PAG's in this drainage are warm grand fir and ponderosa pine. Overall, this drainage is outside HRV in every structural stage except early/mid. Late/old and early have less acres than historically, and middle and very early have more than historically. Again, many of these stands are of high or moderate priority for treatment with regards to species composition. Changing or promoting structure to the early and late/old stages would be preferred while also maintaining components of the existing structure.

Skookum: The Skookum drainage is predominantly composed of warm grand fir with moderate components of lodgepole, cool grand fir, and ponderosa pine PAG's. The late/old, middle, and early structural stages are outside of HRV, with the middle structure being well beyond historic acres at over 15,800 acres. The late/old and early structures are well below the historical ranges. An overall high priority for examination for silvicultural treatment exists in this drainage indicating that species composition is generally of an inappropriate mix to reach the desired condition for theses stands. Recommend treatment of the late/old, middle, and early middle structural stands to enhance and promote the appropriate species mix for each PAG. Portions of the middle structure should also be treated to promote continued growth toward the late/old structure. The very early structure stands should be evaluated and enhanced to promote continued healthy regeneration.

Table 6. Comparison of Existing and Historical Acreages - Structural Stages by PAG and Examination Priorities for Silvicultural Treatment (Acres) - Lower Wall.

DCPAG	Acres
Lodgepole	17
Cool Grand Fir	68
Warm Grand Fir	7,302
Ponderosa Pine	1,174
Total of DCPAG's	8,561
Total FS Acres Lower Wall	11,721

Structural Stage	HRV (Acres)	Existing Condition Acres	Outside HRV	Examination Priorities for Treatment (Acres)		
				High	Moderate	Low
Late/Old	3405-5960	2,808	*	1,512	11	2,882
Middle	1288-2584	4,799	*	671	16	2,515
Early/Mid	429-868	766		207	0	559
Early	429-868	0	*	0	0	0
Very Early	85-439	187		N/A	N/A	N/A

Table 7. Comparison of Existing and Historic Acreages - Structural Stages by PAG and Examination Priorities for Silvicultural Treatment (Acres) - Upper Wall.

DCPAG	Acres
Lodgepole	0
Cool Grand Fir	2,767
Warm Grand Fir	18,065
Ponderosa Pine	4,867
Total of DCPAG's	25,699
Total FS Acres Upper Wall	30,019

Structural Stage	HRV (Acres)	Existing Condition Acres	Outside HRV	Examination Priorities for Treatment (Acres)		
				High	Moderate	Low
Late/Old	9726-17160	11,357		4,802	1,303	5,251
Middle	3993-8264	11,876	*	5,743	310	5,823
Early/Mid	1284-2847	1,351		527	11	416
Early	1284-2847	32	*	1	0	31
Very Early	230-1699	1,083		N/A	N/A	N/A

Table 8. Comparison of Existing and Historic Acreages - Structural Stages by PAG and Examination Priorities for Silvicultural Treatment (Acres) - Little Wall.

DCPAG	Acres
Lodgepole	0
Cool Grand Fir	0
Warm Grand Fir	9,956
Ponderosa Pine	1,335
Total of DCPAG's	11,291
Total FS Acres Little Wall	19,757

Structural Stage	HRV (Acres)	Existing Condition Acres	Outside HRV	Examination Priorities for Treatment (Acres)		
				High	Moderate	Low
Late/Old	4516-7904	2,875	*	1,223	0	1,652
Middle	1693-3388	6,664	*	2,984	0	3,680
Early/Mid	565-1130	1,074		528	0	546
Early	565-1130	67	*	0	0	67
Very Early	113-565	611	*	N/A	N/A	N/A

Table 9. Comparison of Existing and Historic Acreages - Structural Stages by PAG and Examination Priorities for Silvicultural Treatment (Acres) - Skookum.

DCPAG	Acres
Lodgepole	1,854
Cool Grand Fir	4,907
Warm Grand Fir	15,520
Ponderosa Pine	2,796
Total of DCPAG's	25,077
Total FS Acres Skookum	33,696

Structural Stage	HRV (Acres)	Existing Condition Acres	Outside HRV	Examination Priorities for Treatment (Acres)		
				High	Moderate	Low
Late/Old	8307-14784	5,359	*	2,536	1,404	1,419
Middle	4099-8691	15,819	*	11,089	2,057	2,674
Early/Mid	1346-3555	1,697		1,436	17	245
Early	1346-3277	213	*	111	6	95
Very Early	202-1990	1,854		N/A	N/A	N/A

A comparison of the existing structure and 1937 structure is shown in Table 10 (Forest Service acres only). It is difficult to make a direct comparision between the structural stages for the two periods in time because not all structural stages are represented in the interpretation for 1937. An assumption was made that the deforested burn areas of 1937 were in the very early structure. No attempt was made to assign the existing vegetation of 1937 into PAG's.

The 1937 data shows a landscape predominantly dominated by late/old structure (75%) with a very moderate component of middle structure (7%) as compared to the existing late/old strucutre of 25% and middle structure at 45%. Early/mid and early structures are not represented on the 1937 map.

Table 10. Comparison of Landscape Structure - 1937 and Existing

Structure	1937		Existing		Difference (Acres)
	Acres (FS)	%	Acres (FS)	%	
Late/Old	71,508	75	23,519	25	-47,989
Middle	6,733	7	42,754	45	+36,021
Early/Mid	0	0	8,863	9	+8,863
Early	0	0	882	1	+882
Very Early	1,221	1	7,815	8	+6,594
Forested No Structure	3,115	4	0	0	-3,115
Other	12,616	13	11,360	12	-1,256

IV. DISCUSSION

A. Deviations From Historic Conditions

It is important to recognize that elements and processes within ecosystems are naturally dynamic and the structures and compositions of plant communities shift over time. This shifting of the elements and processes occurs within a range of variability. Because data is lacking that describes the statistical distribution of the range of variability, it is impossible to determine the significance of the deviation of the existing condition from the natural or historical. Using the historical range of variability as a template for ecosystem sustainability, maintaining natural ecological vegetative patterns over time can be accomplished.

B. Management Opportunities to Restore Sustainability

The general objective of the recommendations made in this report is to change the vegetative composition of the stands within the Wall watershed toward a sustainable ecological landscape with less departure from natural ecosystem composition, structure, and function. Specifically, if there is departure between the two, opportunities exist to generate the appropriate composition and structural classes to fill the deficit classes. These opportunities could move an existing stand into another structural/species matrix that is currently deficit for that particular DCPAG, or accelerate the growth of earlier structure classes to fill voids in the later ones. There are many choices to be made, each has different effects, costs, and ecologicial returns. From the HRV classification standpoint, possible opportunites may include any of the following:

1. Change species composition of an existing stand such that it "fits" into the correct species composition successional pathway for that site. This type of prescription could, for instance, remove ABGR that is invading a PIPO PAG site. This prescription may include a light underburn for the early structural stages, a precommercial thin for the early/mid structural stages, and a commercial thin for the later structural stages.

2. "Grow" more stands within specific PAG's to correct deficit structural stages. In contrast to the above, this would be an investment that would not be realized until the structural stage advances into a currently deficit category.

3. Maintain/improve the health of existing stands. This type of prescription might involve prescribed burning. It would assist in accomplishing changes in species compostion, or reduce fuel loading to lower the risk of catastrophic fire.

Some example treatments would include: 1) Remove fir on ponderosa pine sites to reduce the component of fir and provide conditions for pine regeneration; 2) Thin from below to promote growth of later structural stages; 3) Selective overstory removal to promote understory growth; and 4) Burn for stocking control to preserve existing composition/structure classes. Specific prescriptions for each of the DCPAG's are discussed below:

Lodgepole Pine Group. Prescriptions for this group would concentrate on stand replacement fires from 40 to 1,000 acres.

Cool Grand Fir Group. Prescriptions for this group would include:

1. Removal of small groups of trees (1-2) acres to mimic low intensity fires and disease or insect disturbance;

2. Creation of patches 5-20 acres in size achieved by leaving 15-20 trees per acre in a shelterwood or commercial thinning that would mimic medium intensity fires; and

3. Creation of large patches 25-500 acres in size that would mimic a stand replacement fire.

Warm Grand Fir Group. Prescriptions may include:

1. Removal of small groups of trees, 1/4 to 2 acres, to mimic patches created by sporadic torching of individual trees by low intensity fire and disease and insect disturbances;

2. Creation of patches 20-1000 acres where low intensity fires provided natural sotcking control and favored seral species; and

3. Creation of patches 5-30 acres in size to mimic medium intensity fires. This type of fire would kill most of the understory and some overstory, leaving 15-25 trees per acre, favoring Dougla-fir and creating open stands; and

4. Creation of large openings up to 200 acres to mimic stand replacement fires.

Ponderosa Pine Group. Prescriptions may include:

1. Small patches of 1/4 to 2 acres created by sporadic torching of individual trees and disease and insect disturbances; and

2. Creation of large patches up to 200 acres where low intensity fire acted as a maintenance function rather than a stand replacement function.

Precsriptions should be site specific and can be tailored to help reduce the potential of insect or disease infestation, reduce fuel loads, maintain or alter stand structure, and enhance or promote species composition.

C. Alternative Management Approaches

There are many avenues for moving the Wall ecosystem to a state that is sustainable and within its historic range of variability. These avenues vary in their risk level, effects on other resources, costs, and ecological benefits. The latter are measured in terms of contributing to the sustainability of the ecosystem. It seems prudent therefore, to try and build some methodology by which different strategies, or combinations of treatments can be evaluated for their ecological and economic costs and benefits.

One approach to this is to use the information in this report and integrate it with other resource information (i.e. hydrology, fisheries, wildlife, soils, fire, etc.) to identify management/restoration opportunities. In this process, reource concerns are identified and areas for treatment are determined by removing from consideration all areas requiring some type of resource protection, including RHCA's, old growth blocks and corridors, cultural sites, sensitive species sites, etc. By managing this information in a geographic information system (GIS), the analysis area can be readily evaluated and priorities can be set to treat areas in a way to reduce risk and maximize restoration to historic range of variability.

In the Wall Analysis area, integration occurred on three levels, subwatershed, subarea, and the entire watershed. By approaching the task of integration at varying levels, the team was able to assess the ecosystem from several different scales and hopefully gain a better understanding of the structure and function of the watershed, as well as identify areas of concern. Table 11 presents the forest vegetation information for the Wall Analysis area for each subwatershed.

Table 10. Forest Vegetation Existing Condition - Wall Analysis Area (FS Acres Only)

Subwtshd	Structural Stage	HRV (Acres)	Existing Condition Acres	Outside HRV	Examination Priorities for Treatment (Acres)		
					High	Moderate	Low
23C	N/A	0	0	*	0	0	0
24A	Late/Old	1709-2994	1196	*	1340	11	1442
	Middle	652-1308	2793	*	350	16	830
	Early/Mid	216-440	255		95	0	160
	Early	216-440	0	*	0	0	0
	Very Early	43-227	70		NA	NA	NA
24G	Late/Old	1695-2966	1612	*	172	0	1440
	Middle	638-1275	2006	*	321	0	1685
	Early/Mid	213-426	511	*	112	0	399
	Early	213-426	0	*	0	0	0
	Very Early	42-213	117		NA	NA	NA
24B	Late/Old	2526-4453	3214		1148	526	1540
	Middle	1032-2132	3158	*	1347	125	1687
	Early/Mid	333-733	96	*	0	0	96
	Early	333-733	0	*	0	0	0
	Very Early	59-435	183		NA	NA	NA
24C	Late/Old	3050-5343	3369		1538	91	1740
	Middle	1158-2325	3655	*	1878	0	1777
	Early/Mid	384-779	425		221	0	204
	Early	384-779	0	*	0	0	0
	Very Early	76-401	230		NA	NA	NA
24D	Late/Old	1019-1844	1482		676	461	344
	Middle	534-1189	1082		621	155	306

Subwtshd	Structural Stage	HRV (Acres)	Existing Condition Acres	Outside HRV	Examination Priorities for Treatment (Acres)		
					High	Moderate	Low
	Early/Mid	152-437	260		164	11	85
	Early	152-437	0	*	0	0	0
	Very Early	20-334	331		NA	NA	NA
24E	Late/Old	1446-2569	2259		1185	225	849
	Middle	638-1353	1197		347	30	820
	Early/Mid	200-477	294		27	0	267
	Early	200-477	32	*	0	0	0
	Very Early	32-315	215		NA	NA	NA
24F	Late/Old	1686-2951	1033	*	255	0	778
	Middle	632-1265	2783	*	1550	0	1233
	Early/Mid	211-422	275		115	0	160
	Early	211-422	0	*	0	0	0
	Very Early	42-211	124		NA	NA	NA
25A	Late/Old	1627-2847	1702		428	0	1274
	Middle	610-1221	2049	*	466	0	1583
	Early/Mid	204-407	169	*	55	0	114
	Early	204-407	50	*	0	0	50
	Very Early	41-204	98		NA	NA	NA
25B	Late/Old	1853-3241	572	*	263	0	309
	Middle	694-1390	3249	*	1193	0	2056
	Early/Mid	231-463	326		40	0	286
	Early	231-463	0	*	0	0	0
	Very Early	47-231	484	*	NA	NA	NA
25C	Late/Old	1037-1815	601	*	532	0	69
	Middle	389-778	1366	*	1325	0	41
	Early/Mid	130-259	579	*	433	0	146
	Early	130-259	17	*	0	0	17
	Very Early	26-130	30		NA	NA	NA

Subwtshd	Structural Stage	HRV (Acres)	Existing Condition Acres	Outside HRV	Examination Priorities for Treatment (Acres)		
					High	Moderate	Low
26A	Late/Old	1700-2976	586	*	159	0	427
	Middle	638-1276	3155	*	2484	0	671
	Early/Mid	212-426	380		299	0	81
	Early	212-426	12	*	0	0	12
	Very Early	43-212	118		NA	NA	NA
26B	Late/Old	1362-2382	128	*	128	0	0
	Middle	529-1057	2160	*	1914	3	243
	Early/Mid	179-363	852	*	852	0	0
	Early	179-363	115	*	71	0	44
	Very Early	35-174	238	*	NA	NA	NA
26C	Late/Old	2554-4599	2370	*	1327	943	100
	Middle	1493-3270	5453	*	3115	1479	859
	Early/Mid	463-1289	63	*	46	17	0
	Early	463-1289	51	*	25	4	22
	Very Early	55-910	616		NA	NA	NA
26D	Late/Old	1748-3148	1859		521	446	892
	Middle	1092-2360	3340	*	2345	572	423
	Early/Mid	371-971	268	*	110	0	158
	Early	371-971	34	*	15	2	17
	Very Early	46-583	732	*	NA	NA	NA
26F	Late/Old	959-1680	416	*	401	15	0
	Middle	363-728	1712	*	1231	3	478
	Early/Mid	120-243	135		129	0	6
	Early	120-243	0	*	0	0	0
	Very Early	23-124	150	*	NA	NA	NA

D. Recommendations, Limitations, and Concerns

-- Recommend that the warm ABGR plant association group be broken into 2 groups, warm ABGR and

PSME. This would offer a more detailed look at the differences between the 2 PAG's and provide a better analysis for those using this information on the ground.

-- Recommend that the species composition for the ponderosa pine PAG be changed from 90% to 80% canopy closure of pine and larch. We believe this will give a more accurate picture of what is actually on the ground.

-- Photo interpreted EVG data layer was only information available at time of this analysis. Incorporation of stand exam information into the EVG layer in a timely manner would portray a more accurate picture of existing condition.

-- Recommend a reevaluation of the Forest Datacell layer. Concerns have been raised by district personnel over the accuracy of this information (GIS layer doesn't match when ground truthed) and I discovered discrepancies also. Specific examples include: 1) out of a total of 422 acres of late/old lodgepole PAG, 181 acres have no lodgepole on them (43%); 2) within the late/old juniper PAG, 375 acres out of 1120 have no juniper component (33%); and 3) of 1515 acres of ponderosa pine PAG, 1350 acres have less than a 10% component of ponderosa pine (89%). I believe that these errors go well beyond the acceptable limits of inherent error.

-- The discovery of such a small component of early structure (approximately 300 acres) in comparison to the amount of very early structure (over 3000 acres) raises questions regarding 1) the accuracy of the EVG layer information and 2) regeneration success of harvested units.

-- Initially at the beginning of this analysis, it was my intention to accomplish a comparison between the EVG data layer and the PMR data layer. Due to time constraints, I was unable to meet this intention. I have professional skeptisim regarding the PMR data layer and am hesitant to utilize it until ground truthing of the data has been accomplished. It is also difficult to work with this data layer because the objectives under and for which it was derived are different from those this analysis team is working under. Direct correlation of the specific "classes" (species groups, structural classes, canopy closures, etc.) Is difficult due to these differences.

V. Literature Cited

Agee, J.K. 1990. The historical role of fire in Pacific Northwest Forests. Oregon State University Press. Corvallis, OR. p. 25-28.

Agee, J.K. 1994. Fire and weather disturbances in terrestrial ecosystems of the Eastern Cascades. USDA Forest Service, PNW Forest and Range Experiment Station. General Technical Report PNW-GTR-320.

Ager, A.A. and R. McGaughey. 1994. Operations manual for UTOOLS. USDA Forest Service, Umatilla National Forest. Pendleton, OR. misc. publication.

Anon. 1994. A federal agency guide for pilot watershed analysis. USDA Forest Service, Pacific Northwest Region, Portland, OR. Version 1.2

Arnold, J.F. 1950. Changes in ponderosa pine bunchgrass ranges in northern Arizona resulting from pine regeneration and grazing. Journal of Forestry 48:188-126.

Bahre, C.J. 1991. A legacy of change - historic human impact on vegetation of the Arizona borderlands. Tuscon, University of Arizona Press. 321 p.

Belsky, J, and D. Blumenthal. 1995. Ecological assessment of livestock grazing in forests of the western interior United States. Paper prepared for the eastside ecosystem management project (US Forest Service). Submitted April 14, 1995. The report is being condensed for submission to Conservation Biology.

Caraher, D.L., Henshaw, J., Hall, F. and others. 1992. Restoring ecosystems in the Blue Mountains - a report to the Regional Forester and the Forest Supervisors of the Blue Mountain Forests. USDA Forest Service, Pacific Northwest Region. Portland, OR.

Cooper, C.F. 1960. Changes in vegetation, structure, and growth of southwestern pine forests since white settlement. Ecol. Monog. 30(2):129-164.

Ellison, L. 1960. Influence of grazing on plant succession on rangelands. The Botanical Review V26(1). Jan-Mar. 78p.

Gast, W.R., Scott, D.W., Schmidt, C. and others. 1991. Blue Mountain forest health report: new perspecitives in forest health. USDA Forest Service, Pacific Northwest Region, Malhuer, Umatilla, and Wallowa-Whitman National Forests. Baker City, OR. 250 p.

Hall, F.C. 1993. Biophysical environments for vegetative screening. Unpublished.

Hall, F.C. 1973. Plant community types of the Blue Mountains in Eastern Oregon and Southeastern Washington. USDA Forest Service, Pacific Northwest Region, Area Guide 3-1. 62 p.

Jameson, D.A. 1968. Species interactions of growth inhibitors in native plants of northern Arizona. Forest Service Research Note RM-133. Rocky Mountain Forest and Range Experiment Station. Fort Collins, CO.

Johnson, C.G. and R.R. Clausnitzer. 1992. Plant associations of the Blue and Ochoco Mountains. USDA Forest Service, Pacific Northwest Region. Portland, OR. R6-ERW-TP-036-92. 208 p.

Johnson, C.G, Clausnitzer, R.R., Mehringer, P., and C. Oliver. 1994. Biotic and abiotic processes of eastside ecosystems: The effects of management on plants and community ecology, and on stand and landscape vegetation dynamics. USDA Forest Service, PNW Forest and Range Experiment Station. PNW-GTR-322.

Maxwell, W.G. and F.R. Ward. 1980. Photo series for quantifying natural forest residues in common vegetation types of the Pacific Northwest. USDA Forest Service, Pacific Northwest Research Station. GTR-PNW-105. 230 p.

Mutch, R.W., Arno, S.F., and J.K. Brown. 1993. Forest health in the Blue Mountains: a management strategy for fire-adapted ecosytems. USDA Forest Service, Pacific Northwest Research Station. PNW-GTR-310. 14 p.

Rietveld, W.J. 1975. Phytotoxic grass residues reduce germination and initial root growth of ponderosa pine. Forest Service Research Note RM-153. Rocky Mountain Forest and Range Experiment Station. Fort Collins, CO.

Rummel, R.S. 1951. Some effects of livestock grazing on ponderosa pine forest and range in central Washington. Ecology 32(4):594-607.

Swanson, F.J., Jones, J.A., Wallin, D.O., and J.H. Cissel. 1994. Natural variability - implications for ecosystem management. In Ecosystem Management: Principles and Applications. M.E. Jensen and P.S. Bourgeron (eds.). USDA Forest Service. PNW-GTR-318. pp. 80-94.

Shilsky, A.J. 1994. Multiscale ecosystem analysis and design in the Pacific Northwest region: the Umatilla National Forest Restoration Project. Volume II: Ecosystem Management: Principles and Applications. PNW-GTR-318. P. 254-262.

Zimmerman and L. Neuenschwander. 1984. (More complete information is unavailable at this time.)

APPENDIX

The development of a landscape structure matrix involves using data with respect to the existing species composition and stand structure that reflect the dominant vegetation on the site. For the Wall analysis, the data used were:

1. Existing vegetation layer (EVG - 1987)
2. EVG Oracle database
3. Budworm defoliation layers for 1988-1991
4. Forest datacell layer for plant community types
5. District harvest layers (1988-1995)
6. USGS digital elevation data

Data were processed and analyzed using UTOOLS software (Ager and McGaughey 1994). The following describes the analysis process.

A. Existing Structure Classification

The classification of existing vegetation into structural stages and species composition was accomplished using vegetation data derived from the 1987 photo interpretation of the forest (EVG layer). This data is contained in a polygon layer and attached Oracle attribute database. The vintage of the layer required updating to present conditions to reflect harvest activity and tree mortality from spruce budworm.

B. Paradox Queries to Analyze HRV

The main vegetation database is a Paradox UCELL database containing layers for plant community type, aspect, slope, elevation, all EVG attribute data, subwatersheds, forest boundary, UTM coordinates and post 1987 harvest activity.

1. Assign group for each plant association (i.e. P, W, C, L, J, etc.)

2. Adjust the canopy closure, species, and size for each harvest unit (See section "D" in Appendix for specifics.).

3. Create dummy fields for the different structural stages (VE, E, E/M, M, and L/O).

4. Calculate those stands in the late/old structure by doing the following query:

L1 Canopy	L1 Size	L2 Canopy	L2 Size	L3 Canopy	L3 Size	L/O
>=10, **1**	>=8					changeto **1**
<10, **2**		>=10, **3**	>=8			changeto **2+3**
<10, **4**		<10, **5**		>10, **6**	>=8	changeto **4+5+6**

#'s in **bold** are example elements

The numbers in the late/old (and other structural categories) will be the percent canopy closure in that structure for that stand.

5. Calculate those stands in the remaining structural stages using the following changes:

Middle - 6 or 7 in the size field
Early/Mid - 4 or 5 in the size field
Early - 1 or 2 or 3 in the size field

As you progress through each of these queries, each preceding structure should say "blank" in it's field. This is to prevent double counting. See below for early structure:

L1Canopy	L1 Size	L2 Canopy	L2 Size	L3Canopy	L3 Size	Early	Early/Mid	Middle	Late/old
>=10, 1	1 or 2 or 3					changeto 1	Blank	blank	blank
<10, 2		>=10, 3	1 or 2 or 3			changeto 2+3	blank	blank	blank
<10, 4		<10, 5		>10, 6	1 or 2 or 3	changeto 4+5+6	blank	blank	blank

The numbers in the size field relate to the EVG size class definitions. Ten percent canopy closure is needed to qualify as existing structure, except in the early structural stage. Following the structure queries, you need to check for and assign a structure class to pixels that were not classified by the above queries.

6. Create dummy fields "L1+L2" and "L1+L2+L3". If the values in the structural stage fields (VE, E, E/M, M, and L/O) are blank or <10, add layer 1 canopy closure and layer 2 canopy closure together and place in field "L1+L2". If the "L1+L2" field is greater that or equal to 10, assign the size class of layer 2 to the appropriate structural class (following the EVG size class definitions).

7. If the values in the structural class are all blank or less than 10, add canopy layers 1+2+3 and place in the field "L1+L2+L3". If this field is greater than 5, assign the size class of layer 3 to the appropriate structural class. If the value is less than 5, then place that value into the very early structural class. Scripts for steps 6 and 7 are below:

L1 Canopy	L2 Canopy	Early	Early/Mid	Middle	Late/Old	L1+L2
1	2	<10 or blank	<10 or blank	<10 or blank	<10 ro blank	changeto 1+2

L2 Size	L1+L2	Early	Early/Mid	Middle	Late/Old
1 or 2 or 3	>=10, 1	changeto 1			
4 or 5	>=10, 2		changeto 2		
6 or 7	>=10, 3			changeto 3	
>=8	>=10, 4				changeto 4

8. Now create one database for each structural class by checking **UTM, Exam_ID, Plant Group,** and the **Structure fields** and put **Not Blank** in the desired structure that you want. This will give you 5 structural databases (VE, E, E/M, M, and L/O).

9. Within each structural database, create the following dummy fields:
    1) Total Canopy (Cover Tree from the main vegetation database),
    2) Total * % (Total canopy times the percent of desired species mix by PAG),
    3) Species Total (Total canopy times the percent of species wanted from the species composition list,
    4) TotCan-Tot*% (Total canopy minus desired canopy species percent),
    5) Treat Prior (Examination priority for silvicultural treatment based on whether the appropriate desired species composition is present or how far it deviates from desired.).

Treatment Priorities is filled in after calculating the four previous dummy fields, scripts are below:

Plant Group	Cover Tree	Tot*%
P	1	changeto 1 * .9
L	1	changeto 1 * .9
W	1	changeto 1 * .8
C	1	changeto 1 * .2 (Early & Early/Mid) changeto 1 * .5 (Middle) changeto 1 * .8 (Late/Old)

Plant Group	PIPO*	ABGR*	PSMEG*	PIEN*	PICO*	LAOC*	Tot Spec
W	1		3			2	changeto 1+2+3
P	1					2	changeto 1+2
L					1		changeto 1
C		1	2	3			changeto 1+2+3

***These numbers are from a "cover database" calculated by Alan Ager. Be sure to get this database from his BEFORE doing harvest updates.**

Plant Group	Tot Spec	Tot*%	TotCan-Tot*%
W	1	2	Changeto 1+2
P	1	2	Changeto 1+2
L	1	2	Changeto 1+2
C	1	2	Changeto 1+2

10. Assign Treatment Priorities field:

    -Ponderosa pine, lodgepole, and warm ABGR: if TotCan-Tot*% field is
        A) >=-5, assign a "3"
        B) <-5, assign a "1"

-Cool ABGR: if TotCan-Tot*% field is

A) >=-5,<=5 assign a "3"

B) >5 assign "2"

C) <-5 assign "2"

The treatment priorities field gives you a priority for examination for treatment list for stands to move them towards the historic range of variability. Stands with priority 1 are of the highest priority and they have an inappropriate species mix for the PAG site or have the wrong plant grouping code (another alert regarding the DD layer). Cool ABGR sites dominated by fir should have received a code 2 or secondary priority. Third (3) priority stands are of the lowest priority and indicates that they have an appropriate species mix.

12. The treatment priorities field can be linked from each structural database back to the main database by creating a dummy field and doing a 'changeto' command linked through the UTM coordinates.

13. A dummy field for the spruce budworm rating should also be created in the main database. Spruce budworm calculations were accomplished by Ed Pugh and are based on the model designed by Alan Ager. Ed provided the spruce budworm database to be linked to the main database. An index of infestation was calculated from the R6 aerial survey (1989-1993) of budworm infestation. If the index score was less than 150, then these stands were assigned a priority 1 (light infestation), stands with a score 150-250 received a 2 or moderate infestation, and stands with a score greater than 250 received a priority 3 rating indicating heavy infestation.

C. Udpate for Harvest Activities

The updating of vegetation canopy and structure on areas that had received harvest treatments was performed by considering the effects of the various prescriptions on the individual layers in the harvested stands. The presence of layer-level information in the EVG database made this type of adjustment possible. The following describes how each prescription was handled.

HROS, HPRC, HRST, HRSW, HSEI prescriptions: Change the layer 1 canopy to zero. Most likely many of the larger trees were removed in this type of harvest activity.

HISM, HISS: Change layer 1 to 50% of its pre-harvest canopy closure, layer 2 to 25%. Layer 3 is unchanged. In these prescriptions, only the infected or diseased structure was removed. Without site specific information it is difficult to tell how much of the original canopy was removed and so this is a rough approximation.

HSEG, HITH: Change layer 1 and layer 2 to 50% of its pre-harvest canopy closure. Layer 3 is unchanged. Again, without site specific information it is difficult to have the exact calculation.

HSSW: Change layer 1 to 10% canopy closure. The other layers remain unchanged. It was determined that overall, many shelterwood type cuts retain approximately 10-20% canopy closure after harvest.

HCSD, HSST: Change layer 1 and layer 2 to zero, and layer 3 to 10%. All trees are generally removed in these type of harvests.