Phase I Goshawk Analysis

Draft

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Introduction

Interim direction and expert interviews both inferred that additional protection measures need to be applied to the 1997 Forest Plan revision in order to ensure northern goshawk (*Accipiter gentilis*) species viability. Nest protection and providing a balance of structural stages were key items in providing goshawk habitat. Interim direction focused on providing nest protection for active or historically active nests. It also instructed to provide for a balance of structural stages within the post-fledgling family area (PFA), which is a minimum of 420 acres in size. Expert interviews focused on providing all aspects of goshawk habitat, well distributed, across the landscape, to account for all goshawk territories, known and unknown. Interviewees felt that providing the earlier and later structural stages are the most critical. These stages would contribute to nesting habitat and provide habitat for goshawk prey species. They recommended providing a balance of structural stages for all conifer cover types across the forest. They recommended using the Reynolds, et al's Management Recommendations for the Northern Goshawk in the Southwestern United States (hereafter referred to as the Southwest Guidelines) in the interim period until better Range of Natural Variability (RNV) information could be gathered for the Black Hills.

Objectives

The objective of Phase I goshawk analysis is to apply the balance of structural stages recommended in the Southwest Guidelines on the Black Hills National Forest. The PFA balance of structural stages will apply to Alternatives 2 and 3 where active or historically active nests occur, while the foraging area balance will apply across the landscape (outside of PFA's) in Alternative 3. The foraging area balance was selected for the landscape approach since the canopy closures required in the foraging area (minimum of 40% in the mid-aged, mature, and old forest) cover some of the range of desired canopy closures that are needed for the PFA and nesting habitat. In this manner, all aspects of goshawk habitat would be provided across the landscape, particularly in areas where unrecorded nests may occur. Providing the foraging area balance at the landscape level does not preclude the need to provide a balance of structural stages for the PFA or to provide the appropriate acreage and quality of nest stands and replacement nest stands where active or historically active nests currently exist. These components of goshawk habitat would still be provided.

Of concern in applying the Southwest Guidelines to the Black Hills is that site productivity and tree physiology differences exist between the southwest and the Black Hills. This document describes how the Southwest Guidelines will be applied in the Black Hills for the Phase I Amendment, the rationale used to apply the Southwest Guidelines' vegetation structural stages (VSS) to the Black Hills, the analysis process used in order to provide the appropriate balance of structural stages by alternative, and an overview of analysis results.

Analysis results are intended for Interdisciplinary Team members to determine relative change between alternatives as compared to the Final Environmental Impact Statement (FEIS) for the 1997 Revision of the Forest Plan. It was not intended to be an ASQ analysis. Actual volumes and acres harvested will depend on site-specific conditions at the project level.

The Southwest Guidelines should be used as a reference while using this document. Page numbers of the Southwest Guidelines will be referenced for clarification purposes.

Application

All balance of structural stages will apply to ponderosa pine (*Pinus ponderosa*) cover types. White spruce (*Picea glauca*) is the only other major conifer cover type. Management restrictions in white spruce cover types for American Marten (*Martes americana*) species viability prevent treatment in some structural stages of white spruce. Existing balance of structural stages could be displayed for white spruce cover types, if necessary, but changing some of them may not be allowed during the interim period. Hardwood treatments (in aspen *[Populus tremuloides]*, paper birch *[Betula papyrifera]*, or bur oak *[Quercus macrocarpa]* stands) were considered beneficial (by the expert interviewees) for goshawk prey needs and for the inherent wildlife values to which hardwoods contribute. Therefore hardwood cover types were not considered in the balance of structural stages. Hardwood treatments and restoration measures should still occur as per Forest Plan direction.

Two levels of analysis were conducted. One was a project level analysis to be done in conjunction with the Project Sample Group analysis, and the other was a landscape level analysis.

Landscape Analysis

Alternative 1

This alternative represents the 1997 Forest Plan Revision. No balance of structural stages will apply. Analysis is applied to ponderosa pine stands within seventh level watersheds that encompass sales in the five-year action plan for the years 2001-2006. The Forest Plan disaggregated solution will be used for ponderosa pine sites to provide estimates of treatment types/acres and potential harvest volume for the area analyzed.

Alternative 2

This alternative was not analyzed on a landscape basis, as the area round each PFA is relatively small. Project Sample Group data (see below) should effectively compare results between Alternatives 1, 2, and 3.

Alternative 3

This alternative follows the foraging area balance described in the Southwest Guidelines (Reynolds, et. al., 1992, Table 1, p. 7, p. 27). This balance would consist of the following percentages in each size class/canopy closure category:

Size Class[1]	Minimum Canopy Closure %	Percent of Balance	Percent Range Applied
1	None	10	7-13
2	None	10	7-13
3	None	20	15-25
4	40	20	15-25
5	40	20	15-25
6	40	20	15-25

Plus or minus 3% variance is applied to balances of 10%, and plus or minus 5% variance is applied to balances of 20% as described by Bassett, et. al., 1994. A detailed site quality analysis was not performed; variance percents were applied arbitrarily.

Simulated treatments maintain between 40% and 70% canopy closure (Reynolds, et. al., 1992, pp. 7, 18). This will allow for some stands within the analysis area to be managed for or designated as goshawk nest stands if new territories are discovered.

This balance will be applied to ponderosa pine stands within seventh level watersheds that encompass sales in the five-year action plan for the years 2001-2006. These watersheds were selected because their size (between 5,000 and 10,000 acres) falls within the size of a goshawk territory (6000 acres) described in the Southwest Guidelines.

[1] Refer to New Tree Size Class discussion on page 7 for a description of size classes.

This balance will also be applied outside of PFA's where active or historically active goshawk nests occur.

Results of this analysis process will provide estimates of ponderosa pine potential harvest volume and treatment types/acres and for the area analyzed.

Project Sample Groups

Alternative 1

The proposed action from individual projects is included in project sample group databases. This alternative reflects applying the 1997 Revision of the Black Hills Land and Resource Management Plan.

Alternative 2

This alternative follows the PFA balance described in the Southwest Guidelines (Reynolds, et. al., 1992, Table 1, p. 7, p. 23). This balance would consist of the following percentages in each size class/canopy closure category:

Size Class[2]	Minimum Canopy Closure %	Percent of Balance	Percent Range Applied
1	None	10	7-13
2	None	10	7-13
3	None	20	15-25
4	50	13	8-18
4	60	7	2-12
5	50	20	15-25
6	50	20	15-25

Plus or minus 3% variance is applied to balances of 10%, and plus or minus 5% variance is applied to balances of 20% as described by Bassett, et. al., 1994. Size class 4 also includes a 5% variance by canopy closure requirement. A detailed site quality analysis was not performed; variance percents were applied arbitrarily.

Simulated treatments maintain between 50% or 60% and 70% canopy closure (Reynolds, et. al, 1992, pp. 7, 16). This will allow for some stands within the analysis area to be managed for or designated as goshawk nest stands.

This balance will be applied to ponderosa pine stands within a 420-acre minimum PFA for all active or historically active goshawk nests within the project sample group analysis area boundary or within ½ mile of the project sample group analysis area boundary.

[2] Refer to New Tree Size Class discussion on page 7 for a description of size classes.

Alternative 3

This alternative follows the foraging area balance described in the Southwest Guidelines. This balance would consist of the percentages listed under Landscape Analysis, Alternative 3 (described on page 4).

This balance will be applied to ponderosa pine stands within seventh level watersheds within the project sample group analysis area boundary. Seventh level watersheds were selected because their size (between 5,000 and 10,000 acres) falls within the size of a goshawk territory (6000 acres) described in the Southwest Guidelines.

Analysis Process

Structural Stage Definitions – Alternatives 2 and 3, Project Sample Group and Landscape Analyses

Rationale for Change

The following table describes habitat structural stage tree size codes and diameter ranges between Regions 2 and 3 in the Forest Service (RMRIS data dictionary, 1998):

Diameter Range (inches)	Tree Size Class	Structural Stage Tree Size Code
Region 2		
	Non-stocked	1
0-1	**E**stablished	2
1-5	**S**mall	3
5-9	**M**edium	3
9-16	**L**arge	4
16 and over	**V**ery Large	4
	Old Growth	5[3]
Region 3		
0-1	Grass/Forb/Shrub	1
1-5	Seedling/Sapling	2
5-12	Young Forest	3
12-18	Mid-Aged Forest	4
18-24	Mature Forest	5
24 and over	Old Forest	6

A direct correlation between Region 2 and Region 3's (e.g. the Southwest Guidelines) structural stage tree size code cannot be made, since the diameter ranges or structural stage tree size codes do not match. Region 2's structural stage codes are too broad and the diameters themselves too small. In addition, Region 2 structural stage tree size codes do not correlate with the reference that describes them (Buttery and Gilliam, 1993). The diameter ranges for ponderosa pine in Region 2 are more closely correlated to Buttery

[3] Old Growth is not a calculated value through the RMSTAND program. Structural stage 5 is manually input when old growth stands are inventoried and classified.

and Gilliam, with a few exceptions. Buttery and Gilliam describe the sapling-pole stage (structural stage tree size code 3) as 1-7 inches DBH, while the mature stage (structural stage tree size code 4) is described as greater than 16 inches. RMSTAND calculates structural stage 3 at 1-9 inches DBH, and structural stage 4 for anything greater than 9 inches DBH. An entire diameter range (9-16 inches), therefore, is grouped with the mature classification (4), where it is not classified according to Buttery and Gilliam. Moreover, RMSTAND uses the same structural stage calculation for all cover types. Buttery and Gilliam describe structural stages by cover type, where different diameter breaks may exist for each structural stage class by cover type.

Region 2's canopy closure breaks for the 3 and 4 structural stages (A=0-40%, B=40-70%, C=70-100%) also do not correlate to the PFA balance or nesting habitat canopy closure requirements. PFA balance of structural stage canopy closure requirements are at 50% or 60% for tree size class 4 (Reynolds, et. al., 1992, Table 1, p. 7) and are at 50% for tree size class 5 and 6 (Reynolds, et. al., 1992, Table 1, p. 7). Nesting habitat canopy closure requirements range at 50-70% and over for tree size classes 5 and 6. The foraging area canopy closure requirements (40%), however, match Region 2's B canopy closure class.

In summary, Region 2's existing structural stage definitions are not appropriate to address the needs of the northern goshawk as described in the Southwest Guidelines. The 3 and 4 classes are too broad and may not capture the larger diameter size classes needed (mid-aged, mature and old forest, Southwest Guide structural classes 4, 5, and 6) for certain components of goshawk habitat (e.g. snags, snag recruitment for prey species and for mature and old forest conditions).

New Tree Size Classes

The following table describes diameter ranges established for Phase I analysis for the Black Hills for the interim period:

Diameter Range (inches)	Tree Size Class	Tree Size Class Code
0-1	Grass/Forb/Shrub	1
1-5	Seedling/Sapling	2
5-9	Young Forest	3
9-14	Mid-Aged Forest	4
14-20	Mature Forest	5
20.0 and over	Old Forest	6

Diameter ranges were determined from Stage 1 Continuing Forest Inventory plots (FIA), on-the-ground knowledge of Black Hills tree physiology, and discussions with local silviculturists and forest wildlife biologists. FIA plots from 1984 indicated a distinct diameter break around 12 or 13 inches. Projecting approximately an inch and a half of growth occurring in 16 years, a diameter break of 14 inches was established. Literature searches of the RNV conducted during the 1997 Forest Plan Revision process indicated that 20 inches was a historical diameter break (Parrish, et al, 1996). The diameter breaks in size classes 1, 2, and 3 are widely recognized size class breaks for seedlings, saplings, and pole timber and are currently used within Region 2's tree size class scheme.

Diameter ranges need to be verified through additional research of the RNV or through the Phase II analysis process. Tree size classes were assigned to fit the whole forest, with the knowledge that they could be too small for the northern Hills and too large for the southern Hills. Timeframes for Phase I analysis did not allow for further breakdowns by site quality.

Existing Condition – Alternatives 2 and 3, Project Sample Group and Landscape Analyses

FVS Simulations

All structural stage existing condition simulations were performed through the Forest Vegetation Simulator's (FVS) front end Suppose with a time interval set from 2000 to 2010. All stand exam data was extracted in FVS ready format through the RMSTAND program. All data was extracted from the February 2000 frozen database. All existing condition simulations were performed for the data set needed for both the landscape and project sample group analysis.

A Black Hills calculated habitat structural stage (CHESS) variable was calculated from an FVS add file script (/fsfiles/office/rwsw/forestplan/id/nepa/phase_1_amend_info/gis/fw_analysis/documentation/bh_hss_revised_ellen.kcp).[4] The CHESS value consisted of a four-digit structural stage value. The first digit represents the tree size class code. The tree size class was based on the Region 2 RMSTAND source code for tree size, using the six new structural stage tree size classes instead of four Regional structural stage tree size classes. (/fsfiles/office/rwsw/forestplan/id/nepa/phase_1_amend_info/gis/fw_analysis/documentation/rmstand_source.txt)[5]. The last three digits represent total canopy closure in the stand. Canopy closure was calculated through FVS with a crown overlap equation developed by Crookston and Stage (1999).

CHESS values were field verified for accuracy in determining size class and total canopy closure. Even-aged stands are more accurately represented, since RMSTAND source code best describe structural stage definitions for even-aged stand conditions. Stands with increasing heterogeneity have a CHESS value that is based on the size class with the dominant basal area. These will generally be the larger size classes. Overall, field verification showed that size class and canopy closures were fairly accurately represented.

CHESS values for the year 2000 were used to establish the existing condition of analyzed watersheds.

Other variables were calculated along with the CHESS values. These included, but are not limited to, trees per acre, basal area per acre, and crown closure percents for each size

[4] Don Vandendriesche, an employee of the Washington Office Service Center in Ft. Collins, CO, wrote the script.

[5] The RMSTAND source code assigns a size class code based on the proportion of basal area in a particular class. The script logic is the same between Region 2 and Region 3 of the Forest Service. New tree size breaks will allow for better representation of VSS classes on the Black Hills National Forest, particularly for the mid-aged, mature, and old forests.

class and for the stand in total. These values were used for stratification and VSS class assignment described later in this document.

Stands Lacking Stand Exam Data

Where stands were lacking intensive stand exam data (approximately 17% of the analyzed stands), CHESS values were assigned from RMRIS tree size and canopy closure fields for the same sites. The following criteria and assumptions were made to assign CHESS values:

- If tree size = Non-stocked or Established, then size class code = 1.
- If tree size = Small, then size class code = 2.
- If tree size = Medium, then size class code = 3.
- If tree size = Large, then size class code = 4.
- If tree size = Very Large, then size class code = 5.

The above assignments assume that stands with the majority of trees in the 14-16 inch range (trees size L) will be assigned to size class 4 (9-14 inch DBH). It also assumes that stands with the majority of trees 16 inches and greater (tree size V) will be assigned to size class 5 (14-20 inch DBH), where some stands could have the majority of trees over 20" DBH. A conservative approach was used in class assignments.

Canopy closures were added to the size class codes to obtain the CHESS value. Where canopy closure information did not exist, a canopy closure of zero was assigned. A conservative approach was also used in canopy closure assignments.

Where no tree size information existed but habitat structural stage (HSS) information did, then the following assumptions were made:

- If HSS was 3, then size class code = 3 (assume M tree size).
- If HSS was 4, then size class code = 4 (assume L tree size).

There were no instances where HSS 1 or 2 existed without a tree size value.

Stands with Harvest Activities Performed after Stand Exam

Queries were performed from the frozen (February, 2000) RMRIS database to determine where any accomplished or contracted activities have or will occur after stand exam was performed. Harvest treatments were simulated to occur in the first year of the FVS cycle, regardless of when treatment actually occurred. This was done to avoid complications of setting different time intervals for every treatment/harvest year combination that could potentially occur; it was less time consuming to simulate all stands of the same treatment type at once than to simulate by treatment type and year.[6] Timeframes for Phase I analysis did not allow for more detailed analysis.

Stands where cover types were converted from ponderosa pine to another type were not included in the existing condition simulations.

[6] This could skew existing condition for the year 2000 if, for example, stand exam was performed in 1980 and treatment did not actually occur until 1998.

Landscape Analysis

Alternative 1

Overview

Slivers of watersheds that fell across a project boundary or across the forest boundary were not selected for analysis. Watersheds that contained approximately 25% or less intensive stand exam data were not selected for analysis. A total of 109 seventh level watersheds were analyzed.

Analysis Process

The Paradox disaggregation scripts developed for the 1997 revision were run for the above watersheds. Required information used for the run was extracted from the February 2000 frozen RMRIS database. Where cover types and structural stages were missing from the February, 2000 frozen RMRIS database, cover type and structural stages were taken from the MS Access data table described in /fsfiles/office/rwsw/forestplan/id/panels/phase_one/index/vegetation/documents/cover_type_structural_stage_update_process.doc

Alternative 3

Overview

Slivers of watersheds that fell across a project boundary or across the forest boundary were not selected for analysis. Watersheds that contained approximately 25% or less intensive stand exam data were not selected for analysis. A total of 109 watersheds were analyzed.

Analysis Process

VSS classes were assigned to individual stands based on CHESS values and cover type. VSS classes represent structural stages for foraging areas as defined by the Southwest Guidelines (see page 4). VSS classes consisted of a three-digit code. The first digit represents the size class; the second and third digits represent a canopy closure range. The following table defines the VSS codes:

VSS[7]	Cover Type	CHESS Value Range
1	Ponderosa Pine	1000.0 – 1100.99
2	Ponderosa Pine	2000.0 – 2100.99
3	Ponderosa Pine	3000.0 – 3100.99
400	Ponderosa Pine	4000.0 – 4039.99
440	Ponderosa Pine	4040.0 – 4100.99
500	Ponderosa Pine	5000.0 – 5039.99
540	Ponderosa Pine	5040.0 – 5100.99
600	Ponderosa Pine	6000.0 – 6039.99

[7] No canopy closure requirements exist in the Southwest Guidelines for VSS classes 1, 2, or 3.

VSS[7]	Cover Type	CHESS Value Range
640	Ponderosa Pine	6040.0 – 6100.99

VSS values of 400, 500, and 600 are not defined in the Southwest Guidelines. These classes currently exist on the Black Hills, and can be considered "surplus" classes as described by Long and Smith, 2000. They were also considered to contribute to other classes, depending on understory composition. For example, if a VSS class of 400 contained approximately 2000 trees per acre in the 0-1 inch diameter range, it was considered to function as a VSS 1.

Percent of VSS values by each watershed was calculated and compared to foraging area balance required in the Southwest Guidelines.

Stratification of Watersheds

All 109 watersheds presented too large a data set to be analyzed in detail during Phase I timeframes. The watersheds were stratified based on the amount of 540 and 640 classes that each watershed contained (VSS classes 540 and 640 were considered limiting factors in most of the watersheds). The following table defines the stratification criteria:

Stratum	Percent of VSS in 540 or 640
Low-none	None, 0 – 4.9
Low	5 – 14.9
Meet	15 – 24.9
Above	25 and over

Each stratum had four representative watersheds selected for detailed analysis. The four represented the highest percent of VSS 540 or 640, the lowest percent of VSS 540 or 640, the most VSS classes represented, and the least VSS classes represented. Two of the watersheds selected in the stratum named Above fell within one of the project sample groups, so they were removed from the landscape analysis. A more detailed analysis would be completed for these watersheds at the project sample group level. A total of fourteen watersheds were analyzed in detail for the landscape analysis.

Detailed Watershed Analysis

The percentage of ponderosa pine VSS classes in each of the fourteen watersheds was displayed. Any surplus that existed in a particular VSS class was redistributed to deficit VSS classes in order to move the watershed towards the desired balance. No "surplus" classes were redistributed to other classes to the point of no longer having the surplus VSS class, if that particular class possessed minimum canopy closure requirements. For example, a portion of a surplus class was retained in that class, or other classes were selected to grow into that class. In this way the surplus class was managed to move into the desired percentage range required for that particular class. This does not mean that all surplus classes were assigned to one deficit class. Surpluses were assigned to multiple deficit classes accordingly. This will allow for all classes to be maintained or developed across the watershed, and therefore, across the landscape. The desired balance would be achieved through simulating a combination of no treatments, group selections, and combinations of precommercial, POL, or commercial thinning. Stands were selected for FVS simulation purposes by examining trees or basal area per acre in each VSS class

within the stand. An example of this process is described below and is depicted in Table 1.

Table 1: Example of assigning percentages of existing VSS classes to other VSS classes for one of the watersheds analyzed in detail.

Strata	Seventh Level Watershed Number	Cover Type	VSS Class	Current Condition (percentage)	Desired Condition, VSS 1 (percentage)	Desired Condition, VSS 2 (percentage)	Desired Condition, VSS 3 (percentage)	Desired Condition, VSS 440 (percentage)	Desired Condition, VSS 540 (percentage)	Desired Condition, VSS 640 (percentage)
MEET	10120203401060	Pine	1	1.98	0	1.98	0	0	0	0
MEET	10120203401060	Pine	2	1.76	0	0	1.76	0	0	0
MEET	10120203401060	Pine	3	10.07	2.00	2.00	5.00	0	0	0
MEET	10120203401060	Pine	400	6.92	0	0	0	6.92	0	0
MEET	10120203401060	Pine	440	62.56	5.00	5.00	5.00	17.00	10.00	20.00
MEET	10120203401060	Pine	500	0.42	0	0	0	0	0.42	0
MEET	10120203401060	Pine	540	16.10	1.00	2.00	2.00	0	11.00	0
MEET	10120203401060	Pine	640	0.20	0	0	0	0	0	0.20
			Total	100.01	9.00	11.98	13.76	23.92	21.42	20.20

If a particular watershed possessed a surplus in VSS class 440 and a deficit existed in VSS class 640, a certain percentage of the surplus was designated to be treated to attain a VSS class 640. Individual stands classified as 440 within that particular watershed were examined for the proportion of basal area per acre that existed in the VSS 640 class. If a high proportion of basal area per acre was encountered in the VSS 640 class, that stand was selected for simulation with a thinning or no treatment to move it towards that class. Up to four stands were selected for simulation to move from one VSS class to another class.

Stands lacking intensive stand exam data were stratified. Stands of similar CHESS values with intensive stand exam data were substituted in FVS simulations. Substitute stands were selected from the same location as the original stand without data. If an appropriate stand did not exist within the location, a stand with the same district code number was selected. If an appropriate stand still did not exist, a stand from anywhere on the forest was selected.

Saw timber and POL volumes were calculated for each analyzed watershed based on total ponderosa pine watershed acres, the percent of ponderosa pine VSS class being treated in each watershed, and the average volume per acre generated from the FVS simulations by treatment type. All treatments that occurred during the FVS cycle from 2000 to 2010 were included in volume calculations. This was because conditions triggering treatment in the FVS event monitor could have been met at any time during the first decade or at the beginning of the second decade. In field application, stands selected for treatment could meet, or be close to meeting, thinning criteria. Actual harvests could occur any time during a 10-year period, given timing of planning, sale preparation, and actual harvest.

Extrapolating Volumes to the Forest Level

Volume per acre was calculated for each of the 14 analyzed watersheds, and then averaged by strata (Low-none, Low, Meet, and Above). Volumes for watersheds in

unanalyzed strata were determined by multiplying average analyzed strata volume per acre by unanalyzed watershed acreage by strata.

Project Sample Groups

Alternative 2

Analysis Process

VSS_PFA classes were assigned to individual stands based on CHESS values and cover type. VSS_PFA classes represented structural stages for PFA's as defined by the Southwest Guidelines (see page 5). VSS_PFA classes consisted of a three-digit code. The first digit represents the size class; the second and third digits represent a canopy closure range. The following table defines the VSS_PFA values:

VSS_PFA[8]	Cover Type	CHESS Value Range
1	Ponderosa Pine	1000.0 – 1100.99
2	Ponderosa Pine	2000.0 – 2100.99
3	Ponderosa Pine	3000.0 – 3100.99
400	Ponderosa Pine	4000.0 – 4049.99
450	Ponderosa Pine	4050.0 – 4059.99
460	Ponderosa Pine	4060.0 – 4100.99
500	Ponderosa Pine	5000.0 – 5059.99
550	Ponderosa Pine	5050.0 – 5100.99
600	Ponderosa Pine	6000.0 – 6049.99
650	Ponderosa Pine	6050.0 – 6100.99

VSS_PFA classes of 400, 500, and 600 are not defined in the Southwest Guidelines. These classes currently exist on the Black Hills, and can be considered "surplus" classes as described by Long and Smith, 2000. They were also considered to contribute to other classes, depending on understory composition. For example, if a VSS class of 400 contained approximately 2000 trees per acre in the 0-1 inch diameter range, it was considered to function as a VSS 1. This determination was made on a site-specific level.

The number of pine acres in each VSS_PFA class for each PFA in a project sample group sale was calculated. The number of pine acres needed in each VSS_PFA class for each PFA in a project sample group sale was also calculated.

A similar analysis process to the landscape analysis for Alternative 3 was used for each PFA. The main difference is that percentage of treatments was determined at the stand level within each PFA. Each stand or a percentage of a stand in the PFA was analyzed for treatment/no treatment until the desired balance was reached. An example is shown in Table 2.

The desired balance would be achieved through simulating a combination of no treatments, group selections, and combinations of precommercial, POL, or commercial thinning. Stands were selected for FVS simulation purposes by examining trees or basal

[8] No canopy closure requirements exist in the Southwest Guidelines for VSS_PFA classes 1, 2, or 3.

area per acre in each VSS class within the stand, similar to the process used in the landscape analysis for Alternative 3. The main difference is that individual stands within the PFA were then simulated to achieve desired stand conditions; no stratification (except for those stands without stand exam data) was performed.

Stands lacking intensive stand exam data were stratified. Stands of similar CHESS values with intensive stand exam data were substituted in FVS simulations. Substitute stands were selected from the same location as the original stand without data. If an appropriate stand did not exist within the location, a stand with the same district code number was selected. If an appropriate stand still did not exist, a stand from anywhere on the forest was selected.

Consultation with district specialists who served on the Interdisciplinary Team for the Project Sample Groups occurred to determine what management constraints existed (e.g. thermal cover, old growth, inoperability, etc). Stands were dropped from or added to treatment as appropriate. Project Sample Group tables were then completed.

Vegetation values for the project sample group tables were based on individual stand simulations, with no extrapolation performed.

Table 2: Example of assigning VSS_PFA percents by stand within a PFA.

Site Number	Site Acres	Current VSS_PFA	Desired Condition VSS_PFA 1 (%)	Desired Condition VSS_PFA 2 (%)	Desired Condition VSS_PFA 3 (%)	Desired Condition VSS_PFA 450 (%)	Desired Condition VSS_PFA 460 (%)	Desired Condition VSS_PFA 550 (%)	Desired Condition VSS_PFA 650 (%)	Desired Condition Acres VSS_PFA 1	Desired Condition Acres VSS_PFA 2	Desired Condition Acres VSS_PFA 3	Desired Condition Acres VSS_PFA 450	Desired Condition Acres VSS_PFA 460	Desired Condition Acres VSS_PFA 550	Desired Condition Acres VSS_PFA 650
1	83	500	0.2	0.4				0.4		16.6	33.2	0	0	0	33.2	0
2	23	450			0.7			0.3		0	0	16.1	0	0	6.9	0
3	70	460			0.3	0.3	0.4			0	0	21	21	28	0	0
4	35	450			0.3	0.7				0	0	10.5	24.5	0	0	0
5	52	460					0.4	0.3	0.3	0	0	0	0	20.8	15.6	15.6
6	24	460					0.4		0.6	0	0	0	0	9.6	0	14.4
7	93	500	0.7					0.3		65.1	0	0	0	0	27.9	0
8	70	550						1		0	0	0	0	0	70	0
9	11	550				0.5		0.5		0	0	0	5.5	0	5.5	0
10	22	460		0.3	0.3	0.4				0	6.6	6.6	8.8	0	0	0
11	67	3			1					0	0	67	0	0	0	0
12	69	650							1	0	0	0	0	0	0	69
13	62	460							1	0	0	0	0	0	0	62
14	60	2			0.6	0.4				0	0	36	24	0	0	0
15	14	2			0.6	0.4				0	0	8.4	5.6	0	0	0
16	38	450		0.5		0.5				0	19	0	19	0	0	0
Total	**793**							Total		81.7	58.8	165.6	108.4	58.4	159.1	161
							Lower Tolerance			76.92	76.92	150.67	100.42	50.26	150.67	150.67
							Acres Needed to Meet Balance			79.30	79.30	158.60	105.70	52.90	158.60	158.60
							Upper Tolerance			81.68	81.68	166.53	110.99	55.55	166.53	166.53
							Current Acreages by VSS_PFA			0	74	67	96	230	81	69
							Surplus VSS_PFA Class			500						
							Surplus Acreage			176						

Alternative 3

Analysis Process

The vegetative structural stage (VSS) assigned for the landscape analysis, Alternative 3 (see pages 4 and 11) is also used for this analysis.

The number of pine acres in each VSS class by watershed was calculated. The number of pine acres needed in each VSS by watershed class was also calculated

A similar analysis process to the Project Sample Group analysis for Alternative 2 was used for each watershed within the Project Sample Group. The main difference is that the foraging area balance of structural stages was applied instead of the PFA balance. Refer to Table 2 for an example of this process.

The desired balance would be achieved through simulating a combination of no treatments, group selections, and combinations of precommercial, POL, or commercial thinning. Stands were selected for FVS simulation purposes by examining trees or basal area per acre in each VSS class within the stand, similar to the process used in the landscape analysis for Alternative 3. The main difference is that individual stands within the watershed were then simulated to achieve desired stand conditions; no stratification (except for those stands without stand exam data) was performed.

Stands lacking intensive stand exam data were stratified. Stands of similar CHESS values with intensive stand exam data were substituted in FVS simulations. Substitute stands were selected from the same location as the original stand without data. If an appropriate stand did not exist within the location, a stand with the same district code number was selected. If an appropriate stand still did not exist, a stand from anywhere on the forest was selected.

Consultation with district specialists who served on the Interdisciplinary Team for the Project Sample Groups occurred to determine what management constraints existed (e.g. thermal cover, old growth, inoperability, etc). Stands were dropped from or added to treatment as appropriate. Project Sample Group tables were then completed.

Vegetation values for the project sample group tables were based on individual stand simulations, with no extrapolation performed.

Analysis Results

Analysis results (for both the Project Sample Groups and the landscape analysis) are intended for Interdisciplinary Team members to determine relative change between alternatives as compared to the Final Environmental Impact Statement (FEIS) for the 1997 Revision of the Forest Plan. It was not intended to be an ASQ analysis. Actual volumes and acres harvested will depend on site-specific conditions at the project level.

Landscape

Alternative 1

Potential harvest volume from ponderosa pine stands within seventh level watersheds covering sales in the five-year action plan for the years 2001-2006: 412 MMBF saw timber. No estimate of POL volume was calculated, though acreage is represented.

Potential acres of treatment:

- Commercial thin = 12,426.
- Overstory removal = 27,637.
- POL treatment = 3,046.
- Shelterwood Seed Cut = 87,447.
- Seed Tree Cut = 1,239.

Approximately 10% hardwood and 10% meadow restoration would be apportioned to watersheds included in the landscape analysis. Acres and volumes were not included in the disaggregation.

These results are intended for Interdisciplinary Team members to determine relative change between alternatives. They are not intended to be an ASQ analysis. Actual volumes and acres harvested will depend on site-specific conditions at the project level.

Alternative 3

Potential harvest volume from ponderosa pine stands within seventh level watersheds covering sales in the five-year action plan for the years 2001-2006: 301-421 MMBF saw timber and 30,979 – 43,371 CCF POL timber.

The distribution of saw timber volume was not evenly distributed across the forest. Higher saw timber volumes were projected from the northern end of the forest. Amounts and distribution of pole timber volumes were fairly evenly distributed across the forest.

Potential acres of treatment (for area producing saw timber volume):

- Group Selection = 34,674 – 48,544.
- POL/Commercial Thin =80,261 –112,365.
- Precommercial/POL/Commercial Thin = 32,185 – 45,058.

Potential acres of treatment (for area producing POL volume):

- Group Selection = 21,401 – 29,962.
- POL/Commercial Thin =46,424 – 64,993.
- Precommercial/POL/Commercial Thin = 59,179 – 82,851.

Total acres of treatment producing saw timber and POL volume are not additive; acres producing saw timber volume may overlap with acres producing POL volume.

Restoration treatments will occur as prescribed (approximately 10% hardwood and 10% meadow restoration apportioned to watersheds included in the landscape analysis).

These results are intended for Interdisciplinary Team members to determine relative change between alternatives. They are not intended to be an ASQ analysis. Actual volumes and acres harvested will depend on site-specific conditions at the project level.

Discussion

Acreages and volumes represent a 30-50% reduction from the total potential that could be performed in order to attain the balance of structural stages. Simulations for the

landscape analysis were unconstrained; they did not take into account management restrictions that could occur at the project level. Several factors were analyzed to determine the percent reduction applied. These included:

1. Management Area. Certain management areas were considered to have goals, objectives, standards, or guidelines that may restrict the amount of area harvested. These included 1.1A, 3.1, 3.2A, 3.32, 3.7, 4.2A, 5.3B, 5.4, 5.4A. Management Area 5.4 had the biggest effect due to thermal cover requirements.
2. Suitability. The proportion of suitable area within the analyzed watersheds was evaluated. Stands with timber component codes of 310 and 700 (RMRIS data dictionary, 1998) and higher were considered ineligible for commercial timber harvest.
3. Timing (see discussion below). A reduction was applied to group selections to account for timing.
4. Economics and Project Level Implementation. Site-specific conditions at the project level may limit economic viability of certain prescriptions due to accessibility, logging method, or other considerations. Reductions were applied to account for project level implementation.

Management Area and suitability constraints were evaluated at the watershed level. Percent reductions were applied by watershed, as applicable. A 50% reduction was applied to group selections. An additional 15-20% reduction was applied for project implementation concerns.

SPECTRUM or other time management software was not used for this analysis. Timing of treatments becomes extremely critical when managing for a balance of structural stages, given that certain structural stages will grow to the next stage within 10-30 years (1, 2, or 3), while other structural stages (4, 5, or 6) may take 40-150 years to move to the next stage, depending on site conditions at the stand level. Additional research would be necessary to determine where the thresholds exist for attaining different size classes by site index. The earlier stages, therefore, must constantly be recruited while not causing a decline in the later structural stages (which are believed to be more limiting in the Black Hills). In addition, care should be taken not to perform all the group selections at one entry to obtain the earlier structural stages. This would cause a “glut” of volume in the first decade. This could also set back the amount of later structural stages that are needed. Project level decisions would need to account for how quickly the balance of structural stages could be achieved, particular for attaining the 1, 2 and 3 classes. For example, only a certain percentage of the total amount of group selections needed for a particular watershed may need to be treated during one analysis period. Another option would be to stagger entry periods for watersheds across the forest, or stagger entries within the watersheds themselves. These options would improve the even-flow situation, but at a cost of achieving a balance of structural stages sooner.

Timing of treatments also becomes critical when managing for particular canopy closure requirements in the 4, 5, and 6 VSS classes. Although simulations were designed to maintain between 40 and 70% canopy closure for the foraging area balance and between 50 or 60 and 70% canopy closure for the PFA balance, all stands on the higher range of

canopy closures for each particular balance should not be treated at the same time, or in some cases, proposed for treatment at all. The potential for having all stands on the lower end of the canopy closure range could then exist. Any resulting deficit in the higher canopy closure range would not provide the appropriate conditions for nesting habitat or for fledgling or nestling protection for any potential unrecorded territories. In addition, higher canopy closures may be necessary to meet the needs of species other than the goshawk or its prey. Options for achieving the balance of structural stages for these particular types of stands would be the same as for applying group selections.

The Southwest Guidelines refer to using irregular group shelterwood, shelterwood with reserves, and group selection as regeneration methods. The created opening maximum size (2 acres in the PFA and 4 acres in the foraging area, Reynolds, et. al, 1992, pp. 24, 26) would hold true for all these regeneration methods. In regeneration openings of this size, the overstory removal to occur after shelterwood with reserves or irregular group shelterwood may conflict with leaving the desired number of replacement trees per acre (3-5). The removal option may not be economical due to the small scale of the operation. These regeneration methods can be performed at the project level, but simulations were conducted as group selections, since this regeneration method seems to most fit the intent of the Southwest Guidelines. Project level analysis and field application will dictate the most appropriate regeneration method to apply.

Group selections in this analysis do have the appearance of being overstory removals, as larger diameter classes were simulated for removal depending on understory tree size class. Due to the small scale of these treatments, they were referred to as group selections. In situations where a VSS 1 would need to be attained, group selection would probably be the most logical choice of regeneration method (see discussion in above paragraph).

Project Sample Groups

Results can be found in project sample group databases.

District consultation for the project sample group sales occurred to verify the feasibility of proposed prescriptions. The project sample group analyses for Alternatives 2 and 3 are refined enough to account for management limitations; no additional reductions in treatment acres or volume produced were applied as for the landscape analysis, Alternative 3. Timing considerations (particularly for group selections) described under the landscape results, Alternative 3, however, would still need to be considered during project implementation of these sales.

Post treatment structural stage information in project sample group databases may not incorporate some of the group selections that were performed for the PFA balance. This is because treatments were applied to a percentage of a stand. The structural stage represented by the treatment applied to the majority of the stand was entered as the post treatment structural stage. In many cases, structural stages 1, 2 and 3 may be under represented in the project sample group data. These structural stages would be inclusions in larger stands.

Habitat structural stage in the project sample group tables reflects Regional structural stage definitions, with the exception of structural stages 1 and 2. Since the 0-.9 inch

DBH range was coded as structural stage 1 in the new tree size classes, it was difficult to determine what proportion of this class was actually in Regional structural stage 2. Therefore, the project sample group tables overestimate the amount of structural stage 1 and underestimate the amount of structural stage 2.

Acreages of selection treatments performed to attain the balance of structural stages in the PFA reflect entire stand acreages. Approximately 10-50% of total stand acreage in these stands was actually simulated with group selections.

Alternative 2

In general, most treatments projected in PFA's were split between adding group selections and pushing a certain VSS class to a larger class. Many of these treatments occurred within the same stand.

Nest

Nest timber sale did not contain any goshawk nests, so the PFA balance did not apply. There was no effect to this sale.

Bullock

Approximately 20% of the stands proposed for treatment in the PFA were simulated for treatment to occur in the first decade. An additional 20% of stands proposed for treatment were not simulated in the first decade, but treatment was triggered during later FVS cycles based on event monitor criteria. Treatments proposed for the remainder of the stands could not be simulated due to management constraints (e.g., sensitive species protection, old growth, inoperability, winter range thermal cover, etc.).

Cub

Approximately 39% of the stands proposed for treatment in the PFA were simulated for treatment in the first decade. Treatments proposed for the remainder of the stands could not be simulated due to management constraints (e.g., sensitive species protection, old growth, inoperability, winter range thermal cover, etc.).

Hanna

Approximately 17% of the stands proposed for treatment in the PFA will be simulated for treatment in the first decade. An additional 31% of stands proposed for treatment were not simulated in the first decade, but treatment was triggered during later FVS cycles based on event monitor criteria. Treatments proposed for the remainder of the stands could not be simulated due to management constraints (e.g., sensitive species protection, old growth, inoperability, winter range thermal cover, etc.).

Six percent of stands proposed for treatment were uneconomical for commercial harvest. Prescriptions for these stands were changed to noncommercial treatments.

Hanna timber sale is a unique case. It covers several watersheds. There are also several other analysis areas that fall within those watersheds. Some of these areas are currently proposed for treatments within active timber sales. Many of these treatments were not yet entered into the frozen database. Therefore, the existing condition CHESS values may be inaccurate. This then affected proposed treatments within the PFA. When this sale will be retrofit or reanalyzed, existing condition data should be better adjusted for active timber sales.

Alternative 3

Treatments in Alternative 3 for the project sample group can be considered a cursory NFMA analysis. While other management limitations were taken into account, these sales would need a full-scale reanalysis at the project level if Alternative 3 is selected as the preferred alternative. This alternative changes the purpose and need for all project sample group sales.

Assigning treatments to provide the foraging area balance of structural stages at the Project Sample Group level were done independently of where actual goshawk nests occurred. During district consultation, nest stands, alternate nest stands, and PFA's were taken into consideration.

Stands that dropped from treatment were due to other management constraints (e.g., sensitive species protection, old growth, inoperability, winter range thermal cover, economics).

Nest

No major effect. As many pine stands needed to be added to treatment as were dropped or changed in order to maintain the balance of structural stages. In addition, many of the stands originally proposed for treatment were in cover types other than ponderosa pine. While some of the treatments in white spruce stands were dropped due to marten concerns, many of the treatments (restoration treatments) in other cover types would still be performed.

Bullock

The majority of treatments are precommercial and POL treatments in order to achieve the balance of structural stages. During analysis, if any POL stand proposed for treatment would result in less than 100 cubic feet of volume per acre, the commercial treatment was dropped from consideration due to economic concerns. This treatment changed to a precommercial/POL thin of the 0-9 inch diameter range. This treatment could then be performed under a service contract.

Commercial volume is minimal. Commercial volume was reduced because, in general, this sale area lacked larger diameter trees in the 5 and 6 tree size codes. What trees existed in the larger size classes needed to be deferred from treatment in order to retain them on site.

Bullock had a surplus of stands in the VSS 400 class. Many of these stands were deferred in order to move them into the 540 and 640 VSS class.

Bullock had a surplus of stands in the 540 VSS class. Stands in this class were simulated to maintain the 540 class, were simulated to attain the 640 class, or were simulated with group selections in order to attain the 1, 2, or 3 classes.

The majority of the cover types were ponderosa pine, so there were limited options for treatments in other cover types.

Cub

No major effect. About as many stands needed to be added to treatment as were dropped or changed in order to maintain the balance of structural stages. Many of the overstory removals and seed tree cuts were changed to group selections. Treatments in cover types other than ponderosa pine (e.g. hardwood release) were not affected.

Hanna

The majority of treatments originally proposed in Hanna were restoration treatments. Alternative 3 increased the amount of treatments in pine stands in order to achieve the balance of structural stages. The maximum amount of treatment was not attained due to other management constraints, which included economic viability due to low volume output, forage/cover ratios for big game, and the status of active timber sales currently within the analysis area. In addition, some pine stands are mixed white spruce/pine stands. Simulations included in this analysis treated all conifer species; simulations in mixed stands were not designed to maintain a minimum of 30% of the basal area of pine stands in white spruce. These stands may have been deferred to maintain stands with high potential for marten occupancy or for marten travel corridors.

The existing condition and treatment discussion under Project Sample Group, Alternative 2 for Hanna also applies to this sale in Alternative 3.

Analysis Limitations, Analysis Notes, Research Needed, and Field Application Notes

New Tree Size Classes

Tree size classes need to be validated through further research of RNV diameter classes for the Black Hills. Further research or Phase II analysis may determine that different tree size classes may be needed for the southern and northern Hills based on site quality differences; the northern Hills has higher site quality while the southern Hills has lower site quality. Lower diameter ranges may be needed for the southern Hills and higher diameter ranges may be needed for the northern Hills. There may be instances in the southern Hills, or on poor quality sites throughout the forest, where mature and/or old size classes may not be attainable.

On the contrary, larger watersheds (representing larger goshawk territories) could be used in the southern Hills to compensate for more open forest conditions.

Tree size breaks used in this analysis process were developed specifically for northern goshawk and its prey. These tree size breaks may not be appropriate for other wildlife species.

Non-Forest Service Ownership

Phase I analysis did not take non-Forest Service ownerships into account. The Black Hills National Forest contains several interspersed inholdings of other ownerships, as well as other ownerships beyond the Forest boundary. These lands would contribute to the balance of structural stages (both for the PFA and foraging area). Other ownerships should be taken into consideration during the Phase II Amendment process.

FVS Simulations and Field Application

Simulation Descriptions

Time intervals for simulations started in the year 2000 and ran between 100 and 200 years, depending on treatment type.

Some adjustments to add files were made in FVS parameters to account for differences in site quality across the forest.

If a treatment occurred since stand exam was performed, that treatment was simulated the year after stand exam was completed (using the same process followed under the Existing Condition-Alternatives 2 and 3, Project Sample Group and Landscape Analyses section). Specific treatments needed to provide the appropriate balance of structural stages were scheduled as described below.

Thinning regimes simulated in this analysis represent thinning from below. In general, treatments moving one size class to larger size classes were treated with precommercial and POL thinning at the first entry, as described by Lilieholm, Long, and Patla, 1994. Later precommercial, POL, and commercial thinnings were triggered by basal area breaks that corresponded to canopy closure breaks in the event monitor. For the foraging area, 40% canopy closure was maintained at approximately 70 basal area per acre. For the PFA, 80 basal area per acre represented 50% canopy closure while 90 basal area per acre represented 60% canopy closure. One hundred-twenty to 140 basal area per acre represented 70% canopy closure. In general, cutting cycles for pushing one class to the next were between 20 and 50-year intervals.

Maintaining a certain VSS class (e.g. keeping a 440 at a 440) involved retaining four trees per acre (average of three to five trees per acre described in Reynolds, et. al, 1992, pp. 24, 28) from the mature and old forest (5 or 6) classes, or from the largest diameter class available. All diameter classes up to the maximum diameter of the class being maintained (e.g. 14 inches for the 440 class) were then thinned to attain the canopy closures described above. Stands in VSS 640 were selected for maintenance treatments during this analysis. Event monitor criteria used for simulations, however, did not select these stands for treatment during the beginning FVS cycle (2000-2010). In general, cutting cycles for maintenance treatments ran from 10-40 year intervals.

Clear-cutting was used to simulate group selections. The minimum diameter specified for removal was the maximum diameter of the class being maintained. For example, if a VSS class 2 was the objective of group selection, the minimum diameter to remove was 5 inches. Four trees per acre (average of three to five trees per acre described in Reynolds, et. al, 1992, pp. 24, 28) in the mature and old size classes (5 or 6) or from the largest diameter class available were selected for retention. Group selections were scheduled to occur during the first two FVS cycles starting in the year 2000. Precommercial thinning of regeneration was scheduled to occur three cycles after group selections were performed in order to retain these classes for a slightly longer time period. In many cases, the VSS 2 class grew into the next class within between 1 and 20 years.

Natural pine regeneration was projected to occur with most simulated treatments. Densities varied according to prescription applied. For example, high densities of regeneration were implemented for group selections, while lower densities were implemented for thinning regimes.

FVS Limitations

Simulations in FVS do not account for between stand interactions. It will simulate individual stand growth and yield.

Stratification is a "generalization" of actual ground conditions. Analysis can be less accurate with the use of stratification.

This model is based on stage II data. Sampling design could vary across, and therefore by, project sample group and within and between watersheds.

Depending on stand typing, stand variation could alter the representation of CHESS values for a particular stand. This could magnify itself during an FVS projection, particularly if stratification is used.

Calculated CHESS values are only as good as the stand delineations that derived them. The more homogenous and even-aged the stand, the more accurately the CHESS value represents the structural stage of that stand.

Spatial distribution of VSS classes is important when providing the balance of structural stages. A very cursory review of spatial distribution was performed during this analysis. Site-specific or project level analysis should account for all VSS classes well distributed across the landscape.

Timing considerations need to be addressed as discussed under results for the landscape analysis, Alternative 3. Additional research would be necessary to determine where the thresholds exist for attaining different size classes by site index.

Some treatments were inadvertently staggered in the simulation process over the first three decades of treatment due to an error in coding that was discovered late in the analysis process. This error consisted of applying treatments based on stand inventory year. Suppose would have automatically applied treatments based on the time scale selected (starting in the year 2000), so stand inventory year adjustments did not need to be made. This error results in slightly less volume produced in the first decade. However, this same error would have addressed some of the even-flow problems discussed under the results for the landscape analysis, Alternative 3.

Field Application

All simulated treatments were designed to mimic treatments described in the Southwest Guidelines. In application, the Southwest Guidelines should be used as the guiding document in applying treatments to PFA's or to foraging areas; simulations were used, and can be used, to approximate those treatments at the project level. For example, in field application, group selections (created openings) performed to maintain the foraging area balance should be no larger than four acres in size (Reynolds, et. al, 1992, p. 26). In the PFA, group selections (created openings) should be no larger than two acres in size (Reynolds, et. al, 1992, p. 24). In addition, the Southwest Guidelines also recommend that 3-5 mature and old trees (size class 5 and 6) need to be maintained for snag recruitment in all treatment types (Reynolds, et. al, 1992, pp. 24, 28).

Additional management recommendations listed in the Southwest Guidelines, including, but not limited to, prescribed fire, down woody material, snags, road densities, and livestock management are also included within the Southwest Guidelines (Reynolds, et. al, 1992, pp. 21-30). These recommendations may be included as standards and guidelines in the Phase I Amendment as necessary. Results of the expert interviews will determine which management recommendations in the Southwest Guidelines will be

incorporated. Review of the standards and guidelines for the National Forests in the southwestern United States will also be reviewed as part of the Phase I Amendment process.

The prescribed burning and thinning from below (primarily in VSS classes 1, 2 and 3) recommendations listed in the Southwest Guidelines are compatible with fire protection and urban interface goals. Many of the recommendations in the Southwest Guidelines encourage open understory conditions and repeated prescribed burning to attain management goals. These efforts could be conducted around private inholdings, particularly where structures exist, to reduce fire hazards.

Thinning in VSS classes 1, 2, and 3 also provides potential for service contracts and pole timber harvest. Additional pole timber markets have potential for development.

Thinning regimes in the lower VSS classes (1, 2, and 3) should thin from below with non-uniform spacing to promote vigorous tree growth, crown development, and herb and/or shrub development. Treatments should allow for irregular spacing of trees in the three older VSS classes to allow stand densities to increase. (Reynolds, et. al., 1992, Table 2, p. 7, pp. 24, 28)

Field application of the Southwest Guidelines will mean much more intensive on-the-ground management than what has been done in the past.

Project level analysis should take site productivity into account. The larger VSS classes should be attainable on higher sites and stands should be considered to move towards these classes on these sites.

Forest Plan (1997 Revision) standards and guidelines were designed primarily around even-aged (shelterwood) silvicultural systems. Managing for the foraging area balance of structural stages across the forest is compatible with providing landscape attributes, such as snags, live tree snag recruitment, old growth, and vertical diversity.

Attaining regeneration is crucial to ensuring that all structural stages are attained through time. This would imply that some reforestation measures may be needed to gain regeneration after each entry, particularly on the Bearlodge District and on the limestone plateau, where sod formation, hardwood stimulation, or other factors limit the amount of natural pine regeneration. Reforestation should be considered particularly for group selections to attain the 1 and 2 VSS classes.

Jasper Fire

The Jasper Fire occurred well after this analysis process was underway. All stand exam data used represents pre-burn conditions. Timeframes for Phase I analysis did not allow for reassessment with post-burn data. Separate future analyses will analyze the Jasper Fire and any related proposed actions.

Settlement

The Settlement of September 5, 2000, was not taken into account in the landscape analysis. The settlement was not finalized until late in the analysis process, so agreement information could not be incorporated. Project level watershed analysis should incorporate the final Settlement agreement.

Output

All related data files and documentation can be found in /fsfiles/office/rwsw/forestplan/id/nepa/phase_1_amend_info/gis/base, analysis, fw_analysis, fw_analysis2, and fw_analysis3 and their subdirectories.

Additional documentation and data files can be found in /fsfiles/office/rwsw/forestplan/id/nepa/phase_1_amend_info/psg and it's subdirectories and /fsfiles/office/rwsw/forestplan/id/panels/phase_one/index/vegetation and it's subdirectories.

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