APPENDIX I
Vegetation Treatments and Timber Harvest as a Tool

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Appendix I - Vegetation Treatments and Timber Harvest Modeling

INTRODUCTION

Under the Proposed Land Management Plan (the Plan), the vegetation management strategy for the Kootenai Idaho Panhandle Plan Revision Zone (KIPZ) is to move toward the desired condition for vegetation, which is defined as Class A of the Range of Variability. Appendix B of this document describes the process in determining the range of variability and the vegetative desired conditions. Assessments of current vegetation composition and structure have revealed that the Zone has too many acres of the medium size class range and also contains reduced levels of small and large size classes (refer to Table I-1 for a description of the size classes).

In order to achieve the vegetation desired condition proposed in the Plan, some of the medium size class should be converted to seedling/sapling and some managed to provide for future old growth. Moreover, some species are at reduced levels from those found historically, including ponderosa pine and white pine; therefore, type conversion of regenerated stands would increase composition of these (and other) species. Management that progresses to the vegetation desired condition will also provide conditions that are more compatible with historic fire levels.

The vegetation treatment modeling for the Proposed Land Management Plan was accomplished using the following suite of tools and models:

Geographic Information System (GIS) – This tool was used to compile vegetation and other data, stratify the land, and summarize conditions. GIS is both an analysis and a display technology, meaning it can be used to both track information and display it in a variety of graphic formats.

SIMulating Patterns and Processes at Landscape scaLEs (SIMPPLLE) - This model was used to provide a means of understanding succession and disturbance activities and to summarize fire behavior.

Forest Vegetation Simulation (FVS) – This forest growth simulation model was used to estimate timber growth and yield.

Spectrum – This model was used to project alternative resource management scenarios and schedule vegetation treatments in response to vegetative desired conditions.

Individual descriptions for each of the above-mentioned tools/models are provided below.

GEOGRAPHIC INFORMATION SYSTEM (GIS)

Many summaries and assessments of vegetation condition were developed using GIS. This tool was also used to build the acres summaries needed for Spectrum analysis areas and spatial data for the SIMPPLLE model. The existing vegetation information used in completing the SIMPPLLE and Spectrum analysis was generated from the Vegetation Mapping Project (VMap) layer that was developed in 2004. The VMap layer was appended with activity data from the Timber Stand Management Record System (TSMRS), recent wild fires, old growth, and vegetation response units (VRUs). The resulting coverage of existing vegetation was utilized in

various models for the Proposed Land Management Plan. Refer to Appendix G for a description of this layer.

SIMPPLLE

SIMPPLLE (**SIM**ulating **P**atterns and **P**rocesses at **L**andscape sca**LE**s) is a model that simulates changes in vegetation on landscapes in response to both natural disturbances and management activities. This model was used to determine the amount of fire disturbance that could be expected on the landscape.

Successional pathways were edited for each Forest using the Westside Region One zone as a base (this zone was already developed in SIMPPLLE, based on input from several forest and district silviculturists. See documentation at http://www.fs.fed.us/rm/missoula/4151/SIMPPLLE/ for more information). Disturbance pathways were those in the Westside Region One zone. A SIMPPLLE area file was built for each Geographic Area (GA) on the Forest. The existing vegetation layer was the primary data used in describing the landscape to the model, along with information on insect and disease disturbances, owner, and management area.

Simulations using current fire suppression were run for each GA. Twenty simulations for five decades were made to estimate the amount of acres with fire disturbance. The resulting amount of acres burned is an average of all simulations and decades by species and size class and was used as input to the Spectrum model.

FOREST VEGETATION SIMULATOR (FVS)

Growth and yield tables for the Plan were developed using the Forest Vegetation Simulator (FVS). FVS is a family of forest growth simulation models. The basic FVS model structure has been calibrated to unique geographic areas to produce individual FVS variants. Since its initial development in 1973, it has become a system of highly integrated analytical tools. These tools are based upon a body of scientific knowledge developed from decades of natural resources research. The use of FVS on the KIPZ and the timber prescriptions are documented in the report *Construction of Vegetative Yield Profiles for Forest Plan Revision*, April 2005, by Don Vandendriesche, USDA Forest Service, Forest Management Service Center. The resulting yield tables were used in modeling timber harvest levels in the Spectrum model.

SPECTRUM

Vegetation treatments were modeled using Spectrum, a software modeling system designed to assist decision makers in exploring and evaluating multiple resource management choices and objectives. Models constructed with Spectrum apply management actions to landscapes through a time horizon and display resulting outcomes. Management actions are selected to achieve desired goals while complying with all identified management objectives.

Spectrum's makes it possible to display management actions to landscapes at multiple spatial and temporal scales. It is very effective for modeling alternative resource management scenarios in support of strategic and tactical planning. Examples of this include scheduling vegetation manipulation activities to achieve desired conditions; modeling resource effects and interactions within management scenarios; exploring "tradeoffs" between alternative management scenarios; and analyzing minimum habitat requirements to ensure species viability and diversity.

With regard to the Proposed Land Management Plan, Spectrum was used to model vegetation treatments in the KIPZ. Based upon these results, the KIPZ Team was able to establish a means of achieving the desired future condition for vegetation in conjunction with a schedule of activities. Specifically, the Spectrum model was formulated to provide answers to the following questions:

1. What are the vegetative treatments and how should they be scheduled to move us toward the desired condition for vegetation?
2. What is the sustainable level of harvest (both regulated and unregulated) from these treatments?
3. How can we reduce fire hazard?
4. What is the level of vegetative treatments, with and without budget limitations?
5. What is the Long-Term Sustained Yield Capacity (LTSYC)? What is the Timber Sale Program Quantity (TSPQ)? What is the regulated volume anticipated for offer?

The process was initiated by the development of two separate models for each Forest. The first model was developed for the 1987 Forest Plan as Amended and the second for the Proposed Land Management Plan. Modeling for the 1987 Forest Plan as Amended was conducted in order to establish a baseline for comparison and to help calibrate the model based on current management. Modeling of the 1987 Forest Plan as Amended incorporated management decisions from the 1987 Forest Plans (as amended), with updated data.

To develop a range of management scenarios for the Plan, this model was run twice. The objective of the first run (Run 1) was to move toward the desired condition for vegetation as quickly as possible. The second run (Run 2) was made using the objective to maximize timber harvest levels in the first decade and then to move toward the desired condition as quickly as possible. The 1987 Forest Plan as Amended was only run once, with the objective to maximize timber harvest levels in the first decade and then to maximize present net value.

The following text provides a description of the components that make up the Spectrum model.

Planning Horizon

Spectrum was used to schedule vegetation treatments for the next 25 decades. This extended planning horizon assures a sustainable yield into the future.

Land Stratification and Analysis Units

Land stratification is the process of identifying a set of attributes, or strata, to use in defining the land base. This is done to organize the forest land base into logical subunits that respond similarly to management actions. In Spectrum, each stratum is a layer and combining these layers results in an “analysis area.” Six layers of information are used to describe analysis areas and while analysis areas are usually homogenous, they are not always contiguous. The attributes used in developing analysis areas are based on the issues to be addressed by the model, differences in resource response, and the reliability of the data.

The six Spectrum land stratification layers identified for the Proposed Land Management Plan were defined as follows:

Layer 1 – Roadless Status

Layer 2 – Management Area/Suitability Group

Layer 3 – Watershed Condition
Layer 4 – Wildlife Condition
Layer 5 – Cover Type
Layer 6 – Size Class

Table I-1 defines the classification for each layer, listing the layer's code, a description, and the one letter code for the analysis area. Analysis areas were developed by combining the six layers in GIS and calculating the amount of acreage for each combination that was present. Activities and outputs that are associated with analysis areas are on a per acre basis.

Table I-1 Spectrum Land Stratification

Layer 1 – Roadless Status	Layer 1 Description	Code in Analysis Area
ira	Inventoried Roadless Area	I
noira	Not Inventoried Roadless Area	N
Layer 2 – Management Area/Suitability Group	**Layer 2 Description**	**Code in Analysis Area**
NSuitN	Not Suitable – No mgmt MAs 1a, 1b, 1c, 3a, 4a, 4b, and All not suitable lands	N
NSuitL	Not Suitable – Some mgmt Other Lands (suitable for timber harvest, but not suitable for timber production) and MAs 2a, 2b, 5a, 5b or 7 or MA6 (with Other lands)	O
SuitM	Suitable – Moderate level of timber management – This layer is only in 1987 Forest Plan as Amended model and defined by the 1987 Forest Plan MAs: IPNF – 1987 Forest Plan MAs 2, 3, 7, 19 KNF – 1987 Forest Plan MAs 3, 5, 14, 17, 18	M
SuitH	Suitable – Timber management Lands suitable for timber production in MA 6 and 3b	H
Layer 3 – Watershed Condition	**Layer 3 Description**	**Code in Analysis Area**
pfcwtr	IPNF – Properly Functioning watershed condition KNF – Condition Class I	P
farwtr	IPNF – Functioning At Risk watershed condition KNF – Condition Class II	F
npfwtr	IPNF – Not Properly Functioning watershed condition KNF – Condition Class III	N
nocond	No Watershed Condition determination	X
Layer 4 – Wildlife Condition	**Layer 4 Description**	**Code in Analysis Area**
bmucmu	Bear or caribou management unit outside griz core (griz core is unsuitable)	B
wntrng	Winter range outside of bmu or cmu	W
lynxhb	Lynx habitat outside bmu or cmu and outside winter range	L
nowldl	No bear, caribou, or lynx requirements	N
Layer 5 – Cover Type	**Layer 5 Description**	**Code in Analysis Area**
DFwet	Douglas-fir – moist habitat type	D
DFPP	Douglas-fir/ponderosa pine mix	P
LP	Lodgepole Pine	C
GFmix	Grand fir/western redcedar/western hemlock/ white pine	G
Larch	Western larch	L

SFmix	Engelmann spruce/subalpine fir/mountain hemlock	S
Layer 6 – Size Class	**Layer 6 Description**	**Code in Analysis Area**
seedsp	Seedling/Sapling (0” to 5”)	E
small	Small (5” – 10”)	S
medium	Medium (10” – 15”)	M
large	Large (15” – 20”)	L
vlarge	Very Large (20”+)	V

Layer 1 Roadless Status was developed using the most recent forest IRA (Inventoried Roadless Area) layer, as documented in the Analysis of the Management Situation (AMS) for the Proposed Land Management Plan.

Layer 2 Management Area and Suitability was developed from a combination of timber suitability and management areas for the 1987 Forest Plans as Amended and the Proposed Land Management Plans. To model the 1987 Forest Plan as Amended, timber suitability was updated using current data and handbook direction (FSH 1909.12, 60). Timber suitability decisions based on management areas was retained for the 1987 Forest Plan as Amended. Management areas from the 1987 Forest Plans were cross-walked to the new management areas for the Proposed Land Management Plan. Timber suitability in combination with management area than determined the Layer 2 classification, as defined in Table I-1. See the Timber section of Chapter 2 of the CER for more information on timber suitability.

Layer 3 – Watershed Condition is the current condition for watersheds. It is based on a variety of physical measures that reflect the inherent sensitivity and resiliency of each watershed, combined with measures that are based on human-caused disturbance histories. This particular analysis is documented in the Watersheds and Aquatic Species section of Chapter 2 and Appendix H.

Layer 4 – Wildlife Condition reflects areas with special management concerns for wildlife. It includes grizzly bear management units outside of core (because core grizzly bear areas are not suitable for timber production), big game winter range, or lynx habitat.

Layer 5 – Cover Type is from the existing vegetation layer, collapsed to the cover types used in the Spectrum model. Cover types for the model were chosen based on classifications used in the vegetation desired condition and for differences in growth and response to management. See Appendix G for more information on the existing vegetation layer.

Layer 6 - Size Class is from the existing vegetation layer. Size classes for the model were chosen based on classifications used in the vegetation desired condition, existing volume, and growth. See Appendix G for more information on the existing vegetation layer.

Management Actions

Silvicultural prescriptions were defined by cover type and other resource conditions. Table I-2 describes the silvicultural prescriptions by cover type. These defined the analysis area management prescriptions. Silvicultural prescriptions were developed to manage vegetation towards desired condition. See the report *Construction of Vegetative Yield Profiles for Forest Plan Revision*, by Don Vandendriesche, for further information on the silvicultural prescriptions.

Table I-2 Silvicultural Prescriptions by Cover Type

Cover Type (Layer 5)	No Mgmt[1]	Regen[2]	ITS[3]	GS[4]	PB[5]	Nat Disturb[6]
DFPP	yes	yes	yes	yes	yes	yes
DFwet	yes	yes	no	yes	yes	yes
LP	yes	yes	no	no	no	yes
Larch	yes	yes	no	yes	yes	yes
GFmix	yes	yes	no	no	no	yes
SFmix	yes	yes	no	yes	no	yes

[1]**No Mgmt** - No management. All analysis areas were given the option of no management.
[2]**Regen** – Even-aged regeneration harvest with reserves (includes clearcut, seedtree and shelterwood with reserves). Includes commercial thinning where appropriate.
[3]**ITS** - Individual Tree Selection
[4]**GS** - Group Selection
[5]**PB** - Prescribed Fire
[6]**Nat Disturb**: Stand replacing fire

As described earlier, natural disturbance amounts were determined by the SIMPPLLE model. Acreages for each decade were input by the desired condition class.

The use of silvicultural prescriptions was also defined by Layer 2 (management area/suitability groups) of the Spectrum model land stratification (refer to Table I-2) as follows:

- *SuitM* (in the 1987 Forest Plan as Amended model only) – all prescriptions in Table I-2 (see above) with reduced management
- *SuitH* – all prescriptions in Table I-2.
- *NsuitL* – all prescriptions in Table I-2 with more prescribed burn than *SuitH* and reduced amount of harvest
- *NsuitN* – natural disturbance or no management only.

Wildlife habitat required special considerations related to defining silvicultural prescriptions by analysis area. For modeling purposes only, silvicultural prescriptions were limited in winter range (Layer 4 code of *wntrng*) and no even-aged regeneration prescriptions were allowed for these areas. For lynx habitat, yield tables were built without pre-commercial thinning if the stand was above 4,500 feet and not a cover type of DFPP.

To meet the Plans' guideline to maintain all existing old growth, all very large size classes were limited to natural disturbance or no management. The single exception to this was DFPP in the Plan model, where individual tree selection was allowed.

Several timing choices were also applied to the silvicultural prescriptions. Timing choices are defined by specifying (within the model) the range of ages in which an existing stand and a regenerated stand may be harvested. The earliest point at which a stand could be harvested was based on Culmination of Mean Annual Increment (CMAI). For the purpose of the Plans, the age at which CMAI is attained was determined by FVS. Existing stands containing medium or large size classes have met CMAI and are ready to harvest at the beginning of the planning horizon. Based on varying constraints and the specified management goals or objectives, the Spectrum model determines the management prescription to apply to an analysis area as well as the timing of the implementation.

Yield tables included the following coefficients:

- Merchantable MCF
- Merchantable MBF
- Diameter of removals and residual volume
- Fire risk
- Snags[1] – delineated by diameter classes of 10 to 20 inches and 20+ inches
- Insect risk (composite rating of insect risk)

[1] For snags, acres were classified by the number of snags per acre as follows:

Diameter Class	Snag Density		
10 to 20-inch snags	0 to 5.9 snags/acre	6 to 9.9 snags/acre	≥10 snags/acre
20+ inch snags	0 to 0.9 snags/acre	1.0 to 3.9 snags/acre	≥4 snags/acre
Total Snags	0 to 5.9 snags/acre	6.0 to 9.9 snags/acre	≥10 snags/acre

Costs for Management Activities

Costs were developed for sale prep and sale admin (combined), reforestation, TSI, prescribed burning, and road construction and reconstruction. A cost for watershed restoration was also developed to track restoration activities in certain watersheds. Table I-3 describes the activity, units, cost and production coefficient for each Forest.

Table I-3 Costs for the Spectrum Model

Activity	Units	Timing	KNF Cost	KNF Production Coefficient	IPNF Cost	IPNF Production Coefficient
Sale Prep and Admin[1]	ccf	With harvest	$50.47	1 per ccf harvest	$56.47	1 per ccf harvest
Reforestation[2]	Acre	With harvest	$700.00	1 per acre regen harvest, 0.2 per acre select harv	$850.00	1 per acre regen harvest, 0.2 per acre select harv
TSI (pre-commercial thin)[3]	Acre	Two decades after regen harv or two decades after selection harv	$260.00	0.35 per acre regen harv, 0.2 per acre select harvest	$260.00	0.35 per acre regen harv, 0.2 per acre select harv
Prescribed Burning[4]	Acre	Timing for Presc. Burn rx	$120.00	1 per acre burned	$130.00	1 per acre burned
Road cons/recons[5]	Miles	With harvest	$10,300.00	.0022 per mbf harvest	$10,000.00	.0022 per mbf harvest
Watershed Restoration[6]	Acres	With harvest	$2700.00	0.1 per acre harvest (except CT)	$2700.00	0.1 per acre harvest (except CT)

[1]Sources: Chris Reichert/Tom Martin based on last year or four-year average (includes cost pools, NEPA, and litigation) – NFTM unit costs only.

[2]Source: 04/02/06 Gary Dickerson, cost comparison spreadsheet (including cost pools) – includes only NFVW costs.

[3]Source: 04/02/06 Gary Dickerson, cost comparison spreadsheet (includes cost pools) – includes only NFVW costs.

[4]Sources: Dan Rose and Mark Grant, based on BFES (includes cost pools).

[5]Sources: KNF - from Paul Stantus, based on five-year average (includes cost pools) based on funding for timber sale work; IPNF – from James Gebhardt, based on two-year average (includes cost pools), and adjusted to be similar to KNF.

[6]Sources: Ellen Frament and Steve Johnson, BFES 03

With the exception of prescribed burning, all costs are part of the budget constraint (see discussion below on management requirements). Watershed restoration activity only applies to the not-properly-functioning or functioning-at-risk watersheds (Layer 3 - code of *nfpwtr* or *farwtr*).

With the exception of road construction/reconstruction within an IRA (Layer 1 - code of *ira*), all activity costs were increased by 20 percent as a result of increased access and analysis costs. Furthermore, timber stumpage values in these areas were reduced to the helicopter logging value (refer to Table I-4, below).

Timber Values

Stumpage values for timber were developed by Mike Niccolucci and Don McKinnon, USDA Forest Service, Northern Region. Values were delineated by stumpage species group, diameter class, and logging system. The stumpage value species group was cross-walked to Spectrum species strata. Values by logging system were then averaged for the amount of tractor, cable, and helicopter logging that has occurred on the Forests over the past several years. Table I-4 displays the average stumpage value for all logging systems and for helicopter logging only (for use in inventoried roadless areas) by Forest.

Table I-4 Stumpage Value by Species and Logging System for each Forest

KNF - Average Stumpage Value ($ per CCF) for all Logging Systems1				
	Average Diameter			
Spectrum Species Strata	**< 7"**	**7 - 9.9"**	**10 - 16"**	**> 16"**
DFPP	$1.00	$171.45	$189.65	$203.59
DFwet	$1.00	$115.63	$139.20	$157.25
LP	$1.00	$111.79	$142.19	$165.47
Larch	$1.00	$115.63	$139.20	$157.25
GFmix	$1.00	$111.79	$142.19	$165.47
SFmix	$1.00	$111.79	$142.19	$165.47
KNF - Average Stumpage Value ($ per CCF) for Helicopter Only Logging Systems				
	Average Diameter			
Spectrum Species Strata	**< 7"**	**7 - 9.9"**	**10 - 16"**	**> 16"**
DFPP	$1.00	$73.59	$91.79	$105.73
DFwet	$1.00	$47.48	$71.05	$89.10
LP	$1.00	$61.70	$92.10	$115.38
Larch	$1.00	$47.48	$71.05	$89.10
GFmix	$1.00	$61.70	$92.10	$115.38
SFmix	$1.00	$61.70	$92.10	$115.38
IPNF - Average Stumpage Value ($ per CCF) for all Logging Systems1				
	Average Diameter			
Spectrum Species Strata	**< 7"**	**7 - 9.9"**	**10 - 16"**	**> 16"**
DFPP	$1.00	$162.70	$180.90	$194.84
DFwet	$1.00	$105.00	$128.57	$146.62
LP	$1.00	$101.01	$131.40	$154.68
Larch	$1.00	$105.00	$128.57	$146.62
GFmix	$1.00	$101.01	$131.40	$154.68
SFmix	$1.00	$101.01	$131.40	$154.68
IPNF - Average Stumpage Value ($ per CCF) for Helicopter Only Logging Systems				
	Average Diameter			
Spectrum Species Strata	**< 7"**	**7 - 9.9"**	**10 - 16"**	**> 16"**
DFPP	$1.00	$72.50	$90.70	$104.64
DFwet	$1.00	$42.18	$65.75	$83.80
LP	$1.00	$54.83	$85.23	$108.51
Larch	$1.00	$42.18	$65.75	$83.80
GFmix	$1.00	$54.83	$85.23	$108.51
SFmix	$1.00	$54.83	$85.23	$108.51

From spreadsheet entitled '*stumpage_values_by_strata*'

[1]Values for the average amount of tractor, skyline, and helicopter logging on the IPNF were determined by Tom Martin, which were based on volume average for 2002-04. Values on the Kootenai were estimated by John Craig.

Transition Pathways

Pathways were developed to indicate how species and size class would be expected to change over time, given the silvicultural prescription. Pathways for cover types are displayed in Table I-5 and pathways for size classes in Table I-6. These pathways were used to model movement towards vegetation desired condition. The treatment designation of "Natural Growth" is the silvicultural prescription equivalent of no management, "Even-aged Harvest" is the silvicultural prescription equivalent of regeneration, and "Uneven-aged Mgt" is the individual tree and group selection silvicultural prescriptions. Pathways were developed by Tom Martin, silviculturist on the KIPZ interdisciplinary team.

Table I-5 Spectrum Cover Type Transition Changes

Treatment	Spectrum Species	Age	Species
Natural Growth	DFPP	Always	DF
	DFwet	0-160	DF
		161+	GFmix
	L	0-90	L
		91-160	DF
		161+	GFmix
	GFmix	Always	GFmix
	LP	0-120	LP
		121+	SFmix
	SFmix	0-350	SFmix
		350+	LP
Even-aged Harvest	DFPP	0-30	DF
		30-70 (PCT)	80% DF, 20% PP
		70-110 (CT)	50% DF, 50% PP
		At regen harvest	100% PP
	DFwet	Same as natural growth until regen, then L	
	L	Always L	
	GFmix	Always GFmix until regen, then WP	
	LP	Always LP	
	SFmix	0-70	Same as natural growth
		70-110 (CT)	25% L, 25% DF, 50% SFmix
		At regen harvest	50% L, 25% DF, 25% SFmix
Prescribe Burn	DFPP	0-30	DF
		31+	20% PP, 80% DF
	DFwet	0-30	DF
		31+	20% L, 80% DF
	L	Always L	
Uneven-aged Mgmt	DFPP	1st entry	20% PP, 80% DF
		2nd entry	40% PP, 60% DF
		3rd entry	60% PP, 40% DF
		4th entry	80% PP, 20% DF
		5th entry	100% PP
	DFwet	1st entry	20% L, 80% DF
		2nd entry	40% L, 60% DF
		3rd entry	60% L, 40% DF
		4th entry	80% L, 20% DF
		5th entry	100% L
	L	Always L	
	SFmix	1st entry	10% L, 5% DF, 85% SFmix
		2nd entry	20% L, 10% DF, 70% SFmix
		3rd entry	30% L, 15% DF, 55% SFmix
		4th entry	40% L, 20% DF, 40% SFmix
		5th entry	50% L, 25% DF, 25% SFmix

Table I-6 Spectrum Size Class Transition Changes

Treatment	Spectrum Species	Age	Size
Natural Growth	DFPP	0-30	SS
		31-80	Small
		81-120	Med
		121-160	Large
		161+	Very Large
		400	Cycle back to SS
	DFwet, GFmix, L	0-30	SS
		31-70	Small
		71-110	Med
		111-150	Large
		151+	Very Large
	DFwet	250	Cycle back to SS
	GFmix	400	Cycle back to SS
	L	350	Cycle back to SS
	LP	0-30	SS
		31-80	Small
		81-120	Med
		121-180	Large
		181+	Very Large
		200	Cycle back to SS
	SFmix	0-40	SS
		41-80	Small
		81-120	Med
		121-160	Large
		161+	Very Large
		350	Cycle back to SS
Even-aged Harvest	DFPP	0-30	SS
		31-70	Small
		71-100	Med
		101-140	Large
		141+	Very Large
		400	Cycle back to SS
	DFwet	0-20	SS
		21-60	Small
		61-100	Med
		101-140	Large
		141+	Very Large
		250	Cycle back to SS
	GFmix	0-20	SS
		21-60	Small
		61-90	Med
		91-130	Large
		131+	Very Large
		400	Cycle back to SS
	L	0-20	SS
		21-60	Small
		61-90	Med
		91-140	Large
		141+	Very Large
		350	Cycle back to SS
	LP	0-20	SS
		21-70	Small
		71-100	Med
		101-140	Large
		141-180	Med

Treatment	Spectrum Species	Age	Size
		181+	Large
		200	Cycle back to SS
Even-aged Harvest	SFmix	0-30	SS
		31-70	Small
		71-110	Med
		111-160	Large
		161+	Very Large
		350	Cycle back to SS
Uneven-aged Harvest	DFPP, DFwet, L, SFmix	1st entry	20% SS, 80% Med (or L, VL if entered)
		2nd entry	20% SS, 20% Small, 60% Med (or L, VL if entered)
		3rd entry	20% SS, 20% Small, 20% Med, 40% Large (or VL if entered)
		4th entry	20% SS, 20% Small, 20% Med, 20% Large, 20% Very Large
		All subsequent entries	Continue size class distribution after 4th entry
Prescribed Burn*	DFPP – seedling/sapling	Entry 1, age 30	100% SS
		Entry 2, age 60	20% SS, 80% small
		Entry 3, age 90	20% small, 80% med
		Entry 4, age 120	20% med, 80% large
		Entry 5, age 150	20% large, 80% very large
		400	Cycle back to SS
	DFPP – small	Entry 1, age 60	20% SS, 80% small
		Entry 2, age 90	20% small, 80% medium
		Entry 3, age 120	20% medium, 80% large
		Entry 4, age 150	20% large, 80% very large
		400	Cycle back to SS
	DFPP – medium	Entry 1, age 90	100% medium
		Entry 2, age 120	100% large
		Entry 3, age 150	100% very large
		400	Cycle back to SS
	DFPP – large	Entry 1, age 120	100% large
		Entry 2, age 150	100% very large
		400	Cycle back to SS
	DFPP – very large	Entry 1, age 150	100% very large
		400	Cycle back to SS
	DFwet, L – seedling/sapling	PCT only until size small/medium – then follow pathway below for small/medium	
	DFwet, L – small/medium	Entry 1, age 60	20% SS, 80% small
		Entry 2, age 120	20% small, 40% med, 40% large
		Entry 3, age 180	20% med, 40% large, 40% very large
		Entry 4, age 240	20% large, 80% very large
	DFwet	250	Cycle back to SS
	L	350	Cycle back to SS
	DFwet, L – large	Entry 1, age 120	100% Large
		Entry 3, age 180	100% Very large
		Entry 4, age 240	100% Very large
	DFwet	250	Cycle back to SS
	L	350	Cycle back to SS
	DFwet, L – very large	Entry 1, age 240	100% Very large
	DFwet	250	Cycle back to SS
	L	350	Cycle back to SS

*For prescribed burn, pathways are after burning sequence has been initiated; use natural growth pathways prior to burning sequence

MANAGEMENT REQUIREMENTS AND OBJECTIVES

The following discussion provides a description of the various constraints that were developed for and incorporated into the Spectrum model in response to Plan components, regulations, and as a means of improving the model's ability to simulate actual management of NFS lands.

Harvest Policy

Harvest policy includes Non-Declining Yield (NDY), LTSY and ending inventory constraints. This variable ensures that the timber yield is sustainable and will not decline in any decade.

For **timber production lands**, Layer 2 (codes of *SuitM*, or *SuitH*) provided input toward the timber sale program quantity (TSPQ), with a separate NDY applied and a separate LTSY calculated. For **other lands**, Layer 2 (code of *SuitL*) provided input toward the TSPQ, with a separate LTSY calculation.

Budget Constraint

The model also included a budget constraint factor in order to assess effects under current budget levels. For the model's planning horizon, the Idaho Panhandle National Forest's the annual budget constraint was $11.9 million and the Kootenai National Forest's was $10.9 million. When the budget was restrictive to a Plan run (which occurred with the IPNF model), a separate run was made to determine output levels without a budget constraint.

Snag Retention

Silvicultural prescriptions conducted for the regeneration prescription also provided snag retention data for the model. Reserves of trees were required and the snag quantities were tracked in the yield tables. Numbers of snags were reported for two diameter classes (10-19.9" and 20"+) for three densities:

Diameter Class	Snag Density		
10 to 20-inch snags	0 to 5.9 snags/acre	6 to 9.9 snags/acre	≥10 snags/acre
20+ inch snags	0 to 0.9 snags/acre	1.0 to 3.9 snags/acre	≥4 snags/acre
Total Snags	0 to 5.9 snags/acre	6.0 to 9.9 snags/acre	≥10 snags/acre

Old Growth

For the 1987 Forest Plan as Amended model, no harvest was allowed in the existing old growth areas (Layer 6 - code of *vlarge*). In the Proposed Land Management Plan model, individual tree selection was allowed in existing old growth in the DFPP cover type and no other harvest allowed in Layer 6 (code of *vlarge*).

Watershed Objectives

Watershed management requirements were defined by watershed condition (Layer 3). Basically, one acre of opening is created for each acre of regeneration harvest. For group selection, 0.2 acres of opening is created for each acre of harvest. For commercial thinning, 0.2 acres of opening is created for each acre of thinning. An opening remains an opening over 60 years, with a decay function over time. During the first decade of harvest, the opening equals 1.0, diminishing to 0.75 in decade 2, 0.55 in decade 3, 0.4 in decade 4, 0.3 in decade 5, and 0.2 in decade 6.

In FAR or Condition Class II watersheds, timber harvest was allowed; however, it occurred with the increased cost of providing restoration (restoration activity code). No more than 12.5 percent (IPNF) and 13.5 percent (KNF) of a watershed was allowed to be in an opening at one time. Watershed constraints were adjusted based on spatial considerations for each Forest.

In NPF or Condition Class III watersheds, timber harvest was allowed; however, it occurred with the increased cost of providing for restoration (restoration activity code). No more than 25 percent (both Forests) of the watershed was allowed to be in an opening at one time.

In PFC, Condition Class I, or No Condition watersheds, timber harvest was allowed but no more than 10 percent (both Forests) of the watershed could be in an opening at one time.

Wildlife Objectives

Wildlife objectives were met through various means. Grizzly bear core areas, old growth, and riparian areas were not suitable for timber production (Layer 3 - code of *NsuitL*). Timber harvest was allowed, but on a limited basis (refer to *Limit on Silvicultural Prescriptions by Management Area*, below).

For grizzly bear and caribou management units located outside grizzly bear core areas (Layer 3 - code of *bmucmu*), an opening was considered an opening for 30 years. Wildlife openings were limited to no more than eight percent of the area over a decade.

For lynx habitat (Layer 3 - code of *lynxhb*), vegetation treatment was limited to no more than 15 percent over a decade.

For winter range (Layer 3 - code of *wntrng*), silvicultural treatment prescriptions were limited to selection harvest (group or individual tree) and prescribed burn.

For Layer 3 (code of *no wildlife condition*), openings were limited to no more than 25 percent of the area.

Limits on Silvicultural Prescriptions by Management Area

Due to limitations of appropriate sites for uneven-aged management, this prescription was limited to no more than 5,000 acres per decade for all decades.

In the 1987 Forest Plan as Amended model only, Layer 2 (code of *SuitM*), timber management was limited to no more than 50 percent of the area.

For Layer 2 (code of *NSuitL*), timber management was limited to no more than five percent of the area, because of the reduced emphasis on timber management within these areas and other resource protection requirements.

As a result of operational and logistical limitations on the amount of prescribed burning the Forests can perform, prescribed burn in the Proposed Land Management Plan model was limited to no more than 5,000 acres per year on the IPNF and 10,000 acres per year on the KNF. There was no prescribed burning in the 1987 Forest Plan as Amended model since this model does not have a goal to move toward vegetation desired condition.

Because of operational and logistical limitations on the amount of thinning the Forests can do, thinning was limited to no more than 5,000 acres per year on the IPNF and 4,000 acres per year on the KNF for the first three decades.

Natural disturbance

The amount of natural disturbance (stand replacing fire) was determined using SIMPPLLE. Disturbance levels were input into the Spectrum model, requiring a certain number of acres to undergo natural disturbance every decade. The amount varies by Layers 5 and 6.

The following acres were themed to stand replacing fire over each decade.

Table I-7 Natural Disturbance by Layer for the KNF and IPNF

Layer 5 – Cover Type	KNF acres per decade	IPNF acres per decade
DFwet	100	100
DFPP	100	200
LP	200	100
GFmix	300	900
Larch	200	300
SFmix	1600	1000
Layer 6 – Size Class	**KNF acres per decade**	**IPNF acres per decade**
seedsp	100	300
small	1100	300
medium	300	600
large	800	1000
vlarge	200	400

Goal for Attaining Desired Condition

For the Proposed Land Management Plan model, the goal was to move towards the desired condition (DC) for vegetation, as defined in the Plan. The DC was defined by cover type and size class and then Goals were developed to achieve DC.

Following are the Goals for the KNF and IPNF models. Ranges for Class A of the vegetation DC were used in defining the goals. Refer to the Vegetation section in Chapter 2 of the CER for further explanation of these classes.

Table I-8 KNF Species Composition – Percent of all forested National Forest acres

Veg Type	DC Minimum %	DC Maximum %
PP	5	9
DF	4	8
LP	12	23
WL	26	52
GF/WRC/WHMix	5	11
WP	4	9
SAF/ES/WBP, MH, AL Mix	11	21

Table I-9 IPNF Species Composition – Percent of all Forested National Forest acres

Veg Type	DC Minimum %	DC Maximum %
PP	5	10
DF	12	25
LP	3	6
WL	10	21
GF/WRC/WHMix	6	12
WP	20	39
SAF/ES/WBP, MH, AL Mix	10	20

Table I-10 KNF Successional Stage (Size Class)

Veg Type	DC Minimum %	DC Maximum %
Seed/Sap	17	33
Small	10	19
Medium	8	16
Large	10	21
Very Large	22	44

Table I-11 IPNF Successional Stage (Size Class)

Veg Type	DC Minimum %	DC Maximum %
Seed/Sap	14	29
Small	9	17
Medium	13	26
Large	13	26
Very Large	18	35

Objective to Maximize Timber

For the 1987 Forest Plan as Amended, the model was run with the objective to maximize timber output levels in the first decade. The results of this run were then 'rolled over' and the model run with an objective to maximize present net value (PNV).

For the Proposed Land Management Plan, to determine an upper end for a range of timber output levels, the model was run a second time (Run 2) with an objective to maximize timber output levels in the first decade. The results of this run were then 'rolled over' and the model run with the objective (goal) to meet DC, as defined above.