6. Cover Yields

Scheduled output tables for cover were built into the FORPLAN Model based on working group and condition class from the 1980 timber inventory, and were derived from the Stand Prognosis Cover Extension Program. Cover outputs vary in response to timber stand manipulation, growth occurring in both manipulated and undisturbed stands, and time. Detailed information is documented in "Modeling Thermal Cover on The Malheur National Forest (May 1988) and "Process for modeling Habitat Effectiveness Index in forest wide applications on the Malheur National Forest" (Peterson, May 1989) Four classes of cover are defined (ranging from satisfactory to low marginal) and may be combined into composites which are convenient for evaluation and for the definition of constraints. For each cover class or composite represented in FORPLAN, a scheduled output is assigned, with it's own set of yield tables. The yield coefficients (usually 0 or 1), when multiplied by the acres applied to, give the acres of cover class or composite, which are used to measure outputs or to set constraints on The most useful combinations are satisfactory cover (COVER1), satisfactory plus the best marginal cover (COVER1 + COVER2), and total cover (COVER1 + COVER2 + COVER3 + COVER4).

It is necessary to "overmodel" the cover constraints, especially for satisfactory cover, which means that the constraints in FORPLAN must be set higher than the minimum standards in order to produce consistently the desired value on the ground. The reasons for this are explained in "Modeling Elk cover and minimum volume constraints" (Peterson, 2/6/90). Other modifications to yield coefficients to assure model feasibility are described in "Negative Cover Yield Coefficients" (Lindley, 10/17/89)

G. ANALYSIS DONE OUTSIDE FORPLAN

The analysis process outside FORPLAN consisted of some analysis completely independent of the FORPLAN model and some analysis processes that were dependent upon FORPLAN outputs

1. Analysis Independent of FORPLAN

Analysis processes that were conducted independently (i.e , not modeled in FORPLAN) include the following

a. Recreation

Areas of the Forest were assigned to different recreation classes using the classifications and procedures given in the Recreation Opportunity Spectrum Users Guide. Only four classes (Primitive, Sem'-Primitive Non-Motorized, Semi-Primitive Motorized, and Roaded Natural) of the six in the Recreation Opportunity Spectrum Users Guide were applicable, plus the additional classification of Roaded Modified.

Recreation capacity was calculated using the approach described in the Recreation Opportunity Spectrum Users Guide The procedures are documented in "Dispersed Recreation Capacity Calculations" (E. Cole, September 27, 1982)

b. Wildlife

Wildlife habitat capability in terms of numbers of animals and/or acres of habitat was calculated outside FORPLAN

Resulting from public and other agency response to the elk modeling approach used in the Draft EIS and inconsistency with other Forests in the Blue Mountains, changes have been made related to elk modeling for inclusion with the Final Environmental Impact Statement For the Draft Environmental Impact Statement, the Forest had developed an elk numbers model based on forage availability in response to creation of transitory forage by timber harvest activities. For inclusion with the FEIS, a Habitat Effectiveness Model for elk was developed using the latest information and research for winter elk habitat, which is applicable for both winter and summer range.

The previous model, which used a cover/forage ratio, assumed that size and spacing standards for cover and forage would be met. However, it was observed that in practice, cover size and spacing standards were not being met, and determining elk habitat solely on forage conditions was not acceptable Though forage supplies the basic need for energy, cover areas free from disturbance which help the animals conserve energy had to be considered This lead to the development of the Elk Habitat Effectiveness Model by Thomas et al. (1988), developed for the Blue Mountains which is now regarded as the most acceptable process by which the results of habitat manipulation can be assessed on the Forest

The Elk Habitat Effectiveness Model is based on the preference of elk for certain types of habitat This model consists of three variables for summer range and an additional one for winter range. Each variable is itself an index of the relative habitat effectiveness for elk One factor considered is the size and spacing of cover, another is cover quality expressed in terms of height and canopy closure, the third is an index relating potential habitat effectiveness to open road density, and the fourth (which is used on winter range only) rates the quality and quantity of forage The actual application of the model on the Forest assumes forage is a constant factor, and is not considered as a variable.

The Elk Habitat Effectiveness Model is a biologically based model that tells us how effective an area will be in supporting elk The model was designed to measure effectiveness on a scale of 0 to 1, with 1 representing the highest potential effectiveness and 0 representing the least desirable situation for elk. It is intended to be only a relative measure of effectiveness, and does not consider many factors that would influence the actual number of elk found on an area. These additional factors include the effects of hunting, predators, disease, yearly changes in weather and forage production, competition with other animals, and the rate at which elk populations can change from one level to another

To make the results of the model easier to interpret, the effectiveness index was translated into a number of animals that could be supported on an area. This was done by estimating the density of animals that could be supported on an area if the habitat were maintained at optimum effectiveness It was then assumed that a habitat effectiveness value of 0 89 translated to this highest possible density of elk, and the lower values would translate to proportionally lower densities. The numbers shown in the document are these numbers of elk that could be supported on the area The numbers are not projections of actual elk populations As noted above, many additional factors would have to be considered in order to project actual elk populations. It is especially important to note that the current elk numbers on an area may not be the direct result of factors that are measured in the habitat effectiveness model. The current population in an area could be limited by the availability of winter range on private land, by hunting pressure, or by any of the other factors discussed above In this case, habitat effectiveness might decline, but have not real influence on the number of elk that occupy the area. Or, habitat effectiveness might increase but still have no influence on the number of elk. Because the numbers shown in tables and graphs only represent habitat effectiveness, it is important to read the full text in order to understand the effect of forest management on the elk populations

Capability for old growth/mature timber indicator species was based on the amount of old growth in dedicated old growth units as well as old growth in roadless areas and wilderness. For more information on how territories were calculated, see the Forest Planning Document "Territory Calculation for Pine Marten and Pileated Woodpecker "

Capability for primary cavity excavators (woodpeckers) was based on estimated snag levels. For example, a 20-percent level of primary cavity excavators means that enough snags will be managed to carry 20 percent of the potential cavity-nesting population

Diversity of animal communities was based on the relative acreages of forest successional stages For more information see Forest Planning Papers "The Diversity Index (H'max)· Its Derivation," and "How to Do Wildlife Data."

Capability for three-toed woodpeckers was based on the estimated acreage of lodgepole pine and subalpine fir. For more information see Forest Planning Paper "Calculating Pairs of Three-toed Woodpeckers."

The ability of the Forest to produce Wildlife and Fish User Days was based on the assumption that the number of big-game hunters using the Forest would increase or decrease in proportion to the number of big game available to hunt. For more information, see the Forest Planning Document "Process Paper· Calculating *Potential Wildlife and Fish User Days on the Malheur National Forest.*"

Wildlife habitat improvements were estimated from past and future projects which manipulate vegetation or install structures to improve fish and wildlife feeding or breeding habitat. For more information, see the Forest Planning Document "Cost Data for Forest Planning."

c. Fish

The existing supply of resident fish angling opportunities exceeds demand. Management requirements will maintain resident fish populations at or above current levels. Forest-wide, demand will probably not exceed supply within the planning period. Therefore, resident fish outputs were not calculated for each alternative.

The process for estimating anadromous fish outputs was revised between the Draft and the Final Environmental Impact Statement In the Draft Environmental Impact Statement, including the Benchmark analyses, estimates were based on actual spawning ground counts of steelhead and Chinook in the John Day River and tributaries. In order to respond to Regional direction, to respond to other agency and organization comments on the draft, and to provide for more consistency between Forests, estimates for the Final Environmental Impact Statement were based on U.S v Oregon coefficients for rearing capacity. As a result, the outputs displayed here for commercial harvest and WFUDs, which are the values with assigned economic values from RPA, are not directly comparable to what was displayed in the Draft Environmental Impact Statement These numbers still reflect the economic value of the anadromous fish habitat on the Forest. They do not reflect the fact that spawning occurs at a higher density on the Forest than in downstream areas. Forest streams are providing spawning for fish that rear downstream from the Forest boundary Another factor that is not accounted for in these calculations is the effect of expected improvement in water quality in many alternatives, on the habitat quality of downstream areas.

One other result of this change in process is that the estimated output numbers from the Benchmark analyses are no longer directly comparable to the numbers for the alternatives For example, with the assumptions used for the Benchmark Max PNV with MRs, and for the No Action alternative (Alternative A), anadromous fish outputs should be a little higher for Alternative A than for the Benchmark run With the change in process, the estimated numbers are somewhat smaller. Benchmarks have not been recalculated to make these numbers comparable

Anadromous fish (spring chinook salmon and summer steelhead trout) habitat capability was calculated outside FORPLAN Changes from the existing condition were calculated for each alternative, based on expected changes in riparian vegetation condition, and on the level of investment for structural watershed and fish habitat improvement The process paper (Gritz, 1988) is included in the Forest planning documents The following is a summary of that document.

Coefficients used to estimate current habitat capability are from U.S v Oregon Catch to escapement ratios and WFUDs (Wildlife and Fish User Days) per fish were agreed to in 1984 for the Blue Mountain Forests Commercial to sport harvest ratios are from Meyer, 1982 Indian harvest is included with commercial harvest Values for commercial and sport harvest are RPA assigned values (used in economic analysis, but not here)

The estimated Forest totals for current habitat capability, expressed as Smolt Habitat Capability Index (SHCI) are 30,740 chinook and 115,700 steelhead.

To express this estimated output in numbers suitable for economic analysis using RPA assigned values, it is necessary to convert them to pounds of commercial harvest and WFUDs This is done with the coefficients from the references noted above. The starting point numbers are 17,568 WFUDs and 23,733 lbs of commercial harvest

Changes over time for each alternative are based on estimated changes in riparian condition and channel morphology, due to changes in livestock management and timber harvest prescriptions in riparian areas, and on the amount of structural watershed and fish habitat improvement work to be done It was estimated that habitat capability within the area treated with structural improvements will increase by about 50 percent (Stuber, 1985). Estimating changes in habitat capability due to expected changes in riparian condition was much more involved

Literature references for increased salmon production due to changes in riparian condition and channel morphology, in response to removing livestock grazing from riparian areas in degraded condition are varied and range up to tenfold increases. This improvement in the shade and bank stability due to more abundant and diverse riparian vegetation, and the increased diversity of instream morphology which usually follows, is referred to as geomorphic recovery. A 200 percent increase in habitat capability (Hall, J D and C.O Baker, 1982, Platts, W S , 1981) prorated over the recovery period was used for this analysis. Approximately 25 percent of the anadromous stream miles were considered to be in a degraded condition Much of this is due to water temperature problems associated with a lack of shade from riparian vegetation The rate of recovery was estimated based on the various livestock management strategies in the alternatives. In Alternative I, the timber management prescription is also modified so that it will provide a long term improvement in riparian condition Geomorphic recovery is a long term process, taking at least a few decades and often much longer to achieve Thus, anadromous fish outputs continue to increase throughout the planning period

Lesser increases in habitat capability can also be achieved by improving riparian condition in those areas that are currently only moderately affected by previous management activities. There are relatively few anadromous riparian areas which have not been affected in some way by man's activities. Increases in habitat capability due to riparian recovery and structural treatment are considered to be additive.

d. Fire

To determine the number of acres that would receive fuel treatment under each alternative, a survey was made on each District to determine the average percent of acres that would normally be treated under each type of cutting prescription used on the Forest The results are given below:

Shelterwoods	85 percent
Overstory removal	80 percent
Selective cuts	60 percent
Clearcuts	100 percent
Precommercial thinning	80 percent

This percentage rate was then applied to the timber harvest acres developed for each alternative

2. Analysis Dependent Upon FORPLAN

Several analysis processes were conducted that were dependent upon FORPLAN output. These processes varied in their dependency on the FORPLAN model; descriptions of the processes follow

a. Biomass

Biomass coefficients were based on timber model components, the "Photo Series for Quantifying Natural Forest Residues in Common Vegetation Types" (1980), "Photo Series for Quantifying Forest Residues" (1979), and fuel inventory data from Forest fuel inventories (See 1920 letter, October 5, 1982 Process Criteria - Development of Biomass Potential) These values were further adjusted for biomass material already sold, from Forest cut-and-sold report (see 1920 letter,February 4, 1985, Additional Timber Volume to be calculated outside the FORPLAN model, Nonchargeable Volume) and the material needed to meet wildlife's down/woody debris requirements, supplied by the Forest Wildlife Section

b. Firewood

Not estimated. This value is considered part of the available biomass totals. Firewood projections are made by using actual sell volumes generated for use in the Forest cut-and-sold report base period, for a 30-month period, June 1983 to December 1985.

c. Allowable Sale Quantity and Timber Sale *Program Quantity*

The Allowable Sale Quantity was obtained by subtracting allowances for snags and material used for fish habitat improvement from the FORPLAN harvest output. The Timber Sale Program Quantity was generated by using the Allowable Sale Quantity *and adding other saleable timber products* (1920 letter, February 4, 1985, Additional Timber Volume to Be Calculated Outside of FORPLAN). This extra volume takes into consideration cull logs, miscellaneous products, and mortality salvage not captured at the time of a scheduled silvicultural entry.

d Reforestation

Reforestation acres were equal to the regeneration timber harvest acres plus nonstocked acres reforested by decade, as scheduled by FORPLAN.

e. Timber Stand Improvement

Timber stand improvement acres are equal to the acres found in FORPLAN under Precommercial Thins and Precommercial Thins under Overstory Removals Timber prescriptions selected by the FORPLAN model determined the timber stand improvements scheduled This varied by working group.

f. Species Mix

For determination of the species mix, the ponderosa pine volume was taken from the FORPLAN output The mixed conifer and lodgepole pine volumes were determined using the species mix papers dated March 4, 1985 and May 19, 1986 for these two groups Using this information, the base percentage was calculated in a spreadsheet program and then applied to the remaining volume to determine the actual mixed conifer and lodgepole pine volumes for the alternative considered. Between the Draft and Final Environmental Impact Statement, a new method for determining ponderosa pine harvest volumes was used by applying a revised yield table against the previous FORPLAN solution.

g Water Yield

Average total annual water yield tables for FORPLAN runs were generated by analyzing different vegetative ecotypes (ponderosa pine, mixed conifer, low-site ponderosa pine/mixed conifer, grass dominated, fir/sedge and mesic shrub, moist/dry meadow, and juniper/sage), slopes (greater than or less than 35 percent), whether areas were roaded or unroaded, and type of harvest (commercial thinning, minimum level management, clearcut, shelterwoods, and final harvest) occurring on those lands available for commercial harvest activities.

The water yields calculated by this procedure for the benchmark runs for the Analysis of the Management Situation showed no significant differences between runs The water outputs for the alternative cases for the Draft Environmental Impact Statement were based on the benchmarks, since the output position in FORPLAN occupied by water was required for another purpose.

h Roads

The FORPLAN model is designed to represent the relationship between acres harvested and miles of local road constructed in inadequately roaded areas as a linear function That is, as 1 acre is harvested, approximately 0 0055 miles of local road is constructed (3 5 miles of road per 640 acres) However, this linear relationship does not apply to actual cases because statistical analysis of historical data for unroaded areas shows that over 95 percent of the transportation network has been constructed when 40 percent of the area has been entered Roads built early in the development of an unroaded area create new access to more acres per mile than roads built later. An additional and more recent consideration is the desire to avoid fragmentation of roadless areas due to future harvest operations, which will require new strategies for road placement to be developed. Also, the FORPLAN output does not account for the fact that some roads will have to be rebuilt (i e. relocated) because they are in riparian areas, or on steep slopes which need to be protected, so that their use would not comply with current standards. Taking all these factors into account, it is estimated that the first decade construction mileage should be increased by a factor of 2.1, and the later decades left at their FORPLAN output values These figures will be reviewed and adjusted as site specific timber sales are developed.

Construction and reconstruction of arterial and collector roads are not represented in FORPLAN, and estimates for these are based on historical data and predictions of future needs These indicate that no additional construction will be necessary, and 62 miles per year of reconstruction should be planned for each alternative.

i Range — Range outputs were calculated in FORPLAN with some manual adjustments outside the model. Four levels of range management intensity were defined A, B, C, and D These are commonly referred to as range strategies or levels, and represent increasingly intense management levels

- A- No grazing
- B- Minimum level management
- C- Management with subdivided pastures
- D- Nonstructural treatments (seed, burn, etc)

FORPLAN used strategies C and D only, and adjustments for A were calculated manually. Level B was not used.

For the adjustments outside FORPLAN, the acres subject to A strategy were developed from allotment maps taking account of riparian ares in unsatisfactory condition These acres were then removed from the FORPLAN output and the animal unit months were reduced using the model coefficients. Table B-9 shows an example of the process. For elk winter range the animal unit months were assumed to be split 75/25 between livestock and elk in the appropriate areas

j. Economic Effects — A spreadsheet simulating the ADVENT computer system was used to integrate the FORPLAN outputs with the resource analyses completed outside FORPLAN, resulting in a complete economic efficiency analysis of each alternative (the economic efficiency analysis process is detailed in Section IV of this appendix) The spreadsheet was used to obtain present net value, discounted costs and benefits by major resource group, and budget requirements for all alternatives. Also derived from the spreadsheet were the returns to the U.S. Treasury and expected payments to local governments. For details see "PNV for FEIS" (Krause, 2/20/90)

An analysis to determine changes in employment and income (within Grant and Harney Counties) was completed using IMPLAN, a Forest Service developed input-output model For this Forest, the FORPLAN outputs of each alternative, specifically the timber harvest and permitted grazing levels, were inserted into the IMPLAN model. These two outputs are the key elements in this region's economy, providing a major portion of the employment base. Refer to Section V (Economic Impact Model) of this appendix for a complete discussion of the IMPLAN model; the Forest planning records contain the supporting documentation.

k. Yield Tables — Resulting from changes incorporated into the Final Environmental Impact Statement, an updated method to determine ponderosa pine volume produced by harvest type for each decade has been used. This method utilizes an approach whereby ponderosa pine yield tables are applied against the FORPLAN solution. This method does not apply to the benchmarks.

1 Cover Production — Scheduled output tables have been built to compute cover production by alternative for the FORPLAN alternative runs Outputs include both total acres of cover produced and acres of cover of different quality levels (satisfactory, marginal and non-cover) These outputs have been used to compute the Habitat Effectiveness Indices for the alternatives This method does not apply to the benchmarks

m Board Foot Volumes — Calculation of board foot outputs are now based on yield tables applied against the FORPLAN model solution and are based on diameter-defined board foot to cubic foot volume conversion ratios. This method does not apply to the benchmarks.

n Watershed Outputs — FORPLAN outputs indicate the major watershed where the activity is scheduled to occur. This does not apply to the benchmarks.

o. Snags — Since the timber yield tables did not account for snags and snag replacements, the calculations for these were done outside FORPLAN. Details of the process are given in "Calculating Snags and Snag Replacements for the FEIS alternatives" (Peterson, 3/14/90).

TABLE B-9

ADJUSTMENT OF FORPLAN RUNS BY ANIMAL UNIT MONTHS AND ACRES [1/]

		DECADE 1		DECADE 2	
		Acres	AUMs	Acres	AUMs
ALTERNATIVE A					
FORPLAN RUN 70 percent Use (Cattle)		1,351,275	131,358	1,351,275	135,152
ADJUSTMENT (Outside FORPLAN)			None		None
ADJUSTED TOTAL BY MGMT. LEVEL					
(Unsat Rips)	A	0	0	0	0
	B	0	0	0	0
	C	1,345,275	130,109	1,345,275	133,811
Tbr. Seeding	D	6,000	1,249	6,000	1,341
TOTAL [2/]		1,351,275	131,358	1,351,275	135,152
ALTERNATIVE B-MODIFIED					
FORPLAN RUN 45 percent Use (Cattle)		1,351,275	120,443	1,351,275	122,883
ADJUSTMENT (Outside FORPLAN)					
Unsatis riparian			-847		-424
ADJUSTED TOTAL BY MGMT LEVEL					
(Unsat. Rips.)	A	2,000	0	2,000	0
	B	0	0	0	0
	C	1,343,275	118,347	1,343,275	121,118
Tbr. Seeding	D	6,000	1,249	6,000	1,341
TOTAL		1,351,275	119,596	1,351,275	122,459
ALTERNATIVE C-MODIFIED					
FORPLAN RUN 45 percent Use (Cattle)		1,351,275	106,675	1,351,275	104,662
ADJUSTMENT (Outside FORPLAN)					
Unsatis riparian			-27,941		-14,435
Winter range			-2,892		-2,892
ADJUSTED TOTAL BY MGMT LEVEL					
(Unsat Rips)	A	375,000	0	375,000	0
	B	0	0	0	0
	C	915,460	75,542	915,460	87,335
(Winter Rge.)	C (75% game, 25% cattle)	60,815	0	60,815	0
	D	0	0	0	0
TOTAL		1,351,275	75,842	1,351,275	87,335

1/The No Change Alternative is not included in this table because no FORPLAN runs were made for this alternative.

2/No adjustment in AUMS or acres because forage seeding was assumed to be included in the model for the No Action (A) Alternative.

DECADE 3		DECADE 4		DECADE 5	
Acres	AUMs	Acres	AUMs	Acres	AUMs
1,345,275	130,239	1,345,275	130,953	1,351,275	130,953
	None		None		None
0	0	0	0	0	0
0	0	0	0	0	0
1,345,275	128,971	1,345,275	129,703	1,345,275	129,728
6,000	1,268	6,000	1,250	6,000	1,225
1,351,275	**130,239**	**1,351,275**	**130,953**	**1,351,275**	**130,953**
1,351,275	122,423	1,351,275	118,704	1,351,275	118,704
	0		0		0
0	0	0	0	0	0
0	0	0	0	0	0
1,345,275	121,155	1,345,275	117,454	1,345,275	117,479
6,000	1,268	6,000	1,250	6,000	1,225
1,351,275	**122,423**	**1,351,275**	**118,704**	**1,351,275**	**118,704**
1,351,275	99,640	1,351,275	106,615	1,351,275	106,615
	0		0		0
	-2,892		-2,892		-2,892
0	0	0	0	0	0
0	0	0	0	0	0
1,290,460	98,222	1,290,460	105,321	1,290,460	105,321
60,815	0	60,815	0	60,815	0
0	0	0	0	0	0
1,351,275	**98,222**	**1,351,275**	**105,321**	**1,351,275**	**105,321**

TABLE B-9 (continued)
ADJUSTMENT OF FORPLAN RUNS BY ANIMAL UNIT MONTHS AND ACRES

		DECADE 1		DECADE 2	
		Acres	AUMs	Acres	AUMs
ALTERNATIVE F					
FORPLAN RUN		1,351,275	119,413	1,351,275	122,870
45 percent USE (Cattle)					
ADJUSTMENT (Outside FORPLAN)					
Unsatis. riparian			-2,236		-3,353
ADJUSTED TOTALS BY MGMT. LEVEL					
(Unsat. Rips.)	A	30,000	0	45,000	0
	B	0	0	0	0
	C	1,315,275	115,928	1,300,275	118,176
	D	6,000	1,249	6,000	1,341
TOTAL		**1,351,275**	**117,177**	**1,351,275**	**119,517**
ALTERNATIVE I					
FORPLAN RUN		1,351,275	114,950	1,351,275	115,475
45 percent Use (Cattle)					
ADJUSTMENT (Outside FORPLAN)					
Unsatis. riparian			-2,236		-3,353
ADJUSTED TOTALS BY MGMT. LEVEL					
(Unsat. Rips.)	A	30,000	0	45,000	0
	B	0	0	0	0
	C	1,315,275	111,465	1,300,275	110,781
	D	6,000	1,249	6,000	1,341
TOTAL		**1,351,275**	**112,714**	**1,351,275**	**112,122**

DECADE 3		DECADE 4		DECADE 5	
Acres	AUMs	Acres	AUMs	Acres	AUMs
1,351,275	118,185	1,351,275	117,970	1,351,275	117,986
	-1,117		0		0
15,000	0	0	0	0	0
0	0	0	0	0	0
1,330,275	115,800	1,345,275	116,720	1,345,275	116,761
6,000	1,268	6,000	1,250	6,000	1,225
1,351,275	**117,068**	**1,351,275**	**117,970**	**1,351,275**	**117,968**
1,351,275	114,652	1,351,275	115,979	1,351,275	115,979
	-1,117		0		0
15,000	0	0	0	0	0
0	0	0	0	0	0
1,330,275	112,267	1,345,275	114,729	1,345,275	114,754
6,000	1,268	6,000	1,250	6,000	1,225
1,351,275	**113,535**	**1,351,275**	**115,979**	**1,351,275**	**115,979**