

2006 Tongass Spectrum Model

Draft

Summary of Model Constraints

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Draft March 19, 2007

1. High Volume Strata Harvest Constraint by Alternative

Definition:

The maximum percentage of total old growth acres harvested in any decade that can come from high volume strata.

What it Does:

The constraint prevents model from over emphasizing harvest in high volume strata; i.e. high grading especially in early decades of the planning horizon.

Rationale (why constraint needed):

1997 Appendix B-14: to ensure the harvest acres include a mix of volume strata.

2006 Process:

The percentage used reflects how much of the high volume strata occurs in that alternative, it is proportional to on-the-ground condition. The determination of proportional occurrence was recalculated for each alternative by Eric Henderson, analyst, based on updated suitable lands and volume strata figures.

Sources:

Randy Fairbanks, Tetra Tech, updated suitability analysis and updated volume strata figures by using Caouette and DeGayner (2005) Size-Density Model.

High volume strata harvest constraint by Alternative

Alternative	CHT	KTN	STK
1	44%	54%	47%
2	40%	51%	43%
3	40%	48%	41%
4	40%	47%	40%
5	40%	47%	41%
6	40%	47%	41%
7	40%	47%	40%

*Maximum percentage of total old growth acres harvested in any decade that can come from the high volume strata

2. Normal Operability Constraint by Alternative

Definition:

Maximum percentage of all acres harvested that can be from normal operability “NIC I” lands.

What it Does:

Directs model to select harvest on normal operability lands in approximate proportion to their occurrence.

Rationale (why constraint needed):

1997 Appendix B-14: “...to ensure that all harvesting does not come from the most economic normal operability areas.” This constraint addresses the time-sensitive nature of the Spectrum model. Spectrum recognizes the time value of money (i.e., dollars today are worth more than dollars 100 years from now), and will tend to harvest the more economically efficient NIC I lands today and leave the more difficult NIC II lands for harvest in the future. This constraint ensures that a realistic mix of harvesting activities is prescribed in all time periods of the model.

2006 Process:

In the 2006 LSTA process, normal operability was considered to be shovel, short-span cable, and short helicopter yarding distances (less than 3/4 mile). Difficult operability was considered long-span cable and intermediate helicopter yarding distances (3/4 to 2 miles) and isolated was considered long helicopter yarding distances (greater than 2 miles).

The determination of proportional occurrence was recalculated for each alternative by Eric Henderson, analyst, based on updated operability figures. The table below shows the proportion of acres in normal operability (NIC I) in each administration area for each alternative.

Sources:

Randy Fairbanks, Tetra Tech, updated operability data based on new Forest-wide Logging System and Transportation Analysis (LSTA).

Normal Operability Constraint by Alternative

Alternative	CHT	KTN	STK
1	98%	97%	96%
2	94%	94%	93%
3	90%	92%	91%
4	87%	93%	92%
5	83%	93%	91%
6	85%	93%	92%
7	87%	92%	92%

* Maximum percentage of all acres harvested that can be from "Normal" Operability (shovel, short span cable, and Short-length helicopter)

3. Model Implementation Reduction Factor Constraints (MIRF):

Definition:

Minimum percentage of acres in each Administrative Area/Operability/Volume Strata category that must be assigned the “no harvest” prescription.

What it Does:

Directs model to account for unmapped non-suitable lands, such as stream buffers, over-steepened slopes, and non-commercial forests that are not mapped or are mapped incorrectly.

Rationale (why constraint needed):

1997 Appendix B-15 – B-17: to ensure that ASQ estimates will be more consistent with what is likely to be found during implementation. Acres assumed to be suitable for timber production, and thus used in the Spectrum model, include some inherently non-suitable lands due to the following factors:

- Land Selections – reduction due to the conveyance of selected lands to the State of Alaska and Native interests
- TTRA Stream Buffers – reduction due to unmapped Class I and II stream buffers
- Non-Commercial Forest – reduction due to volume class mapping errors
- Slope/Soil Hazard – reduction due to unmapped steep slopes
- Cost Efficiency – excludes stands with the lowest economic potential from the suitable base
- Riparian Habitat (Class III streams) – reduction due to unmapped Class III stream buffers
- Karst/Caves – reduction due to upgrading of the karst classification to high vulnerability on some areas
- Deer Habitat reduction due to implementation of deer habitat standards and guidelines (some 1997 alternatives included these)
- Remaining Standards & Guidelines – reduction due to unmapped raptor and murrelet nests, wolf dens, mountain goat habitat, and habitat linkages.

These acres cannot be mapped and removed before the analysis, so MIRF is applied to the model in proportion to the acres’ assumed occurrence in different operability/volume strata (see table below).

2006 Process:

MIRF factors were recalculated by Tetra Tech based on updated GIS data, new LSTA information, and additional years of Forest Plan implementation experience.

Sources:

Randy Fairbanks, TetraTech, updated MIRF analysis. See “MIRF 2006 Documentation” paper (November 10, 2006).

MIRF Constraints - applied to all alternatives

Chatham						
Operability / Vol Strata	Shovel	Short Span Cable	Short Helicopter	Long Span Cable	Mid-Helicopter	Long-Helicopter
High	39%	39%	39%	39%	39%	39%
Medium	39%	39%	39%	39%	39%	64%
Low	49%	49%	49%	74%	74%	99%
2nd Growth	18%	18%	18%	18%	18%	18%
Ketchikan						
Operability / Vol Strata	Shovel	Short Span Cable	Short Helicopter	Long Span Cable	Mid-Helicopter	Long-Helicopter
High	19%	19%	19%	19%	19%	19%
Medium	19%	19%	19%	19%	19%	44%
Low	29%	29%	29%	54%	54%	79%
2nd Growth	11%	11%	11%	11%	11%	11%
Stikine						
Operability / Vol Strata	Shovel	Short Span Cable	Short Helicopter	Long Span Cable	Mid-Helicopter	Long-Helicopter
High	13%	13%	13%	13%	13%	13%
Medium	13%	13%	13%	13%	13%	38%
Low	23%	23%	23%	48%	48%	73%
2nd Growth	8%	8%	8%	8%	8%	8%

4. Maximum Regulation Class 3 Harvest Constraint:

Definition:

Maximum percentage of acres harvested each decade that can come from Regulation Class 3 lands. Regulation Class 3 lands, put simply, are visually sensitive lands where only small, low visual-impact treatments are allowed. Regulation class 3 is determined as a function of Land Use Designation, Distance Zone, Scenic Integrity Objective, and Visual Absorption Capacity. 2006 DEIS Appendix B Table B-5 displays how these factors combine to delineate Regulation Class.

What it Does:

Limits the total acreage harvest in Regulation Class 3 to be no more than 7% of the total acres harvested.

Rationale (Why constraint needed):

This is the same constraint that was used in the 1997 model. This was based on the historic amount of harvest from lands with incidental yields (see table 3-81 in the 1997 FEIS). The constraint was used to ensure that a disproportional amount of harvest on uneconomic lands did not occur in the distant future (100 years or more).

2006 Process:

Regulation Class 3 constraints were the same for all alternatives (see table below).

Sources:

1997 Tongass FORPLAN model.

1997 Tongass FEIS Table 3-81.

Maximum Regulation Class 3 harvest*

Alternative	CHT	KTN	STK
1	7%	7%	7%
2	7%	7%	7%
3	7%	7%	7%
4	7%	7%	7%
5	7%	7%	7%
6	7%	7%	7%
7	7%	7%	7%

* Maximum percentage of all acres harvested in any decade that can be in Reg Class 3

5. Precommercial Thinning Constraint:

Definition:

Maximum number of acres of precommercial thinning allowed in any year.

What it Does:

Limits the model to prescribing a maximum of 6,300 acres of commercial thinning per year.

Rationale (why constraint needed):

1997 Appendix B-14: the amount of precommercial thinning considered feasible given budget and personnel limitations.

2006 Process:

This constraint remained the same as in 1997 after review by the forest silviculture program manager.

Sources:

1997 Appendix B-14, Tongass forest silviculture program manager.

Maximum Acres of Precommercial Thin - any decade

Alternative	CHT	KTN	STK	
1	15750	31500	15750	63000
2	15750	31500	15750	63000
3	15750	31500	15750	63000
4	15750	31500	15750	63000
5	15750	31500	15750	63000
6	15750	31500	15750	63000
7	15750	31500	15750	63000

6. Minimum Timber Constraint

Definition:

Minimum harvest level to be achieved in decades 1, 2, and/or 3 of the planning horizon in each alternative. The constraint for alternatives 1, 2, and 3 is for sawlog only; constraints for alternatives 4, 5, 6, and 7 are for sawlog and utility; i.e. ASQ. The table below displays these constraints in more detail.

What it Does:

Causes the model to meet projected demand and/or target harvest level associated with each alternative. The model is directed to harvest at least the designated level of this constraint.

Rationale (Why Constraint Needed):

The alternative frameworks were developed to meet a number of social, environmental, and economic variables. The Ninth Circuit Court said the alternatives should satisfy a range of market demand scenarios, so one of the key aspects of each framework was to satisfy a specific market demand. Within the framework of each alternative, this constraint was used to help the alternative produce a volume level that approximately corresponded with a specific potential demand scenario, in the initial decades as well as in the later ones.

2006 Process:

These levels were set approximately at the demand scenarios of the Brackley et al. (2006) report, adjusting for the types of wood (e.g., sawlog vs. utility) that would be useable by the infrastructure that would be in place under each scenario.

The 2006 process differs from the 1997 process in that, in 1997, the maximum feasible amount of timber for the first decade was determined first. Then, this level was used as a constraint in a maximize PNV run the same as we have modeled here. In 2006, the level was determined based on different levels of projected timber demand. Constraints by alternative are listed in the table below.

Sources:

The Brackley et al. (2006) report was used as a guide to define market demand scenarios and these scenarios, along with other social and environmental factors were used to define the land bases for the alternatives, which also served to constrain the volumes.

Minimum boardfoot Constraint - MBF per Decade

Alternative	Decade	Unit	CHT	KTN	STK	Total
1	1	Sawlogs	83600	208000	158000	449600
2	1	Sawlogs	147000	681000	487000	1315000
	3	Sawlogs	156000	724000	505000	1385000
3	1	Sawlogs	297000	736000	563000	1596000
	2	Sawlogs	337000	821000	630000	1788000
4	1	Sawlogs	567000	1188000	945000	2700000
	2	Saw + Util	880000	1400000	1135000	3415000
5	1	Saw + Util	535000	1206000	931000	2672000
6	1	Saw + Util	535000	1202000	933000	2670000
7	1	Saw + Util	930000	1990000	1290000	4210000

7. Goshawk/Marten, Legacy, and Old Growth Retention Standards and Guidelines

Definition:

Limits harvest activities in certain VCUs to mimic the goshawk and marten standards and guidelines in the current Forest Plan, the Legacy standards and guidelines in the proposed Forest Plan, and the old-growth retention requirement of Alternative 4.

- Goshawk/marten constraints limit the Productive Old Growth (POG) harvest in certain areas of the Forest important for goshawk or the high-volume strata POG harvest in certain areas of the Forest important for marten. Goshawk/marten standards were applied only to Alternative 5.
- Legacy constraints assume 2-14% retention on even-aged prescriptions in Regulation Classes 1 and 2 in certain VCUs. Legacy constraints were applied to Alternatives 1, 2, 3, and 6.
- Old-growth retention constrained certain VCUs to a maximum number of old growth acres that could be clearcut and/or a maximum of 50% of the original old growth that could be clearcut in any 50 year period. Old Growth Retention was applied only to Alternative 4.

The table below shows the constraints used by each alternative.

Goshawk/Marten, Legacy, and Old Growth Retention S&G Constraints

Alternative	Apply Gos/Mart?	Apply Legacy?	Apply OG Retention?
1	No	Yes	No
2	No	Yes	No
3	No	Yes	No
4	No	No	Yes
5	Yes	No	No
6	No	Yes	No
7	No	No	No

What it Does:

Causes the model to leave legacy trees or a certain amount of old growth canopy closure depending on the constraint.

Rationale (why constraint needed):

To meet the applicable Plan standards and guidelines for the specific alternative.

2006 Process:

These constraints are typically modeled as a combination of maximum limits on old growth harvest in certain VCUs or as a yield modification that simulates leaving a certain amount of trees on the ground. The following processes were used to determine the constraint levels.

A. Goshawk/Marten Standard & Guideline: applied to DEIS Alternative 5

In VCUs with >33% POG harvest

Goshawk

- On Prince of Wales in VCUs with >33% POG harvest as of 1997
- Within openings >2 acres, leave >30% canopy closure over unit, including 8 large trees, must be windfirm, etc.

Marten

- In six biogeographic provinces, in high-volume POG, <1,500 feet, with >33% POG harvest
- Within openings >2 acres, leave >30% canopy closure over unit, including 8 large trees, must be windfirm, etc.

Modeling

- Assume for units >2acres, that 30% canopy cover equates to retaining 25% beyond what is already being retained due to blind leads and MIRF
- Then assume that 1/10 of unit area is <2 acres
- **Therefore, retention = 1/10 @ 0% plus 9/10 @ 25% or 22.5% overall**

In VCUs with <33% POG harvest

Goshawk

- No restrictions

Marten

- In six biogeographic provinces, in high-volume POG, <1,500 feet, with >33% POG harvest
- Within openings >2 acres, leave 10-20% of original stand, including 4 large trees, must be windfirm, etc.

Modeling

- Assume for units >2acres, 10-20% canopy cover equates to retaining 5% beyond what is already being retained due to blind leads and MIRF
- Then assume that 1/10 of unit area is <2 acres
- **Therefore, retention = 1/10 @ 0% plus 9/10 @ 5% or 4.5% overall**

B. Legacy Standard & Guideline: Applied to DEIS Alternatives 1, 2, 3, 6

The retention of legacy forest structure in harvest units is prescribed by Forest-wide Standards & Guidelines WILD112, Subsection IV. The amount of legacy forest structure to be retained will vary, depending on the current and future conditions of the surrounding landscape. The scale of assessing the context of the surrounding landscape is the Value Comparison Unit, or VCU, and the measure is the amount of productive old growth in that VCU. Three VCU categories of landscape risk are defined based on the amount of past and future harvest. More legacy forest structure is to be retained in higher risk VCUs and less in lower risk VCUs. The VCUs by risk category where Legacy standards and guidelines are applied are described in the 2006 Tongass National Forest plan amendment Appendix I.

Higher Risk VCUs:

Higher Risk VCUs are defined as VCUs where 33 percent or more of the productive old growth has been harvested as of 2005, or VCUs where less than 33 percent has been harvested but more than 67 percent of the productive old growth is projected to be harvested by the end of the Forest Plan planning horizon. There are 49 VCUs in this category.

Quantitative description: Within openings >10 acres, leave 30% or more

Modeling

- Assume for units >10 acres, 30% equates to a 20% retention
- Then assume that 1/3 of unit area is <10 acres
- **Therefore, retention = 1/3 @ 0% plus 2/3 @ 20% or 13.33% overall**

Moderate Risk VCUs:

Moderate Risk VCUs are defined as VCUs where less than 33 percent of productive old growth has been harvested as of 2005, but where it is projected that 33 to 67 percent of the productive old growth will be harvested by the end of the Forest Plan planning horizon. There are 154 VCUs in this category.

Quantitative description: Within openings >20 acres, leave 15% or more

Modeling

- Assume for units >20 acres, 15% equates to a 5% retention
- Then assume that 2/3 of unit area is <20 acres
- **Therefore, retention = 2/3 @ 0% plus 1/3 @ 5% or 1.67% overall**

Low Risk VCUs:

Lower Risk VCUs are defined as VCUs where less than 33 percent of productive old growth has been harvested as of 2005 and where it is projected that less than 33 percent will be harvested at the end of the Forest Plan planning horizon. All of the 741 remaining VCUs are in this category.

Quantitative description: No retention beyond Reserve Tree S&G

Modeling

- **0% overall**

C. Old Growth Retention Standard and Guideline: Applied to DEIS Alternative 4

Alternatives 1, 2, 3, 5, and 6 refine, but maintain the old-growth conservation strategy that is included in the current Forest Plan, which is primarily based on a Forest-wide system of old-growth reserves. Alternative 7 does not incorporate old-growth reserves or a specific old-growth retention strategy. Alternative 4 is an intermediate system that includes old-growth reserves in four biogeographic provinces and an old-growth retention strategy in the others. Reserve areas are excluded from the model, and the retention strategy is modeled with a series of constraints.

The alternative framework says that within each VCU where timber harvest is scheduled, the following constraints should apply:

- 1) harvest no more than 50% of the productive old growth during any 50-year period
- 2) retain a minimum of 33% of the VCU in an old-growth forest condition

Constraint 1 is formulated based on the amount of 2006 suitable POG relative to the amount of POG present in 1954 (represents the “original” amount of POG present). If the amount of suitable POG in 2006 is less than 50% of the total amount of 1954 POG, there is no danger of violating Constraint 1, and therefore the VCU is not constrained. In the remaining VCUs, the constraint was formulated so that no more than 50% of the 2006 suited POG could be harvested in any 50 year period.

Constraint 2 was formulated based on how much of the remaining suitable POG could be harvested before 67% of the 1954 POG was harvested. If it was possible to harvest enough suitable POG to cross the 67% threshold, the constraint was set so that harvest would stop once 67% of the POG was removed. Otherwise, the constraint was not necessary as one could harvest 100% of the remaining suitable POG and still leave 33% or more of the 1954 POG in the VCU.

Sources:

Randy Fairbanks, Tetra Tech, GIS analyses based on the following Tongass GIS layers: suitable forestland, size-density model, land status, regulation class, contours, alternative LUDs, and others.

8. Watershed Opening Constraints

Definition:

Limits the maximum amount of openings created by management to less than 20% of any given watershed. VCU is used as a proxy for watershed. Opening is defined as an even-aged management activity less than 30 years old.

What it Does:

Causes the model to forego management in VCUs where more than 20% of the area is less than 30 years old.

Rationale (why constraint needed):

1997 Appendix B-14: to minimize cumulative watershed impacts from harvest operations

2006 Process:

Total suitable area of each VCU was calculated in each alternative. If the total suitable area was less than 20 % of the total area, there was no need for the constraint since even 100% management of the suitable land would not violate the 20% threshold for the VCU. For other VCUs, the constraint was calculated considering the total amount of land in the VCU relative to the suitable portion. The following formula was applied to determine the constraint level C.

$$C = .2 * T / s$$

Where .2 = the 20% limit, T = total land in the VCU and s = suitable land in the VCU.

Finally, constraints were filtered to exclude VCUs where C was greater than 50% (i.e., if one could harvest 50% or more of suitable acres of the VCU and still not create an opening larger than 20% of the total acres in the VCU). Filtering was done to reduce model size and provide consistency with the

1997 process. It may be surmised that in most cases, 50% is the critical level before the constraint would be meaningful, as other constraints (such as dispersion) may be more constraining above that level.

Source:

Randy Fairbanks, Tetra Tech, Updated suitability analysis and size-density model

9. Regulation Class Management Intensity Constraints

Definition:

Limitations on opening creation from harvest activities in VCU/Regulation Class classifications in combination with a definition of opening persistence per VCU/Regulation Class classification.

What it Does:

Estimates how much of a viewshed can be disturbed at any one time and still meet the adopted visual quality objectives of the area.

Rationale (why constraint needed):

1997 Appendix B-14: to meet the adopted visual quality and adjacency objectives of each Land Use Designation

2006 Process:

For each Regulation Class, specify the minimum amount of time to wait before harvest of adjacent units. Also specify the maximum amount of openings that can persist in a regulation class as a proxy for harvest unit size.

Regulation Class 1 green-up interval of 20 years comes from the 1997 Alternative 11 FORPLAN model. Regulation Class 2 green-up reflects the 35-year period used in the 1997 FORPLAN model. The Regulation Class 3 green-up interval was modified from 60 years (1997) to 50 years to better reflect the modified Regulation Class 3 prescription of 25% area removal every 50 years (developed by Forest silviculture program manager). The prescription was modified from 1997 to enable the model to recognize an entire area as “treated” despite the fact that only 25% of the area is physically treated. By design, the remaining 75% should not be harvested during the green-up interval, and the modified modeling design captures the nature of the problem.

Source:

Randy Fairbanks, Tetra Tech, Updated suitability analysis, size-density model, and updated regulation class figures, based on LUD, distance zone, Visual Absorption Capacity, and Scenic Integrity Objectives (see DEIS Appendix B-14 – B-15).

The VCU map resides in the Tongass library and is maintained by Tongass forest staff.

Reg

Class Constraint Description

- | | |
|---|--|
| 1 | No more than 40% of the Suitable acres of Reg Class 1 in a VCU can be less than 20 years old |
| 2 | No more than 30% of the Suitable acres of Reg Class 2 in a VCU can be less than 35 years old |
| 3 | No more than 20% of the Suitable acres of Reg Class 3 in a VCU can be less than 50 years old |