

2006 Tongass Spectrum Model

Draft

Summary of Treatments Modeled in Spectrum

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1. No-harvest/minimum management

Definition:

Prescription choice to not harvest the stand

What it Does:

Allows the model to not harvest uneconomical stands or stands that may be constrained to be not harvested (such as MIRF stands). Also allows for standing inventory at the end of the planning horizon to meet the ending inventory long-term sustained yield constraints.

Rationale (why harvest system needed):

To allow for realistic modeling; there are some stands that will simply never be harvested.

2006 Process:

Simple model incorporation; apply this prescription option to all stands.

Sources:

Standard Spectrum input

2. Clearcut

Definition:

Even-aged management prescription available to all suitable/available types of land, except Regulation Class 3

What it Does:

All trees from the stand are removed at the time of harvest (except if there are standards and/or guides that dictate that legacy trees should be left)

Rationale (why harvest system needed):

To model a common silvicultural treatment option on the Tongass National Forest

2006 Process:

The clearcut treatment option is defined as a viable choice for all Regulation Class 1 and 2 lands. In Alternatives that have VCUs where legacy trees are to be retained, a yield modification factor is applied to approximate the volume not removed from the site at the time of harvest. This option is available to both old-growth and young-growth/regenerated stands.

Sources:

Jim Russell, Forest silviculture program manager, description of the system and yield tables (Young growth yields June, 2006; Old-growth yields October, 2006)

Randy Fairbanks, TetraTech, VCUs where legacy trees must be left and how many legacy trees must be left (the yield modification factor). See Item 7 in the 2006 Tongass Spectrum Model, Summary of Model Constraints document.

3. Clearcut with pre-commercial thin

Definition:

Precommercially thin young-growth at age 20. At rotation age, clearcut the stand. Only available to Regulation Classes 1 and 2 on Productivity Class 1 sites.

What it Does:

At age 20, the stand is treated with a precommercial thin to accelerate growth of the remaining stand. At rotation age, all trees from the stand are removed at the time of harvest (except if there are standards and/or guides that dictate that legacy trees should be left)

Rationale (why harvest system needed):

To model a common silvicultural treatment on the Tongass National Forest and increase stand productivity.

2006 Process:

Yield tables were developed to recognize increased growth from a precommercial thin at age 20. A cost at age 20 is input into the Spectrum model, but no yield is recognized. Available age of the clearcut is increased to allow the stand to be fully recovered and increased growth from the thin to be realized before it is treated. This treatment option is defined as a viable choice for high Productivity Class 1 sites on Regulation Class 1 and 2 lands. In Alternatives that have VCUs where legacy trees are to be retained, a yield modification factor is applied to approximate the volume left at the time of harvest. This option is available only to young-growth stands (existing in 2006 or resulting from a modeled old-growth clearcut), as old-growth stands are assumed to be beyond the age where precommercial thins are a viable silvicultural option.

Sources:

Jim Russell, Forest silviculture program manager, description of the system and yield tables (Young growth yields, June 2006).

Randy Fairbanks, TetraTech, VCUs where and how many legacy trees must be left (the yield modification factor). See Item 7 in the 2006 Tongass Spectrum Model, Summary of Model Constraints document.

4. Commercial Thin - Clearcut

Definition:

Commercial thin at age 70, 80, or 90. Clearcut at choice of rotation ages. Applies to Productivity Class 1 lands, Regulation Classes 1 and 2.

What it Does:

At the age of commercial thin, the stand is treated to remove merchantable volume and accelerate growth of the remaining stand. At rotation age, all trees from the stand are removed at the time of harvest (except if there are standards and/or guides that dictate that legacy trees should be left)

Rationale (why harvest system needed):

To model and evaluate the use of a potential treatment on the Tongass National Forest and increase stand productivity.

2006 Process:

Yield tables are developed to recognize thinning volume at the appropriate rotation age. Age at which the clearcut occurs is modified to allow the stand to be fully recovered and for increased growth to be adequately captured. This treatment option is defined as a viable choice for High Productivity Class 1 sites on Regulation Class 1 and 2 lands. In Alternatives that have VCUs where legacy trees are to be retained, a yield modification factor is applied to approximate the volume not removed from the site at the time of harvest. This option is available only to young-growth stands (existing in 2006 or resulting from a modeled old-growth clearcut), as old-growth stands are assumed to be beyond the age where commercial thins are a viable silvicultural option.

Sources:

Jim Russell, Forest silviculture program manager, description of the system and yield tables (Young growth yields, June 2006).

Randy Fairbanks, TetraTech, VCUs where and how many legacy trees must be left (the yield modification factor). See Item 7 in the 2006 Tongass Spectrum Model, Summary of Model Constraints document.

5. Precommercial Thin – Commercial Thin - Clearcut

Definition:

Precommercial thin at age 20. Commercial thin at age 60, 70, or 80. Clearcut at choice of rotation ages. Applies to Productivity Class 1 lands, Regulation Classes 1 and 2.

What it Does:

At age 20, the stand is treated with a precommercial thin to accelerate growth of the remaining stand. At the age of commercial thin, the stand is treated to remove some merchantable volume and accelerate growth of the remaining stand. At rotation age, all trees from the stand are removed at the time of harvest (except if there are standards and/or guides that dictate that legacy trees should be left)

Rationale (why harvest system needed):

To model and evaluate the use of a potential treatment on the Tongass National Forest and increase stand productivity.

2006 Process:

For this treatment option, Spectrum hard wires in precommercial thinning costs at age 20 and recognizes no merchantable yield. Yield tables are developed to recognize commercial thinning volume after a precommercial thin at the appropriate rotation age. Available age of clearcuts are designed to allow the stand to be fully recovered and increased growth to be captured. This treatment option is defined as a viable choice for High Productivity Class 1 sites on Regulation Class 1 and 2 lands. In Alternatives that have VCUs where legacy trees are to be retained, a yield modification factor is applied to approximate the volume left at the time of harvest. This option is available only to young-growth stands (existing in 2006 or resulting from a modeled old-growth clearcut), as old-growth stands are assumed to be beyond the age where precommercial and commercial thins are a viable silvicultural option.

Sources:

Jim Russell, Forest silviculture program manager, description of the system and yield tables (Young growth yields, June 2006)

Randy Fairbanks, TetraTech, VCUs where and how many legacy trees must be left (the yield modification factor). See Item 7 in the 2006 Tongass Spectrum Model, Summary of Model Constraints document.

6. Group Selection / Uneven-aged management (Reg Class 3 prescription)

Definition:

Apply small (2-3 acre) clearcuts to maintain the visual integrity of the area.

What it Does:

Defines the allowable treatment of Regulation Class 3 lands

Rationale (why harvest system needed):

This prescription is intended to maintain visual integrity in visually sensitive areas.

This prescription was modeled to capture the nature of harvest in Regulation Class 3. In Regulation Class 3, an entire stand is considered “treated” even if only 25% of the area is removed in small 2-3 acre clearcuts. The remaining portion is to be left untreated for at least 50 years.

2006 Process:

This prescription is an option for all existing old-growth stands and existing young-growth stands. The prescription may also be applied to regenerated stands, although they will not come into solution until after the end of the planning horizon.

This prescription is modeled as a series of removals that occur every 50 years and remove 25% of the volume at every entry. For old-growth stands standing volume in these yield tables will be constructed as a combination of remaining old-growth plus assumed regrowth of the small patch. Green-up interval is implied by the regulated scheduled entries; rotation age will be 150 years after first entry. Existing young-growth stands in Regulation Class 3 will be modeled in a similar manner as the old-growth (25% of the volume will be removed upon first entry (starting age 80) and 25% will be removed at second entry, etc.).

LTSY will be input into the model from a “placeholder” yield table and reflect the removal of 25% of 200 year-old second-growth every 50 years. These yield tables have only 1 coefficient to represent this yield (at age 50) and there is only 1 timing choice for stands that will access the table (age 50), thereby ensuring the correct LTSY calculation.

The equation to calculate standing volume on an acre of an existing old-growth stands is:

Between first and second entries:

$$SV_{at} = .25RV_{a1} + .75SV_{ai}$$

Between second and third entries:

$$SV_{at} = .25RV_{a1} + .25RV_{a2} + .5SV_{ai}$$

Between third and fourth entries:

$$SV_{at} = .25RV_{a1} + .25RV_{a2} + .25RV_{a3} + .25SV_{ai}$$

Where

SV_{at} = total standing volume per acre at age a time t since start of planning horizon

RV_{ax} = per-acre standing regeneration volume aged 'a' starting accounting in the period associated with timing choice x

SV_{ai} = full acre standing volume of the original acre aged 'a' starting accounting in the initial period i

Sources:

Jim Russell, Forest silviculture program manager and Eric Henderson, analyst, designed timing choices.

Jim Russell, Forest silviculture program manager, Young-growth yield tables, June 2006; Old-growth yield tables, October, 2006.

7. Old-Growth 2-aged Management (Partial Cut)*

Definition:

Remove 77.5% of the old-growth volume from a stand and leave 22.5% of the volume. On subsequent entries, leave the original old-growth and remove the regenerated portion of the stand.

What it Does:

Implements the Alternative 5 Goshawk/marten standards and guidelines in applicable VCUs

Rationale (why harvest system needed):

This prescription is necessary when the 33% remaining POG threshold is crossed in VCUs where Goshawk and Marten standards and guidelines from the 1997 TLMP Revised Plan apply.

2006 Process:

This prescription is an option for the High volume strata Regulation Classes 1 and 2. The prescription is triggered by a constraint to disallow full clearcutting once productive old-growth is reduced to 33% of the original amount in key VCUs. This prescription does not apply to existing young-growth stands since it is assumed they have no old-growth component.

First Entry: On first entry into old-growth stands, remove 77.5% of the land area (corresponds to 77.5% of the standing volume).

Subsequent Entries: The stand will then be considered "regenerated" and young-growth activities will be allowed on the cut portions of the stand starting at age 80. Standing volume will be a function of remaining old-growth (the 22.5%) plus assumed regeneration, derived by the following formula.

Formula: $SVa = OG + YGa$

Where

SVa = standing volume at age a

OG is remaining old-growth volume

YGa is young-growth volume at age a)

Regenerated stand volume after a partial cut will be approximately 10% less than full young-growth volume, due to the increased shading from reserve trees. Yields are calculated using a shelterwood prescription proportion defined in the Spectrum input file. The regenerated portion of the stand is fully removed and the old-growth portion left in the first entry is retained. Therefore, the proportion removed varies by age and is calculated by the function:

$$PRa = (YGa - OG)/SVa$$

where

PRa is proportion removed at age a

YGa is the young growth volume at age a

OG is the standing old-growth volume

SVa is the standing volume at age a.

Sources:

Jin Russell, Forest silviculture program manager, timing choices and design

Randy Fairbanks, TetraTech, percent of stand removal (see Item 7 in the 2006 Tongass Spectrum Model, Summary of Model Constraints document).

* This prescription is unique to Alternative 5. The DEIS summary table 3.13-9 (p. 3-260) uses “Two-aged” regeneration harvest to represent both the alternative 5 two-aged system and any prescription that occurs on Regulation Class 2 lands.

Appendix 1: Rotation ages and thinning timing choices for the Tongass Spectrum model 2006

Note: Old-growth ages are placeholders as the true ages of these stands are unknown

High volume Strata= 220 years at the start of the planning horizon, Mid volume strata = 230 years and Low volume strata = 240 years.

Timing choices are adjusted accordingly

Note: The Regulation class 3 clearcut is assumed to remove 25% of the volume every 50 years. Timing choices represent options for first entry

Prod Class	Geo Zone	Reg Class	VOL STRAT	Prescription	First Thin Age	Last Thin Age	First Removal Age	Last Removal Age
Young-growth Reg Class 1								
Prod Class 1		Reg Class 1	2nd Growth	Clearcut			60	150
Prod Class 1		Reg Class 1	2nd Growth	Precom. Thin - CC			70	160
Prod Class 1		Reg Class 1	2nd Growth	Comm. Thin - Clearcut	70	90	110	160
Prod Class 1		Reg Class 1	2nd Growth	Precom. Thin - Comm. Thin - CC	60	80	110	160
Prod Class 2		Reg Class 1	2nd Growth	Clearcut			80	170
Prod Class 3		Reg Class 1	2nd Growth	Clearcut			150	190
Young-growth Reg Class 2								
Prod Class 1		Reg Class 2	2nd Growth	Clearcut			80	150
Prod Class 1		Reg Class 2	2nd Growth	Precom. Thin - CC			90	160
Prod Class 1		Reg Class 2	2nd Growth	Comm. Thin - Clearcut	70	90	110	160
Prod Class 1		Reg Class 2	2nd Growth	Precom. Thin - Comm. Thin - CC	60	80	110	160
Prod Class 2		Reg Class 2	2nd Growth	Clearcut			100	170
Prod Class 3		Reg Class 2	2nd Growth	Clearcut			170	190
Young-growth Reg Class 3								
Prod Class 1		Reg Class 3	2nd Growth	Clearcut	80	120	240	240
Prod Class 2		Reg Class 3	2nd Growth	Clearcut	90	130	250	250
Prod Class 3		Reg Class 3	2nd Growth	Clearcut	100	140	260	260
Old-growth High Vol Strata Reg Class 3								
Prod Class 1	North Island	Reg Class 3	High	Clearcut			220	260
Prod Class 1	North Mainland	Reg Class 3	High	Clearcut			220	260
Prod Class 1	South Island	Reg Class 3	High	Clearcut			220	260
Prod Class 1	South Mainland	Reg Class 3	High	Clearcut			220	260

Prod Class 1	Yakutat	Reg Class 3	High	Clearcut	220	260
Prod Class 2	North Island	Reg Class 3	High	Clearcut	220	260
Prod Class 2	North Mainland	Reg Class 3	High	Clearcut	220	260
Prod Class 2	South Island	Reg Class 3	High	Clearcut	220	260
Prod Class 2	South Mainland	Reg Class 3	High	Clearcut	220	260
Prod Class 2	Yakutat	Reg Class 3	High	Clearcut	220	260
Prod Class 3	North Island	Reg Class 3	High	Clearcut	220	260
Prod Class 3	North Mainland	Reg Class 3	High	Clearcut	220	260
Prod Class 3	South Island	Reg Class 3	High	Clearcut	220	260
Prod Class 3	South Mainland	Reg Class 3	High	Clearcut	220	260
Prod Class 3	Yakutat	Reg Class 3	High	Clearcut	220	260
Old-growth High Vol Strata All Prod Classes, Reg Classes 1 and 2						
	North Island		High	Clearcut	220	380
	North Mainland		High	Clearcut	220	380
	South Island		High	Clearcut	220	380
	South Mainland		High	Clearcut	220	380
	Yakutat		High	Clearcut	220	380
Old-growth High Vol Strata Prod Classes 1 and 2, Reg Classes 1 and 2						
Prod Class 1	North Island	Reg Class 1	High	Partial Cut	220	380
Prod Class 1	North Mainland	Reg Class 1	High	Partial Cut	220	380
Prod Class 1	South Island	Reg Class 1	High	Partial Cut	220	380
Prod Class 1	South Mainland	Reg Class 1	High	Partial Cut	220	380
Prod Class 1	Yakutat	Reg Class 1	High	Partial Cut	220	380
Prod Class 1	North Island	Reg Class 2	High	Partial Cut	230	390
Prod Class 1	North Mainland	Reg Class 2	High	Partial Cut	230	390
Prod Class 1	South Island	Reg Class 2	High	Partial Cut	230	390
Prod Class 1	South Mainland	Reg Class 2	High	Partial Cut	230	390
Prod Class 1	Yakutat	Reg Class 2	High	Partial Cut	230	390
Prod Class 2	North Island	Reg Class 1	High	Partial Cut	220	380
Prod Class 2	North Mainland	Reg Class 1	High	Partial Cut	220	380
Prod Class 2	South Island	Reg Class 1	High	Partial Cut	220	380
Prod Class 2	South Mainland	Reg Class 1	High	Partial Cut	220	380
Prod Class 2	Yakutat	Reg Class 1	High	Partial Cut	220	380

Prod Class 2	North Island	Reg Class 2	High	Partial Cut	230	390
Prod Class 2	North Mainland	Reg Class 2	High	Partial Cut	230	390
Prod Class 2	South Island	Reg Class 2	High	Partial Cut	230	390
Prod Class 2	South Mainland	Reg Class 2	High	Partial Cut	230	390
Prod Class 2	Yakutat	Reg Class 2	High	Partial Cut	230	390
Old-growth Mid Vol Strata Reg Class 3						
Prod Class 1	North Island	Reg Class 3	Mid	Clearcut	230	270
Prod Class 1	North Mainland	Reg Class 3	Mid	Clearcut	230	270
Prod Class 1	South Island	Reg Class 3	Mid	Clearcut	230	270
Prod Class 1	South Mainland	Reg Class 3	Mid	Clearcut	230	270
Prod Class 1	Yakutat	Reg Class 3	Mid	Clearcut	230	270
Prod Class 2	North Island	Reg Class 3	Mid	Clearcut	230	270
Prod Class 2	North Mainland	Reg Class 3	Mid	Clearcut	230	270
Prod Class 2	South Island	Reg Class 3	Mid	Clearcut	230	270
Prod Class 2	South Mainland	Reg Class 3	Mid	Clearcut	230	270
Prod Class 2	Yakutat	Reg Class 3	Mid	Clearcut	230	270
Prod Class 3	North Island	Reg Class 3	Mid	Clearcut	230	270
Prod Class 3	North Mainland	Reg Class 3	Mid	Clearcut	230	270
Prod Class 3	South Island	Reg Class 3	Mid	Clearcut	230	270
Prod Class 3	South Mainland	Reg Class 3	Mid	Clearcut	230	270
Prod Class 3	Yakutat	Reg Class 3	Mid	Clearcut	230	270
Old-growth Mid Vol Strata, All Prod Classes, Reg Classes 1 and 2						
	North Island		Mid	Clearcut	230	390
	North Mainland		Mid	Clearcut	230	390
	South Island		Mid	Clearcut	230	390
	South Mainland		Mid	Clearcut	230	390
	Yakutat		Mid	Clearcut	230	390
Old-growth Low Vol Strata Reg Class 3						
Prod Class 1	North Island	Reg Class 3	Low	Clearcut	240	280
Prod Class 1	North Mainland	Reg Class 3	Low	Clearcut	240	280
Prod Class 1	South Island	Reg Class 3	Low	Clearcut	240	280
Prod Class 1	South Mainland	Reg Class 3	Low	Clearcut	240	280
Prod Class 1	Yakutat	Reg Class 3	Low	Clearcut	240	280

Prod Class 2	North Island	Reg Class 3	Low	Clearcut	240	280
Prod Class 2	North Mainland	Reg Class 3	Low	Clearcut	240	280
Prod Class 2	South Island	Reg Class 3	Low	Clearcut	240	280
Prod Class 2	South Mainland	Reg Class 3	Low	Clearcut	240	280
Prod Class 2	Yakutat	Reg Class 3	Low	Clearcut	240	280
Prod Class 3	North Island	Reg Class 3	Low	Clearcut	240	280
Prod Class 3	North Mainland	Reg Class 3	Low	Clearcut	240	280
Prod Class 3	South Island	Reg Class 3	Low	Clearcut	240	280
Prod Class 3	South Mainland	Reg Class 3	Low	Clearcut	240	280
Prod Class 3	Yakutat	Reg Class 3	Low	Clearcut	240	280
Old-growth Low Vol Strata, All Prod Classes, Reg Classes 1 and 2						
	North Island		Low	Clearcut	240	400
	North Mainland		Low	Clearcut	240	400
	South Island		Low	Clearcut	240	400
	South Mainland		Low	Clearcut	240	400
	Yakutat		Low	Clearcut	240	400