Type 4 Silviculture Strategy

Addendum to Modelling and Analysis Report – 100 Mile House TSA Western Larch Scenarios

Version 1.2
Draft

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1 Introduction

1.1 Context

This document is an addendum to the Modelling and Analysis Report of the Type IV Silviculture Strategy for the 100 Mile House Timber Supply Area (TSA) (FESL, 2015). It presents the results of two scenarios that investigate the potential timber supply impacts of Western Larch (Larix occidentalis) on the TSA timber supply. In the scenarios, Western Larch (Lw) replaced Lodgepole Pine (pine) as the future species of choice for planting stock in parts of the TSA.

The rationale for considering Lw in forest management in the TSA is two-fold:

1. Lw is not susceptible to the same insects and diseases as pine and using it selectively may create future forests that are more resistant to common forest health agents.
2. Lw yields higher volumes per ha than pine, partly due to success in breeding programs. While these gains are notable they are not available until late in the rotation (close to 100 years) due to the slower initial growth rates compared to pine.

2 Analysis Assumptions

Analysis assumptions used in this analysis are detailed in the Data Package (FESL, 2013), one of the documents that make up the Type 4 Silviculture Strategy.

2.1 Seed Selection Area for Lw

In this analysis, Lw was considered a suitable species for regenerating harvested stands within its expanded seed selection area as shown in the map below.

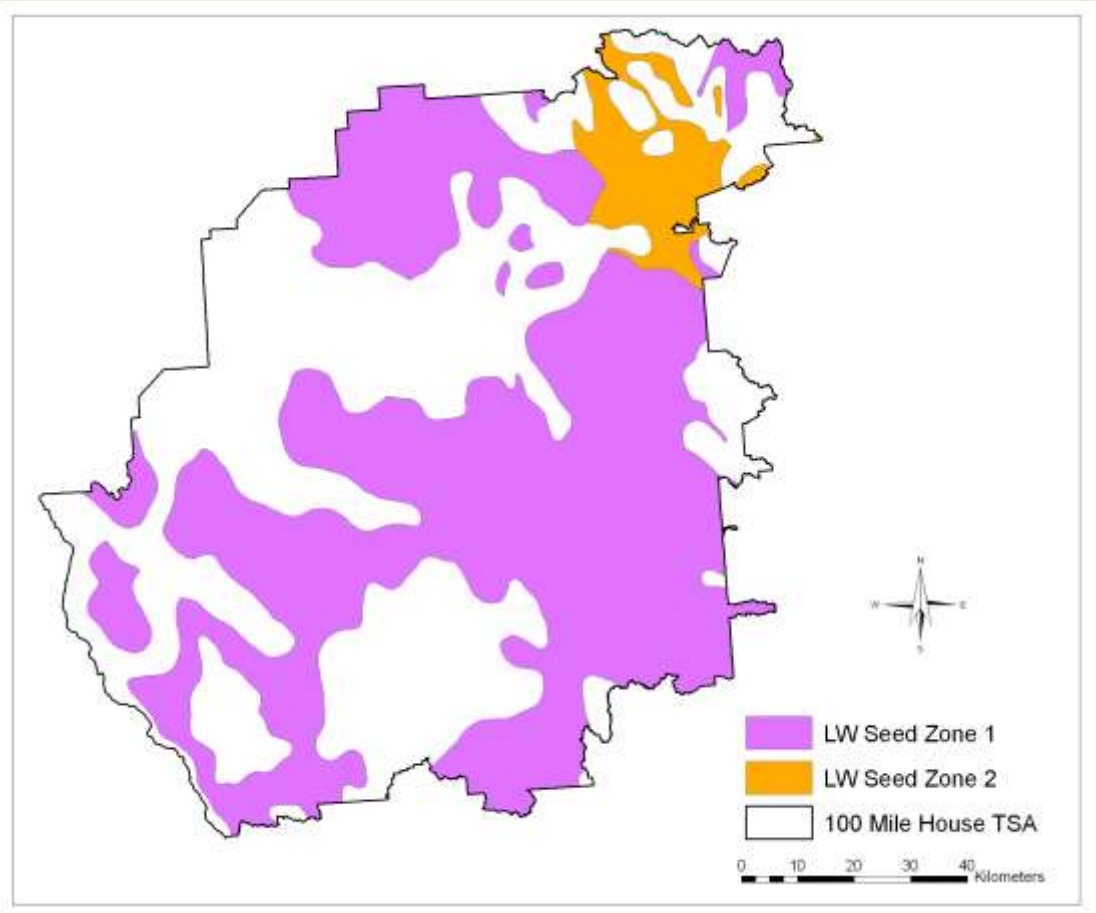

Figure 1: Larch Seed Zones in 100 Mile House TSA (MFLNRO, 2014)

2.2 Site Index

Only areas with site index higher than 16 were considered suitable for planting Lw. The site index for Lw was converted from pine site index using the following equation developed by Nigh (1995):

SI (Lw) = 1.92 + 0.960 x SI (Pl)

2.3 Analysis Units

Lw was regenerated in the forest estate model by replacing pine good and pine very good analysis units with corresponding Lw analysis units. In the first scenario (Lw Scenario 1), 25% of the area under pine good and pine very good analysis units was randomly assigned to Lw good and Lw very good analysis units as shown in Table 1. In the second scenario (Lw Scenario 2), 50% of the area under pine good and pine very good analysis units was randomly assigned to Lw good and Lw very good analysis units also shown in Table 1. Table 2 and Table 3 show the distribution of Lw analysis units by BEC in Lw Scenario 1 and 2 correspondingly.

Table 1: Areas of pine good and very good analysis units converted to Lw good and very good

Analysis Unit	SI	THLB Area (ha)		
		Base Case	Lw Scenario 1	Lw Scenario 2
Pine Good	18.9	148,909	111,149	73,993
Pine Very Good	21.1	68,377	51,816	34,663
Lw Good	20.1	0	37,760	74,916
Lw Very Good	22.1	0	16,561	33,714
Total		217,286	217,286	217,286

Table 2: Pine and Lw good and very good analysis unit areas by BEC, Lw Scenario 1

BEC	Analysis Unit Area (ha)				
	Pine Good	Pine Very Good	LW Good	LW Very Good	Total
ESSFdc3	1,016	0	371	0	1,386
ESSFwc3	0	0	4	0	4
ESSFwk1	2,288	214	832	66	3,400
ESSFxc3	66	0	12	0	78
ICHdk	26	3,537	3	1,220	4,786
ICHmk3	30	2,406	4	809	3,249
ICHmw3	0	117	0	46	163
IDFdk3	60,318	27	20,748	11	81,104
IDFmw2	13	258	2	83	356
IDFxm	15	0	2	0	18
MSxk2	14,508	27	4,966	27	19,528
MSxk3	1,263	0	381	0	1,645
SBPSmk	13,004	23,848	3,855	7,760	48,467
SBSdw1	789	18,583	309	5,761	25,443
SBSdw2	9,600	1,081	3,267	308	14,257
SBSmc1	6,851	774	2,547	196	10,369
SBSmm	1,362	944	455	273	3,033
Total	111,149	51,816	37,760	16,561	217,286

Table 3: Pine and Lw good and very good analysis unit areas by BEC, Lw Scenario 2

BEC	Analysis Unit Area (ha)				
	Pine Good	Pine Very Good	LW Good	LW Very Good	Total
ESSFdc3	674	0	712	0	1,386
ESSFwc3	0	0	4	0	4
ESSFwk1	1,453	144	1,667	136	3,400
ESSFxc3	43	0	35	0	78
ICHdk	11	2,298	18	2,458	4,786
ICHmk3	24	1,743	10	1,473	3,249
ICHmw3	0	66	0	96	163
IDFdk3	39,665	21	41,401	17	81,104
IDFmw2	10	212	5	129	356
IDFxm	10	0	8	0	18
MSxk2	9,800	14	9,674	40	19,528
MSxk3	861	0	784	0	1,645
SBPSmk	8,853	16,042	8,006	15,566	48,467
SBSdw1	521	12,352	577	11,993	25,443
SBSdw2	6,543	664	6,324	725	14,257
SBSmc1	4,616	437	4,783	533	10,369
SBSmm	909	668	907	548	3,033
Total	73,993	34,663	74,916	33,714	217,286

2.3.1 TIPSY Inputs

The attached table shows the TIPSY inputs that were used for modelling the growth and yield of Lw. In both analysis units the Lw % was set to 80%, as this would be an explicit management target. The initial density was set to 1,400 stems per hectare (sph) to reflect approximately 1,000 sph at year 60 as predicted by TIPSY. The species compositions for both Lw analysis units were adjusted from those of the pine analysis units by increasing the leading species % to 80 and reducing the minor species percentages correspondingly. The genetic gain for Lw planting stock was assumed to be 25%. Standard OAF values of OAF1 - 15% and OAF2 - 5% were used.

Table 4: Tipsy inputs for modelling the growth and yield of Lw

Analysis Unit	Site Index	Regeneration Delay	Species Composition	Genetic Worth	Initial Density
Lw good	20.1	2	Lw 80% At 9% Fdi 8% Sx 2%	25%	1,400
Lw very good	22.1	2	Lw 80% At 16% Sx 4%	25%	1,400

2.3.2 Minimum Harvest Criteria

The minimum harvest criteria for Lw stands was set at 60 years and 65 m^3 per ha; i.e. stands must be at least 60 years of age with a minimum of 65 m^3 per ha before they can be harvested in the forest estate

model. These criteria are the same as those used for the pine good and pine very good analysis units in the base case.

2.3.3 Yield Comparison

Figure 2 and Figure 3 illustrate the growth and yield differences between the pine leading managed stands and Lw leading managed stands as modeled in this analysis. Lw stands are predicted to be significantly more productive; however the gains in productivity are not realized until late into the stand rotation. The reduced yield at around age 130 in both figures depicts the dying off of the deciduous component of the stand.

Figure 2: Predicted yield for pine good analysis unit versus Lw good analysis unit

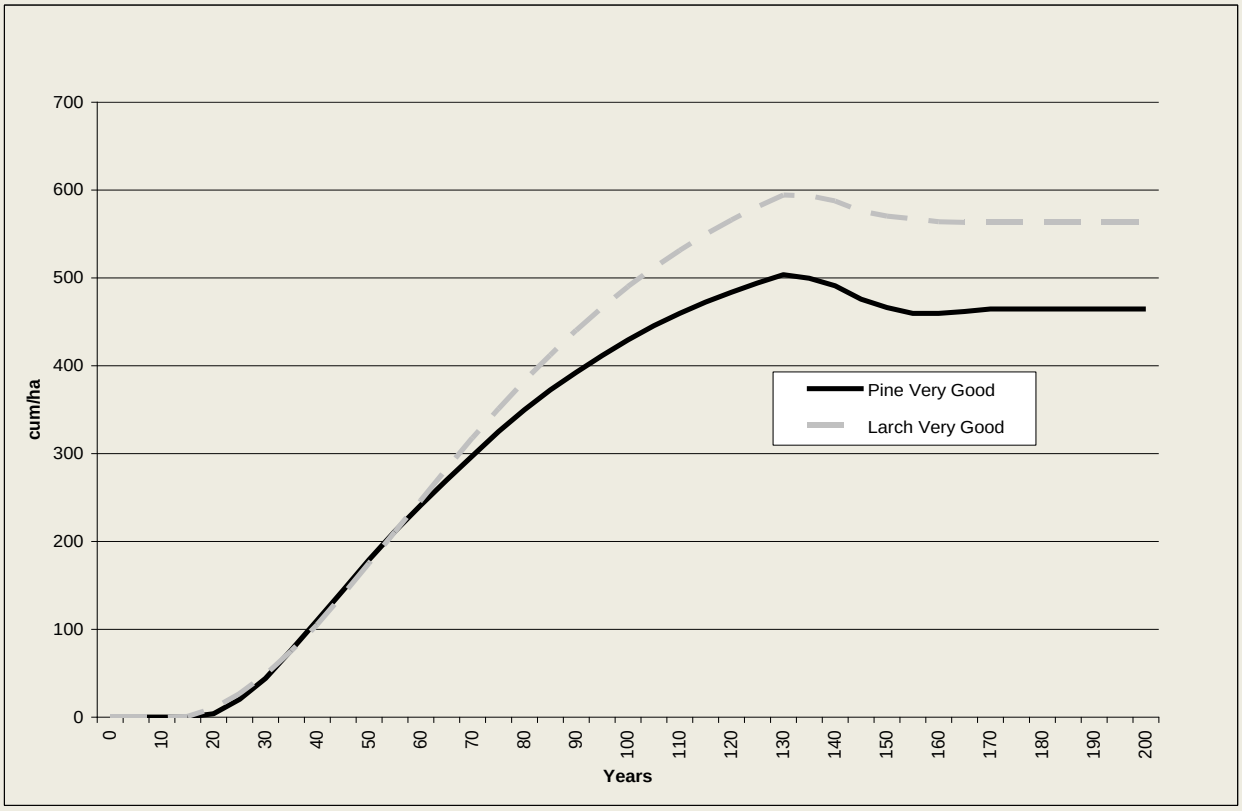

Figure 3: Predicted yield for pine very good analysis unit versus Lw very good analysis unit

3 Results

3.1 Lw Scenario 1

3.1.1 Harvest Forecast

Reforesting 25% of the pine good and pine very good analysis units to Lw had no timber supply impact. Harvesting at the Base Case harvest level (Figure 4) creates no additional growing stock as can be seen in Figure 5. The harvest of Lw does not start until year 70 as illustrated in Figure 6.

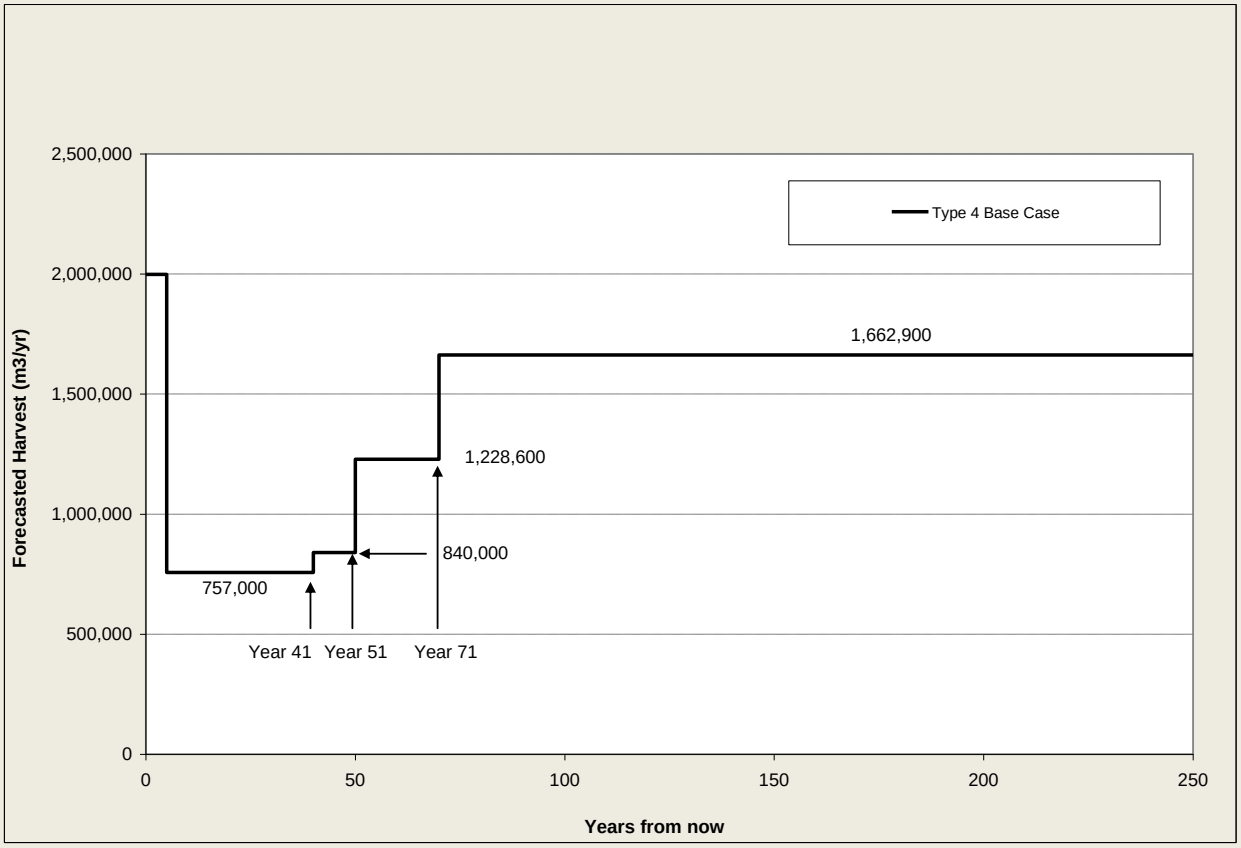

Figure 4: Base case harvest forecast

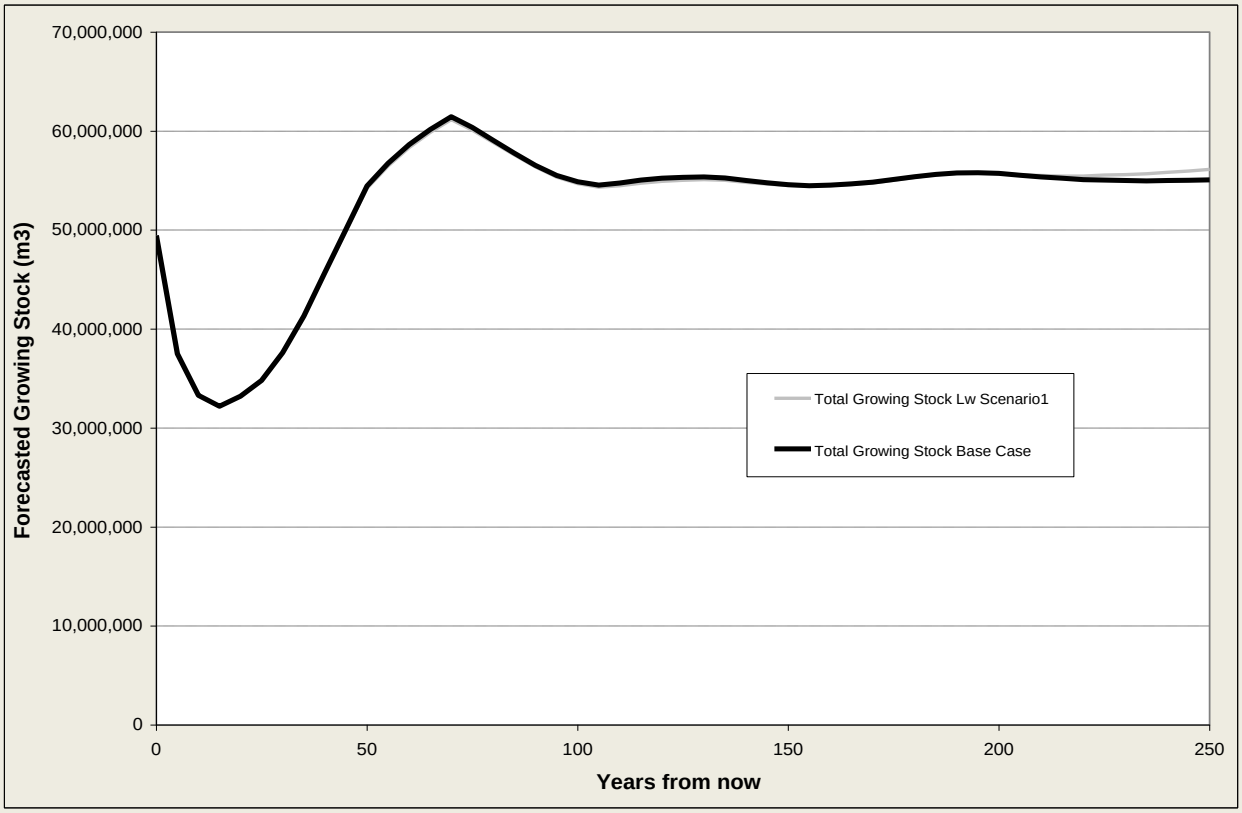

Figure 5: Predicted total growing stock; Base Case and Lw Scenario 1

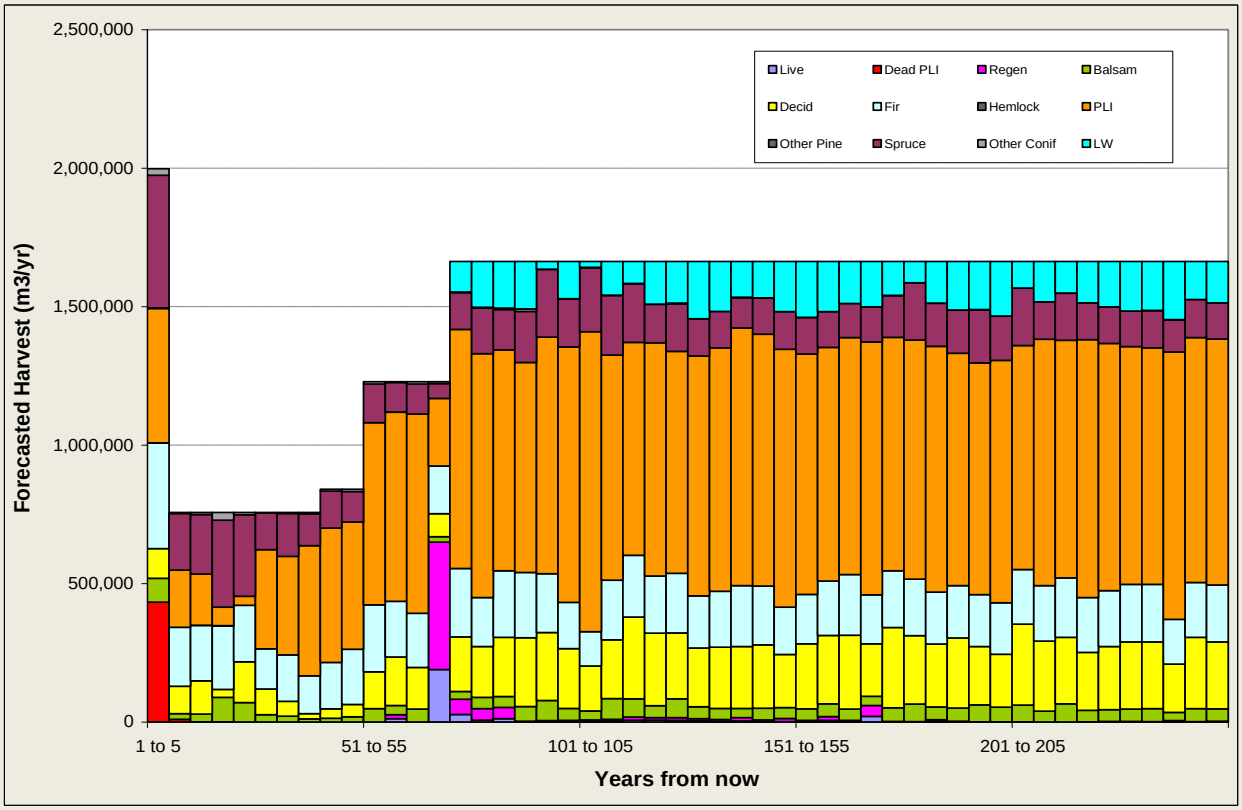

Figure 6: Harvest forecast by species; Lw Scenario 1

3.2 Lw Scenario 2

3.2.1 Harvest Forecast

Reforesting 50% of the pine good and pine very good analysis units to Lw had a minute impact on the long-term timber supply; the long-term harvest level can be increased only by 8,400 m^3 per year to 1,671,900 m^3 per year or 0.5% (Figure 7). The comparison of predicted growing stock to that of the Base Case is illustrated Figure 8. As in the previous scenario the harvest of Lw does not start until year 70 as illustrated in Figure 9.

Further investigation revealed that the Lw leading stands were harvested in the model on average within 10 years of their minimum harvest age of 60, thus providing no volume benefit at all. The minimum harvest criteria for the Lw stands was changed to 80 years and a sensitivity analysis was completed to test the impact of this change.

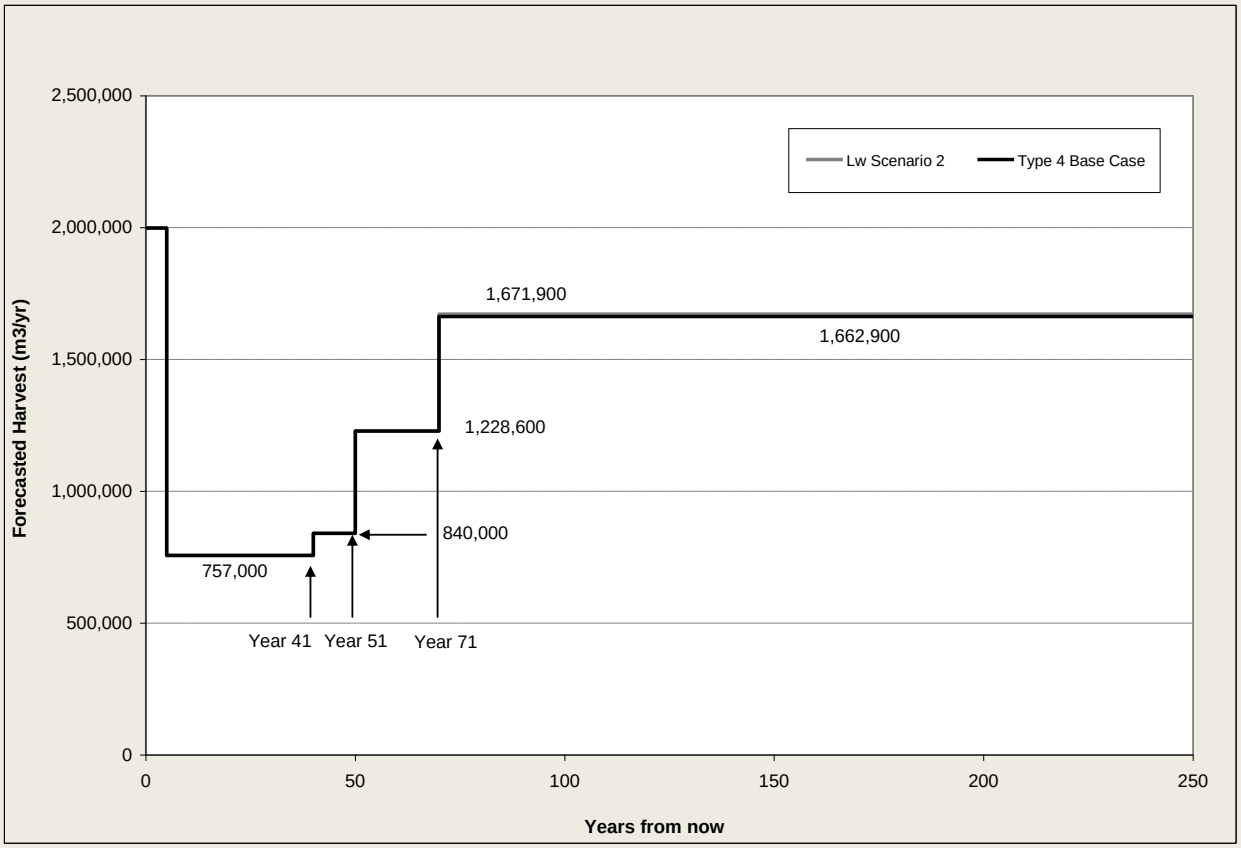

Figure 7: Comparison of harvest forecast between Type 4 and TSR base case

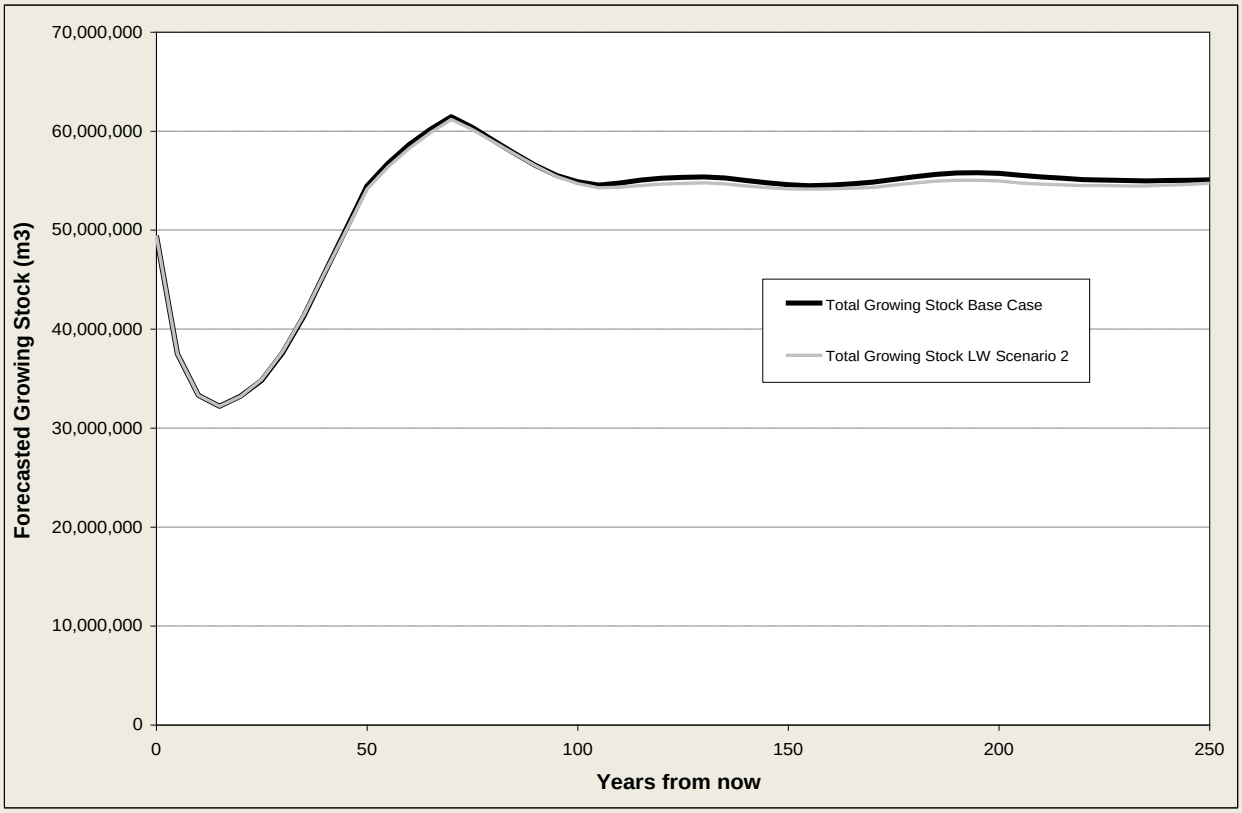

Figure 8: Predicted total growing stock; Base Case and Lw Scenario 2

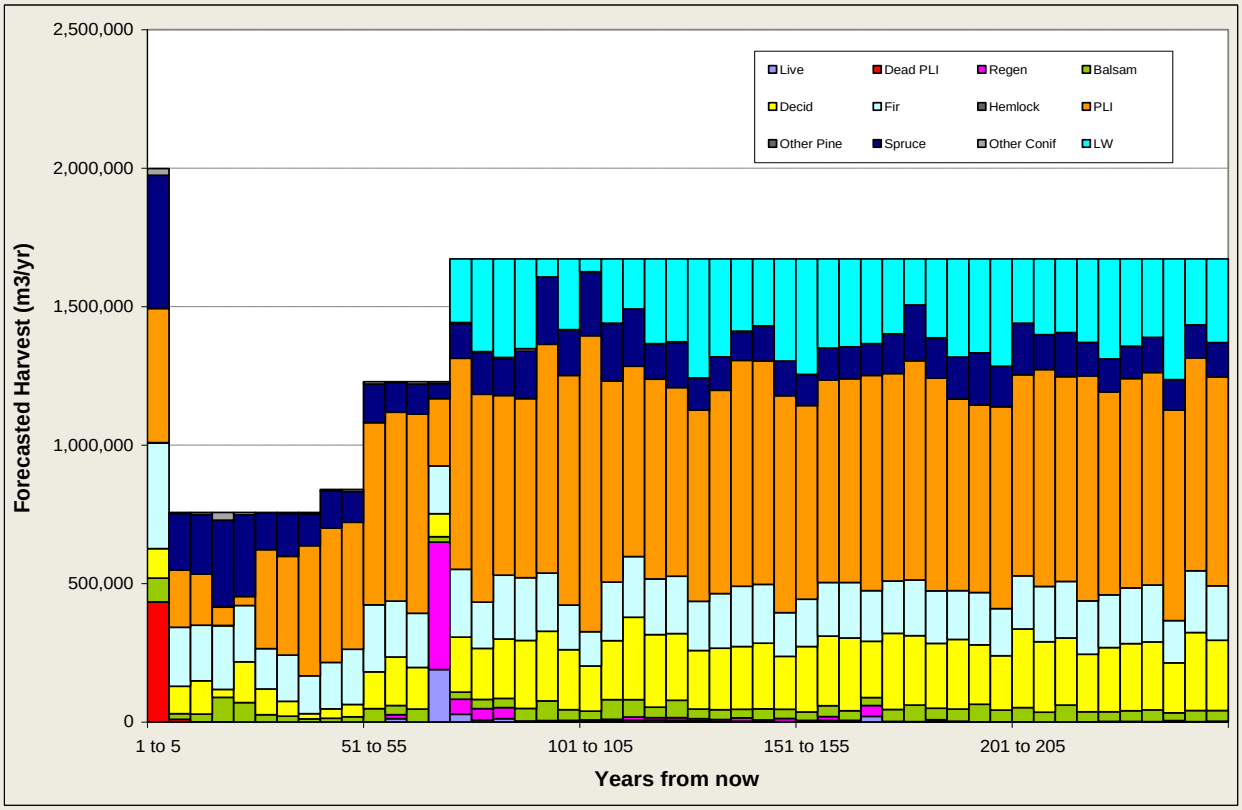

Figure 9: Harvest forecast by species; Lw Scenario 2

3.2.2 Sensitivity Analysis, Minimum Harvest Age of 80 for all Lw Leading Stands

In this sensitivity analysis the minimum harvest criteria for the Lw stands was changed to 80 years; all other Lw Scenario 2 assumptions prevailed.

The harvest forecast for this sensitivity analysis can be seen in Figure 10. The long-term harvest level increased at year 130 to 1,696,600 m^3 per year, a 2% increase from the base case. The comparison of predicted growing stock to that of the Base Case is illustrated in Figure 11. In this sensitivity analysis the harvest of Lw starts 15 years later at year 85 as illustrated in Figure 12.

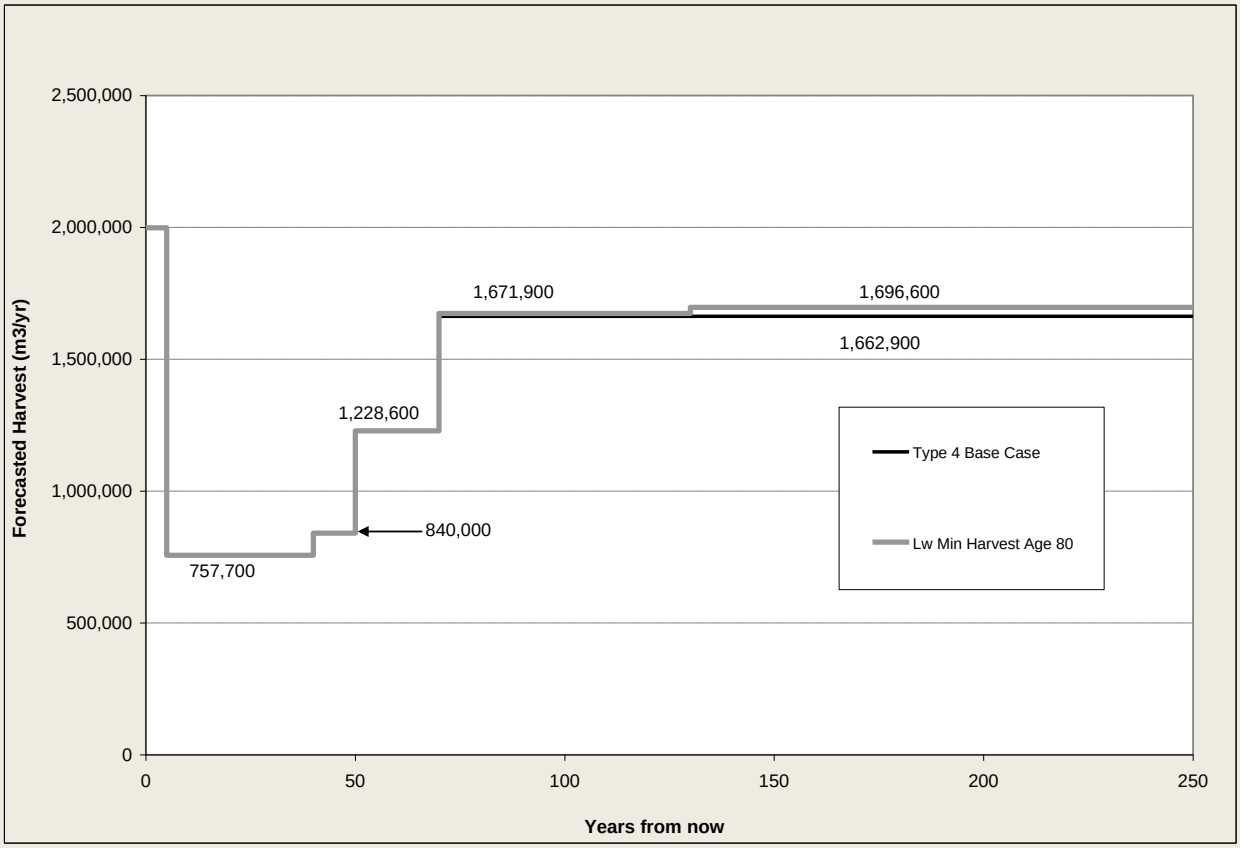

Figure 10: Harvest forecast; Lw minimum harvest age = 80

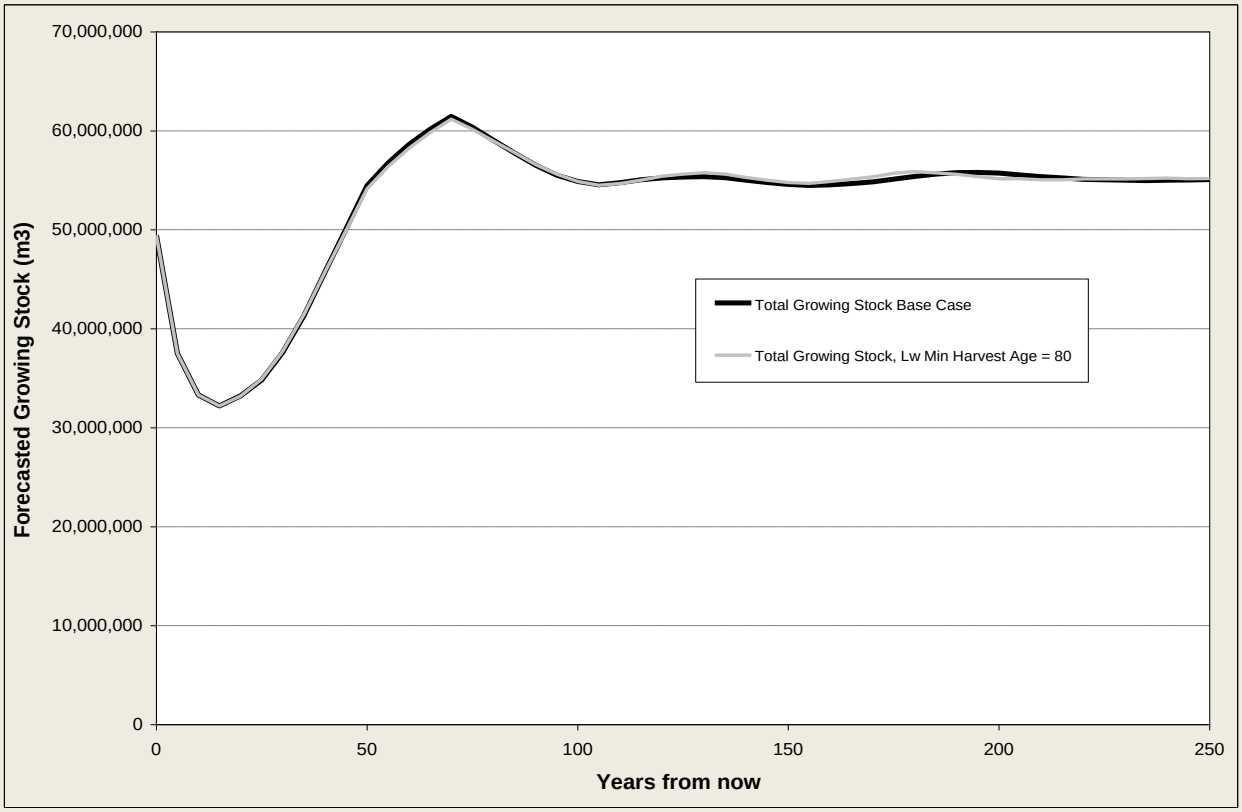

Figure 11: Predicted total growing stock; Base Case and Lw Scenario2 with Min harvest age=80

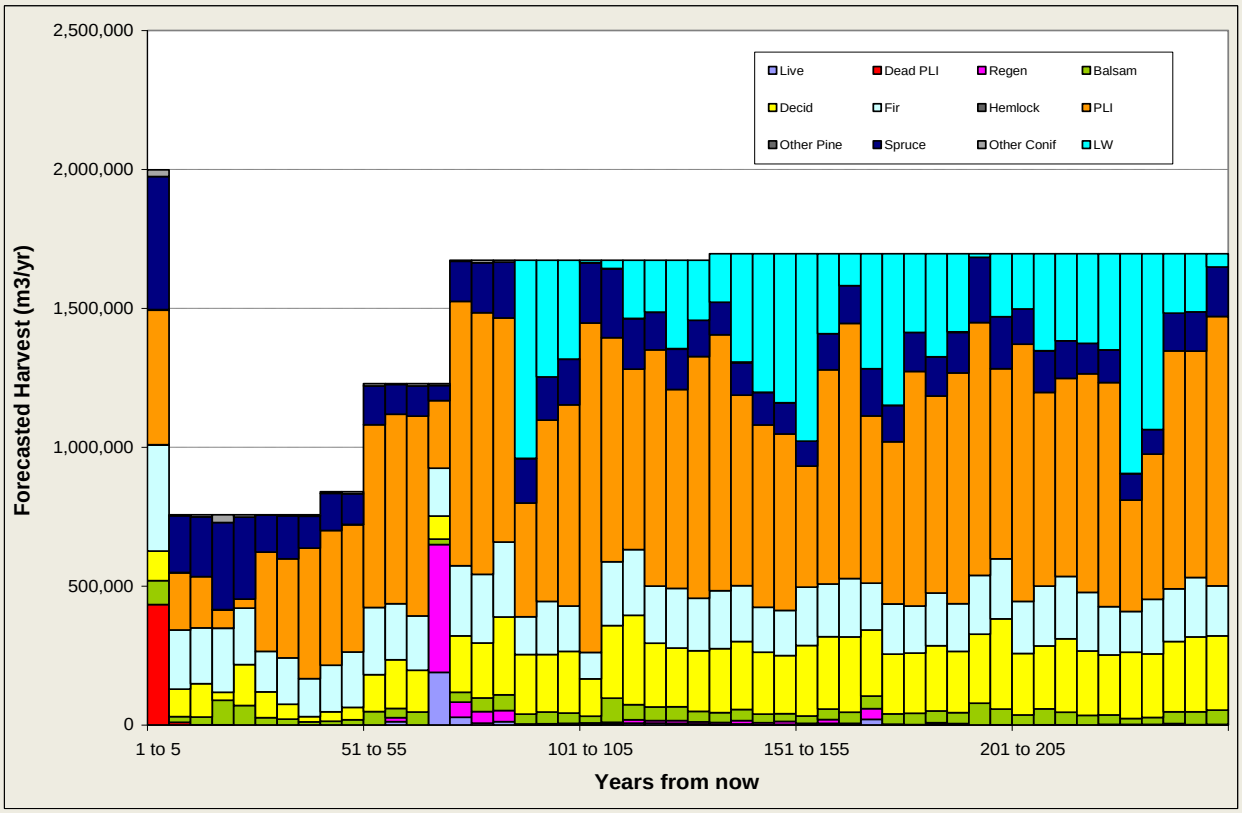

Figure 12: Harvest forecast by species; Lw Scenario 2 with Min harvest age = 80

4 Discussion

This analysis tested the timber supply impact of substituting Lw for pine within the newly expanded Lw seed zones in the 100 Mile House TSA. There is interest in experimenting with Lw as it might not be as susceptible to insects and diseases as pine and using it selectively may create future forests that are more resilient. The currently available planting stock is expected to yield higher volumes per ha than pine; however, the gains in volume are not available until late in the rotation (close to 100 years) due to the slower initial growth rates.

Reforesting 25% of the pine good and pine very good analysis units to Lw had no timber supply impact, while reforesting 50% of the pine good and pine very good analysis units to Lw had a small, 0.5% impact on the long-term timber supply. If 50% of the pine good and pine very good analysis units were reforested to Lw and the minimum harvest age in the forest estate model for Lw stands was set to 80, the long-term harvest level could be increased at year 130 by 2% compared to the base case.

The forest health benefits of utilizing Lw in forest management are not known. Its growth and yield, and suitability for industrial use are not well understood. More research is required to determine the ultimate benefits of using Lw in the 100 Mile House TSA.

5 References

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