Iisaak Forest Resources Ltd.

Tree Farm License 57

Area Based AAC Timber Supply Analysis Report

November 18, 2003

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1.0 Introduction

Iisaak has long been interested in the area based Allowable Annual Cut (AAC) approach due to its compatibility with the Clayoquot Sound Scientific Panel (CSSP) recommendations. An earlier attempt was made to pursue this through a Forest Practices Code (FPC) Pilot Project. At the time when the Management Plan and timber supply analysis was started there were no provisions in the legislation for area based AAC's and therefore a traditional volume based timber supply analysis (dated December 30, 2002) was completed as part of MP 1. During this time legislation has been changed to allow for area based AAC's and therefore, although it is now late in the management planning process, Iisaak has included an area-based analysis and are requesting an area-based AAC.

2.0 Approach and Assumptions

Given the late stage in the management planning process, the approach used for the area based analysis was developed with the intention of utilizing as much of the work already done for the volume based timber supply analysis as possible. This work is documented in the following reports:

- Tree Farm License 57 – Timber Supply Analysis Information Package - June 5, 2002
- Tree Farm License 57 – Timber Supply Analysis Report – December 30, 2002
- Tree Farm License 57 – Addendum to the Timber Supply Analysis Report – August 28, 2003
- Draft Management Plan No 1. – August 2001

The general area based analysis approach was developed in a meeting held at the Resource Analysis Branch on August 14, 2003 between:

Tim Bogle – Timber Supply Forester, Resource Analysis Branch
Vera Sit – Research Branch
Darrell Errico – Consultant to the Forest Service on area based AAC issues
Greg Rowe – representing Iisaak Forest Resources Ltd.

The modifications to the existing volume-based timber supply modeling were developed by Tim Bogle in a cooperative approach between Iisaak Forest Resources Ltd. and the Resource Analysis Branch of the Ministry of Forests to meet the requirements of the area-based AAC program.

Details of the analysis assumptions and modeling approaches are documented in the "Information Package" for the volume based timber supply analysis (June, 2002). The area based harvest forecasts are produced using FSSIM, the same model as was used for the volume based timber supply analysis.

Key differences from the Information Package specifications include:

- **Silvicultural systems** – Operationally, the choice of a silviculture system is guided by the recommendations of the CSSP, which result in a retention system being used throughout the TFL. The amount and pattern of retention can vary widely from 15% retention of aggregates to 70% evenly dispersed retention according to the interaction of site specific resource values with CSSP recommendations. In the volume based analysis this was all modeled as equivalent clear-cut for simplicity. In the area based analysis the silviculture systems were separated into two groups as described below:

  1-Even aged management – (patches >0.3 ha)
  2-Uneven aged management – (narrow strips (<20m wide), small groups (<0.2 ha), individual trees)

  For the purposes of the analysis "uneven aged management" was applied to all three of the visual zones (Natural Appearing, Minimal Alteration, Small Scale Alteration, in total about 50% of the Timber Harvesting Land Base (THLB)) and "even aged" management was applied everywhere else. This distinction was made since in the area based AAC environment there needs to be a link between the area harvested and the "intensity" of harvest. In the "Area Based AAC Trial Program Regulation" under the definition of "allowable annual cut" it is specified that the area from which timber may be harvested annually can be specified for different silvicultural systems.

- **Forest cover requirements** – In the volume analysis, forest cover requirements were assigned for old growth, watershed rate of cut, visuals, and recreation management. In the area based analysis forest cover requirements (the same ones as in the volume analysis) were used only for old growth and watershed rate of cut. As noted above visuals were modeled under an uneven aged management regime (partial cutting) regime. This involved creating additional analysis units, specific to visual areas, with percentage removals and re-entry periods assigned to match the original disturbance and green-up periods specified as forest cover requirements in the volume based analysis. At each entry (in the visual areas) part (the percent allowed for removal, 25%, 30%, or 35% depending on which visual zone) of the area is assigned to an analysis with an age of –3 years and the remainder is assigned an age of 120 years. The unharvested part is assigned the appropriate re-entry period (24-27-30 years depending on visual zone). To retain the total treatment area intact, the young stands are consequently transferred to the same age as the unharvested portion of the treatment area and both will be treated as an entity upon next entry. This is an assumption that while reasonable from a modeling perspective does have some implications for reporting on future forest condition as volume per hectare and stand condition are surrogates rather than actuals. However, this allows the uneven aged management approach to function in accordance with prescribed limits and also allows the remaining forest cover requirements to consider the partially cut area on a clear cut equivalent basis. The recreation management zone was not constrained in the area based analysis since it is a relatively small area (783 ha of THLB outside of visual zones).

- **Minimum harvest ages** – These were the same as for the volume based analysis (revised based case harvest forecast as documented in the August 28, 2003 addendum to the Timber Supply Analysis Report) except for AU 126 (Cedar –poor - reduced from 160 years to 110 years) and AU 136 (Hemlock / Balsam poor- reduced from 180 to 120 years). These changes were made in order to remove the influence of high rotation ages based on the inventory site index data. The revised ages were chosen based on averaging the time taken to reach 300 m3/ha using inventory site index and old growth site index adjustments (OGSI). The changes are significant since these analysis units include approximately 74% of the THLB.

The following, while not actual changes in the modeling approach from the earlier volume based analysis, are items that were considered in structuring this approach:

- **Class IV terrain** – Under the CSSP recommendations Class IV terrain is managed with high levels of dispersed retention which results in an approach similar in terms of opening size and spatial arrangement to the uneven aged management described above. The major difference is that in the visual areas there are regular re-entrees (after visually effective greenup has occurred) whereas in the Terrain Class IV there is just the one entry, everything else is retained until the next rotation. The permanent retention has already been dealt with as a land base deduction (see Information Package). There is also a significant degree of overlap between the Class IV terrain and the 3 visual zones (approximately 62% of the total Class IV terrain in the THLB is located in one of the three visual zones). For this reason, and also due to the way in which the analysis was already structured, the Class IV terrain outside of visual areas was modeled as even aged.

- **Location of silvicultural systems on the land base** - The linkage between particular silvicultural systems and specific parts of the timber harvesting landbase is not as direct as implied in this analysis. The actual application of silvicultural systems will vary according to site conditions. Some even aged management has and will likely continue to occur in the visual zones (mostly where screened by reserves or topography) and some uneven aged management will occur outside visual zones. The link between visuals and silviculture system was made to simplify a complex and evolving management regime for analysis and administrative purposes. This approach will provide an approximate breakdown of the relative amounts of these two systems, and a general idea of where the use of each may predominate. It is not intended to be more specific than that with respect to linking a silviculture system to a part of the land base. Also the removal percentage varies from 25% to 30% and 35% between the three visual zones, variation in harvest area between the zones was not controlled in the analysis.

- **Cut control and silviculture systems** – For the purposes of cut control it is proposed that the "even aged harvest area" would be the sum of the area of all the patches cut (regardless of how blocks are defined operationally), for the "uneven aged area" one would take the total treatment area less the area of any permanent reserves outside of the timber harvesting land base which are not inventoried.

- **Scenarios** - A partitioned (by area targets by silviculture system) and an un-partitioned scenario were run. The un-partitioned scenario allows the relative amounts of even and uneven aged treatment area to fluctuate over the time horizon, whereas in the partitioned scenario each is kept constant. The partitioned one is intended to show a potential harvest schedule for an AAC determination. The un-partitioned one provided a starting point for setting the partition targets and provides a simpler base for examining forest trends and for sensitivity analysis.

3.0 Results

3.1-Un-partitioned Harvest Forecast

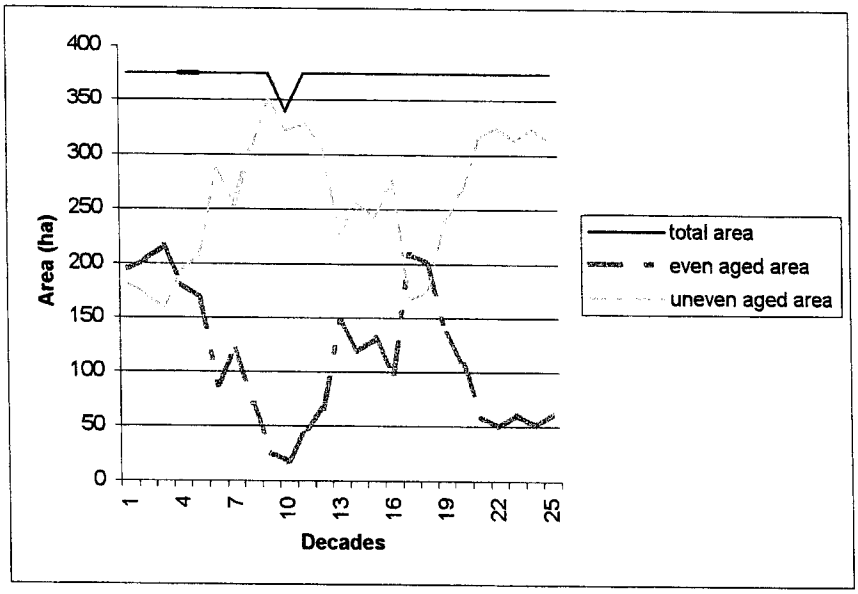

Figure 1 – Harvest Forecast

Figure 1 show that the total harvest level of 375 ha per year can be sustained for the entire planning horizon except for one minor deficiency (340 ha instead of 375 ha) in decade 10. The relative amount harvested under the two silviculture systems varies dramatically over the planning horizon however with the even aged harvest falling as low as 26 ha in decade 9. The average area of even aged harvesting over the entire planning horizon is 113 ha. Since total volume harvested is related to (among other things) the proportion of even aged harvested area, harvest volume would likely fluctuate significantly under this harvest forecast. In reality it is likely that there would be a more consistent mix of the two systems since many development units contain areas best suited to both management approaches.

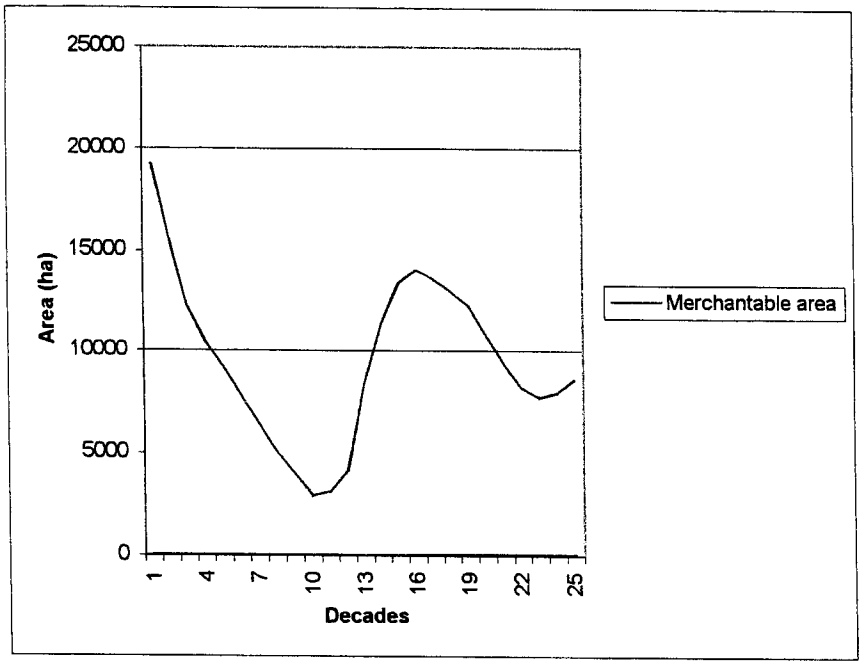

Figure 2 – Merchantable Area

Figure 2 shows the merchantable area (area above minimum harvest age) throughout the planning horizon. This declines to a low level between decades 9 and 11 where there is just enough merchantable area to support the harvest forecast and rises to a higher level and fluctuates for the rest of the planning horizon.

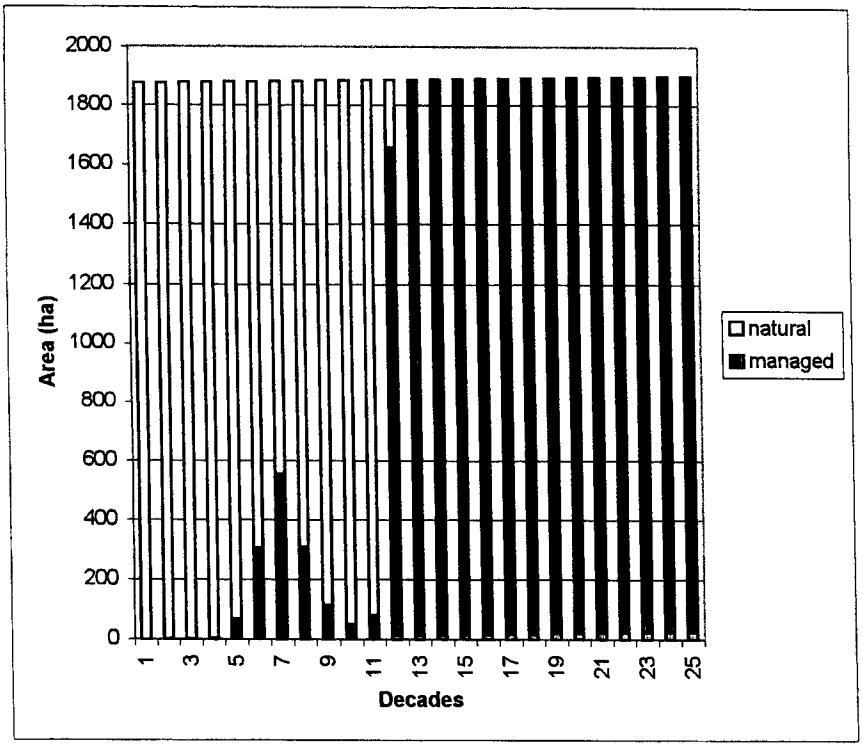

Figure 3 – Timber Supply Sources – Natural Versus Managed Stands

Figure 3 shows the source (existing natural stands or existing of future managed stands) of timber supply. Harvesting is completely in natural stands at the start of the planning period, shifts partly to managed stands in decades 5-8, returns mostly to natural stands in decades 9-11, before finally shifting to managed stands. The return to near total reliance on natural stands in decades 9-11 coincides with a large proportion of uneven aged harvest during this period.

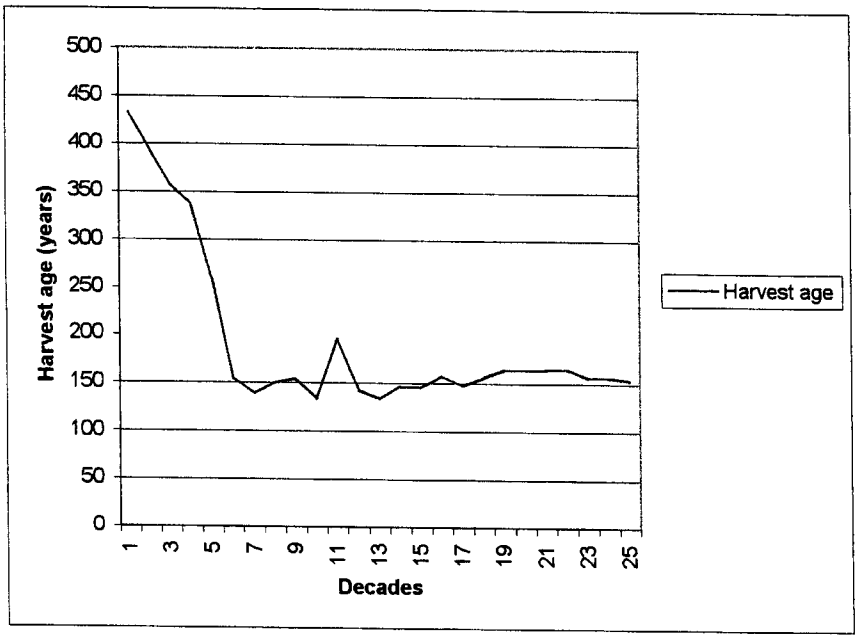

Figure 4 - Average Harvest Age

Figure 4 shows the average harvest age steadily dropping over the first 60 years of the time horizon before leveling off at about 150 years. This is a much faster decline in average harvest than in the volume-based analysis. This is a result of the large areas treated under the uneven aged management regime during decades 6-12, the approach used to assign ages to these stands following the initial entry (remaining stand is assigned an age of 120 years), and the likelihood that many of these stands are being entered for the second time during this period. A second entry would result in a harvest age of 120 years +(24-30 year re-entry delay) for a total as low as 144 years.

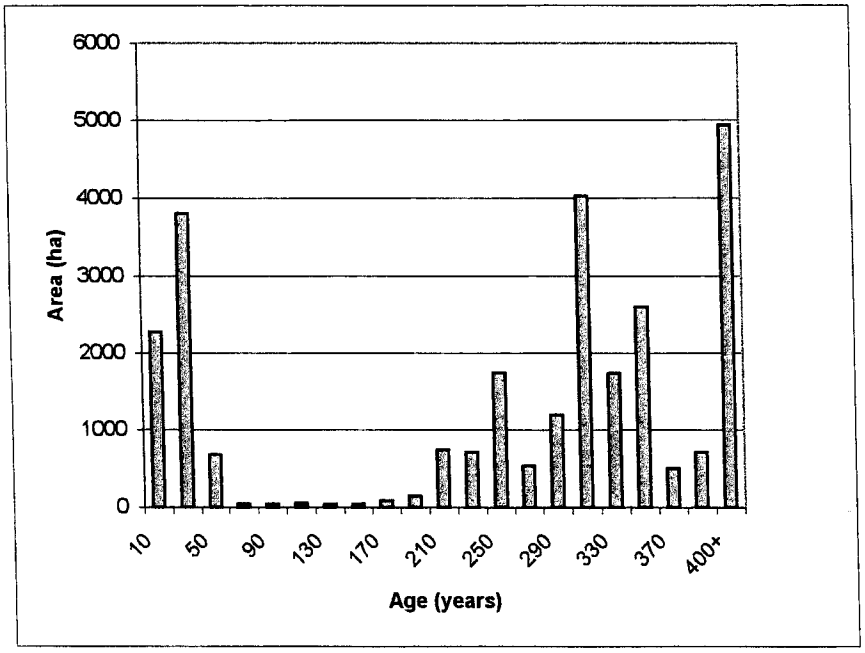

Figure 5 – Age Class Distribution on the THLB – current

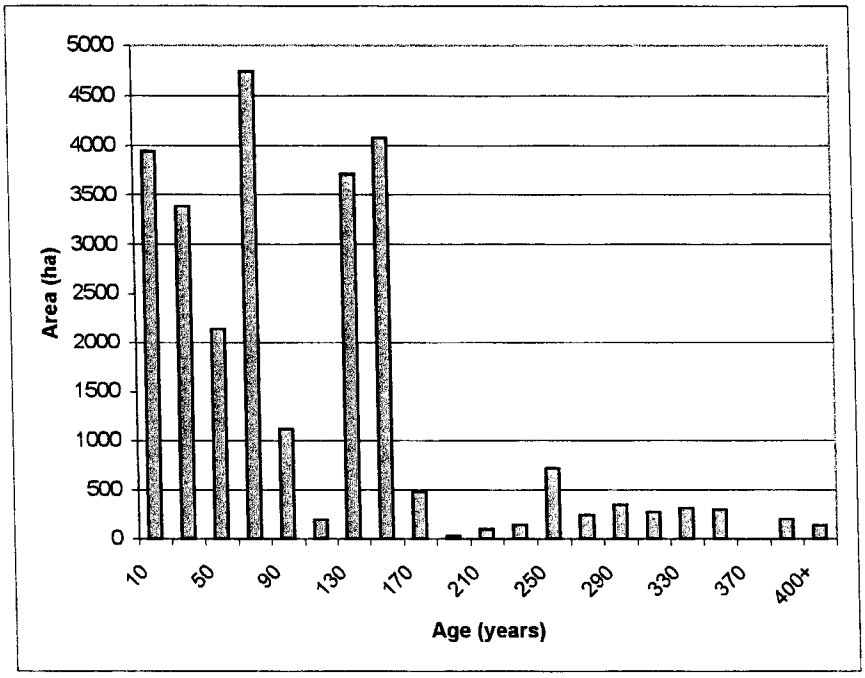

Figure 6 – Age Class Distribution on the THLB – 50 years

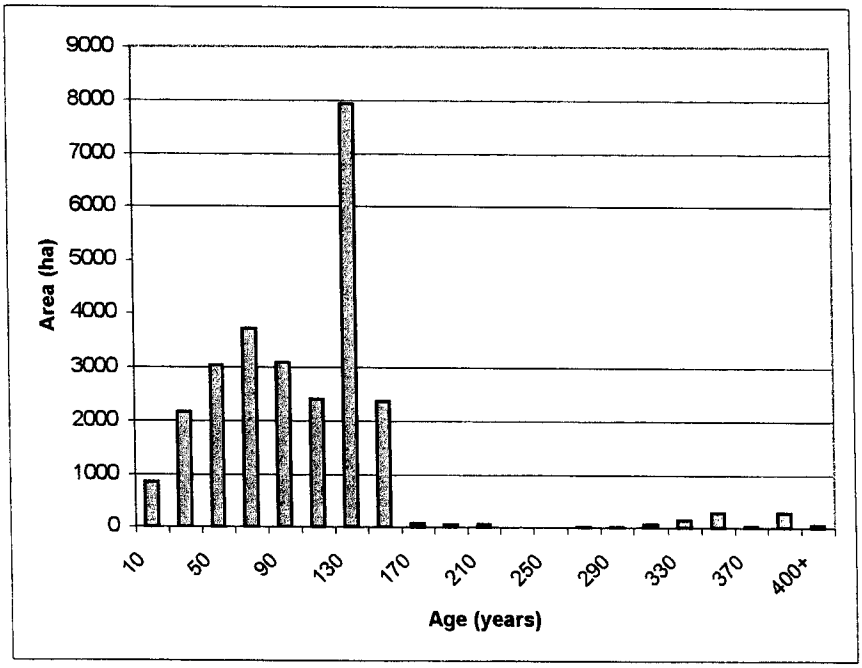

Figure 7 – Age Class Distribution on the THLB - 100 years

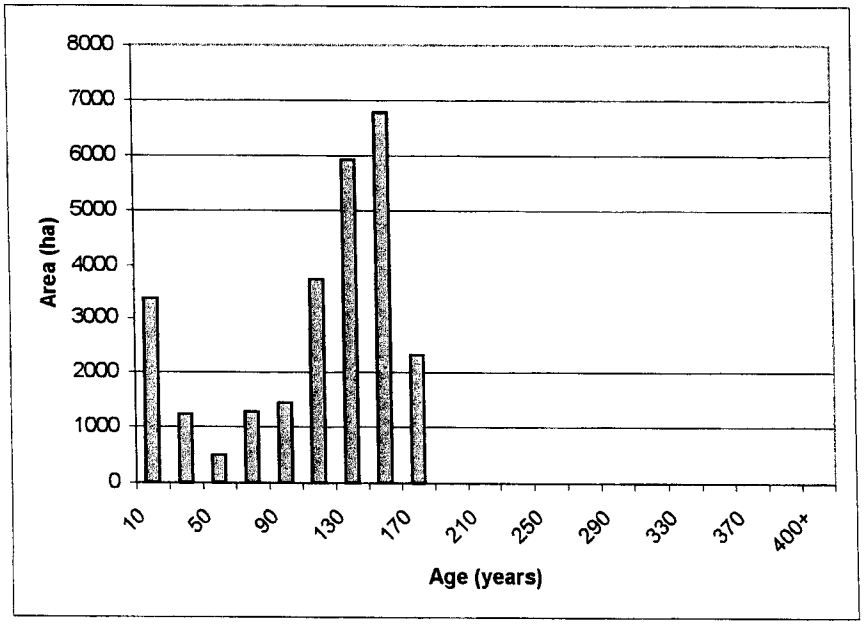

Figure 8 – Age Class Distribution on the THLB - 150 years

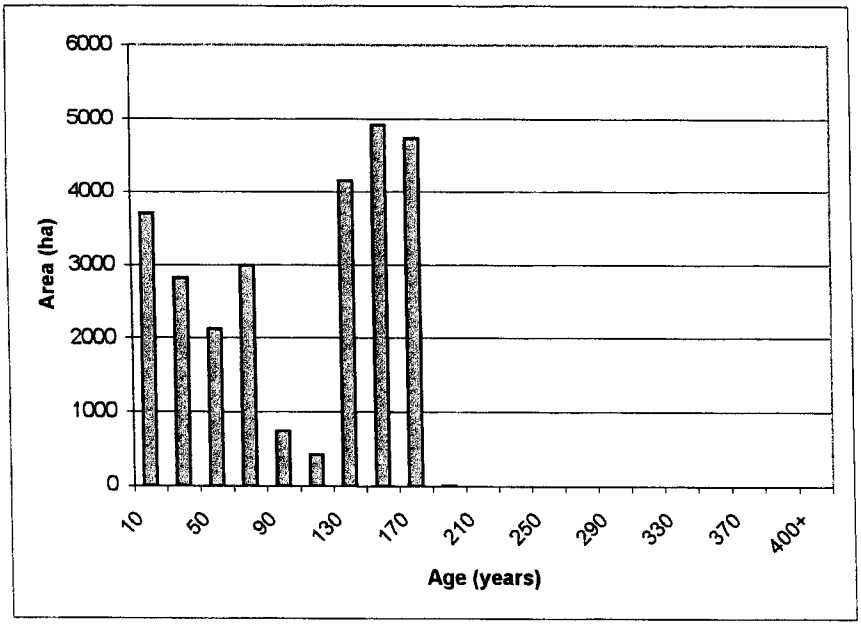

Figure 9 – Age Class Distribution on the THLB - 200 years

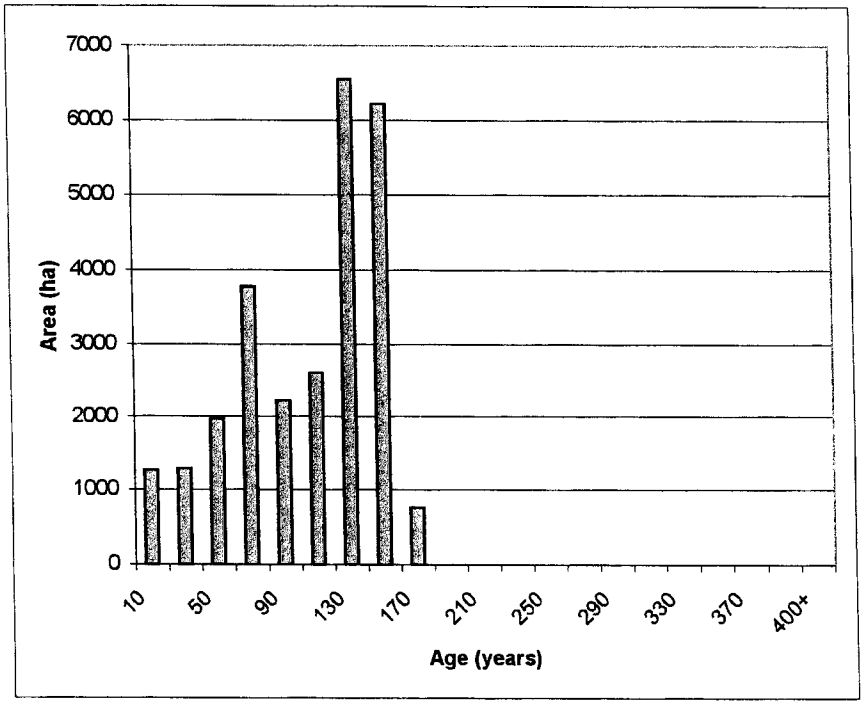

Figure 10 – Age Class Distribution on the THLB - 250 years

Figures 5-10 show the age class structure on the timber harvesting land base at 50-year intervals. The age class distribution on the THLB at the present time shows considerable area in stands less than 60 years of age, large areas in stands greater than 200 years of age, and very little area between 60 and 200 years of age. Over time the age class distribution becomes more balanced although there is always a large area between 120 and 180 years due to the process used for assigning ages to the stands subject to the uneven aged management. It should also be noted that the age class distribution will be much different for the TFL as a whole (with a large amount of old forest at all times) since there is no harvesting outside of the THLB.

3.2-Partitioned Harvest Forecast

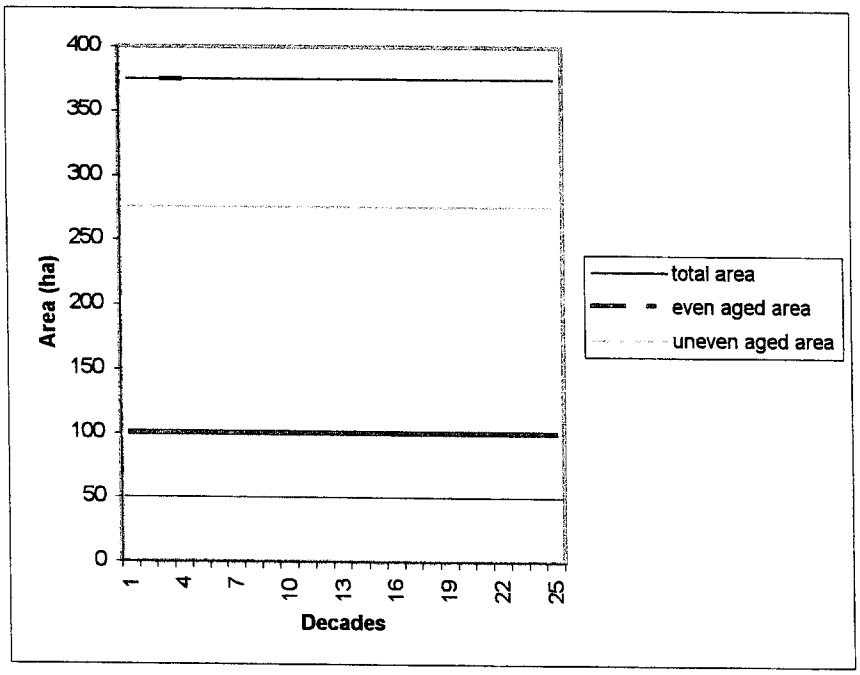

Figure 11 – Partitioned Harvest Forecast

Figure 11 shows that the total harvest forecast of 375 ha per year comprised of 100 ha of even aged harvesting and 275 ha per year of uneven aged harvesting can be sustained for the entire planning horizon. In contrast to the un-partitioned harvest forecast there is no drop below this level.

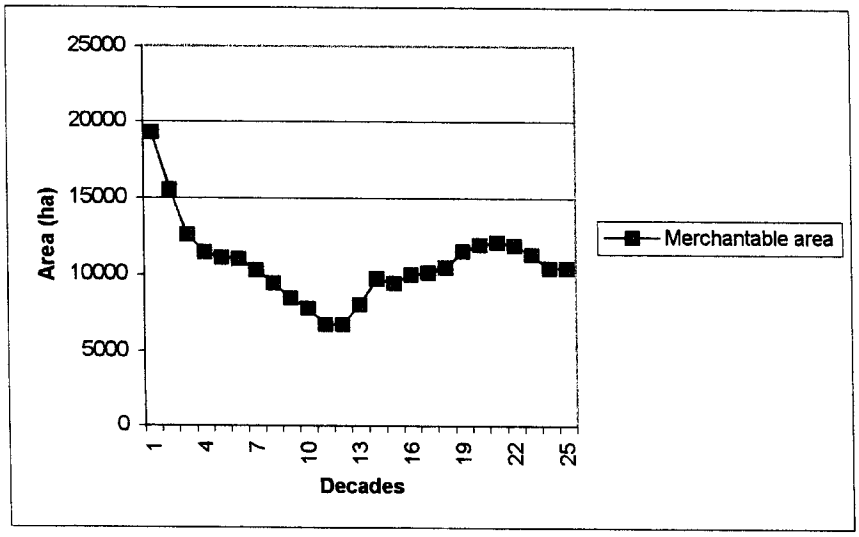

Figure 12 – Merchantable Area

The merchantable area over time shows a generally similar trend to that shown in Figure 2 for the un-partitioned harvest but with much less pronounced dips and peaks. This difference is likely due to the avoidance of heavy reliance on uneven aged harvesting at any particular point in the time horizon.

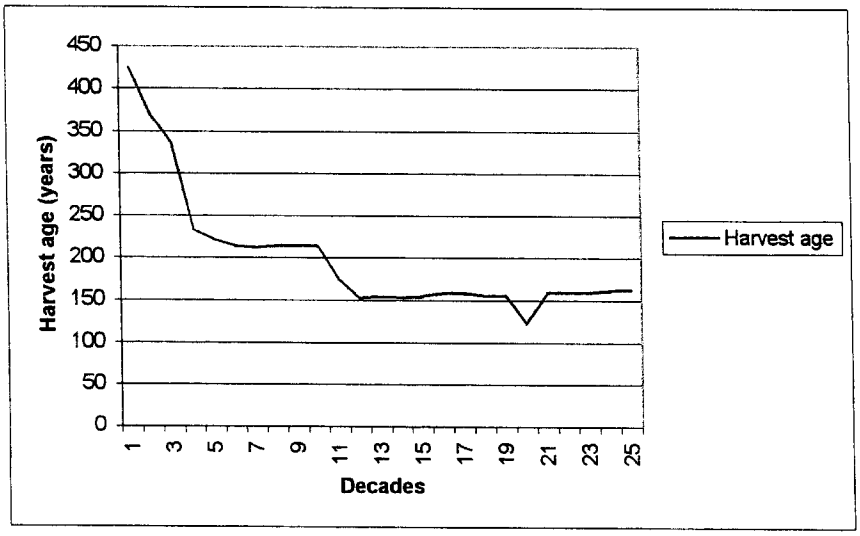

Figure 13- Average Harvest Age

Figure 13 shows the average harvest age steadily dropping over the first 60 years of the time horizon and then more slowly until approximately 120 years before leveling off at about 150 years. This is a slower decline than shown in Figure 4 for the un-partitioned harvest forecast; it is more like the trend shown in the volume based analysis. This significant difference from the base case is a result of a significantly lower reliance on un-even aged harvesting during decades 6-12 and therefore fewer re-entry cuts during this period.

3.3-Sensitivity analysis

Minimum harvest age – the minimum harvest ages were changed back to those used in the volume analysis (derived using the original criteria from the information package). This had no effect on the harvest forecast.

Size of the THLB - In the volume based analysis the harvest forecast was shown to be highly sensitive to both increasing and decreasing the size of timber harvesting land base. It is expected that a similar relationship would exist in the area-based analysis.

Most other sensitivity analyses are either related to volume or site productivity and therefore not relevant to the area-based analysis or are dealt with as scenarios in the previous volume based timber supply analysis.

Additional sensitivity analysis work was not done for the area based analysis since it would either repeat work done for the volume analysis or the adjustments made to the analysis structure to convert what was originally set up as volume analysis to an area based analysis made it difficult to interpret the results of additional sensitivity analysis.

4.0 Discussion

The partitioned harvest forecast features a non-declining flow of 100 ha of even aged harvest and 275 ha of uneven aged harvest for a total of 375 ha per year.

The partitioned and un-partitioned runs result in generally similar trends in average harvest age although the un-partitioned run has a more rapid decline.

In a traditional volume based analysis the total volume of growing stock on the timber harvesting land base is generally examined as an indicator of the stability (e.g. the long run harvest level should have a stable growing stock trend) of the harvest forecast and merchantable volume is used to show availability. In the case of this area based analysis merchantable area was shown over the time horizon to show the reasonableness of the harvest forecast. This shows that the partitioned harvest forecast in particular is likely to be achievable in practice, given the significant buffer between merchantable area and rates of harvest.

Average volume harvested has the potential to vary considerably over the time horizon while area harvested is kept constant. The volume based analysis shows considerable variation in average volume per hectare harvested over time. This could lead (at least within the timber supply modeling environment) to significant variation in the volume per year harvested, however the lack of confidence in the inventory estimates of volume and site productivity was one of the reasons for using the area based approach.

The harvest forecast is sensitive to land base changes. The impacts of removing specific parts of the land base can be estimated by looking at the results of the volume based

analysis (marbled murrelet areas, eehmiis areas, marginally economic areas). It is not highly sensitive to changes in minimum harvest ages.

It was found in the volume analysis that the harvest forecast was not sensitive to changing forest cover requirements for watershed rate of cut or visuals.

The table below provides a summary of Iisaak's operations to date:

Year	Area	Even aged area (ha)	Uneven aged area (ha)
2000	Cypre	0*	103.0
2002	Bedingfield	34.5	85.6
2003	Herbert	24.0	90.8

*This area was classified differently in the Silviculture Prescriptions than the others, some of it would now be included in the even aged category.

The above summary of past harvesting is included to provide some general background on how the proposed area based AAC relates to past operations in TFL 57.
The above summary of past operations represent a start up period for Iisaak in which these harvests represent a small proportion of the present AAC in volume terms (ranging from approximately 8% for 2000 to 28% for 2002). The levels of harvest modeled in this analysis are approximately 3 times those of 2002.

5.0 Recommended AAC

Iisaak recommends the following harvest level:

Even aged –100 ha/year
Uneven aged – 275 ha/year
Total – 375 ha/year