Review Comments by Pacific Analytics Inc. December 3, 2003

Introduction

The assessment of this Forestry Report has been challenging for several reasons. First, I am not a forester, and therefore there are several sections of the report (e.g., the sections regarding growing stock and violations of landscape-level retention constraints) for which I do not have the requisite expertise to comment. As a consequence, I have focused my efforts on the economics of the projection analysis, leaving the forestry implications to those better qualified.

A second reason why the report was challenging to assess is that the report makes heavy use of the output of the EGSA-Timber Model, with whose structural equations I am not familiar. I have assumed in my review that the model equations are specified correctly, that the forestry-based sub-routines (e.g., those generating growing stock and volume yield curves) meet correct forestry theory, and that the model implementation of Ecosystem-Based Management (EBM) targets is correct. Effectively, this means that Appendix A is specified correctly and, as such, I have foregone any assessment of that Appendix.

A correctly specified model with "correct" ("reasonable") input assumptions will, by definition, generate "correct" ("reasonable") output. Thus I have spent most of my effort examining the economic input assumptions (explicit and implicit) of the model. The following highlights my comments.

Main Report Assessment

Although most of my comments are directed at Appendix B and C of the report where the detailed explanations of input cost and revenue assumptions are discussed, there are a few points in the main body of the report worth noting.

1. Section 3.2.3 (page 14) discusses sensitivities, specifically regarding the change in harvest activity due to price changes (output elasticities). I find it somewhat remarkable (but perhaps not incorrect) that a fall in log price to 25% of price-cycle amplitude[1] will only cut harvesting by 50%. According to the 2003 Woodflow analysis by Pierce and Lefebvre,[2] 64% of the growing stock is Hemlock/Balsam. On page B5 of the Forestry Report, the price-cycle amplitude reported for H/B is $62 to $96. A 25% price cycle results in an average price of ($62 + .25*($96-$62) = $70.50. According to Figure B1 in Appendix B there is less than 5% of the operable land base that has Delivered Wood Costs under $70. Perhaps I don't understand the exact model structure properly, and therefore I don't understand how harvesting is allocated among woodsheds and species. However, since 64% of the land base is H/B and virtually none of this H/B could be harvested profitably, how is it possible, especially in the log run, to that harvesting would fall by only 50% with this price of $70.50 per m^3?
2. On page 15, the report states that "stumpage is calculated as a fixed rate per m^3 and the return to enterprise determined by subtracting stumpage from net revenue". My understanding is that Net Revenue closely approximates Economic Rent (with some minor adjustments for other taxes). Theoretically, stumpage is suppose to extract all of the economic rent except for a portion left to the enterprise such that the enterprise earns a risk-adjusted "normal" rate of return on its assets (usually in the 8-12% range). The specification in the model therefore seems to be incorrect, and is the main

[1] The discussion of this price-cycle pricing is somewhat confusing. Initially I thought that a 25% price meant a price of 25% compared to the top-of-the-cycle price. Actually it the price is calculated by taking the bottom-of-the-cycle price and adding 25% of the top-to-bottom difference. This needs to be explained better in the text of the main report and especially on page B-6 of Appendix B.

[2] *Analysis of Woodflow in the Coast Forest Region*, prepared for the Ministry of Sustainable Resource Management, prepared by Pierce Lefebvre Consulting, 2003.

reason why the profits to enterprise outlined in Table 3-3 are so high under the FE and EBM(H) scenarios (e.g., the five scenarios imply average return to enterprise over the first 20 years of $11.84, $47.78, $30.99, $28.49 and $22.30 per m^3 respectively). If returns to enterprise are abnormally high, then stumpage rates are likely to be adjusted to better collect economic rent Since return to government is a serious decision-influencing variable, this needs to be addressed. Note that it probably can be adjusted outside the model, since I don't believe there is any feedback loop from stumpage and/or Net Revenues back to harvest activity.

3. Section 3.5.2 provides mapping information for Delivered Wood Costs and Development Costs by woodshed area. A quick review of these maps suggests that both levels of costs are fixed over time, even though the size of a woodshed appears to be relatively large. My immediate question would be: is it not more reasonable to assume that, as more remote and inaccessible timber is harvested, costs would increase. This point is assessed in more detail in my discussion of Appendix B below.

Appendix B Assessment

In my audit of Appendix B, I have kept an important assumption foremost in my mind: "delivered wood cost is determined independently from employment income (page 15). The following comments are heavily influenced by this assumption.

1. Section B.1 defined the total (projected) delivered wood costs (DWC) as a function of four costs: Development Costs (bridge construction, road building and maintenance, etc.), Haul-Distance Related Costs (loading hauling costs, crew transportation), Water Transportation Costs (boom and barging costs) and Other Costs (tree-to-truck costs, reloading, silviculture, etc.).

   Development Costs are assumed to be fixed within a woodshed and therefore the development costs per 000 m^3 will vary by the rate of actual harvest. I am not clear as to how this assumption is specified in the model structure itself, but the *theoretical* implication is that, if the development costs of harvesting really are fixed, then the marginal development cost of cutting an additional 1000 m^3 is zero. Thus, theoretically the assumption leads toward cutting greater quantities of timber when in reality the likely response will be to forego development of the watershed.

   Both Haul-distance Related Costs and Water Transportation Costs are defined in a similar manner, that is, as fixed per woodshed, and therefore the problem of marginality is duplicated. There is another concern here, however, and that is there is no real reason to believe that these cost should be fixed. Rather, one would expect that say, loading and hauling costs would be a function of the number of trees hauled and loaded and, in addition, that as harvesting moves further away from, say, accessible waterways, that these costs should also increase. If true, then the model is under-estimating DWC which would make marginal timber profitable. Correcting this would result in lower harvests and lower Net Revenues.

2. The most serious concern with the costing methodology is its abstraction from employment income (page 15) and consequently labour productivity. If labour productivity associated with harvesting continues to fall as has been the record of the last years (see my discussion of Appendix C below),[3] then one would expect that many harvesting costs would also increase. Increasing harvesting costs

[3] A projected fall in labour productivity is quite consistent with the natural evolution of harvesting on the Coast. One would expect that the more accessible, more easily harvested areas would be harvested first (that is, years ago) and, only over time would the less accessible, more difficult areas be harvested. The more difficult areas generally speaking will require more labour. The Coast Woodflow Analysis (2003) by Pierce and Lefebvre confirm that logging productivity was falling between 1992 and 1997 (page 22), but that productivity turned around by 1999. Unfortunately, no information on employment and productivity levels for 2000 -2002 period is provided.

would, *ceteris paribus*, reduce the operable land base and indeed could also increase average development costs, further reducing the operable land base. Harvest consequently would be lower as would Net Revenues.

3. The model also assumes that Development Costs will decline in the future as second growth takes over. But the second growth will not be available for 80-120 years (page 86). So the question is: are annual maintenance costs in already-cut areas embedded in the model? If not, is it reasonable to assume that the 100 year old infrastructure would still be useable? Again, if the decline in Development Costs is not as great as anticipated, projected harvesting should be slightly lower.
4. In Section B.2, the report states that the current mature inventory was estimated from "cutting permit-specific appraisal data". This, to me, is unlikely to represent the average inventory of an entire woodshed, since it is likely (at least theoretically) that each company would have requested cutting permits for the most highly valued (net) timber. As such, the remaining inventory is likely of a lesser quality and therefore of lower value (e.g., lower value species or lower value quality – sawlog/pulp log mix). This would result in lower unit revenues and would reduce the overall operable land base.

The implication of all of these points is that the model input specifications seem to bias costs downward and bias unit revenues upward. The inference is that harvesting activity has been over-estimated. What is not clear is whether these cost and revenue implications are linear, that is, affect all scenarios equally, or whether the impact on one scenario could be greater. This could be a very important question, since it may be that the *difference* (that is, the loss in activity) between the Base Case TSA output and the EBM outputs could be significantly lower than otherwise suggested in this Forestry Report.

Appendix C

Much of Appendix C concerns itself with estimating employment coefficients and productivity trends for use in a subsequent analysis. Nevertheless, I have reviewed these inputs and my comments are as follows.

1. The raw data used (Statistics Canada data, footnoted page C-1) to estimate labour productivity and the trends in labour productivity are NOT, as indicated in the report "for the entire Coast". Rather, the data are for the entire province of BC. As labour productivity in the Interior is acknowledged as being much higher than on the Coast, the point estimate for 2003 (0.17 jobs per 1000 m^3) is likely much lower than the labour productivity actual found on the Central Coast. The significance of this is that the employment and employment income these assumptions would generate will be projected at much too low a value. If, as discussed earlier, employment income should be linked to harvesting costs, then these assumptions will project harvesting at too high a level.
2. The projected trend in labour productivity is based on an historic (1964 – 1997) trend of an "annual loss of 0.006 jobs per 1000 m^3". Three important observations:
    - Productivity gains over the historic period were likely higher in the Interior since it is the Interior where the greatest increase in mechanizing harvesting has taken place.
    - Productivity gains in the BC logging industry have reversed themselves significantly in the latter 1990s. Using the same data sources as the report, the three year average 1995 – 97 was approximately 0.269 jobs per 1000 m^3 whereas the three year average 1988 – 1990 was 0.235 jobs per 1000 m^3. This represents a loss in labour productivity of roughly 14 percent over the period or an annual gain of roughly 0.005 jobs per 1000 m^3 over the same period.
    - The data sourced in the Forestry report stop at 1997. In the Pierce Lefebvre report, their data go to 1999, and they suggest that productivity may have increased between 1996 and

1999. Using gross data from BC STATS[4] productivity was lower in 2000 (when production peaked) than in 1998, but was lower in 2001 (when production had fallen somewhat) than in 1998.

The significance of these points is that the projected labour productivity estimates to be used in the subsequent analysis to generate projected employment and employment income may be much too low for the start period and furthermore, that the projected trends in productivity may be over-estimating what will likely happen. The consequence of this is that projected employment and employment income should be higher, and with projected higher employment income, the operable land base should be smaller that what will be generated using the productivity numbers in the Forestry Report.

3. Table C-1 highlights the employment coefficients used in the present analysis. One assumes that the "jobs within CIT CC area" are logging jobs and therefore are analogous to the figures in Figure C-1. This presents some problems. Mid-Coast, for example, is estimated at 0.28 which, although higher than the estimated trend in Figure C-1, is more-or-less the same value as for all BC for the years 1996 and 1997 (equal to 0.279). More important, it appears that the figures in Table C-1 are fixed over the entire projection period,[5] even though recent productivity trends are negative. If negative trends were introduced into the model, the projected employment and employment income would be higher than stated in the report. Of course, if productivity is expected to rise over time, then the Report is understating harvesting activity in the future.

Conclusion

Two major concerns were identified:

- The various assumptions regarding Delivered Wood Costs (DWC) suggest that the model may be understating these costs and therefore the operable land base may be overestimated;
- The lack of a link between DWC and employment suggests that, if productivity will be falling in the future, the operable land base may be overestimated;

Several other less observations were made:

- Stumpage does not appear to be defined correctly;
- Because of the use of current cutting permit data to estimate future inventory, inventory could be of lesser quality than supposed in the Report;
- Price sensitivities may have peculiar results.

Respectfully submitted

Jim Johnson
Managing Principal
PACIFIC ANALYTICS INC.

November 2, 2003

[4] The BC STATS data appear to be defined quite differently from the data used in the Forestry Report (the BC STATS productivity estimates are in the range of 0.4 to 0.5 jobs per 000 m^3). Nevertheless, one would expect the *trends* to be indicative of overall productivity trends.

[5] This seems to be confirmed after viewing the Wood Cost Maps.