Millar Western Forest Products Ltd.

Carbon Accounting on the DFA

2007-2016 Detailed Forest Management Plan

Prepared by Carbon Impact Assessment Group

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EXECUTIVE SUMMARY

International agreements such as the Kyoto Protocol have increased awareness of the potential impacts of climate change, have put pressure on governments to act, and have provided means through which carbon sequestered in ecosystems can be sold on the open market.

The Timber Supply Analysis for the Whitecourt DFA was subjected to carbon modeling using the Carbon Budget Model of the Canadian Forest Service. Results show that under the TSA assumptions, ecosystem carbon within the DFA can be expected to increase from its initial value of 435 Mt of carbon to 465 Mt over a 205 year period. However, given that fire was not included in the analysis of the TSA, these numbers cannot be expected to reflect the future condition of carbon stocks for the TSA, even if the Preferred Forest Management Strategy is implemented over the next 205 years.

Future work incorporating the impacts of fire, and possibly climate change, will need to be conducted in order to obtain more realistic estimates of future carbon stocks.

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1. Introduction

As evidence has accrued for the potential risks associated with human-induced climate change over the past decades, the peoples of the world have sought to develop means to counteract the frightening changes that have been predicted by climatologists and other scientists. The Kyoto Protocol to the United Nations Framework Convention on Climate Change (or simply, "Kyoto Protocol") was adopted on 9 May 1992 by the UN to address the issue of climate change at a global scale. The protocol was opened for signature at the UN Conference on Environment and Development in June 1992, and entered into force on 16th of February 2005, 90 days after receipt of Russia's signature. There had been established 2 requirements for the protocol's entry into force: first, that 55 countries sign on, and second, and that at least 55% of 1990 developed country (Annexe 1 in UN vocabulary) CO_2 emissions be represented by the signatories. It currently has been ratified by 166 countries (UNFCCC, 2006). Canada signed on the 29th of April 1998 and ratified on the 17th of February 2002 (UNFCCC, 2006). Meanwhile, the current government has suggested that a US led initiative may be more appropriate for Canada.

The Protocol, in an attempt to limit the world's production of greenhouse gases (GHG), establishes a system of "cap and trade". Through this system, limits are established on participating countries' GHG emissions (the "cap") and the countries that exceed these caps are required to buy "carbon credits" from other countries that have produced less than their own quota (the "trade"). Similar systems have already been applied to limit emissions of pollutants, with some success. For example, sulphur dioxide (SO_2) emissions have been subjected to a cap and trade system in the US under the 1990 Clean Air Act, and this system led to an overall decrease in the SO_2 produced in the US.

There are currently several agencies dealing in carbon credit trading. The Dutch ERUPT programme is actively seeking to develop programs in various countries to generate Clean Development Mechanisms and produce carbon credits (SenterNovem, 2006). The World Bank's Carbon Finance Unit (Carbon Finance Unit, 2006), Trading Emissions PLC 2006, the EU's Emissions Trading Scheme (EU-ETS, 2006) are also dealing in carbon credits.

With the prospect of selling carbon credits in mind and in order to contribute to the abatement of climate change impacts, the forest industry is looking into carbon accounting as an integral part of forest management. This report presents the results of carbon accounting for the Millar Western Forest Products (MWFP) Whitecourt defined forest area (DFA).

2. Methods

The Canadian Forest Service (CFS) Carbon Budget Model (CBM) (CFS, 2006) was applied to the Timber Supply Analysis (TSA), produced by The Forestry Corp. (TFC), for the Whitecourt defined forest area (DFA). Since not all species combinations are present in the CBM, assignments of TSA tree species (as BAP, or Biodiversity Assessment Project, strata) to CBM species were required. It should be noted that with the CBM, it is only possible to assign one species combination to the "mixedwood" category. Table 1 illustrates the linkages between the TSA strata and the CBM species. A similar process was run for the disturbance types; equivalencies are given in Table 2. Information on the thinning treatment was drawn from the yield curve document produced by TFC, dated April 7th 2006 (Yield_Curve_Document_20060407.doc).

Table 1. Assignment of CBM species to BAP strata in the TSA.

TSA BAP strata	CBM species name
Aw	trembling aspen
Aw_Pl	trembling aspen
Aw_SwSb	mixedwood
Bw	white birch
Lt	tamarack / larch
Pb	balsam poplar
Pb_Con	balsam poplar
Pl	lodgepole pine
Pl_Dec	lodgepole pine
Sb_Low	black spruce
Sb_Up	black spruce
Sw	white spruce
SwSb_Dec	white spruce

Table 2. Assignment of CBM disturbance types to TSA disturbance types.

TSA disturbance	CBM disturbance type
Succession	Senescence
Clearcut, planned block, no veg control	Clearcut
Clearcut, planned block, veg control	Clearcut
Clearcut, no veg control	Clearcut
Clearcut, veg control	Clearcut
Clearcut, returning to Crop Plan	Clearcut
Commercial Thinning	Thinning with 35% removal

The TSA data was imported into the CBM as a spatial Woodstock database; this database having been produced from output from the Patchworks model used by TFC to produce the optimized TSA for MWFP. The default simulation was run, and the results are presented hereafter.

3. Results and discussion

Results of the carbon modeling show that total carbon stocks within the DFA will decrease slightly (hitting a low value of 386 Mt of carbon at year 90) and then increase above initial levels (to 465 Mt by year 205) near the end of the simulation time horizon (Figure 1). The increase in the dead organic matter (DOM) pool, which includes coarse woody debris and soil organic matter, is mostly responsible for this increase in the total carbon stocks of the DFA (Figure 2). The trajectory of the live biomass component of ecosystem carbon (Figure 2) and the shifting of the age class structure of the DFA to the right (Figure 3), indicating an increase in the area occupied by older stands, together suggest that the DOM accumulates as the stands become older and senescent. Indeed, it can be observed from Figure 4 that as simulation time moves forward, younger stands (less than 160 years) decrease in abundance, and old stands increase in abundance.

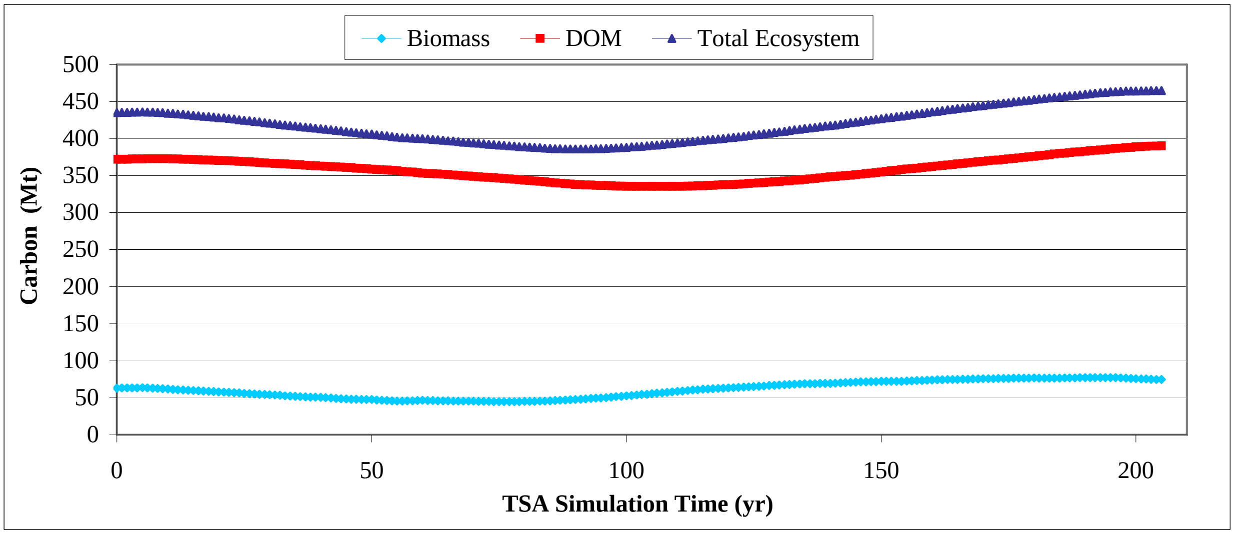

Figure 1. Evolution of the carbon stocks, as dead organic matter, biomass, and the sum of the two, for the MWFP Whitecourt DFA, from year 0 to year 205 of simulation.

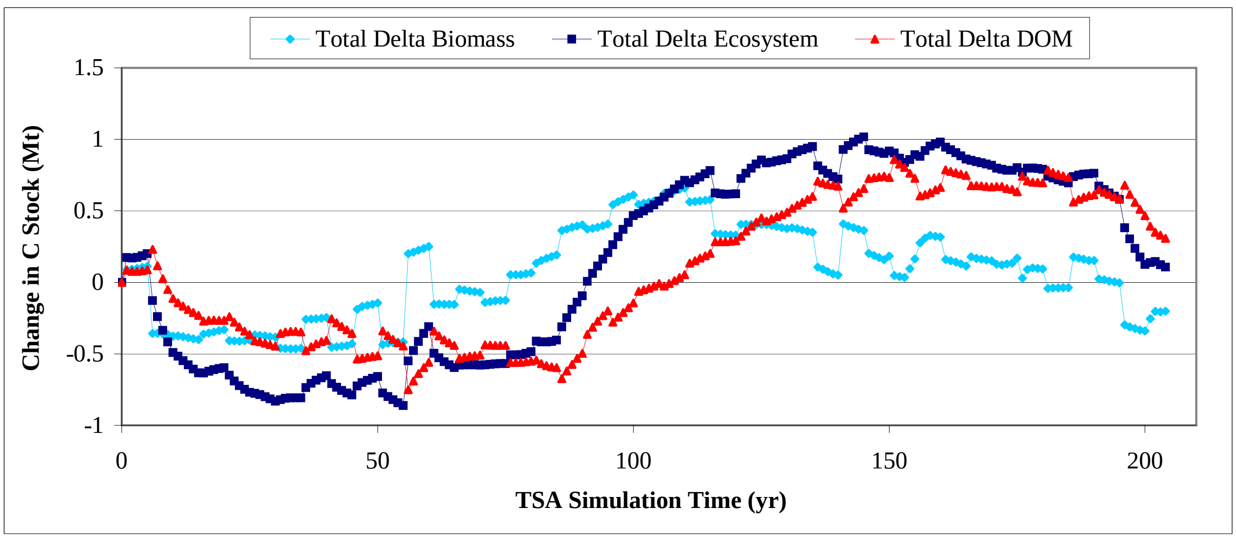

Figure 2. Change in carbon stock for the DFA.

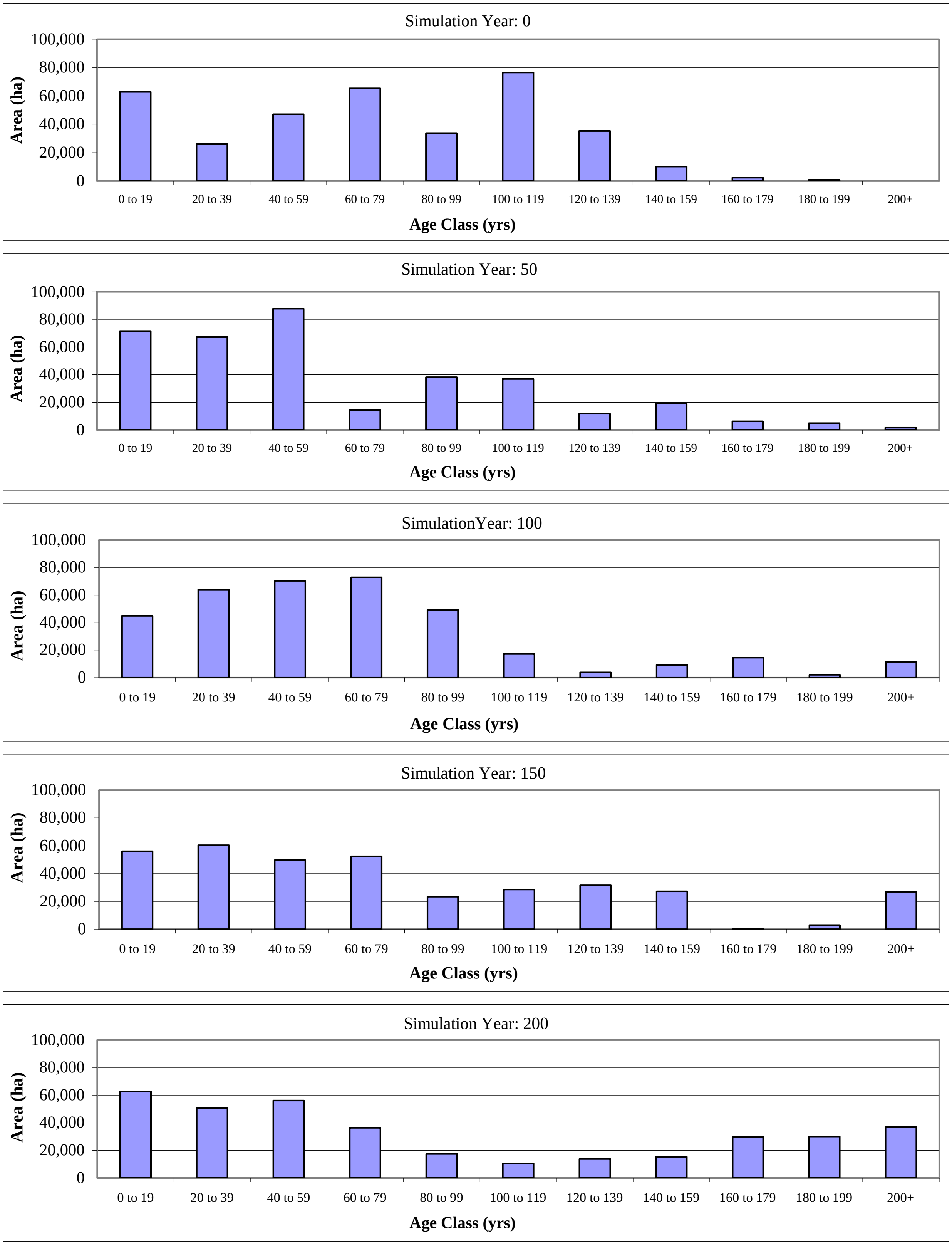

Figure 3. Evolution of the age class distribution for year 0 to year 200 within the TSA.

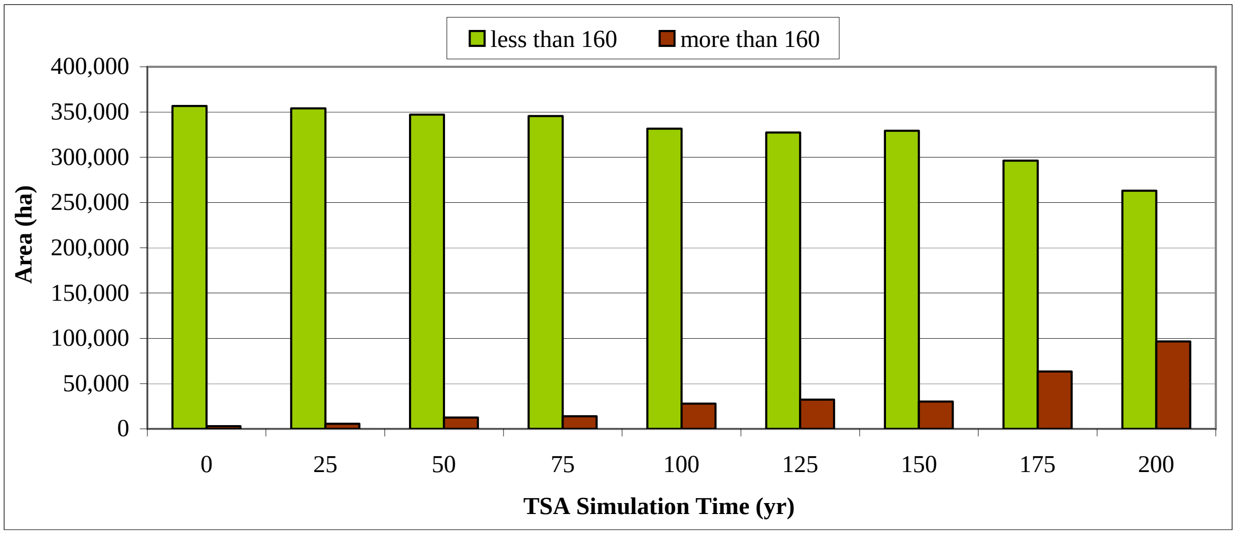

Figure 4. The amount of area in two age classes (less than and more than 160 years) for 9 time steps in the TSA.

It is worth noting that while snag carbon (Figure 5) and coarse woody debris carbon (Figure 6) decrease over time (by 17 and 27 Mt, respectively), soil carbon (Figure 7) increases (by 30 Mt). An increase in soil carbon can be seen as good for carbon sequestration, since this is the most stable form of ecosystem carbon, and can even withstand certain wildfire events (crown fires and light surface fires).

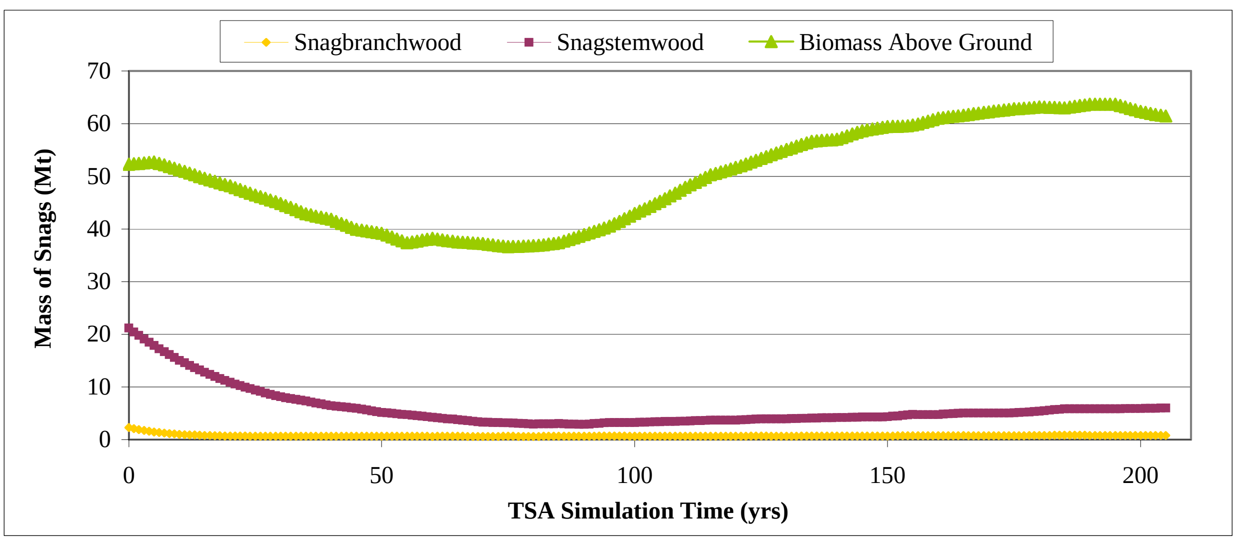

Figure 5. The evolution of snag and above-ground biomass carbon for the DFA, over the 200-year simulation time horizon of the TSA.

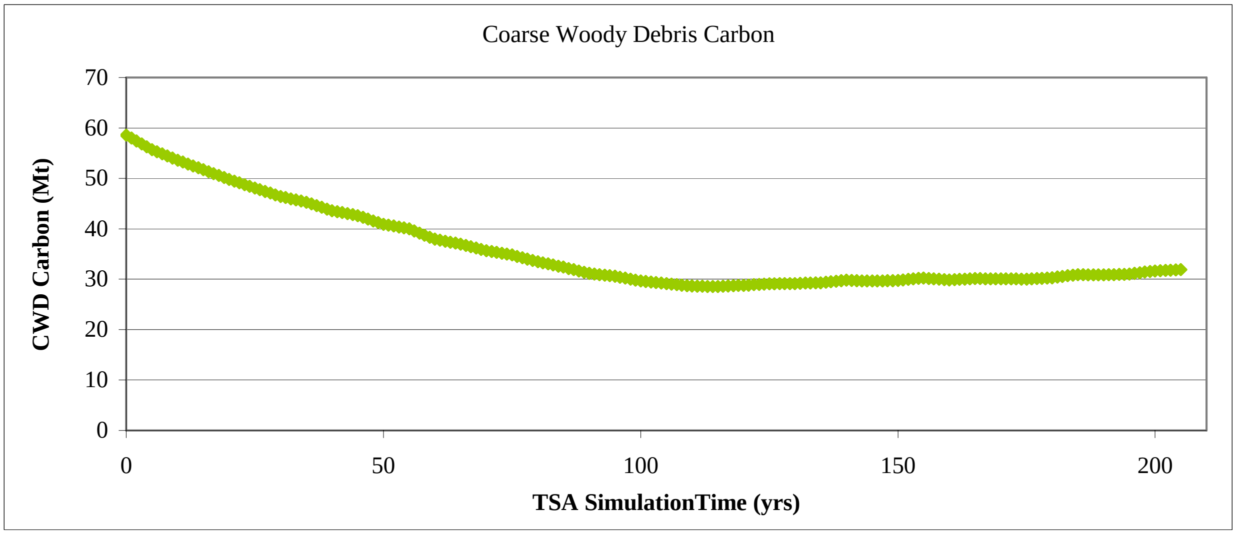

Figure 6. The evolution of coarse woody debris on the DFA, over the 200-year simulation time horizon of the TSA.

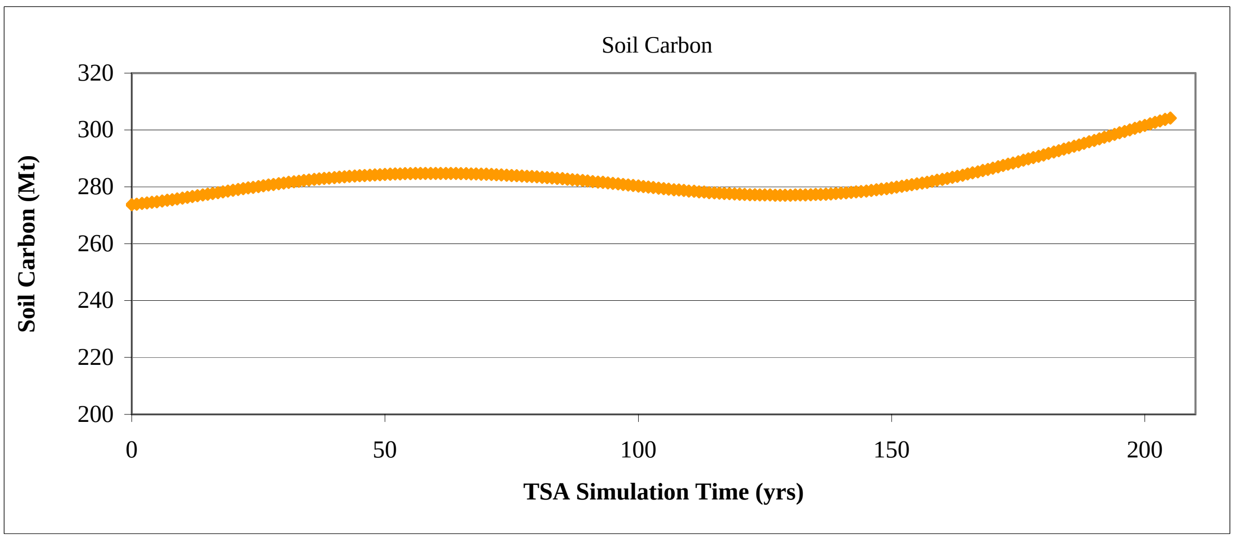

Figure 7. The evolution of soil carbon for the DFA, over the 200-year simulation time horizon of the TSA.

It is important to note that the outcome presented here results from the assumptions made for the TSA; most importantly for ecosystem carbon, that there are no fires in the DFA. Work presented elsewhere (see "Cumulative Impacts Modeling on the Millar Western DFA" for details) shows that the old forest that can be seen to accumulate in the TSA is mostly consumed by fire in the cumulative impact analysis.

4. Conclusion

Results indicate that carbon stocks for the Millar Western Whitecourt DFA, given the assumptions of the TSA, can be expected to increase over the next 205 years. However, since fire is not included in the TSA analysis and since fire has a very important impact on ecosystem carbon, these results must be interpreted with caution, and cannot be expected to reflect the future state of carbon stocks for the DFA. The CFS's CBM is an efficient and flexible tool for the analysis of carbon in forested ecosystems.

5. Recommendations for future work

Given that the TSA does not take fire into account, and that fire has a very important impact on the carbon stocks within a forest, it would be important to link the CBM to a stochastic landscape model, such as the Athabascan Plains Landscape Model (APLM). Through use of such a tool, a more probabilistic approach to the potential impact of fire on carbon pools could be applied.

6. References

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