

PROJECT MONITORING REPORT

VOLUNTARY CARBON STANDARD

The Nature Conservancy of Canada

DARKWOODS FOREST CARBON PROJECT

v. 1.4

Project Title	Date of Issue
<i>Darkwoods Forest Carbon Project</i>	April 20, 2011
Version	Monitoring Period
Version 1.4	April 1, 2008 to December 31, 2010
Project ID	Report Prepared By:
n/a	3GreenTree Ecosystem Services Ltd. On behalf of: Nature Conservancy of Canada

Table of Contents:

1.	Project Details:	4
1.1.	Summary Description of Project:.....	4
1.2.	Sectoral Scope and Project Type	4
1.3.	Project Proponent.....	4
1.4.	Other Project Participants.....	5
1.5.	Project Start Date and Project Crediting Period.....	5
1.6.	Project Location:.....	5
1.7.	Title and Reference of Methodology:	6
2.	Implementation Status	7
2.1.	Implementation Status of the Project Activity	7
2.2.	Deviations from the Monitoring Plan	7
2.3.	Grouped Project.....	9
3.	Data and Parameters	9
3.1.	Data and Parameters Available at Validation	9
3.2.	Data and Parameters Monitored	9
3.3.	Description of the Monitoring Plan	9
4.	GHG Emission Reductions and Removals	16
4.1.	Baseline Emissions	16
4.2.	Project Emissions	18
4.3.	Leakage.....	19
4.4.	Net GHG Emission Reductions and Removals	19
4.5.	Calculation of the Uncertainty Factor.....	20
5.	Supporting Files and Additional Information	21
6.	Bibliography	22

List of Figures:

FIGURE 1 - DARKWOODS PROPERTY OVERVIEW MAP	6
FIGURE 2 - PROJECT HARVESTING ACTIVITIES 2008-2010	11
FIGURE 3 - DARKWOODS FIELD PLOT LOCATIONS SPRING 2011 PLOTS (INITIAL 12 PLOTS)	13

List of Tables:

TABLE 1 - LEGAL DESCRIPTIONS AND PARCEL IDENTIFIERS OF DARKWOODS PARCELS.....	6
TABLE 2. SIMULATED AND ACTUAL HARVEST AREAS IN THE BASELINE AND THE PROJECT SCENARIOS BY ANALYSIS UNIT. CELLS HIGHLIGHTED IN YELLOW INDICATE THOSE REPRESENTED BY THE MONITORING PLOTS.	8
TABLE 3 - DARKWOODS MONITORED FIRE EVENTS 2008-2010 (GIS INVENTORY UPDATED ACCORDINGLY):.....	10
TABLE 4 - DARKWOODS PROJECT HARVESTING ACTIVITIES 2008-2010.....	11
TABLE 5 - NCC LOGGING ACTIVITY ON OTHER PROPERTIES (ACTIVITY SHIFTING RISK) 2008-2010	12
TABLE 6 - LIST OF COMPONENTS USED TO CALCULATE BIOMASS IN THE STANDISH ET AL. (1985) BIOMASS EQUATIONS.....	15
TABLE 7. A DESCRIPTION OF THE REVISED ANALYSIS UNITS USED TO MODEL STAND-LEVEL CARBON STORAGE FOR THE DARKWOODS PROJECT AREA. THE SI CRITERIA FOR THE HIGHLIGHTED AU'S WERE CHANGED FROM THE PDD.	17
TABLE 8. ANNUAL EMISSIONS/REDUCTIONS FOR THE BASELINE SCENARIO CALCULATED FOR 2008-2010. THE MAIN COMPONENTS OF THE CALCULATION ARE ALSO SHOWN.	18
TABLE 9. ANNUAL <i>EX-POST</i> EMISSIONS/REDUCTIONS FOR THE PROJECT SCENARIO CALCULATED FOR 2008-2010. THE MAIN COMPONENTS OF THE CALCULATION ARE ALSO SHOWN.	19
TABLE 10. ANNUAL MARKET LEAKAGE DISCOUNTS 2008-2010 MONITORING PERIOD.	19
TABLE 11. TOTAL SALEABLE VCUS AND TERMS USED IN THEIR CALCULATION FOR THE 2008-2010 VERIFICATION PERIOD.....	20
TABLE 12. SUPPORTING FILES USED IN THE CALCULATION OF CARBON OFFSETS FOR THE 2008-2010 PERIOD. THE NAMES OF WORKSHEETS IN WHICH SPECIFIC DATA AND/OR CALCULATIONS ARE LOCATED ARE ALSO SHOWN.	21

1. Project Details:

1.1. Summary Description of Project:

The Nature Conservancy of Canada (NCC) acquired the fee simple 54,792 ha (135,394 acre) Darkwoods Property near Creston, BC in April of 2008, with the objective of managing the land for ecological conservation objectives. NCC has undertaken a 100 year VCS IFM-LtPF forest carbon project with a start date of the acquisition date to provide carbon finance to complete acquisition financing and funding for ongoing property management, conservation project activities, and ownership costs.

The Darkwoods Forest Carbon Project achieves net GHG emission reductions and removals through the avoidance of emissions due to logging in the baseline scenario.

Under the baseline scenario, a 100-year uneven harvest schedule is implemented with the typical regional practice of clearcut logging with minimum legal requirements for private forestlands in B.C. and comparable regional practices.

The project scenario is conservation management activities, wherein NCC undertakes the carbon project and ecosystem protection and enhancement activities. The project scenario anticipates a low level of timber removal as part of conservation management activities for ecosystem/habitat enhancement and risk management.

1.2. Sectoral Scope and Project Type

Sector 14 - AFOLU

Improved Forest Management (IFM),

Logged Forest to Protected Forest (LtPF).

The Darkwoods Property is consistent with the VCS eligibility for an IFM-LtFP project by “protecting unlogged forests that would be logged in the absence of carbon finance”.

1.3. Project Proponent

Organization	Role	Contact/Address
Nature Conservancy of Canada	Project Proponent	Tom Swann 825 Broughton Street, Suite 200 Victoria, BC, Canada V8W 1E5 Tel: +1 250-479-3191

1.4. Other Project Participants

Organization	Role	Contact/Address
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1.5. Project Start Date and Project Crediting Period

The Darkwoods carbon project and the crediting period start dates are the date of closing on the acquisition. The GHG emission reductions began the day of acquisition, when competing bidder's development plans were avoided by NCC's acquisition.

Project Start Date: April 1, 2008 - The project start date is the date of acquisition, and is the same as the crediting period start date.

Crediting Period Start Date: April 1, 2008 - The GHG emission reductions began at the acquisition, when avoided logging began due to NCC's ownership.

Crediting Period: 100 years - NCC intends to own and manage the Darkwoods property in perpetuity, and has selected the maximum carbon project length.

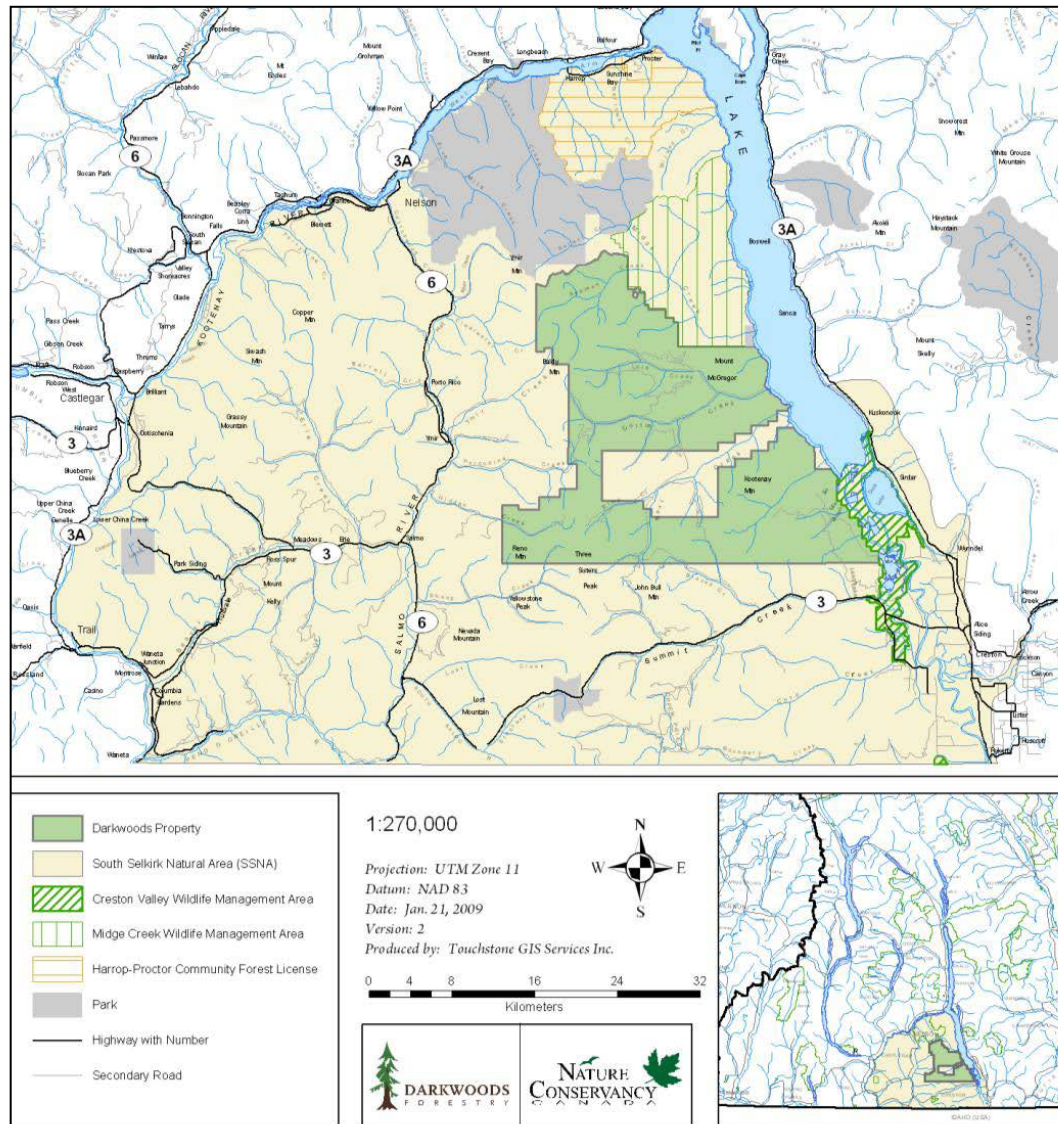
1.6. Project Location:

The Darkwoods property is a 54,792 ha (135,394 acre) contiguous parcel of fee simple private property in south eastern British Columbia just north east of the municipality of Creston. The Darkwoods property is bounded by Kootenay Lake on the east and various crown and private land on the other property boundaries. There is a significant in-holding in the center of the property which is owned and managed by the Windall Box Company, with access rights through the Darkwoods property. The boundaries are surveyed (see Table 1, Figure 1) with the following legal land description:

Table 1 - Legal Descriptions and Parcel Identifiers of Darkwoods Parcels

PID #	Description
PID 007-608-349	Sublot 1, District Lot 2381, Kootenay District, Plan X74, except (1) Plans 1760 and NEP77791 and (2) Part in Lot 15184 known as "Tramline" MC
PID 007-608-594	Sublot 7, District Lot 2381, Kootenay District, Plan X74
PID 007-608-446	District Lot 887, Kootenay District, except part included in Plan 1760
PID 026-235-927	District Lot 15184, Kootenay District

Figure 1 - Darkwoods Property Overview Map



1.7. Title and Reference of Methodology:

Methodology: *VM0012 Improved Forest Management on Privately Owned Properties in Temperate and Boreal Forests (LtPF) v1.0.*

2. Implementation Status

2.1. Implementation Status of the Project Activity

This monitoring period, referenced as project years 1, 2, and 3 or equivalent years 2008, 2009, 2010, includes project activities implemented since the project start date, but prior to the validation of the project.

During this monitoring period, NCC has undertaken timber harvesting in the project scenario. The harvesting has followed NCC's project plan to ramp the previous owners harvest level down over the initial 3-5 year period to reduce the impact on local communities, and to focus on managing and salvaging Mountain Pine Beetle (MPB) attacked pine stand types. The monitoring period harvest levels are consistent with the project scenario plan in the PDD.

NCC has fully updated the Darkwoods property inventory data within a GIS database and other documentation. The project has undertaken all required monitoring activities on an annual basis during the monitoring period as outlined in Section 3.3.

2.2. Deviations from the Monitoring Plan

There have been two monitoring deviations from the methodology and related monitoring plan elements described in the PDD:

1. The first deviation relates to the initial installation of field plots not fully meeting the requirements of the methodology. Specifically, full representation of every analysis unit has not been achieved with field plots due to the physical constraints of winter field conditions. In addition, the current field plots were installed in winter under snow covered conditions, and hence only the standing dead portion of the coarse woody debris field data has been collected.

The initial plot network installed in early 2011 was focused on the analysis units in which the harvesting in the baseline and project scenarios occurred (Table 2). It should be noted that spatially explicit harvesting activities in the baseline scenario were not included as part of the PDD (as the baseline scenario is intended to represent likely harvest levels by forest type and age, rather than by specific locations); however, spatial polygon selections were projected based on harvesting rules and criteria as part of the FPS-ATLAS harvest scheduling function (see link to FPS-ATLAS harvesting output file in Section 5). Therefore, the initial plot network has been focused on achieving a high level of representation of the analysis units that were spatially targeted by FPS-ATLAS for harvest in the baseline scenario. The initial plot network was targeted into analysis units that represent 98.3% of the area affected by baseline and project harvesting activities. Thus, it provides a high level

of representative data for the analysis units where there was the risk of carbon stock inventory errors affecting carbon offset calculation results.

Table 2. Simulated and actual harvest areas in the baseline and the project scenarios by analysis unit. Cells highlighted in yellow indicate those represented by the monitoring plots.

AU	Harvested area ¹ % of total	Total area (ha)
101	0.2%	5.3
102	11.5%	389.7
103	4.2%	142.9
104	1.4%	46.1
105	7.2%	244.0
106	65.1%	2205.1
107	0.01%	0.4
108	10.3%	347.7
109	0.2%	6.6
total	100%	3387.7

The remaining analysis units (not listed in Table 2) without plot representation were not affected by activities in either the project or baseline scenario during this monitoring period (2008-2010) and therefore any unanticipated error in the non-sampled analysis units will affect the baseline and project scenario equally during this monitoring period. Following this logic, the deviation for the lack of plot representation across all analysis units does not affect the ex-post offset credit calculations.

While it has not been physically possible to measure the lying deadwood component of the coarse woody debris (CWD) pool in the initial plot network due to snow conditions; standing dead trees were measured. In these forest types the standing dead component is likely to represent a significant if not the largest portion of the deadwood pool. For the purposes of model comparison and the calculation of the Uncertainty Factor (see Section 4.5), the measured aboveground live biomass pool was added to the standing dead pool to calculate a total aboveground ecosystem C pool. This amount was compared against the sum of modeled-projected aboveground biomass pool and the total deadwood pool (standing + lying deadwood). This represents a conservative comparison because if the model were over-predicting lying deadwood it would cause an increase in the model error component of the Uncertainty Factor.

¹ Includes simulated area for baseline scenario and actual harvested area in the project scenario.

2. The second and relatively minor monitoring deviation is that the carbon-monitoring program has not yet been fully integrated within all NCC standard operating procedures and management plan documentation. Interim procedures/standard practices are in place for the relevant monitoring elements (described in Section 3.3), however NCC has a robust set of regional and national standard operating procedures for biodiversity monitoring and other documented standard operating procedures which will be modified over the next six months to incorporate the carbon project requirements directly into the relevant documents. This deviation does not affect the collection or treatment of ex-post data, nor does it affect the calculation of offset credits for the monitoring period.

2.3. Grouped Project

Not Applicable

3. Data and Parameters

3.1. Data and Parameters Available at Validation

See Darkwoods Project Design Document, Section 3.1, Table 7.

3.2. Data and Parameters Monitored

See Darkwoods Project Design Document, Section 3.2, Table 8. All required parameters have been monitored.

3.3. Description of the Monitoring Plan

The Darkwoods project monitoring plan contains three primary activities:

1. Annual inventory change monitoring

NCC has undertaken a non-systematic spatial monitoring on the entire property annually over the monitoring period. This was undertaken via a combination of aerial helicopter reconnaissance, field observations, field surveys of identified project activities, and field surveys of any identified disturbance events (i.e. fires, etc.). In addition, NCC has updated inventory databases with information from biodiversity and other non-carbon monitoring programs installed since 2008.

a. Natural disturbance events (i.e. fires, high mortality pest and disease areas, blow-down areas, slides, etc.).

NCC has collected monitoring data on the spatial extent of annual forest fires during the monitoring period (Table 3).

Table 3 - Darkwoods Monitored Fire Events 2008-2010 (GIS Inventory Updated Accordingly):

Project Year	# Fire Occurrences	Monitored Fire Occurrence (ha)
2008	2	1.6 ha, 17 ha
2009	0	0 ha
2010	0	0 ha

No specific inventory updates were made related to high mortality pest and disease areas. The BC Ministry of Forests has published Mountain Pine Beetle (MPB) outbreak data covering the Darkwoods property (which are available upon request), which was used to inform the assumptions about pine mortality occurring in the monitoring period. See the PDD, Section 4.1 for notes related to the treatment of MPB attack areas within the carbon calculations, which affect the calculation of carbon in the monitoring period, but have been done conservatively. The field inventory for pine polygons affected by MPB will be adjusted over time as field plot data and other inventory updates are made which track pine mortality and decay over time.

b. Planned project activities (i.e. harvests, road construction, reforestation, etc.)

NCC undertook timber harvesting, as per the project scenario plan on an annual basis during the monitoring period. The harvest areas were predominantly related to management and salvage of MPB infested pine stands. The harvesting by monitoring period year is shown in Figure 2 and summarized in Table 4.

Figure 2 - Project Harvesting Activities 2008-2010

Actual (Ex-post) harvested area for the within the Darkwoods Project area 2008-2010

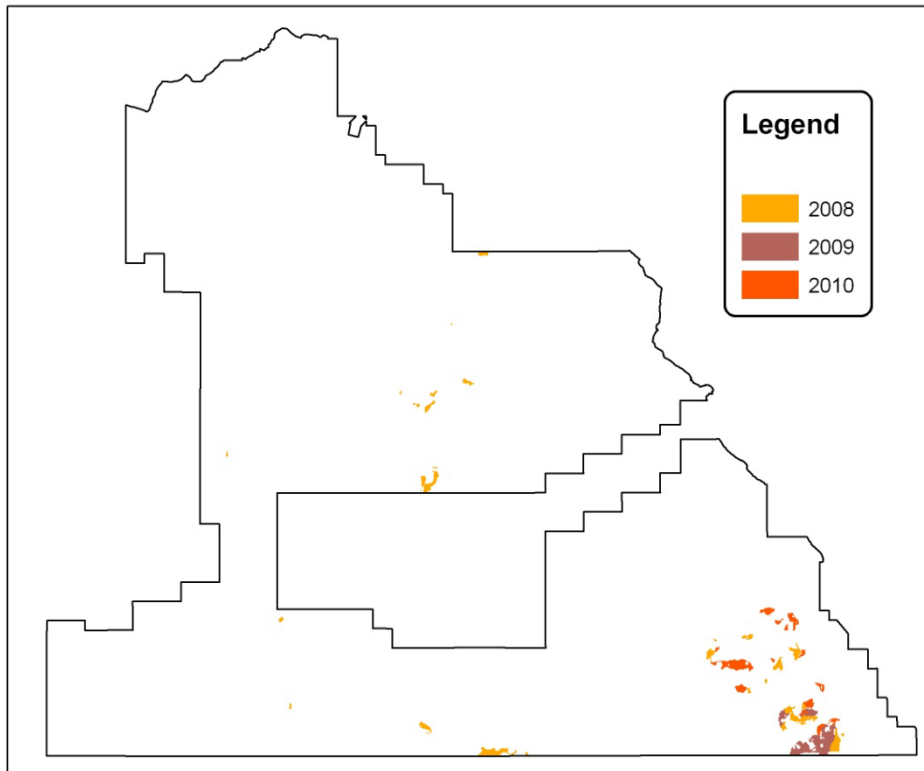


Table 4 - Darkwoods Project Harvesting Activities 2008-2010.

Project Year	Year	Ex-Post Projected Volume (m ³)	Ex-Post Delivered Volume (m ³)	Ex-Post Actual Area (ha)
1	2008	60,645	50,763	224
2	2009	41,418	40,443	137
3	2010	32,472	23,819	118

The ex-post area data shown in Table 4 are from digitized maps of actual Darkwoods harvest block areas. The projected volume is projected by FORECAST/ATLAS assuming a clearcut on the planned area polygons, converted to

merchantable volume. The actual harvest volume is from BC Assessment Authority scaling data. There are some differences in the delivered vs. projected harvest volumes due to: 1) the fact there is within harvest block tree retention (small groups and single tree retention) in the field that is not represented within the models; 2) small differences in the timing of reporting; and 3) differences in projected vs. actual merchantability. However, the simulation of clearcut harvesting is conservative from an ecosystem carbon storage perspective (as compared to the actual harvest sites which have additional carbon in the retained trees).

c. Unplanned man-made disturbances (i.e. non-*de minimis* illegal or unplanned harvests, etc., if applicable)

No unplanned or illegal harvest or other activities were observed on the property during the monitoring period, and no inventory updates or adjustments have been necessary. NCC has completed an access management plan, installed access controls on the property (i.e. gates), and implemented a mandatory permit system to monitor access on the property.

2. Other Monitoring Requirements of the Project

NCC has also documented the other monitoring requirements of the PDD, including:

a. Activity shifting leakage (annually)

NCC has not undertaken any material level of timber harvesting on any owned or managed property outside Darkwoods for the period 2008 to 2010, and therefore there is no risk of starting activity shifting risk (see Table 5).

Table 5 - NCC Logging Activity on Other Properties (activity shifting risk) 2008-2010

Property	Project Year	Logging Volume (m ³)	Activity shifting evidence/comment
All NCC properties outside Darkwoods	2008	0.0	n/a – no harvest
All NCC properties outside Darkwoods	2009	0.0	n/a – no harvest
All NCC properties outside Darkwoods	2010	0.0	n/a – no harvest

b. Annual market leakage calculations (annually)

Annual Calculations of market leakage are shown for the years 2008-2010 in Section 4.3.

3. Field plot monitoring

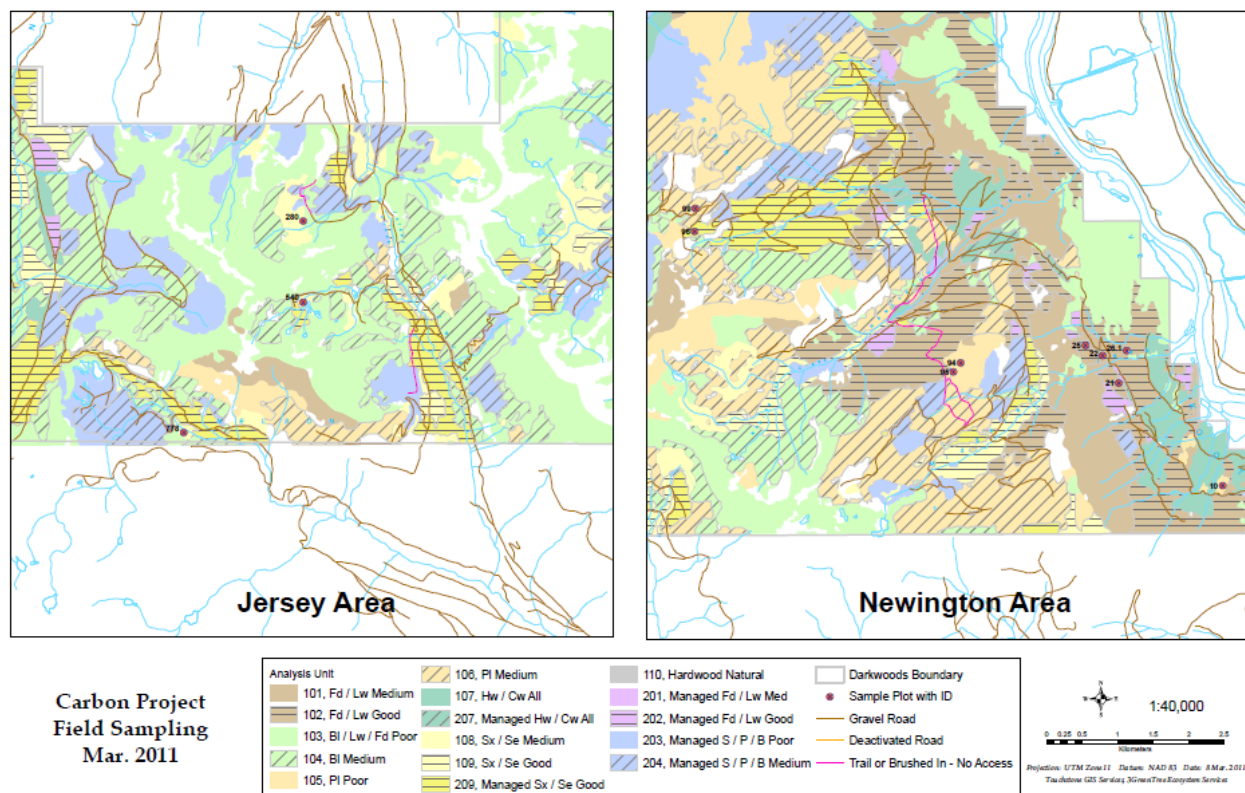
NCC has completed a limited field plot implementation in targeted areas of the property in February/March of 2011. As described in Section 2.2 (Deviation 1), there was a deviation from the methodology in the sampling due to the snow-covered conditions such that it was not possible to measure the lying dead component of the dead wood pool. Rather, sampling was focused on measuring aboveground live biomass and standing dead.

Type and Number of Sampling Plots:

Plot type

In February/March 2011, 16 fixed-area plots (4m, 14m, and 20m radius circular plots) were installed, as per the procedures outlined above. The locations of the initial 12 plots are shown in Figure 3, and all actual UTM plot coordinates are shown in the supporting plot data files (Table 12).

Figure 3 - Darkwoods Field Plot Locations Spring 2011 Plots (Initial 12 plots)



Sampling Design

The field crews were given several potential sample plot locations using standard GIS software to generate the UTM coordinates of candidate polygons within the Darkwoods land base. Candidate polygons were identified by selecting polygons that represented the analysis units that were the focus of harvesting activities in the baseline and project scenarios during the first three years of the project (2008-2010). Other criteria used in the selection of candidate polygons included: 1) Age - stands had to be >60 years old, 2) Accessibility - stands had to be accessible during winter conditions, and 3) minimum polygon size of 4ha (i.e. the minimum inventory target polygon size).

The plot sampling operating procedures are available upon request. Summarized: Crews were instructed to avoid placing plots within 1.5 tree lengths of a polygon boundary. Plot size (radius = 4m, 14m, or 20m) was determined based upon the DBH range of the trees within the plots such that a minimum of 60 trees were measured in each plot. Crews were instructed to establish a plot centre (due to snow conditions, a live plot center was selected for each plot) and to measure the top height and DBH of each standing stem with a diameter ≥ 5 cm. Species and tree condition class (Live, Dead, Snag) were also recorded. 'Dead' indicated recently dead with branches still largely intact while 'Snag' indicated a standing dead stem with significant loss of branches. Crew also made note if a stem had a broken top and the recorded the height at break.

The following carbon pools were calculated from plot measurements:

- Live trees: aboveground + belowground
- Standing dead trees: aboveground
- Lying dead wood was not measured – see Methodology deviation 1 in Section 2.2.

Measurement and Data Analysis Techniques

Trees

A reference to the file containing the plot data for the 12 installed plots is available in Section 5. Tree biomass per hectare for each plot was then calculated from equations from (Standish, Manning, & Demaerschalk, 1985) that relate biomass to DBH and height for the 22 main tree species in British Columbia (as described in Section 3.4 of the PDD). The components for the Standish et al. (1985) equations were selected based upon tree class as shown in Table 6.

Table 6 - List of components used to calculate biomass in the Standish et al. (1985) biomass equations.

Class	Components used (a & b) ²	Belowground included ³
Live	DTOTAL	yes
Dead	DWOOD + DBRAN1	no
Snag	DWOOD	no

Belowground biomass (t ha^{-1}) was calculated from live aboveground biomass using equations derived from (Li, Kurz, Apps, & Beukema, 2003) and (Lehtonen, Makipaa, Heikkinen, Sievanen, & Liski, 2004). Tree-level measurements (kg biomass per tree) were converted to area-based stand-level measurements (t ha^{-1}) and a conversion factor (0.50) was used to convert biomass into carbon. A detail description of the equations used in these calculations can be found in Section 3.4 of the PDD. The application of the biomass and carbon calculations are shown in the sample plot data spreadsheet referenced in Section 5.

Dead organic matter

As noted in the monitoring deviation above, lying dead CWD was not measured due to snow conditions in the plots.

Quality Assurance/Quality Control Measures (QA/QC)

The current draft field plot procedure for the initial plots is included in Section 5.

NCC undertook a 10% blind check cruise program, which resulted in 2 plots being 100% re-sampled, including re-counting the plot tree core ages. DBH, Height, and Age measurements met the accuracy threshold of $\pm 10\%$ at 90% CI, as required by the PDD (See Section 5).

QA/QC for Data Entry

The data was recorded electronically in the field, and transferred electronically into the referenced excel analysis files (Table 12).

QA/QC for Data Archiving

NCC has stored the electronic field data files, summary excel files, and age core samples at the Darkwoods field office. NCC data management procedures are in place and being followed for the files and relevant databases.

² The Standish et al. (1985) equations include different sets of component values depending on which biomass components are required. DTOTAL = total tree dry mass, DWOOD = stemwood dry mass, DBRAN1 = dry mass of large braches ($>2.5\text{cm}$)

³ Belowground biomass was estimated from aboveground biomass for live stems only. Dead stems and snags were assumed to have no live belowground biomass (only dead belowground biomass which is not included in the monitoring program).

Use of monitoring data to update carbon stock calculations

Data gathered through the monitoring process has been used to:

1. update and improve the inventory and calculations of carbon stocks as described in the PDD Section 3.4 (described in Section 4 below); and
2. update error estimates used in the calculation of the uncertainty factor described in PDD Section 3.5 (described in Section 4.5 below).

4. GHG Emission Reductions and Removals

4.1. Baseline Emissions

Stratification of Land Area

The project land base has been stratified using an analysis unit approach as described in Section 4.1 of the PDD.

Post-stratification

Post-monitoring re-assignment of inventory data has occurred based on ex-post data from project activities (i.e. the actual harvest areas have been updated in the inventory, and the carbon modeling re-run accordingly).

In addition, one post-plot strata update has been made, where it became clear that the allocation criteria for forest type polygons into analysis units should be adjusted to better fit the field data within analysis units.

Specifically, the analysis unit criteria for Analysis Unit 108 was adjusted to include only stands with Site Index (SI) of 13-17, while the Spruce stands ≤ 13 SI were re-allocated to Analysis Unit 103 with similar forest productivity classes. A summary of the revised Darkwoods analysis units is presented in Table 7. This re-allocation is unbiased as the field inventory results are correct and unchanged, and it is only a re-allocation of all similar stands within all affected analysis units. This change refines the inventory and model error calculations, and the carbon calculations for the project and baseline scenarios have been re-run to incorporate this updated stratification.

Although inventory updates for specific polygons from all monitoring field activities is anticipated by the methodology, no adjustments were made to inventory polygon forest typing from the results of the field plot installation process due to the potential insertion of bias into the uncertainty results in the inventory error calculation (see Section 4.5). For example, the data from some plots revealed that the polygon was miss-typed (i.e. usually the leading species and secondary species were flipped) and not matching the anticipated stand type criteria for the analysis unit. Although over time these inventory typing errors will be corrected, it was decided this needed to be in a separate process where inventory-typing errors can

be identified and corrected in an unbiased or more systematic manner not directly related to plot installation. This decision increases the uncertainty factor from inventory error and therefore is conservative and does not increase the number of credits calculated in this monitoring period.

Table 7. A Description of the revised analysis units used to model stand-level carbon storage for the Darkwoods project area. The SI criteria for the highlighted AU's were changed from the PDD.

AU	Description	Lead Sp. ⁴	Age ⁵	Productivity class	Site index Range ⁶	Average SI	Area Operable (ha)	Area Inoperable (ha)
999	no trees							7018.6
101	Natural F / L_med	F / L	>40	med	13-17	15.2	1909.7	419.4
102	Natural F / L_good	F / L	>40	good	≥17	21.0	2589.8	91.0
103	Natural B / L / F / S_poor	B / L / F / S	>40	poor	<13 ≤13 (S)	9.8	9525.1	7938.9
104	Natural B_med	B	>40	med	≥13	15.5	5202.2	294.5
105	Natural P_poor	P	>40	poor	<13	10.6	1839.3	489.9
106	Natural P_med	P	>40	med	≥13	16.8	2601.7	557.7
107	Natural C / H_med-good	C / H	>40	med-good	all	16.9	2333.4	78.6
108	Natural S_med	S	>40	med	13-16	15.2	1198.1	44.2
109	Natural S_good	S	>40	good	≥16	21.6	1023.2	9.2
110	Natural E / A_Med	E / A	>40	Med	all	15.8	15.3	0.0
201	Managed F / L_med	F / L	≤4 0	med	13-17	16.0	119.7	0.0
202	Managed F / L_good	F / L	≤4 0	good	≥17	21.7	326.5	1.2
203	Managed S/P/B_poor	S/P/B	≤4 0	poor	<13	8.9	2068.8	586.1
204	Managed S/P/B Med	S/P/B	≤4 0	med	≥13	15.5	3615.0	4.1
207	Managed C / H_med-good	C/H	≤4 0	med-good	all	16.9	231.9	7.6
209	Managed S_good	S		good	≥16	20.0	2649.8	1.5
210	Magaged E / A_Med	E / A		Med		n/a	0.0	0.0

¹ F = Douglas-Fir, L = Western Larch, B = Subalpine Fir, S = Hybrid spruce or Engelmann Spruce, P = Lodgepole pine and White bark pine, C = Western red cedar, H = Western hemlock, E = Paper birch, and A = Trembling aspen.

² Age group separates managed from natural stands.

³ Site Index based on ht at breast-height age 50. The average shown is for the operable landbase.

Calculation of annual emissions/reductions

Annual emissions/reductions for the baseline scenario for the years 2008-2010 were calculated using the output from the FPS-ATLAS model simulation. Output with respect to volume harvested and annual emissions/reductions (including key components) are shown in Table 8. A link to the detailed FPS-ATLAS output file is provided in Section 5.

Table 8. Annual emissions/reductions for the baseline scenario calculated for 2008-2010. The main components of the calculation are also shown.

Year	Ann. Baseline (Emissions) Reductions (tCO ₂ e)	Volume Harvested (m ³)	Baseline Net Change in Ecosystem C (tC)	Baseline Storage HWP (tC)	Baseline Storage Waste Products (tC)	Baseline Emissions Equipment & Production (tC)
2008	(316,806)	309,878	(87,581)	3,952	1,273	(3,968)
2009	(281,998)	301,109	(78,061)	3,840	1,237	(3,855)
2010	(460,747)	302,970	(126,774)	3,864	1,245	(3,879)

4.2. Project Emissions

Stratification of Land Area

The project land base has been stratified using an analysis unit approach as described in Section 4.1 of the PDD.

Post-stratification

Post-monitoring re-assignment of inventory data has occurred based on ex-post data from project activities (See Section 4.1).

Calculation of annual emissions/reductions

Annual emissions/reductions for the baseline scenario for the years 2008-2010 were calculated using the output from the FPS-ATLAS model simulation. Output with respect to actual project scenario volume harvested and annual emissions/reductions (including key components) are shown in Table 9. A link to the detailed FPS-ATLAS output file is provided in Section 5.

Table 9. Annual *ex-post* emissions/reductions for the project scenario calculated for 2008-2010. The main components of the calculation are also shown.⁷

Year	Ann. Project (Emissions) Reductions (tCO ₂ e)	Actual Volume Harvested (m ³)	Project Net Change in Ecosystem C (tC)	Project Storage HWP (tC)	Project Storage Waste Products (tC)	Project Emissions Equipment & Production (tC)
2008	870	50,763	31	647	209	(650)
2009	49,714	40,443	13,382	516	166	(518)
2010	(21,416)	23,819	(5,932)	304	98	(305)

4.3. Leakage

Market Leakage

The market leakage factors were calculated using Option 2 – CAR Leakage Calculation (See link to the spreadsheet file in which leakage calculations were made in Section 5). This market leakage option does not require further monitoring activities, other than monitoring actual scenario harvest volumes (shown in Table 4). The resulting leakage risk factors determined for each monitoring period year are shown in Table 10.

Table 10. Annual Market Leakage Discounts 2008-2010 Monitoring Period.

Year	Change in carbon associated with harvested wood (tCO ₂ e)	Leakage Risk Discount (tCO ₂ e)	Leakage Risk % of VCUs
2008	190,190	(38,038)	12.0%
2009	191,329	(38,266)	11.5%
2010	204,897	(40,979)	9.3%

4.4. Net GHG Emission Reductions and Removals

The determination of net GHG Emissions and the associated calculation of total saleable VCUs were made following the approach and equations described in Section 4.4 of the PDD. The results for the 2008-2010 verification period are shown in Table 11. The spreadsheet used to calculate the values shown in Table 11 is referenced in Section 5.

⁷ Note, as expected, these *ex-post* values differ from the *ex-ante* values shown in the PDD due primarily to the replacement of projected harvest volume with actual harvest volume.

Table 11. Total saleable VCUs and terms used in their calculation for the 2008-2010 verification period.

Year	Ann. Net Emissions Reductions (tCO ₂ e)	Leakage Risk Discount (tCO ₂ e)	Uncertainty Risk Discount (tCO ₂ e)	Non-Perm. Buffer Contribution (tCO ₂ e)	Cumulative Non-Perm. Buffer Account (tCO ₂ e)	Release From Buffer (tCO ₂ e)	Annualized Saleable VCU (tCO ₂ e)
2008	317,676	(38,038)	(4,195)	(31,436)	31,436	0	244,007
2009	331,713	(38,266)	(4,402)	(32,838)	64,273	0	256,207
2010	439,332	(40,979)	(5,975)	(43,576)	107,849	0	348,802

4.5. Calculation of the Uncertainty Factor

As described in Section 3.5 of the PDD, an Uncertainty Factor including inventory and model error terms were calculated based upon the comparison of the stand-level measures of net aboveground ecosystem C within the field plots and the associated model-projected values. The value of the Uncertainty Factor was determined to be 1.5% based upon a calculated Inventory error (E_I) term of 25.8% and a model error (E_M) term of -25.2%.

The model error term was negative (under predicting carbon storage) and the inventory error term was elevated primarily due to the fact that most of the pine stands (AU 105 and AU 106) were actually higher productivity stands than the inventory site index suggested. As more data come in from additional sampling and a more extensive plot network is established in support of future verifications, this under prediction will be addressed by systematically adjusting analysis unit assignment criteria for these stands and by revising model runs and associated stand-level carbon curves for the pine leading analysis units. In the short term, however, these results suggest that the determination of carbon offsets calculated for these three years is very likely to be lower than the actual amount within the targeted areas of the Darkwoods property and thus the analysis provides a conservative estimate of carbon offsets.

As described in Section 3.5 of the PDD the Uncertainty Factor is determined from the inventory and model error terms as follows:

Uncertainty Factor =

If $E_p < 10\%$ then 1.5%;

If $E_p > 10\%$ then $1.5\% + E_p - 10\%$

where:

$$E_p = E_I + E_M$$

$$E_p = \text{Total project error (\%)}$$

E_i = Inventory error at the 90% confidence interval (% , expressed as the absolute value of the $\pm$ error term).

E_M = Model error (%). May be positive (model > measured value) or negative (model < measured value).

The spreadsheet used in the calculation of the Uncertainty Factor is referenced in Section 5.

5. Supporting Files and Additional Information

A list of supporting files used in the calculation of carbon offsets for the 2008-2010 period is provided in Table 12.

Table 12. Supporting files used in the calculation of carbon offsets for the 2008-2010 period. The names of worksheets in which specific data and/or calculations are located are also shown.

Description	File Name	Worksheet
Tree measurement data from monitoring plots	Darkwoods Sample Plot Data Mar 2011 v3.2.xlsb	Plot data
Tree-level biomass calculations	Darkwoods Sample Plot Data Mar 2011 v3.2.xlsb	Plot data
Stand-level biomass & carbon calculations	Darkwoods Sample Plot Data Mar 2011 v3.2.xlsb	Summary
Uncertainty Factor calculations	Darkwoods Sample Plot Data Mar 2011 v3.2.xlsb	Uncertainty Factor revised
QA Check Plot Data	QA Carbon Field Sampling Results_NCC Darkwoods_25Feb2011.xlsx	QA_AU105_Plot 10; QA_AU102_Plot 21
ATLAS Carbon output	ATLAS Runs Updated Mar 2011.xlsx	2011 carbon
ATLAS Volume output	ATLAS Runs Updated Mar 2011.xlsx	Volume 2011
ATLAS Harvest area by AU during 2008-2010	Area_by AU_by_Period_Mar_2011.xlsx	AU Harvest 2008-2010
Calculation of C storage and emissions associated with the production of HWP	Darkwoods Carbon Model Ex-post 2008-2010 v8.7a.xlsx	HWP Carbon Model
Calculation of Market Leakage	Darkwoods Carbon Model Ex-post 2008-2010 v8.7a.xlsx	Summary Tables and Figures
Calculation of Saleable VCUs	Darkwoods Carbon Model Ex-post 2008-2010 v8.7a.xlsx	Summary Tables and Figures

6. Bibliography

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