Modeling Plan

BLUE SOURCE

Modeling Plan
Version 1.7

October 20, 2017

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Ecological Carbon Offset Partners, LLC
2930 Shattuck Ave, Suite 305
Berkeley, CA 94705
www.ecopartnersllc.com

Kyle Holland
Managing Member
(415) 634-4650
kholland@ecopartnersllc.com

TABLE OF CONTENTS

APPENDICES

1 INTRODUCTION

This report presents model parameterization, calibration, implementation and predictions for the Blue Source - Powellton Improved Forest Management Project. This report also describes modeling assumptions and constraints for the baseline and project scenarios.

Baseline carbon stocks in above-ground living trees were modeled to an average **84.34 tCO2e/ac**. This is equivalent to an average **3,709,923 (102.27 tCO2e/ac)** in the Project Area under the baseline scenario for above-ground living, below-ground living and standing dead wood. The total predicted harvest yield of trees in the baseline scenario is **348,104,991 ft^3** net of defect.

2 FOREST GROWTH AND YIELD MODEL

The selected model was run using the Forest Vegetation Simulator (FVS) developed and maintained by the USDA Forest Service.

3 MODEL PARAMETERIZATION

The model was parameterized with silvicultural prescriptions and local calibration. It was parameterized to consider the required legal constraints of the baseline scenario, and the same legal constraints plus management plan objectives in the project scenario.

3.1 SILVICULTURAL PRESCRIPTIONS

The following silvicultural prescriptions were defined in Table 1. A summary of area by prescription type for the baseline and the project scenario is given by Table 2.

Prescription	Parameters	Regime Description
Commercial Thinning	Basal Area retention 10-40 ft^2, with initial harvests starting in 2016	Thin from above to a basal area target of 10-40 sq ft per acre, with no preference to species groups. Assumes natural regeneration from post-harvest sprouting and added natural recruitment for species NC, OH, PP, VP and WP. Revisit period of 40 years.
Grow	Default FVS	No management, assumes default natural regeneration.

Table 1: Descriptions of targeted silvicultural regimes.

Prescription	Baseline (ac)	Project (ac)
Commercial Thinning	34,183.19	29,783.20
Grow	2,092.02	6,492.01

Table 2: Area of application by targeted silvicultural prescription in FVS.

See sections 4.5.1 and 4.5.2 for more information on baseline modeling and project modeling, respectively.

3.2 CONSTRAINTS

Several constraints including streamside management zones and High Conservation Value Forest were considered in the construction of modeling units and the parameterization of the FVS model. The following legal and management plan constraints in Table 3 were considered when parameterizing the model.

Constraint	Description	Modeling Technique
Streamside Management Zone	West Virginia BMPs define SMZs of 100 feet slope distance on either side of perennial streams and 25 feet slope distance on either side of ephemeral streams. Cutting and pulling trees from SMZs is allowed, but equipment operation should be limited. Log landings, truck roads, and skid roads are limited in SMZs.	All streams were buffered by 75 horizontal feet on either side. Conservatively, no forest management was practiced in these stands in the model. It is reasonable to assume that all limitations on equipment operation and roads and landings would be met.
High Conservation Value Areas	Restricted management in designated high conservation value areas within the project scenario. High Conservation Value Forests are forests that possess one or more of the following attributes: a) Forest areas containing locally, nationally, or regionally significant: concentrations of biodiversity values (e.g. endemism, endangered species, refugia); and/or large, landscape level forests, contained within, or containing the management unit, where viable populations of most if not all naturally occurring species exist in natural pattern of distribution and abundance b) Forest areas that are in or contain rare, threatened or endangered ecosystems. c) Forest areas that provide basic services of nature in critical situations (e.g. watershed protection, erosion control) d) Forest areas fundamental to meeting basic needs of local communities (e.g. subsistence, health) and/or critical to local communities' traditional cultural identity (areas of cultural, ecological, economic or religious significance identified in cooperation with such local communities)	These stands are digitized and no management occurs in these areas in the model.

Constraint	Description	Modeling Technique
	There was one area within the project area identified as High Conservation Value Forest: 1. Cemeteries There is no legal requirement restricting forest management in HCVF.	

Table 3: Description of legal and management plan constraints.

In order to best model the constraints within streamside management zones (SMZs), the West Virginia BMPs were consulted (see Appendix A). The West Virginia BMPs designate an SMZ buffer size of 100 feet around perennial and intermittent streams, but the SMZ requirements in the BMPs do not restrict forest management, only limiting the building of new roads and log landings in SMZs. For modeling, a 75 foot buffer has been placed on all perennial and intermittent streams in the project area where no management is practiced; it is therefore reasonable to assume the BMPs are being met in the model.

The streamside management zone, as the only legally restricted constraint, was grown conservatively over the project lifetime without any management prescriptions in both the project and baseline scenarios. The acres shown in Table 4 represent acres assigned to each individual constraint class. However, as the same area can have multiple constraints applied, the total area of constrained areas is not equivalent to the sum of all types of constrained area.

For the baseline and project model, all constraints were considered inoperable. A map showing the constraints can be found in Appendix B.

There are no Rare, Threatened, or Endangered species that impact forest management in the Project Area.

Constraint	Baseline Prescription	Project Prescription	Acres
Streamside Management Zone	Grow	Grow	2,090.81
High Conservation Value Areas	Grow	Grow	1.56

Table 4: Assigned prescriptions by constraint.

3.3 MODEL CALIBRATION

The FVS model was calibrated in order to most accurately reflect FVS variant parameters, merchantability, site index, regeneration, and mortality. This was done using the FVS Overview document for the Northeast variant (Appendix C) and inventory and regeneration data obtained from 2016 (Appendix D). For more details on the implementation of site index for model calibration see section 4.4 of this report.

3.3.1 GENERAL FVS CALIBRATIONS

Several important parameters including variant, location codes, and habitat codes were set to ensure that the model would best represent the forest systems seen within the project area.

The Northeast variant for FVS was selected to model the project. Additionally, the location code 921 for Monongahela National Forest was selected to calibrate the model based on the closest national forest to the project area. See Appendix C for the FVS Northeast Variant Overview.

3.3.2 MERCHANTABILITY CALIBRATION

Default pulpwood and sawtimber specifications from the FVS Northeast Variant Overview (See Appendix C) were used to parameterize the model and the relevant specifications are detailed in Table 5.

NE Variant Merchantability Specs	Hardwoods	Softwoods
	Minimum DBH/Top Diameter	Minimum DBH/Top Diameter
Pulpwood Volume Specifications		
Monongahela	5.0/4.0 inches	5.0/4.0 inches
Sawtimber Volume Specifications		
All Location Codes	11.0/9.6 inches	9.0/7.6 inches

Table 5: Pulpwood and sawtimber specs for hardwood and softwood species in the Northeast variant.

In reality, merchantability specifications would be changed over time as milling systems and markets evolved. The model did not assume how merchantability specifications would have changed over the modeling period and thus these specifications were fixed throughout the modeling period.

3.3.3 REGENERATION CALIBRATION

Several types of regeneration were accounted for within the FVS model and were parameterized in order to produce the most accurate modeling results. The Northeast variant in FVS uses a partial establishment model that includes default regeneration from stump sprouts for most species. Any species that were not represented in the default FVS stump sprouting model were added in as natural regeneration.

Natural regeneration was parameterized using the NATURAL keyword in FVS for the species shown in Table 6, as was specified in section 6 of the Northeast Variant Overview (see Appendix C). The stocking values calculated for each species in Table 6 were found by counting the number of regen saplings (trees less than 5” DBH), dividing by the number of plots, and expanding by a factor of 100 trees per acre (see Appendix D). The regeneration data used to parameterize the NATURAL keyword was collected as part of the forest inventory.

Species Name	Species Code	Stocking (TPA)
Non-commercial hardwoods/ Other tree	NC	16
Other hardwoods	OH	10
Pitch pine	PP	6
Virginia pine	VP	15
Eastern white pine	WP	2

Table 6: Natural regeneration species and stocking numbers.

In addition to parameterizing regeneration data keywords, several adjustments were made to the FVS model inputs due to a problem encountered with the FVS modeling predictions for regeneration data included in the model. When all regeneration data collected in the field was included in the FVS model, FVS was found to over-predict the survival and growth of the regeneration seedlings, which resulted in the majority of the regeneration being modeled to grow in to the canopy. This problem in the model, specific to the Northeast variant, is recognized in published literature (Ray et al. 2009), and a solution for resolving this problem and improving the model outputs is discussed. As was advised for Issue 5 in Ray et al. (2009) regarding the estimation of regeneration response in FVS, a subset of regeneration data was selected that represents the species diversity found within the regen data, while only selecting the individuals most likely to survive. Any regen stems less than 1 inch in diameter were excluded from the input data for the model on the basis that they were the least likely individuals to survive. Excluding the smallest of the regeneration data helped to resolve this problem and produce reasonable model estimates.

3.3.4 MORTALITY CALIBRATION

The FVS model was parameterized to realistically estimate post-harvest mortality. As noted in Ray et al. (2009), the FVS model overestimates post-harvest growth as a result of not accounting for mortality related to logging damage within skid trails and landings as well as damage to sub-merchantable trees. To account for this harvest-related mortality, the model was parameterized based on the strategy for Issue 2 in Ray et al. (2009). This involves using the keyword FIXMORT to eliminate 15% of all stems due to predicted damage of skids and landings as well as 30% of all stems less than 4.5 in. DBH due to harvest-induced mortality.

4 MODEL IMPLEMENTATION

The FVS model was implemented by stratifying the project area by vegetation type, constructing logical modeling units, resampling tree data, assigning site index, and running the model for the baseline and project scenarios. Figure 1 shows a flow diagram of the modeling process which is described in the following sections.

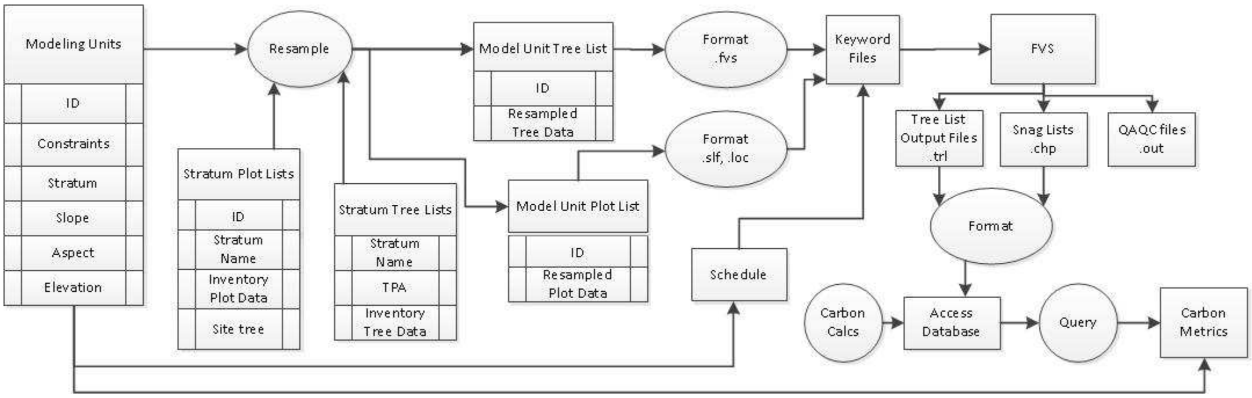

Figure 1. FVS model flow diagram.

4.1 STRATIFICATION OF PROJECT AREA

Vegetation was stratified by the forest owner based on cover type. The cover types and their corresponding areas are shown in Table 7 below.

Vegetation Stratum	GIS Area (ac)
Cove Hardwood	4,979.93
Mixed Hardwoods	4,761.89
Northern Hardwoods	18,555.67
Oak-Hickory	7,783.14
Mixed Pine-Hardwood	194.58

Table 7: Area by stratum.

4.2 CONSTRUCTION OF MODELING UNITS

The basis of the modeling units were the stand-level vegetation cover type polygons. Constraint layers were created for each of the constraints mentioned above and unioned with the cover type shapefile. This was then split into single-part features, where each feature was a contiguous area. These units were then merged into modeling units using an algorithm that took each unit and merged adjacent units of the same stratum and constraint class until it had reached a size of 200 acres. See Appendix F for a shapefile of the modeling units.

4.3 RESAMPLING TREE DATA

In order to produce the final keyword files needed for the FVS modeling process, the 2016 inventory data and modeling units were run through a resampling procedure. The resampling process for the tree data was intended to produce modeling units and corresponding tree lists that were representative of the project for the modeling process.

Some modeling units contained inventory plots and thus had a known tree list. Other uncruised modeling units did not contain inventory plots. Where modeling units did not contain inventory plots, representative tree lists were compiled. See Appendix E for inputs into resampling.

To compile representative tree lists for uncruised modeling units, a non-parametric resampling method was used. Similar methods had been used by Gehringer (2006) and for other ARB-approved projects. Plots were randomly selected from the inventory plot list with probabilities proportional to their original selection probability under the inventory sampling design. Non-parametric resampling – also known as the bootstrap – theoretically guaranteed that the resampled subset was a representative population. Five plots were selected for each uncruised modeling unit from inventory plots in the same stratum. Individual tree records from these plots were used to compile representative tree lists for uncruised modeling units.

4.4 ASSIGNING SITE INDEX

Site Index was assigned to modeling units using site index data from NRCS soil data, as well as field-measured site trees in the inventory, where NRCS data was not available. For field-measured data, the site trees' ages and heights were used with the Carmean equations (Carmean et al. 1989) to determine a site index value for each sampled plot.

For cruised modeling units, this site index and site species was assigned to each modeling unit. Uncruised modeling units were assigned the site species and site index from one of the assigned plots. See Appendix E for inputs into resampling.

4.5 MODELING GROWTH AND YIELD

Both a baseline and a project scenario were modeled in FVS over the project lifetime. Model outputs of growth and yield estimates were organized by modeling unit (see Appendix H) and then compiled into databases for processing (see Appendix I). Due to the large data size of the model outputs, the databases were used to run calculations and queries on the model outputs. The results of the calculations were condensed and transferred from the databases into an Excel workbook in order to best display and summarize the modeling results (see Appendix J).

4.5.1 BASELINE SCENARIO

The model ran different treatments on operable and inoperable modeling units for both the project and baseline scenarios. Each modeling scenario was run considering constraints and financial feasibility.

The baseline harvest prescriptions are similar to the example harvest documents provided. In the baseline scenario, stands are thinned from above (using the THINABA keyword) to a residual basal area of 10 to 40 square feet (see Commercial thinning in Table 1). Each operable modeling unit was harvested every 40 years, with harvests staggered every year across the units. There is no species specific retention. Modeling for the baseline scenario was done to reflect the common practice in the region based on FIA data.

For constrained stands in the baseline scenario, the model was parameterized to grow the stands forward over 100 years with no management applied. Although harvesting is allowed under West Virginia BMPs within streamside management zones and other areas included within the constrained management units, these areas were modeled without management in order to conservatively estimate carbon stocks.

Carbon stocks for each modeling unit were calculated using post-harvest outputs of tree data from FVS in order to accurately estimate carbon stocks for each 10 year modeling cycle. The FVS Database Extention was used to include Ht2TDCF, the height to the pulpwood top diameter. For the Monongahela location code, pulpwood top diameter is 4 inches for all species. This value was used to represent the bole height in the Woodall volume and biomass equations.

4.5.2 PROJECT SCENARIO

The project scenario was based on current management. Constrained stands were allowed to grow without management for the duration of the model.

Within all unconstrained modeling units, the harvesting regime used for the model was even aged management with a basal area retention of 40 square feet per acre (see Commercial Thinning in Table 1). Using these harvesting parameters, one to two modeling units were entered each year over the 100 year project lifetime.

4.6 MODELING STANDING DEAD

Standing dead was assumed to stay static over the 100 year model. Carbon in standing dead was estimated at 1.39 tCO2e/ac from inventory calculations. As the baseline scenario includes clearcutting and the removal of all standing dead trees at every harvest, carbon in standing dead in the baseline scenario would decrease from current inventory estimates over the 100 year model. Therefore it is conservative to assume standing dead is static throughout the 100-year model.

4.7 QUALITY CONTROL AND ASSURANCE

4.7.1 FVS MODELING INPUT DATA CHECKS

Data checks were conducted on the modeling inputs for FVS, including keyword files and the Scheduler's parameters.

Keyword, tree list, and stand list files were spot-checked before model runs to ensure that the data was properly formatted to be input into the FVS model. In order to verify a keyword file's formatting, keywords were input manually into FVS for several modeling units in order to generate output keyword files. These individually generated output keyword files were then compared with the keyword files generated through the Scheduler. Any differences in formatting were analyzed and corrected through data formatting and the Scheduler.

The Scheduler's parameters were reviewed each time the model was run to ensure that parameters match the common practice harvesting regimes in the region.

4.7.2 FVS MODELING OUTPUT DATA CHECKS

The data checks listed below were performed on modeling output data to ensure that carbon stocks, diameters, trees per acre, and residual basal area all either match the Scheduler parameters or are reasonable representations of forest growth and regeneration dynamics in the region. The tree lists for several modeling units were spot-checked. All project years must be represented in the model, and the basal area, maximum and minimum DBH, and the number of trees per acre across the modeling unit must reflect harvests and regeneration. Additionally, the average carbon calculated for the modeling unit must match the carbon number calculated by the Scheduler.

In addition to checking outputs within the tree list, the cutlist and aftertreatment lists were reviewed in order to confirm that the model is functioning properly. The cutlist was checked for the maximum and minimum DBH of harvested trees, in order to ensure that the model is following parameterized silviculture. Additionally, the aftertreatment list was reviewed for the basal area retention post-harvest, as well as the maximum and minimum DBH of trees left post-harvest. Collectively, these checks confirmed the parameterization of the Scheduler.

5 MODEL PREDICTIONS

The total stratified area within the project area is 36,275.18 acres. Average carbon stocks were estimated from all modeling units.

The initial carbon stocks (AGBGSD) in the FVS model as of 2016 were 140.62 tCO2e/ac compared to 140.40 tCO2e/ac reported for project start date. The initial carbon stocks in above-ground only as of 2016 were 116.60 tCO2e/ac compared to 116.41 tCO2e/ac reported for project start date. These values are not statistically different and, as the initialized model is slightly greater than the inventory, also conservative.

5.1 BASELINE CARBON STOCKS OVER TIME

Table 7 shows how baseline carbon stocks decreased over time due to even-aged, intensive management. A report of inventory and growth by modeling unit is given as Appendix J.

Year	AG Stocks (tCO2e/ac)	AG Stocks (tCO2e)	AG, BG and SD Stocks (tCO2e/ac)	AG, BG and SD Stocks (tCO2e)
2015	116.60	4,229,718.89	140.62	5,101,019.60
2025	91.33	3,312,847.36	110.57	4,010,996.40
2035	54.50	1,976,867.98	66.66	2,417,971.55
2045	87.33	3,168,015.92	105.90	3,841,618.24
2055	129.70	4,704,856.71	156.46	5,675,570.71
2065	92.28	3,347,480.97	111.73	4,053,006.76
2075	42.25	1,532,776.89	51.98	1,885,614.13
2085	68.06	2,468,714.75	82.88	3,006,542.82
2095	109.99	3,989,812.93	132.99	4,824,282.64
2105	87.30	3,166,670.24	105.80	3,838,095.92
2115	44.67	1,620,290.51	54.86	1,990,033.64
Average	**84.34**	**3,059,304.84**	**102.27**	**3,709,922.58**

Table 7: Carbon stocks by end of scheduled period.

5.2 PROJECT CARBON STOCKS OVER TIME

As demonstrated in Table 8, carbon stocks increased over time as reflected by periodic, low-intensity management. The data for Table 8 can be found in Appendix J.

Year	AG Stocks (tCO2e)	AG Stocks (tCO2e/ac)	AG, BG and SD Stocks (tCO2e/ac)	AG, BG and SD Stocks (tCO2e)
2015	116.60	4,229,718.89	140.62	5,101,019.60
2025	146.22	5,304,081.75	175.97	6,383,361.73
2035	168.66	6,118,111.12	202.68	7,352,434.53
2045	183.42	6,653,579.82	220.22	7,988,643.81
2055	192.04	6,966,298.30	230.46	8,360,024.53
2065	197.99	7,182,156.68	237.52	8,615,981.47
2075	199.05	7,220,733.85	238.74	8,660,379.86
2085	199.29	7,229,407.05	239.00	8,669,624.67
2095	198.74	7,209,293.31	238.32	8,645,238.79
2105	197.55	7,166,268.47	236.91	8,594,042.50
2115	198.28	7,192,573.46	237.77	8,625,313.44
Average	**184.04**	**6,676,107.65**	**220.90**	**8,013,289.84**

Table 8: Carbon stocks by end of scheduled period.

5.3 PROJECT VERSUS BASELINE CARBON STOCKS OVER TIME

As illustrated in Figures 2 and 3, found in Appendix J, the average carbon stocks in above-ground living trees for the baseline and project scenarios diverged over the 100 year modeling period.

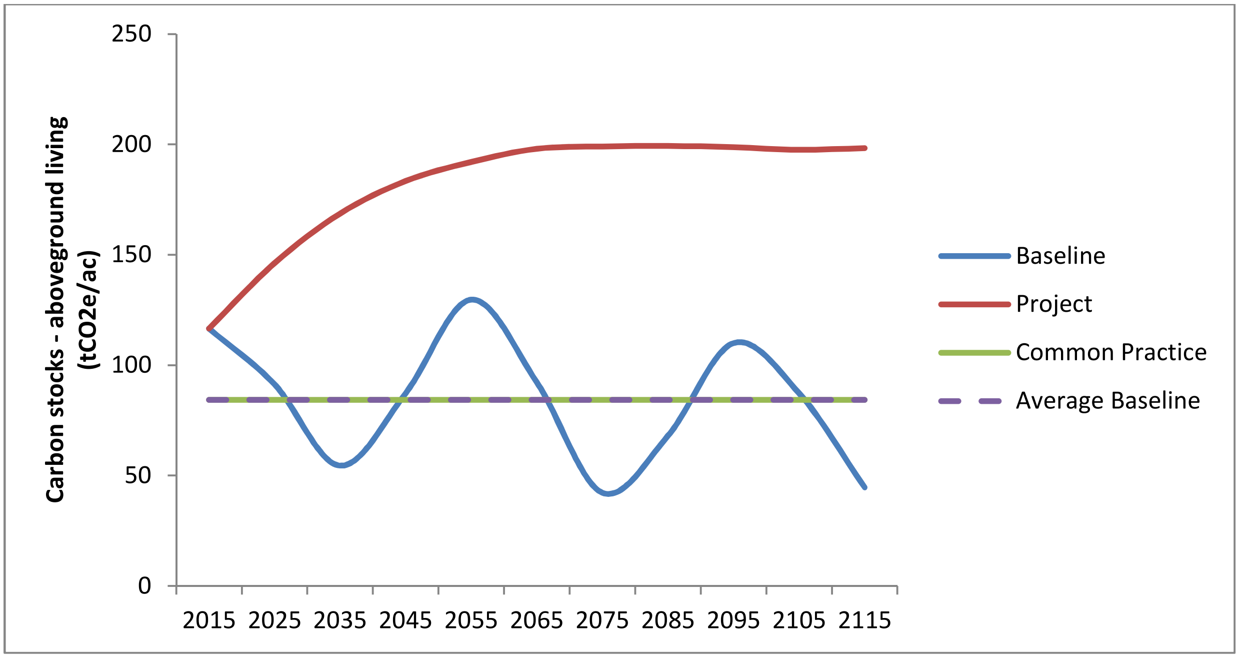

Figure 2: Above-ground carbon stocks overtime for the baseline and project scenarios, average baseline carbon stocks over 100 year modeling period (tCO2e/ac).

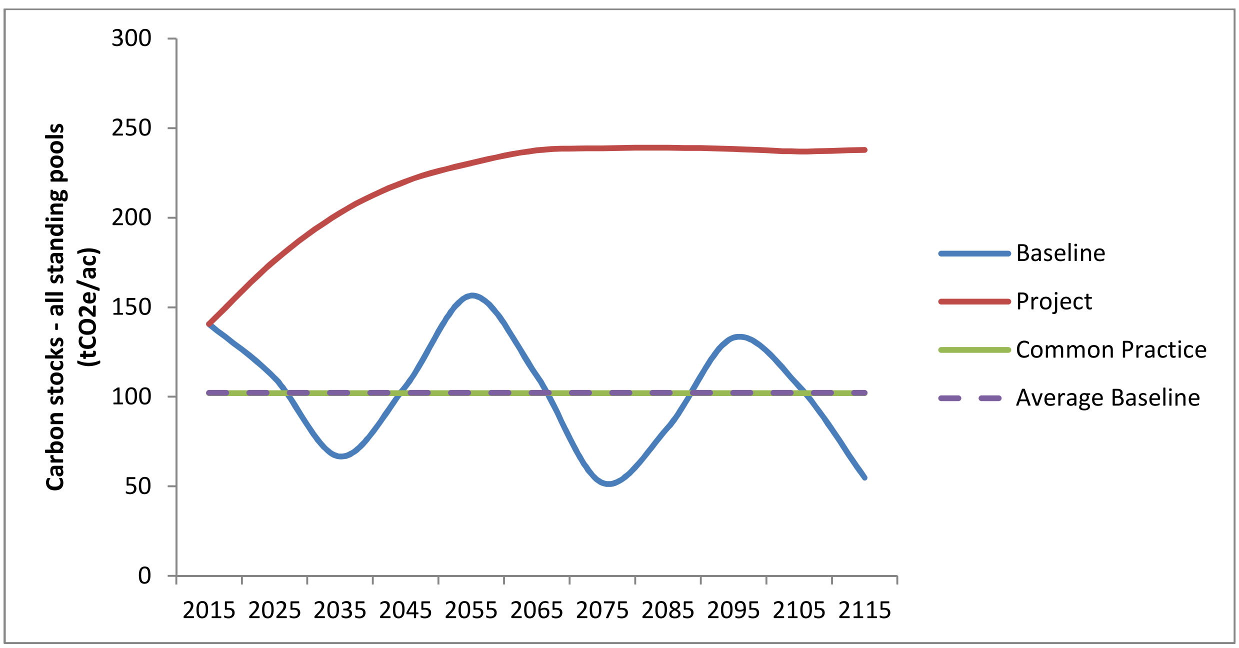

Figure 3: Carbon stocks in all pools over time for the baseline and project scenarios, average baseline carbon stocks over 100 year modeling period (tCO2e/ac).

Initial baseline carbon stocks dropped over the first three periods as a result of the expected management for timber revenue to fund the land acquisition. Such a drop would also be expected to even out age/size classes for long-term MSY. Baseline carbon stocks regrew over time in the baseline with periodic thinning. The project scenario reflected possible harvests scheduled in the management plan occurring periodically.

5.4 BASELINE HARVEST OVER TIME

Harvest yields summarized from the FVS harvest scheduler are presented in Table 9 (see Appendix K for harvest summaries). Cubic foot volumes are calculated using ARB-approved volume equations and not native FVS outputs. Table 10 shows a summary of harvest areas per year in the baseline scenario.

Species	Total Pulp (ft^3)	Pulp (ft^3/year)	Total Saw (ft^3)	Saw (ft^3/year)
AB	2,727,888	27,279	1,801,703	18,017
AH	232,008	2,320	0	0
AI	1,259,748	12,597	175,226	1,752
BC	1,536,666	15,367	1,449,725	14,497
BE	234,532	2,345	49,963	500
BG	5,901,809	59,018	3,232,011	32,320
BK	3,439,072	34,391	729,078	7,291
BN	72,578	726	58,141	581
BO	2,097,397	20,974	3,574,212	35,742
BT	255,283	2,553	155,831	1,558
BW	6,969,279	69,693	7,961,350	79,613
CK	17,771	178	7,861	79
CO	6,852,544	68,525	12,389,029	123,890
CT	4,281,322	42,813	4,937,704	49,377
DW	807,473	8,075	0	0
EH	64,248	642	94,348	943
EL	1,171,186	11,712	793,538	7,935
HH	102,537	1,025	0	0
HI	4,483,630	44,836	4,632,865	46,329
HK	63,541	635	243,128	2,431
MG	29,807	298	0	0
NC	1,266,590	12,666	38,046	380
OH	2,487,785	24,878	984,970	9,850
PP	1,535,617	15,356	1,064,465	10,645
PR	148,448	1,484	0	0
PS	9,392	94	0	0
PW	1,882,819	18,828	354,261	3,543
RB	86,877	869	24,099	241

RL	365,248	3,652	289,144	2,891
RM	41,701,954	417,020	12,076,707	120,767
RO	3,662,587	36,626	9,429,702	94,297
SB	5,689,778	56,898	906,240	9,062
SD	20,580,705	205,807	6,257,538	62,575
SE	78,334	783	0	0
SM	29,277,687	292,777	11,533,148	115,331
SO	1,717,568	17,176	2,455,911	24,559
SS	16,200,197	162,002	3,773,753	37,738
ST	742,837	7,428	0	0
SU	273,393	2,734	347,084	3,471
SY	822,766	8,228	1,505,894	15,059
VP	3,169,196	31,692	1,990,586	19,906
WA	1,421,672	14,217	607,346	6,073
WN	197,191	1,972	278,867	2,789
WO	743,080	7,431	2,080,137	20,801
WP	570,792	5,708	1,286,533	12,865
YB	753,573	7,536	224,890	2,249
YP	38,024,558	380,246	29,074,006	290,740
YY	1,782,744	17,827	1,442,242	14,422
Grand Total	**217,793,708**	**2,177,937**	**130,311,284**	**1,303,113**

Table 9: Yield of harvested wood in the baseline scenario for each species.

Period	Harvest Area (ac)
2016-2025	18,383.24
2026-2035	14,999.95
2036-2045	800.00
2046-2055	18,383.24
2056-2065	14,999.95
2066-2075	800.00
2076-2085	18,383.24
2086-2095	14,999.95
2096-2105	800.00
2106-2115	18,383.24
2116	0.00
Total	120,932.81*

Table 10: Harvest area per modeling cycle (10 years) in the baseline scenario.

*Total harvested acres reflects three different treatments within the same operable units of the project area over the 100 year modeling period.

5.5 PROJECT HARVEST OVER TIME

Harvest yields summarized from the FVS harvest scheduler are presented in Table 11 (see Appendix K for harvest summaries). A summary of acres harvested within the project area can be found in Table 12.

Species	Total Pulp (ft^3)	Pulp (ft^3/year)	Total Saw (ft^3)	Saw (ft^3/year)
AB	159,561	1,596	2,029,835	20,298
AI	124,468	1,245	83,544	835
BC	313,435	3,134	3,193,093	31,931
BG	217,398	2,174	1,352,684	13,527
BK	426,912	4,269	607,319	6,073
BN	8,601	86	17,630	176
BO	537,035	5,370	6,095,832	60,958
BT	10,751	108	23,846	238
BW	1,106,947	11,069	11,216,972	112,170
CK	1,574	16	18,041	180
CO	2,056,458	20,565	17,868,873	178,689
CT	880,805	8,808	6,410,857	64,109
EH	4,938	49	130,906	1,309
EL	146,176	1,462	903,544	9,035
HH	4	0	0	0
HI	1,070,214	10,702	7,055,034	70,550
HK	14,186	142	222,437	2,224
MG	1,765	18	11,203	112
NC	12	0	0	0
OH	73,802	738	7,845	78
PP	79,386	794	890,490	8,905
PR	3,089	31	0	0
PS	8,443	84	0	0
PW	128,592	1,286	857,557	8,576
RB	2,444	24	5,306	53
RL	72,822	728	485,298	4,853
RM	4,922,387	49,224	12,371,579	123,716
RO	1,197,696	11,977	16,403,204	164,032
SB	467,002	4,670	893,223	8,932
SD	954,276	9,543	1,664,741	16,647
SE	1	0	0	0
SM	2,879,912	28,799	12,742,401	127,424
SO	300,370	3,004	3,276,237	32,762
SS	396,021	3,960	855,260	8,553
ST	17,288	173	0	0

SU	9,968	100	48,508	485
SY	205,146	2,051	2,048,167	20,482
VP	36,840	368	548,517	5,485
WA	86,288	863	336,518	3,365
WN	31,317	313	349,416	3,494
WO	322,925	3,229	2,780,649	27,806
WP	60,475	605	835,242	8,352
YB	48,730	487	379,142	3,791
YP	2,808,793	28,088	34,415,100	344,151
YY	167,155	1,672	1,199,243	11,992
Grand Total	**22,362,408**	**223,624**	**150,635,294**	**1,506,353**

Table 11: Yield of harvested wood in the project scenario for each species.

Period	Harvest Area (ac)
2016-2025	2,800.00
2026-2035	2,999.99
2036-2045	2,981.08
2046-2055	2,999.99
2056-2065	2,783.27
2066-2075	3,000.00
2076-2085	2,999.99
2086-2095	2,999.99
2096-2105	2,840.04
2106-2115	2,978.84
2116	400.00
Total	**29,783.20**

Table 12: Harvest area per modeling cycle (10 years) in the project scenario.

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