

SUSTAINABLE HARVEST INTERNATIONAL STUDY
ESTIMATION OF CARBON SEQUESTRATION POTENTIAL
FROM TREE PLANTING EFFORTS

For

Sustainable Harvest International
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By



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Project Overview

Environmental Services, Inc. (ESI) was contracted by Sustainable Harvest International (SHI) to conduct an assessment of the carbon sequestered through their planting efforts. In particular, ESI undertook to estimate an average of the carbon sequestered for each tree planted. Additional information provided through the study includes an estimate of the total carbon dioxide sequestered through all of SHI's planting efforts to date and recommendations for additional data to be collected for all future plantings to facilitate carbon credit certification.

SHI's Program and Carbon Benefits

SHI is a non-for-profit organization that provides families in Central America the training and tools to overcome poverty while working to restore the planet's forests. Much of this work is done through the planting of trees for fruit, nut and timber production. Plantings are conducted in many Central American countries, including Belize, Honduras, Nicaragua and Panama. One of the many ancillary benefits of SHI's plantings includes the sequestration of carbon dioxide, which has a positive impact on global warming. ESI's preliminary study will serve to support SHI's efforts by providing them an estimate of the total carbon dioxide sequestered through their plantings, and through providing a foundation from which a larger study can be conducted to formally certify the carbon credits generated under one of the existing greenhouse gas programs.

Methodology

ESI conducted initial interviews with SHI to assess general planting practices, techniques, and species utilized. Additional information was provided by SHI outlining the total trees planted to date, an approximate breakdown of the percentage planted for some of the species, and an estimated rate of survival for plantings. Given that this is a preliminary study and no field sampling or review of formal records was conducted, some general assumptions had to be made to fill any gaps in the data provided. These assumptions included approximating an average height and lifespan, and consolidating the percentage planted by species.

ESI conducted a review of the existing methods for modeling the carbon sequestered through SHI's planting efforts, and for estimating the sequestration capability of a 'representative tree' over its anticipated lifespan. Given the limited data available from SHI at the time of the study, the U.S. Department of Energy's (DOE) "Method for Calculating Carbon Sequestration by Trees in Urban and Suburban Settings" was selected to model the carbon benefits from SHI's plantings. This tool was designed for use by participants in the DOE's Voluntary Reporting of Greenhouse Gases program. Though it was created to model the carbon sequestration capabilities of trees in urban and suburban settings, given the limited information provided and the lack of studies available for trees grown in Central America in non-plantation settings, we believe it is the best method available for our purposes.

The inputs required for the model include the species planted, which allows for consolidating species with similar growth rates, the year planted, and the age of the tree when planted. Results of the model are reported in total pounds of sequestered by species or group from within a given year planted.

From the data provided, ESI was able to approximate that the majority of species planted by SHI would fall within the ‘fast growing’ group, with the exception of a few species planted in relatively small proportion. It was approximated that roughly 10% of the plantings consisted of species with a bush or shrub form. As this would result in considerably less carbon sequestered than species with a tree form, we ran separate calculations for a ‘tree’ stratum (90%) and a ‘bush’ stratum (10%). To account for this reduction in the carbon sequestration capability of shrub species, a 50% reduction was then applied to the estimated total carbon sequestered by the bush stratum.

The model provides a table for estimating the rate of survival for a species within a given growth rate category and a separate table for estimating initial rate of survival in bare root seedlings. Given that the DOE model was designed to estimate carbon sequestered by trees within temperate climates in an urban/suburban setting, and that growth and survival rates are anticipated to be higher for trees in tropical climates, the initial survival rates (years 1 – 6) were increased from 44.3% to 70%. Until detailed rates of survival can be provided from in-field surveys, we believe this is the best method to adjust for regional and climatic differences within the model.

An average anticipated lifespan of 50 years was assumed for all plantings. This average was derived by reviewing the scientific literature for the species list provided by SHI and adjusting for the species utilized for the largest portion of its plantings.

Results

Trees sequester carbon dioxide at different rates through the various stages in their development. To represent this, the calculations were run three times for each initial planting year, to represent the early, mid and mature age trees. The three sets of calculations were then averaged to represent the average rate of carbon sequestration by year. The years utilized can be seen in the table at the end of this report (Table 1).

The findings of our study are as follows:

- An estimated 30 pounds of carbon dioxide are sequestered (reported as lifetime average) by each planting annually.
- An estimated 1,514 pounds of carbon dioxide (0.69 metric tonnes) are sequestered by each planting over its lifetime (50 years).
- An estimated 24,779,460 pounds of carbon dioxide (11,238 metric tonnes) have been sequestered by the plantings for years 2006 – 2009.
- An estimated 73,425,000 pounds of carbon dioxide (33,299 metric tonnes) have been sequestered by all of SHI’s planting efforts to date.

These results are based upon the numbers provided for plantings, species and percent survival by SHI, along with the assumptions made by ESI described previously. These numbers do not include any below ground carbon, which lends to the conservative nature of our calculations. Dependant upon the species, management activities and site specifics, it can be safely assumed

that the roots comprise approximately 15% of the above ground carbon sequestered; i.e. an additional 15% could be added to the figures above if the carbon stored in roots were to be included.

Recommendations

It is very important to note that these calculations of carbon sequestered through SHI's activities are an estimate based upon the information provided. No field study or verification has been conducted of the figures or information provided by SHI. Given the limited information provided by SHI and the limited studies regarding carbon sequestration in non-plantation settings within Central America, the results should be viewed as an estimate. A full study, including field and analysis components, would need to be conducted to formally certify the carbon credits sequestered under any of the respected voluntary standards.

Regarding the level and format of the information that would be needed for a detailed study, in particular, reliable information about the exact number of trees planted by species is vital. This can be accomplished through record keeping and later verified during the carbon certification approval process, or an inventory can be conducted of the current plantings using a representative sample to characterize all plantings. Also, detailed survival information will help to significantly facilitate the certification process, particularly in consideration of the fact that your plantings are atypical (i.e. not plantations). Please keep in mind that we recognize the difficulty SHI faces working outside of the United States with high numbers of private individuals and groups. Though it may not be possible or cost effective to obtain the information required for a detailed study, it may be possible to take steps toward collecting the necessary information and/or refine existing information.

In closing, ESI would like to restate their appreciation for having been selected to undertake this study for SHI. We recognize the value in your work, and are proud to be associated with your organization. If we can be of further assistance, please contact Shawn McMahon (904-833-9941) at your convenience. We look forward to the opportunity of working with SHI in the future.

References

“Method for Calculating Carbon Sequestration by Trees in Urban and Suburban Settings”, U.S. Department of Energy

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“Total-Tree Weight, Stem Weight, and Volume Tables for Hardwood Species in the Southeast,” Alexander Clark III, Joseph R. Saucier, and W. Henry McNab, Research Division, Georgia Forestry Commission, January 1986.

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Table 1
Sustainable Harvest International
Carbon Sequestration Estimation Analysis

A. Species Characteristics			B.		C. Number of Age 0 Trees Planted (adjusted BY .7 survival factor)		D. Survival Factor (Refer to table 2)	E. Number of Surviving Trees (C X D)	F. Annual sequestration rate (lbs/tree) refer to table 2	G. Carbon Sequestered (lbs) E X F
Name	Tree Type (Hrdwd/Cnfr)	Growth Rate	Tree Age	Original Planting						
2006 (Tree)	Hrdwd	Fast	3	183451	128415.875	0.706	90661.60775	4.1	371713	
2007 (Tree)	Hrdwd	Fast	2	230223	161156.345	0.736	118611.0699	3.1	367694	
2008 (Tree)	Hrdwd	Fast	1	146555	102588.71	0.798	81865.79058	2.2	180105	
2009 (Tree)	Hrdwd	Fast	0	141855	99298.36	0.837	83112.72732	1.4	116358	
2006 (Bush)	Hrdwd	Fast	3	32374	22661.625	0.706	15999.10725	4.1	32798	
2007 (Bush)	Hrdwd	Fast	2	40628	28439.355	0.736	20931.36528	3.1	32444	
2008 (Bush)	Hrdwd	Fast	1	25863	18103.89	0.798	14446.90422	2.2	15892	
2009 (Bush)	Hrdwd	Fast	0	25033	17523.24	0.837	14666.95188	1.4	10267	
Total LBS Carbon									1127270	
Total LBS CO2 Equivalent (*3.67)									4137080	
Average LBS of CO2 Per Tree									5	
CO2 Sequestered in Metric Tonnes									1876	
2006 (Tree)	Hrdwd	Fast	19	183451	128415.875	0.484	62153.2835	28.8	1790015	
2007 (Tree)	Hrdwd	Fast	18	230223	161156.345	0.495	79772.39078	26.9	2145877	
2008 (Tree)	Hrdwd	Fast	17	146555	102588.71	0.505	51807.29855	25	1295182	
2009 (Tree)	Hrdwd	Fast	16	141855	99298.36	0.516	51237.95376	23.2	1188721	
2006 (Bush)	Hrdwd	Fast	19	32374	22661.625	0.484	10968.2265	28.8	157942	
2007 (Bush)	Hrdwd	Fast	18	40628	28439.355	0.495	14077.48073	26.9	189342	
2008 (Bush)	Hrdwd	Fast	17	25863	18103.89	0.505	9142.46445	25	114281	
2009 (Bush)	Hrdwd	Fast	16	25033	17523.24	0.516	9041.99184	23.2	104887	
Total LBS Carbon									6986247	
Total LBS CO2 Equivalent (*3.67)									25639528	
Average LBS of CO2 Per Tree									31	
CO2 Sequestered in Metric Tonnes									11628	
2006 (Tree)	Hrdwd	Fast	44	183451	128415.875	0.26	33388.1275	89	2971543	
2007 (Tree)	Hrdwd	Fast	43	230223	161156.345	0.268	43189.90046	86.2	3722969	
2008 (Tree)	Hrdwd	Fast	42	146555	102588.71	0.276	28314.48396	83.4	2361428	
2009 (Tree)	Hrdwd	Fast	41	141855	99298.36	0.284	28200.73424	80.7	2275799	
2006 (Bush)	Hrdwd	Fast	44	32,374	22661.625	0.26	5892.0225	89	262195	
2007 (Bush)	Hrdwd	Fast	43	40,628	28439.355	0.268	7621.74714	86.2	328497	
2008 (Bush)	Hrdwd	Fast	42	25,863	18103.89	0.276	4996.67364	83.4	208361	
2009 (Bush)	Hrdwd	Fast	41	25,033	17523.24	0.284	4976.60016	80.7	200806	
Total LBS Carbon									12331599	
Total LBS CO2 Equivalent (*3.67)									45256970	
Average LBS of CO2 Per Tree									55	
CO2 Sequestered in Metric Tonnes									20525	
AVERAGE LBS OF CO2 SEQUESTERED ANNUALLY BY SINGLE TREE									30	
AVERAGE LBS OF CO2 SEQUESTERED BY SINGLE TREE LIFETIME									1514	
AVERAGE METRIC TONNES OF CO2 SEQUESTERED BY SINGLE TREE LIFETIME									0.69	

Reduced by 50% to reflect 'bush' species

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