THE CHOCÓ-DARIÉN CONSERVATION CORRIDOR REDD PROJECT

<table>
<thead>
<tr>
<th>Project Title</th>
<th>The Chocó-Darién Conservation Corridor REDD Project</th>
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<tbody>
<tr>
<td>Version</td>
<td>Version 2.35</td>
</tr>
<tr>
<td>Report ID</td>
<td>2012-9666 Revision 1</td>
</tr>
<tr>
<td>Date of Issue</td>
<td>16 July 2012</td>
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<tr>
<td>Project ID</td>
<td>PL856</td>
</tr>
<tr>
<td>Monitoring Period</td>
<td>18 October 2010 to 15 June 2012</td>
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<tr>
<td>Prepared By</td>
<td>Anthrotect and ecoPartners</td>
</tr>
<tr>
<td>Contact</td>
<td>Brodie Ferguson Anthrotect S.A.S.</td>
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<td>Kyle Holland ecoPartners, LLC</td>
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<td>+57 (4) 266-1250 +1 (415) 634-4650</td>
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</tbody>
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Appendix A: Validation of Allometry
Annexes

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<tbody>
<tr>
<td>A</td>
<td>Map of Project Area</td>
<td>Confidential</td>
</tr>
<tr>
<td>B</td>
<td>Forest Measurement Protocol</td>
<td>Confidential</td>
</tr>
<tr>
<td>C</td>
<td>Leakage Plot Sampling Protocol</td>
<td>Confidential</td>
</tr>
<tr>
<td>D</td>
<td>Destructive Sampling Protocol - Palms</td>
<td>Confidential</td>
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<tr>
<td>E</td>
<td>Destructive Sampling Protocol - Trees</td>
<td>Confidential</td>
</tr>
<tr>
<td>F</td>
<td>Data and Parameters Available at Validation</td>
<td>Public</td>
</tr>
<tr>
<td>G</td>
<td>Data and Parameters Monitored</td>
<td>Public</td>
</tr>
<tr>
<td>H</td>
<td>Monitoring Plan</td>
<td>Public</td>
</tr>
<tr>
<td>I</td>
<td>NER Worksheet</td>
<td>Confidential</td>
</tr>
<tr>
<td>J</td>
<td>Inventory</td>
<td>Confidential</td>
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<tr>
<td>K</td>
<td>Plot List</td>
<td>Confidential</td>
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<tr>
<td>L</td>
<td>Leakage Worksheet</td>
<td>Confidential</td>
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<td>M</td>
<td>Species Allometry</td>
<td>Confidential</td>
</tr>
<tr>
<td>N</td>
<td>Allometry Sampling Map</td>
<td>Confidential</td>
</tr>
<tr>
<td>O</td>
<td>Allometry Sampling Plot List</td>
<td>Confidential</td>
</tr>
<tr>
<td>P</td>
<td>Proxy Inventory</td>
<td>Confidential</td>
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<tr>
<td>Q</td>
<td>Map of Plot Locations</td>
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</tbody>
</table>

Table of Monitoring Report Requirements

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<thead>
<tr>
<th>MR</th>
<th>Requirement</th>
<th>Applicability</th>
</tr>
</thead>
<tbody>
<tr>
<td>MR.1</td>
<td>A digital (GIS-based) map of the project area with at least the above minimum requirements for delineation of the geographic boundaries.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.2</td>
<td>The project start date.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.3</td>
<td>The project crediting period start date, end date and length.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.4</td>
<td>A list and descriptions of all instances in the group.</td>
<td>Not applicable. Not a grouped project.</td>
</tr>
<tr>
<td>MR.5</td>
<td>A map of the locations or boundaries of all instances in the group indicating that all instances are in the same region.</td>
<td>Not applicable. Not a grouped project.</td>
</tr>
<tr>
<td>MR.6</td>
<td>A digital (GIS-based) map of the accounting areas with at least the above minimum requirements for delineation of the geographic boundaries.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.7</td>
<td>For each project activity instance in the group, its project activity instance start date.</td>
<td>Not applicable. Not a grouped project.</td>
</tr>
<tr>
<td>MR.8</td>
<td>For each project accounting area, the value of</td>
<td>Not applicable. Not a grouped project.</td>
</tr>
<tr>
<td>MR.9</td>
<td>A table of covariate values as of the project activity instance start dates and a description of how the values were determined including any interpolation or extrapolation methods.</td>
<td>Not applicable. Not a grouped project.</td>
</tr>
<tr>
<td>MR.10</td>
<td>Calculations of current baseline emissions $E_B^{[m]}$ as of the current</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR</td>
<td>Requirement</td>
<td>Applicability</td>
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</tr>
<tr>
<td>MR.11</td>
<td>Calculations of baseline emissions $E_{B \Delta}^{m-1}$ from prior monitoring periods.</td>
<td>Not applicable. First monitoring period.</td>
</tr>
<tr>
<td>MR.12</td>
<td>Calculations of cumulative baseline emissions for each selected pool ($E_{B BM}^{[m]}$ and $E_{B SOC}^{[m]}$) and undecayed carbon ($C_{B BGB}^{[m]}$, $C_{B BW}^{[m]}$, and $C_{B W}^{[m]}$), as of the current monitoring period.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.13</td>
<td>Calculations of cumulative baseline emissions from biomass $E_{B BM}^{[m]}$ for the current monitoring period.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.14</td>
<td>Calculations of cumulative baseline emissions from biomass $E_{B BM}^{[m]}$ for all prior monitoring periods.</td>
<td>Not applicable. First monitoring period.</td>
</tr>
<tr>
<td>MR.15</td>
<td>The order of strata from lowest carbon stocks to highest carbon stocks based on the average across all pools.</td>
<td>Not applicable. Not Type U3.</td>
</tr>
<tr>
<td>MR.16</td>
<td>Calculations for each step which are carried through from monitoring period to monitoring period.</td>
<td>Not applicable. Not Type U3.</td>
</tr>
<tr>
<td>MR.17</td>
<td>Calculations of cumulative baseline emissions from biomass $E_{B BM}^{[m]}$ for prior monitoring periods.</td>
<td>Not applicable. Not Type U3.</td>
</tr>
<tr>
<td>MR.18</td>
<td>An estimate of current baseline emissions from biomass $E_{B \Delta SOC}^{[m]}$ as of the current monitoring period.</td>
<td>Not applicable. Not Type P1 or P2.</td>
</tr>
<tr>
<td>MR.19</td>
<td>An estimate of cumulative baseline emissions from biomass $E_{B SOC}^{[m]}$ for the current monitoring period.</td>
<td>Not applicable. Not Type P1 or P2.</td>
</tr>
<tr>
<td>MR.20</td>
<td>Calculations of cumulative baseline emissions from biomass $E_{B SOC}^{[m]}$ for all prior monitoring periods.</td>
<td>Not applicable. Not Type P1 or P2.</td>
</tr>
<tr>
<td>MR.21</td>
<td>An estimate of current baseline emissions from biomass $E_{B \Delta SOC}^{[m]}$ as of the current monitoring period.</td>
<td>Not applicable. Not Type U1.</td>
</tr>
<tr>
<td>MR.22</td>
<td>An estimate of cumulative baseline emissions from biomass $E_{B SOC}^{[m]}$ for the current monitoring period.</td>
<td>Not applicable. Not Type U1.</td>
</tr>
<tr>
<td>MR.23</td>
<td>Calculations of cumulative baseline emissions from biomass $E_{B SOC}^{[m]}$ for all prior monitoring periods.</td>
<td>Not applicable. Not Type U1.</td>
</tr>
<tr>
<td>MR.24</td>
<td>An estimate of current baseline emissions from biomass $E_{B \Delta SOC}^{[m]}$ as of the current monitoring period.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.25</td>
<td>An estimate of cumulative baseline emissions from biomass $E_{B SOC}^{[m]}$ for the current monitoring period.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.26</td>
<td>Calculations of cumulative baseline emissions from biomass $E_{B SOC}^{[m]}$ for all prior monitoring periods.</td>
<td>Not applicable. First monitoring period.</td>
</tr>
<tr>
<td>MR.27</td>
<td>An estimate of carbon stored in non-decayed DW $C_{B \Delta DW}^{[m]}$, for the selected carbon pool.</td>
<td>Not applicable. Not a selected carbon pool.</td>
</tr>
<tr>
<td>MR</td>
<td>Requirement</td>
<td>Applicability</td>
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<tr>
<td>MR.28</td>
<td>An estimate of cumulative baseline emissions from DW $E_{B\Delta DW}^{[m]}$ for the current monitoring period.</td>
<td>Not applicable. Not a selected carbon pool.</td>
</tr>
<tr>
<td>MR.29</td>
<td>An estimate of cumulative baseline emissions from AGMT $E_{B\Delta AGMT}^{[m]}$ for the current monitoring period.</td>
<td>Not applicable, de minimus in the baseline and combined with AGOT.</td>
</tr>
<tr>
<td>MR.30</td>
<td>Calculations of cumulative baseline emissions from DW $E_{B\Delta DW}^{[m]}$ for all prior monitoring periods.</td>
<td>Not applicable. Not a selected carbon pool.</td>
</tr>
<tr>
<td>MR.31</td>
<td>Calculations of cumulative baseline emissions from AGMT $E_{B\Delta AGMT}^{[m]}$ for all prior monitoring periods.</td>
<td>Not applicable. Not a selected carbon pool.</td>
</tr>
<tr>
<td>MR.32</td>
<td>An estimate of carbon stored in non-decayed BGB $C_{B\Delta BGB}^{[m]}$ for the current monitoring period.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.33</td>
<td>An estimate of cumulative baseline emissions from BGB $E_{B\Delta BGB}^{[m]}$ for the current monitoring period.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.34</td>
<td>Calculations of cumulative baseline emissions from BGB $E_{B\Delta BGB}^{[m]}$ for all prior monitoring periods.</td>
<td>Not applicable. First monitoring period.</td>
</tr>
<tr>
<td>MR.35</td>
<td>An estimate of carbon stored in non-decayed SOC $C_{B\Delta SOC}^{[m]}$ for the current monitoring period.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.36</td>
<td>Carbon stored in long-lived wood products $C_{B\Delta WP}^{[m]}$ after 100 years.</td>
<td>Not applicable, de minimus in the baseline.</td>
</tr>
<tr>
<td>MR.37</td>
<td>Calculations to determine $C_{B\Delta WP}^{[m]}$</td>
<td>Not applicable, de minimus in the baseline.</td>
</tr>
<tr>
<td>MR.38</td>
<td>A map of the boundaries of any significant disturbance in the project accounting areas during the monitoring period.</td>
<td>Not applicable. No emissions events during the monitoring period.</td>
</tr>
<tr>
<td>MR.39</td>
<td>Evidence that plots were installed into these disturbed areas and were measured per section 9.</td>
<td>Not applicable. No emissions events during the monitoring period.</td>
</tr>
<tr>
<td>MR.40</td>
<td>A table of events when woody biomass was burned during the monitoring period, showing the weight of woody biomass in tonnes and the date consumed.</td>
<td>Not applicable. No biomass burning from project activities.</td>
</tr>
<tr>
<td>MR.41</td>
<td>Carbon stored in long-lived wood products $C_{B\Delta WP}^{[m]}$ after 100 years.</td>
<td>Not applicable, de minimus in the baseline.</td>
</tr>
<tr>
<td>MR.42</td>
<td>Scale reports or records of carbon in long-lived wood products by wood product type $C_{P\Delta WP}^{[m]}$.</td>
<td>Not applicable, de minimus in the baseline.</td>
</tr>
<tr>
<td>MR.43</td>
<td>Calculations to determine $C_{P\Delta WP}^{[m]}$.</td>
<td>Not applicable, de minimus in the baseline.</td>
</tr>
<tr>
<td>MR.44</td>
<td>A description of project activities that have been implemented since the project start date and the estimated effects of these activities on</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR</td>
<td>Requirement</td>
<td>Applicability</td>
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<tr>
<td>MR.45</td>
<td>Calculated cumulative baseline emissions from activity-shifting leakage for the current monitoring period $E_{LAS}^{[m]}$ and supporting calculations.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.46</td>
<td>Calculated cumulative baseline emissions from activity-shifting leakage for the prior monitoring periods $E_{LAS}^{[m]}$.</td>
<td>Not applicable. First monitoring period.</td>
</tr>
<tr>
<td>MR.47</td>
<td>A description and justification of the change to the activity-shifting leakage area.</td>
<td>Not applicable. First monitoring period.</td>
</tr>
<tr>
<td>MR.48</td>
<td>A map of the delineated boundaries.</td>
<td>Not applicable. First monitoring period.</td>
</tr>
<tr>
<td>MR.49</td>
<td>Maps of the landscape configuration, including: a) topography (elevation, slope, aspect); b) recent land use and land cover (either a thematic map created by the project proponent or publicly available map); c) access points; d) soil class maps (if available); e) locations of important markets; f) locations of important resources like waterways or roads; and g) land ownership /tenure boundaries.</td>
<td>Not applicable. First monitoring period.</td>
</tr>
<tr>
<td>MR.50</td>
<td>A narrative describing the rationale for selection of activity-shifting leakage area boundaries. If the activity-shifting leakage area is smaller than the project accounting area or cannot be defined, justification for the size of the area.</td>
<td>Not applicable. First monitoring period.</td>
</tr>
<tr>
<td>MR.51</td>
<td>Results of a spatial analysis to demonstrate the activity-shifting leakage area is entirely forested as of the project start date.</td>
<td>Not applicable. First monitoring period.</td>
</tr>
<tr>
<td>MR.52</td>
<td>Results of a spatial analysis to demonstrate the activity-shifting leakage area is as large or larger than the project accounting area.</td>
<td>Not applicable. First monitoring period.</td>
</tr>
<tr>
<td>MR.53</td>
<td>A map of the delineated boundaries.</td>
<td>Not applicable. First monitoring period.</td>
</tr>
<tr>
<td>MR.54</td>
<td>The estimated value $p_{LDEG}^{[m]}$ for the current monitoring period and supporting calculations.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.55</td>
<td>The calculated value $p_{LDEG}^{[m=0]}$ calculated for the first monitoring period.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.56</td>
<td>Estimated cumulative baseline emissions from market-effects leakage for the current monitoring period $E_{LME}^{[m]}$ and supporting calculations.</td>
<td>Not applicable. No market-effects leakage.</td>
</tr>
<tr>
<td>MR.57</td>
<td>Calculated cumulative baseline emissions from market-effects leakage for the prior monitoring periods $E_{LME}^{[m]}$.</td>
<td>Not applicable. No market-effects leakage.</td>
</tr>
<tr>
<td>MR.58</td>
<td>Provide evidence in the form of GIS imagery, PRA evidence, or the baseline operator’s management plan that management plans or land-use designations have not changed in the baseline operator’s other lands.</td>
<td>Not applicable. Not Type P1 or P2.</td>
</tr>
<tr>
<td>MR.59</td>
<td>Quantified GERs for the current monitoring period including references to calculations.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.60</td>
<td>Quantified GERs for the prior monitoring period.</td>
<td>Not applicable. First monitoring period.</td>
</tr>
<tr>
<td>MR.61</td>
<td>A graph of GERs by monitoring period for all monitoring periods to date</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR</td>
<td>Requirement</td>
<td>Applicability</td>
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<tr>
<td>MR.62</td>
<td>The confidence deduction $E_{m}^{[m]}$ and estimated standard errors used to determine the confidence deduction.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.63</td>
<td>Reference to calculations used to determine the confidence deduction.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.64</td>
<td>The linear model used to generate GERs for the current monitoring period.</td>
<td>Not applicable. Linear model not used.</td>
</tr>
<tr>
<td>MR.65</td>
<td>A graph of GERs from the linear model by monitoring period for all monitoring periods to date that used a linear model.</td>
<td>Not applicable. Linear model not used.</td>
</tr>
<tr>
<td>MR.66</td>
<td>A description of the reversal including which pools contributed to the reversal and reasons for its occurrence.</td>
<td>Not applicable. No reversals in this monitoring period.</td>
</tr>
<tr>
<td>MR.67</td>
<td>A description of the reversal including a summary of new data obtained in the reference area.</td>
<td>Not applicable. No reversals in this monitoring period.</td>
</tr>
<tr>
<td>MR.68</td>
<td>Quantified NERs for the current monitoring period including references to calculations.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.69</td>
<td>Quantified NERs for the prior monitoring period.</td>
<td>Not applicable. First monitoring period.</td>
</tr>
<tr>
<td>MR.70</td>
<td>A graph of NERs by monitoring period for all monitoring periods to date.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.71</td>
<td>Reference to the VCS requirements used to determine the buffer account allocation.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.72</td>
<td>Reference to calculations used to determine the buffer account allocation.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.73</td>
<td>Quantified NERs for the current monitoring period including references to calculations.</td>
<td>Not applicable. Only one accounting area.</td>
</tr>
<tr>
<td>MR.74</td>
<td>Quantified NERs for the prior monitoring period.</td>
<td>Not applicable. Only one accounting area.</td>
</tr>
<tr>
<td>MR.75</td>
<td>A graph of NERs by monitoring period for all monitoring periods to date.</td>
<td>Not applicable. Only one accounting area.</td>
</tr>
<tr>
<td>MR.76</td>
<td>Quantified NERs by vintage year for the current monitoring period including references to calculations.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.77</td>
<td>Comparison of NERs presented for verification relative to NERs from ex-ante estimates.</td>
<td>Not applicable. No ex ante estimates for first monitoring period.</td>
</tr>
<tr>
<td>MR.78</td>
<td>Description of the cause and effect of deviations from ex-ante estimates.</td>
<td>Not applicable. No ex ante estimates for first monitoring period.</td>
</tr>
<tr>
<td>MR.79</td>
<td>List of parameters from Appendix H, their values and the time last measured.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.80</td>
<td>Quality assurance and quality control measures employed for each.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.81</td>
<td>Description of the accuracy of each.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.82</td>
<td>Documentation of training for field crews.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.83</td>
<td>If included in project activities, a description of procedures used to estimate the rate of biomass burning and charcoal production and demonstration that these estimates are conservative.</td>
<td>Not applicable. No biomass burning or charcoal production in project activities.</td>
</tr>
<tr>
<td>MR</td>
<td>Requirement</td>
<td>Applicability</td>
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<tr>
<td>MR.84</td>
<td>Documentation of data quality assessment such as a check cruise and plots of the data such as diameter distributions by strata or plot.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.85</td>
<td>Maps of a stratification (if any) and references to plot allocation.</td>
<td>Not applicable. No stratification.</td>
</tr>
<tr>
<td>MR.86</td>
<td>List of plot GPS coordinates.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.87</td>
<td>Description of plot size and layout (such as the use of nests and their sizes) for each carbon pool.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.88</td>
<td>If applicable, a detailed description of the process used to develop allometric equations, to include: a) Sample size b) Distribution (e.g. diameter) of the sample c) Model fitting procedure d) Model selection</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.89</td>
<td>The estimated carbon stock, standard error of the total for each stock, and the sample size for each stratum in the area selected.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.90</td>
<td>Log export monitoring records and standard operating procedure in the project area, if there is commercial harvest in the project scenario.</td>
<td>Not applicable. No commercial harvest in the project scenario.</td>
</tr>
<tr>
<td>MR.91</td>
<td>Deviations from the measurement methods set out in Appendix B or the monitoring plan, per current VCS requirement.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.92</td>
<td>The frequency of monitoring for each plot for all plots – all plots should be measured for the first verification. All leakage plots should be measured every verification, and all proxy and project accounting area plots at least every 5-10 years, or after a significant event that changes stocks.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.93</td>
<td>A list of all selected allometric equations used to estimate biomass for trees and non-trees.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.94</td>
<td>For each selected allometric equation, a list of species to which it being applied and the proportion of the total carbon stocks predicted by the equation.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.95</td>
<td>For each selected allometric equation, indication of when it was first employed to estimate carbon stocks in the project area (monitoring period number and year of monitoring event).</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.96</td>
<td>For each selected allometric equation, indication of whether was validated per methodology sections 9.3.1.1 or 9.3.1.2.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.97</td>
<td>Documentation of the source of each selected allometric equation and justification for their applicability to the project area considering climatic, edaphic, geographical and taxonomic similarities between the project location and the location in which the equation was derived.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.98</td>
<td>A list of allometric equations validated by destructive sampling.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.99</td>
<td>For each, the number of trees (or non-trees) destructively sampled and the location where the measurement were made relative to the project area.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.100</td>
<td>A field protocol used to measure destructively sampled trees (or non-trees).</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.101</td>
<td>Justification that the field protocol for the destructive measurement method is conservatively estimates biomass.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR</td>
<td>Requirement</td>
<td>Applicability</td>
</tr>
<tr>
<td>------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>MR.102</td>
<td>For each allometric equation in the list, a figure showing all the descriptive measurements of biomass compared to predicted values from its selected allometric equation.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.103</td>
<td>A list of allometric equations cross validated.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.104</td>
<td>For each, the number of trees (or non-trees) destructively sampled to build the equation and the location where the measurement were made relative to the project area.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.105</td>
<td>A field protocol used to measure trees (or non-trees) when developing the equation.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.106</td>
<td>Justification that the field protocol for the measurement method to build the equation conservatively estimates biomass.</td>
<td>Applicable</td>
</tr>
<tr>
<td>MR.107</td>
<td>For each allometric equation in the list, the value of ( \bar{F} ).</td>
<td>Applicable</td>
</tr>
</tbody>
</table>
1 PROJECT DETAILS

1.1 Summary Description of Project

This project leverages carbon finance to avoid mosaic conversion of tropical forests and therefore reduce greenhouse gas emissions. The project employs a Reduced Emissions from Deforestation and Degradation (REDD) project methodology to determine the magnitude of these emissions reductions. Through a combination of forest protection and sustainable development activities, this project is estimated to avoid the emission of 2.5 million metric tonnes of CO₂e.

The Chocó-Darién Conservation Corridor is located in the Darién region of northwest Colombia within the administrative jurisdictions of the Department of Chocó and the Municipality of Acandi. The Colombian Darién is part of the Chocó biogeographic region, recognized as one of the most biodiverse regions in the world for its strategic geographic location and high levels of species endemism.

The project is additional because the project activities would not have been possible without carbon financing. The project baseline is an extension of actual deforestation that was occurring aggressively in the reference area adjacent to the project area.

1.2 Sectoral Scope and Project Type

The project falls under VCS Sectoral Scope 14 - Agriculture, Forestry and Other Land Uses under project activities Reduced Emissions from Deforestation and Degradation (REDD). This project is categorized as Type U2 (AUDD unplanned deforestation) by the definition provided in the VM0009 methodology (version 2).

This is not a grouped project.

1.3 Project Proponent

The project proponent is Anthrotect, a Colombian organization dedicated to making conservation a viable alternative to economic opportunities that result in land degradation. Anthrotect works with community landholders to implement payment for ecosystem services projects that connect communities with emerging markets for carbon and biodiversity. Anthrotect has a longstanding
relationship with the communities of *Cocomasur*. *Cocomasur* signed a formal agreement to collaborate with Anthrotect on this project in October 2010.

Contact:
Brodie Ferguson
Anthrotect S.A.S.
Calle 7D #43C-23
Medellin, Colombia
Tel +57 (4) 266-1250
http://www.anthrotect.com

### 1.4 Other Entities Involved in the Project

Anthrotect is leading project design and carbon finance of this project. The following organizations also are involved in this project in the capacities indicated:

<table>
<thead>
<tr>
<th>Organization</th>
<th>Capacity</th>
<th>Contact</th>
<th>Addresses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cocomasur</td>
<td>Implementing Organization</td>
<td>Ms. Everildys Córdoba</td>
<td>Barrio Julio Córdoba Acandi, Colombia +57 (310) 369-1631 <a href="mailto:everildyscordoba@gmail.com">everildyscordoba@gmail.com</a></td>
</tr>
<tr>
<td>Fund for Environmental Action</td>
<td>Implementing Partner</td>
<td>Mr. Jose Luis Gomez</td>
<td>Carrera 7 No. 32 – 33 Piso 27 Bogota, Colombia +57 (1) 285-3862 <a href="mailto:joselgomez@accionambiental.org">joselgomez@accionambiental.org</a></td>
</tr>
<tr>
<td>ecoPartners</td>
<td>Technical Partner</td>
<td>Dr. Kyle Holland</td>
<td>2930 Shattuck Ave. Ste. 305 Berkeley, CA 94703 USA +1 (415) 634-4650 <a href="mailto:kholland@ecopartnersllc.com">kholland@ecopartnersllc.com</a></td>
</tr>
<tr>
<td>Carnegie Institution for Science</td>
<td>Technical Partner</td>
<td>Dr. Greg Asner</td>
<td>260 Panama St. Stanford, CA 94305 USA +1 (650) 223-6902 <a href="mailto:gpa@stanford.edu">gpa@stanford.edu</a></td>
</tr>
<tr>
<td>Strategic Environmental Management</td>
<td>Legal Advisor</td>
<td>Ms. Maria del Pilar Pardo</td>
<td>Carrera 11 No. 81-26 Piso 5 Bogota, Colombia +57 (1) 621-3280 <a href="mailto:mppardo@gestionambientalestrategica.com">mppardo@gestionambientalestrategica.com</a></td>
</tr>
<tr>
<td>Medellin Botanical Garden</td>
<td>Technical Partner</td>
<td>Dr. Alvaro Cogollo</td>
<td>Calle 73 N 51D – 14 Medellin, Colombia +57 (4) 444-5500 <a href="mailto:alvaro.cogollo@botanicomedellin.org">alvaro.cogollo@botanicomedellin.org</a></td>
</tr>
</tbody>
</table>
1.5 Project Start Date

MR.2 The project start date.

The project start date is October 18, 2010.

1.6 Project Crediting Period

MR.3 The project crediting period start date, end date and length.

The project crediting period begins at the project start date October 18, 2010 and continues until October 17, 2040. The project crediting period is 30 years.

1.7 Project Location

The project is located in the Darién region of northwest Colombia within the administrative jurisdictions of the Department of Chocó and the Municipality of Acandi. The project is approximately 250km northwest of Bogota and 10km southwest of the town of Acandi, and is adjacent to the Colombia-Panama border.

MR.1 A digital (GIS-based) map of the project area with at least the above minimum requirements for delineation of the geographic boundaries.

See Annex A – Map of Project Area.

MR.6 A digital (GIS-based) map of the project area with at least the above minimum requirements for delineation of the geographic boundaries.

See Annex A – Map of Project Area.

1.8 Title and Reference of Methodology

The project employs version 2.0 of the VM0009 Methodology for Avoided Deforestation. This methodology quantifies greenhouse gas removals generated from avoiding mosaic deforestation caused by subsistence agriculture. In the methodology, external drivers of deforestation can be used to inform the rate of deforestation for the baseline scenario.

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

Project activities are described in section 1.8 (Description of the Project Activity) of the Project Document. The project activities are designed to mitigate deforestation by developing economic alternatives for local communities, in addition to ensuring that the monetary and other benefits of this project are realized largely by local communities.
<table>
<thead>
<tr>
<th>Project Activity</th>
<th>Start Date</th>
<th>Status</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Governance</td>
<td></td>
<td></td>
<td>Legal documentation completed that enables Council to operate under the national legal framework. Statutes and rules of procedure updated. Nine land conflicts identified for intervention to ensure peaceful resolution. Workshop conducted on Law 70 (collective rights). Community survey developed to monitor community awareness of community rights and benefits.</td>
</tr>
<tr>
<td>Community territory awareness and land dispute resolution</td>
<td>September 2009</td>
<td>Implementation</td>
<td>Cocomasur completed assessment and reorganization of Local Councils to comply with organizational statutes. Focal areas for project activities were identified. Protocols for communication among Local Councils were established.</td>
</tr>
<tr>
<td>Governance education and communication</td>
<td>October 2010</td>
<td>Implementation</td>
<td>Cocomasur completed assessment and reorganization of Local Councils to comply with organizational statutes. Focal areas for project activities were identified. Protocols for communication among Local Councils were established.</td>
</tr>
<tr>
<td>Internal transparency and accountability</td>
<td>January 2012</td>
<td>Design</td>
<td>Regular monitoring of implementation activities and expenses by the Fund for Environmental Action. Annual financial review completed by independent auditor.</td>
</tr>
<tr>
<td>Enforcement and Management</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Territorial demarcation</td>
<td>August 2010</td>
<td>Implementation</td>
<td>Field observations to improve demarcation of territorial boundaries by corroborating community boundaries with coordinates provided by the Colombian government. Field trips were conducted in August 2010, October 2010, November 2010, February 2011, April 2011, May 2011, and June 2011.</td>
</tr>
<tr>
<td>Administrative and financial best practices</td>
<td>April 2012</td>
<td>Implementation</td>
<td>Fondo Accion ICAF assessment completed and areas for administration and finance training identified. Cocomasur capacity demonstrated in financial management and bookkeeping. Cocomasur bank account activated.</td>
</tr>
</tbody>
</table>


The forest patrols shall be carried out according to the protocols and requirements prescribed in Annex H – Monitoring Plan.  *Cocomasur* completed at least five field trips during 2010-2011 to borders and other high-risk areas for more focused surveillance.  Additional surveillance activities were completed during December to June of 2012 by teams conducting taxonomic identification and carbon stocks assessments, which detected and documented several instances of encroachment during their field surveys.

Leakage is monitored according to the method described in section 3.3.1 (Estimating Emissions from Activity-Shifting Leakage) of the Project Document and in Annex C – Leakage Plot Sampling Protocol. Several project activities – including efforts to improve agricultural and silvopastoral practices, develop sustainable timber harvest plans, and secure access to credit and markets for non-timber goods and services – are intended to manage and/or mitigate leakage resulting from the project. Furthermore, many project activities are intended at least in part to provide jobs for local community members, thereby reducing pressure on forests throughout the region.

Several project activities were also designed to manage and/or mitigate the internal, external and natural non-permanence risks described in section 3.4.2 (Determining Reversals) of the Project Document. Nearly all project activities address the long-term financial sustainability of the project, thereby reducing internal risks related to financial viability and project longevity. External risks are addressed by efforts to design effective and inclusive mechanisms for territorial governance, build awareness of the local communities’ territorial rights and of the benefits of this project, and achieve greater health and well-being for local communities. The non-permanence risk analysis determined that the project proponent has mitigated most internal and external risks, including project management, opportunity cost, project longevity, land and resource tenure, community engagement, and political risk. Furthermore, natural risks to permanence were judged to be low.

### 2.2 Project Description Deviations

**MR.91** Deviations from the measurement methods set out in Appendix B or the monitoring plan, or current VCS requirement.

No deviations from the monitoring plan have occurred. Refer to Section 2.6 of the Project Document for deviations from the methodology at the time of validation.
2.3  Grouped Project

This project is not a grouped project.

3  DATA AND PARAMETERS

3.1  Data and Parameters Available at Validation

MR.79  List of parameters from Appendix H, their values and the time last measured.

Refer to Annex F – Data and Parameters Available at Validation.

MR.80  Quality assurance and quality control measures employed for each.

Refer to Annex F – Data and Parameters Available at Validation.

MR.81  Description of the accuracy of each.

Refer to Annex F – Data and Parameters Available at Validation.

3.2  Description of the Monitoring Plan

The objective of the monitoring plan is to achieve accurate, regular estimates of carbon stocks and emissions reductions by the project. The monitoring plan includes four continual monitoring activities:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Frequency</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest Patrols and Perimeter Observation</td>
<td>Twice per year</td>
<td>Patrol team inspects perimeter of project area</td>
</tr>
<tr>
<td>Plot Measurements</td>
<td>Once per year</td>
<td>Sampling teams visit a portion of plots</td>
</tr>
<tr>
<td>Identification of Significant Disturbance</td>
<td>Once every 2-3 years or after major disturbance event</td>
<td>Periodic inspection of aerial imagery or videography, with ground inspection when necessary</td>
</tr>
<tr>
<td>Recordation of Log Production</td>
<td>When biomass harvest occurs in the project area</td>
<td>Data recordation and reporting at time of verification</td>
</tr>
</tbody>
</table>

Descriptions and frequencies of these monitoring activities are described in Annex H – Monitoring Plan. The monitoring plan also maintains the organizational structure of the people responsible for the implementation of the monitoring plan. Finally, the monitoring plan includes training and internal audit procedures for quality control and assurance.

MR.82  Documentation of training for field crews.

Refer to Annex H – Monitoring Plan.
MR.84 Documentation of data quality assessment such as a check cruise and plots of the data such as diameter distributions by strata or plot. 

Refer to Annex H – Monitoring Plan.

MR.86 List of plot GPS coordinates. 

Refer to Annex K – Plot List. For a map of plot locations, refer to Annex Q – Map of Plot Locations.

MR.87 Description of plot size and layout (such as the use of nests and their sizes) for each carbon pool. 

Refer to Annex H – Monitoring Plan.

MR.89 The estimated carbon stock, standard error of the total for each stock, and the sample size for each stratum in the area selected. 

Refer to Annex H – Monitoring Plan and Annex J – Inventory.

MR.92 The frequency of monitoring each plot for all plots – all plots should be measured for the first verification, and all proxy and project accounting area plots at least every 5-10 years, or after a significant event that changes stocks.

All plots were measured in the first monitoring period. Refer to Annex H – Monitoring Plan for the schedule of re-measurement of plots. For a map of plot locations, refer to Annex Q – Map of Plot Locations.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

Baseline emissions were determined by means of a logistical cumulative deforestation model, based upon historical deforestation observed in the reference area.

<table>
<thead>
<tr>
<th>Component</th>
<th>First Monitoring Period (m₁)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross NERs</td>
<td>124,497 tCO₂e</td>
<td>124,497 tCO₂e</td>
</tr>
<tr>
<td>16% buffer tonnes to VCS</td>
<td>19,920</td>
<td>19,920</td>
</tr>
<tr>
<td>Net NERs</td>
<td>104,577</td>
<td>104,577</td>
</tr>
</tbody>
</table>

Refer to Annex P – Proxy Inventory for carbon stock estimates in the baseline scenario.

MR.10 Calculation of current baseline emissions $\mathcal{P}_{B}^{[m]}$ as of the current monitoring period.

MR.12  Calculations of cumulative baseline emissions for each selected pool \( E_{B \Delta BM}^{[m]} \) and \( E_{B \Delta SOC}^{[m]} \) and undecayed carbon \( C_{B \Delta BGB}^{[m]} \), \( C_{B \Delta DWP}^{[m]} \), \( C_{B \Delta SOC}^{[m]} \) and \( C_{B \Delta WF}^{[m]} \), as of the current monitoring period.


MR.13  Calculations of cumulative baseline emissions from biomass \( E_{B BM}^{[m]} \) for the current monitoring period.


MR.24  An estimate of current baseline emissions from biomass \( E_{B \Delta SOC}^{[m]} \) as of the current monitoring period.


MR.25  An estimate of cumulative baseline emissions from biomass \( E_{B SOC}^{[m]} \) for the current monitoring period.


MR.31  An estimate of cumulative baseline emissions from AGMT \( E_{B AGMT}^{[m]} \) for the current monitoring period.

Not applicable. This pool has been combined with AGOT in the baseline because wood products are de minimus.

MR.32  An estimate of carbon stored in non-decayed BGB \( C_{B \Delta BGB}^{[m]} \) for the current monitoring period.


MR.33  An estimate of cumulative baseline emissions from BGB \( E_{B BGB}^{[m]} \) for the current monitoring period.


MR.35  An estimate of carbon stored in non-decayed SOC \( C_{B \Delta SOC}^{[m]} \) for the current monitoring period.


MR.36  Carbon stored in long-lived wood products \( C_{B \Delta WF}^{[m]} \) after 100 years.

Not applicable because wood products in the baseline scenario are de minimus.

MR.37  Calculations to determine \( C_{B \Delta WF}^{[m]} \).
Not applicable because wood products in the baseline scenario are *de minimus*.

### 4.2 Project Emissions

Project emissions during this monitoring period were zero. There were no disturbance events (e.g., fire, logging, burning) in the project area. The project proponent made this determination after having regularly observed the project area in the course of conducting the forest inventory and implementing forest patrols.

### 4.3 Leakage

Leakage emissions are determined by first observing degradation and deforestation in the leakage area, and then subsequently determining the cumulative extent of degradation and deforestation that occurs over time. The method and associated protocols for estimating leakage emissions have been established for this project; randomly selected plots were observed for evidence of degradation and deforestation and will be re-measured in future monitoring periods. (Refer to Annex C – Leakage Plot Sampling Protocol.)

**MR.44** A description of project activities that have been implemented since the project start date and the estimated effects of these activities on leakage mitigation.

Project activities that are intended to mitigate leakage are described in section 1.13.1 (Leakage Management) of the Project Document.

<table>
<thead>
<tr>
<th>Project Activity</th>
<th>Start Date</th>
<th>Status</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access to health and educational resources</td>
<td>July 2011</td>
<td>Implementation</td>
<td>New community clinics and health insurance will increase health access for project beneficiaries. Access to education will expand via curriculum development, teaching materials, and continued learning through higher education grants. Community census completed to track basic information on health and education.</td>
</tr>
<tr>
<td>Education and awareness of ecosystem service values</td>
<td>October 2012</td>
<td>Design</td>
<td>Community members will participate in and learn about new knowledge and experience gained through biodiversity inventory and other monitoring.</td>
</tr>
<tr>
<td>Improved agricultural and silvopastoral practices</td>
<td>July 2013</td>
<td>Design</td>
<td>Community members will receive information and training on state of the art techniques to improve land productivity.</td>
</tr>
<tr>
<td>Sustainable timber harvesting</td>
<td>January 2013</td>
<td>Design</td>
<td>Community-led forest management plan will seek to balance environmental service values with sustainable harvesting of timber and non-timber forest products. Community cooperative will be formed to leverage existing knowledge, skills and resources within <em>Cocomasur</em>.</td>
</tr>
</tbody>
</table>
### Project Activity Details

<table>
<thead>
<tr>
<th>Project Activity</th>
<th>Start Date</th>
<th>Status</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reforestation</td>
<td>January 2013</td>
<td>Design</td>
<td>Activity will employ native species at risk of extinction and species of high value to communities and wildlife. Priority areas will include areas facing high conversion threat and areas of high conservation value.</td>
</tr>
<tr>
<td>Access to credit and markets for non-timber goods and services</td>
<td>July 2013</td>
<td>Design</td>
<td>Project funding will be leveraged to establish semi-formal community financial institutions to finance sustainable microenterprises and other income generating activities. Multi-stakeholder research on new economic and livelihood alternatives will be based on fair and sustainable resource use.</td>
</tr>
</tbody>
</table>

**MR.45** Calculated cumulative emissions from activity-shifting leakage for the current monitoring period $E_{L,AS}^{[m]}$ and supporting calculations.

For the first monitoring period ($m_1$), leakage emissions are zero, as prescribed by the methodology.

**MR.54** The estimated value $\hat{E}_{L,DEG}^{[m]}$ for the current monitoring period and supporting calculations.


**MR.55** The calculated value $\hat{E}_{L,DEG}^{[m]}$ for the first monitoring period.


### 4.4 Summary of GHG Emission Reductions and Removals

<table>
<thead>
<tr>
<th>Component</th>
<th>Value (tonnes CO$_2$e)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated Baseline Emissions, $m_1$</td>
<td>124,497</td>
</tr>
<tr>
<td>Uncertainty Deduction</td>
<td>0</td>
</tr>
<tr>
<td>Project Emissions, $m_1$</td>
<td>0</td>
</tr>
<tr>
<td>Leakage Emissions, $m_1$</td>
<td>0</td>
</tr>
<tr>
<td>Gross NERs, $m_1$</td>
<td>124,497</td>
</tr>
<tr>
<td>NERs to VCS Buffer Pool (16%)</td>
<td>19,920</td>
</tr>
<tr>
<td>Net NERs, $m_1$</td>
<td>104,577</td>
</tr>
</tbody>
</table>

**MR.59** Quantified GERs for the current monitoring period including references to calculations.

Refer to Annex I – NER Worksheet.

**MR.61** A graph of GERs by monitoring period for all monitoring periods to date.
Refer to Annex I – NER Worksheet.

MR.62 The confidence deduction $E_U$ and estimated standard errors used to determine the confidence deduction.

Refer to Annex I – NER Worksheet.

MR.63 Reference to calculations used to determine the confidence deduction.

Refer to Annex I – NER Worksheet.

MR.68 Quantified NERs for the current monitoring period including references to calculations.

Refer to Annex I – NER Worksheet.

MR.70 A graph of NERs by monitoring period for all monitoring periods to date.

Refer to Annex I – NER Worksheet.

MR.76 Quantified NERs by vintage year for the current monitoring period including references to calculations.

Refer to Annex I – NER Worksheet.

MR.71 Reference to the VCS requirements used to determine the buffer account allocation.

The VCS Non-Permanence Risk Tool (version 3.1) was used to determine the buffer account allocation.

MR.72 Reference to the calculations used to determine the buffer account allocation.

Refer to section 3.4.2.2 (Determining the Buffer Account Allocation) of the Project Document.

5 ADDITIONAL INFORMATION

5.1 Allometric Equations

MR.88 If applicable, a detailed description of the process used to develop allometric equations, to include: a) sample size, b) distribution (e.g., diameter) of the sample, c) model fitting procedure, and d) model selection.

Tree biomass was estimated using published allometric equations at the genus or species level. However, there were many species in the inventory for which no published allometry was found. For these species, using data from destructive sampling either an equation was fit, or a general equation was modified and cross-checked with data from destructive sampling. Published allometric equations for trees were not found for 166 species, representing 85.6% of tree species and 80.9% of the basal area in the inventory.
Allometric equations were selected from the literature with an eye towards employing equations that were developed under similar climatic, edaphic, geographical and taxonomical conditions as the project area (Appendix M). As a further check of the validity of published allometric equations, the range of tree diameters contained in the inventory (also provided in Appendix B) were found generally to fall within the available diameter ranges of the applicable published equation used for each species.

Two palm species, *W. quinaria* and *S. exorrhiza*, were found to be the dominant palm species in the inventory. Accordingly, 32 and 31 stems were respectively harvested and measured from each species following the protocol for palm allometry development. (Refer to Annex D – Destructive Sampling Protocol – Palms.) Allometric equations for these species were fit using linear ordinary least squares (OLS) regression with a log-log transformation of the dependent and independent variables (i.e. a power model). Linear, exponential, quadratic, reciprocal, and logarithmic transformations also were attempted. Goodness of fit for all these transformations was compared by examination of residuals and of the $R^2$ values. The power model was selected for the two species as it provided the best fit to the data ($R^2$ of .92 and .83, respectively), without any apparent patterns in the residuals. Non-linear OLS and generalized linear models also were considered and tested, but they did not provide any appreciable improvement in fit.

Fitted equations from the analysis are:

\[
W. Q. \text{ biomass } = e^{-0.5920} \times 2.4739h
\]

\[
S. E. \text{ biomass } = e^{0.4375} \times 1.9574h
\]

where $h$ is height in meters and biomass is in terms of kilograms.

Back-transformed equations were cross-validated using the leave-one-out cross validation methods described in the VM0009 methodology. The equation for *W. quinaria* had a cross-validated error of approximately 5.3%, while that from *S. exorrhiza* was approximately 11%.

MR.93 A list of all selected allometric equations used to estimate biomass for trees and non-trees.

Refer to Annex M – Species Allometry.

MR.94 For each selected allometric equation, a list of species to which it is being applied and the proportion of the total carbon stocks predicted by the equation.

Refer to Annex M – Species Allometry.

MR.95 For each selected allometric equation, indication of when it was first employed to estimate carbon stocks in the project area (monitoring period number and year of monitoring event).

All allometric equations were first employed in the first monitoring period.

MR.96 For each selected allometric equation, indication of whether it was validated per sections 9.3.1.1 or 9.3.1.2.
Refer to Annex M – Species Allometry.

MR.97 Documentation of the source of each selected allometric equation and justification for their applicability to the project area considering climatic, edaphic, geographical and taxonomic similarities between the project location and the location in which the equation was derived.

Refer to Annex M – Species Allometry, which includes the source in the literature as well as the region and ecosystem type in which the respective allometric equations were developed.

5.1.1 Validating Previously Developed Allometric Equations

MR.98 A list of allometric equations validated by destructive sampling.

A general equation modified from Sierra, Valle, & Orrego, 2007 for palms and for the Chave 2005 equation for moist tropical forests for trees were used.

MR.99 For each, the number of trees (or non-trees) destructively sampled and the location where the measurements were made relative to the project area.

<table>
<thead>
<tr>
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Refer to Annex N – Allometry Sampling Map.

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# Monitoring Report: VCS Version 3

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MR.100 A field protocol used to measure destructively sampled trees (or non-trees).


MR.101 Justification that the field protocol for the destructive measurement method conservatively estimates biomass.

To derive acceptable equations for species with no allometric equation at the genus or species level, a subset of 30 trees was selected for destructive sampling. (Refer to Annex E – Destructive Sampling Protocol – Trees.) Five randomly allocated plots were chosen within an accessible area within or near the project area. At each plot, sampling teams sampled the closest six trees without literature equations at the species or genus level, recording stem and branch diameters and cutting and weighing selected branches.

Using these data, the general allometric equations were compared to the sample measurements and model coefficients were adjusted to ensure these equations were sufficiently conservative (less than or +/-10% difference between the measured and predicted values).

For the palm species in the inventory which were not *W. quinaria* or *S. exorrhiza*, a general equation modified from Sierra, Valle, & Orrego, 2007 was validated by destructively sampling 37 stems that were not *W. quinaria* or *S. exorrhiza*. The measured biomass was compared to that predicted by the allometric equation. The biomass measured during the course of sampling was 92% of that predicted by the equation. The equation used for the rest of the palm species in the inventory was

\[
\text{other. palm. biomass} = 45.48 + 7.5h^{1.8}
\]

where \( h \) is height in meters and biomass is in terms of kilograms.
The field protocol assumes that stems radiate outward from the base of the tree, the shortest path from the base of the tree to the prescribed measurement zone. In reality, stems take a longer path to the outside of the measurement zone which would result in higher biomass than that estimated by the protocol. All samples for wood density, dry-to-wet ratios and biomass outside the measurement zone are based on unbiased statistical samples.

MR.102 For each allometric equation in the list, a figure showing all the destructive measurements of biomass compared to predicted values from its selected allometric equation.

Refer to Appendix A.

5.1.2 Validating Newly Developed Allometry

MR.103 A list of allometric equations cross-validated.

Fitted equations from the analysis for *W. quinaria* and *S. exorrhiza* are:

\[
W. \ Q. \ biomass = e^{-0.5930} \times 2.4739h
\]

\[
S. \ E. \ biomass = e^{0.4795} \times 1.9574h
\]

MR.104 For each, the number of trees (or non-trees) destructively sampled and the location where the measurements were made relative to the project area.

See MR 100 for the number of trees sampled for each species. See below table for locations

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MR.105A field protocol used to measure trees (or non-trees) when developing the equation.


MR.106 Justification that the field protocol for the destructive measurement method conservatively estimates biomass.

The protocol for palm measurement excludes all biomass not in the main bole, and requires that measurements be taken from a random sample from the species of interest. The sampling frame included stems from all height classes for each species of interest found in the inventory.

MR.107 For each allometric equation in the list, the value of $E$.

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Table 3: Values of $E$ and sample size
Appendix A: Validation of Allometry

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Error (proportion) 0.0798
## Monitoring Report: VCS Version 3

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Error (proportion) **0.0286**
Figure 1: Measured tree biomass as compared to predicted biomass using derived allometric equation from Chave et. al 2005
Figure 2: Measured values plotted against the model of best fit for W. Quinaria
Figure 3: Log-log transformation.

The residuals for the fit of a log-log transformation of the data, and the corresponding linear model.
Figure 4: Measured values plotted against the model of best fit for S. Exorrhiza.
Figure 5: log-log transformation.

The residuals for the fit of a log-log transformation of the data, and the corresponding linear model.
Figure 6: Predicted values from equation modified from Sierra, Valle, & Orrego, 2007 plotted against measured values from 37 palms