Tool Submission:

Tree diameter growth modelling on smallholder farms

Developed by:

Taking Root (www.takingroot.org) : Methodology and Standards Department

Authors: Kwame T. Awuah (kwame@takingroot.org) and David Baumann (david@takingroot.org)

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1   Summary

Taking Root is submitting the tool, <u>Tree diameter growth modelling on smallholder farms,</u> to Plan Vivo in the following concept note. The tool's primary purpose is to provide step-by-step instructions to model tree DBH growth for ex-ante carbon sequestration on smallholder farms when there is lack of historical time series data - typical in smallholder tropical forestry settings. The tools provide a step-by-step process for their user to model tree growth as is required in PV module PU001, 5.1.3 and in AR-TOOL14 v4.2 Section 8.2-47

This tool is part of the Taking Root Protocol, a collection of methodological tools that reflects Taking Root's best practices to quantify our projects' impacts.

This tool provides **instructions** for:

1) Defining the desired end state of each planting design (See the tool Summary below for more details on the 'desired end state)
2) Locating the representative parcels of the desired end state
3) Collecting field measurements of the trees in the representative parcels by referencing Taking Root's Tree measurement and data entry on farms Tool.
4) Modelling the DBH growth curve of trees using field measurements collected

This tool currently **applies** to the following **project intervention types**: Afforestation and Reforestation (AR); Forest Restoration/Regeneration (FR)

The tool seeks to overcome a challenge typical in smallholder agroforestry and ARR systems: It is uncommon for systems to contain time series data from which a stand growth curve can be modelled; long-term datasets on specific polyculture planting designs are uncommon in the tropics. To address this challenge, we have developed a novel approach. We first identify an existing stand, the 'desired end state' of the planting design. This desired end state functions as the basis for the future model and the final carbon results. Also, the tool directs the user to find similar parcels of different ages to add power to the tree and stand growth modelling in the earlier years of the stand.

2   Relationship to Existing Approaches

Taking Root is unaware of any similar published methodology for modelling tree growth in smallholder agroforestry and ARR systems that do not require time series data.

This tool was developed to aid the user in aligning with:

1) the Plan Vivo Module 'PU001: *Estimation of baseline and project GHG removals by carbon pools in Plan Vivo Projects*' section 5.1.3 *Project removals in woody biomass: Expected project removals in woody biomass* and
2) AR-TOOL14 v4.2 Section 8.2-47[1].

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[1] *Tree growth (e.g. diameter or height increment) is simulated by taking into account local tree-growth data from past experience (e.g. age-diameter curves, yield tables, yield curves) while also considering relevant site factors (e.g. soil, terrain, slope, aspect, precipitation) and stand parameters.*

3 Scope and Applicability

Applicability Criteria

The following applicability criteria apply to the tools:

Project intervention types

- Afforestation and Reforestation (AR);
- Forest Restoration and Regeneration (FRR)

Certificate types

- fPVCs

Geographical Locations

- Global applicability

Requirements

- Access to representative parcels is required to collect tree data, soil type and physiographic measures (e.g., elevation, slope, aspect)

Data Access and Availability

- The tool is designed to accommodate the diversity of tree species typically used on farms in conservation areas, woodlots, agroforestry systems, silvopastoral systems, etc.
- This tool should be harnessed when time-series inventory data on tree species for the selected planting design are unavailable.

Carbon Pools and Emission sources

- The tool addresses carbon pools in live woody biomass. The tool does not estimate emission sources.

Existing Projects

We will apply this tool to the following projects:

1) The CommuniTree Carbon Program - in preparation for the upgrade to version 5 of the PV Standard
2) Any other applicable program type that Taking Root registers under the Plan Vivo Standard.

4 Baseline Scenario and Additionality

This section is not applicable to this tool. The tool does not describe methods for determining the baseline scenario or additionality.

5 Quantification of Carbon Benefits

At this point, the tool provides guidance to estimate the DBH growth of trees, which is a primary parameter when estimating ARR and agroforestry project pools.

The tool does not provide guidance to estimate tree biomass and carbon benefits from the tree DBH growth curves. Taking Root has decided not to include this additional tool as our methodology for estimating tree biomass and carbon removals is unchanged from our methodology approved in the most recent CommuniTree PDD. This tool will come in a later submission.

6 Development Team

Kahlil Baker, Ph.D.: Chief Executive Officer

Kahlil is the co-founder and Executive Director of Taking Root. He leads the organization to accelerate the restoration of the world's forests. He has spent over 15 years dedicated to tropical reforestation with smallholder farmers and has served as an advisor for leading forest carbon standards, including Plan Vivo and the Gold Standard. A featured CBC changemaker and a recipient of Canada's Meritorious Service Cross, Kahlil holds a Master's in Forest Statistics and a Ph.D. in Economics from the University of British Columbia.

Kahlil was a principal reviewer of the tools.

Kwame T. Awuah, Ph.D: Forest Carbon Researcher

Kwame develops and updates Taking Root's methodologies for forest carbon quantification. He works closely with engineering and reforestation teams to ensure their integration within Taking Root's platform and ease of use in the field. He previously worked as a project researcher at the Chair of Forestry Inventory and Remote Sensing – University of Goettingen. Kwame holds a dual Master's in Sustainable Forest and Nature Management from the University of Goettingen & Swedish University of Agricultural Sciences and a Ph.D. in Physical Geography from Edge Hill University.

Kwame was the principal developer of the tools.

David Baumann: Methodologies & Standards Director

David develops Taking Root's best practice methodologies to ensure that the carbon removals our reforestation partners create are science-based and aligned with industry standards. One of the original Directors of Taking Root, David has more than 14 years of experience working with carbon and environmental data and reporting. His experience includes developing the early concepts of Taking Root's technology platform and working as a Senior Analyst at Dunsky Energy and Climate Advisors. He holds a Master's in Public Affairs from the University of Texas.

David supported the development and internal and external review of these tools.