I. INTRODUCTION

This document outlines the allometric equations used to calculate above ground biomass. This tool is prepared only as a high-level introduction and does not replace any peer reviewed research.

The tool refers to the aboveground biomass estimation as per GHG quantification guidance.

II. TABLE OF CONTENTS

1 Concept

To estimate tree biomass and carbon content, tree diameters are measured and applied as a variable in specific allometric biomass regression equations. To create an allometric equation for estimating aboveground tree dry biomass, a study is conducted where trees are destructively harvested to estimate their biomass. Variables such as tree height and trunk diameter, are compared to the tree's total dry aboveground biomass. For further guidance please refer to Allometric Equation Evaluation Guidance Document by Winrock International (Walker, et al., 2016).

2 FCO Guideline reference

This tool refers to the allometric equation referred to as $f(\rho, DBH, H)$ in FCO tool: GHG quantification guidance.

Variable	Description	Unit
$f(\rho, DBH, H)$	Allometric function, which is a function of the following variables: • Biomass density • Diameter at breast height • Tree height	t d.m.
ρ	Biomass density	g / cm^{-3}
DBH	Diameter at breast height	cm
H	Tree height	m

In this document where H is not available, we will use the notation $f(\rho, DBH)$ to refer to the allometric equation.

3 Recommendation

FCO Program recommends a conservative approach among the peer-reviewed allometric equations for the suitable environment as applicable. Suitable experienced forest researchers with local understanding can also be appointed for further guidance.

It is recommended to use the latest version from peer-reviewed and published in reputable journal unless the applicable legal authority provides a recommendation. It is required to demonstrate that the latest version creates biomass output in a ±10% range from the previous version. Sensitivity analysis is recommended to be provided.

Below are some of the reference documents for allometric equations:

1 Brown, S., 1997. Estimating biomass and biomass change of tropical forests: a primer. Volume 134.

2 Brown, S., Gillespie, A. & Lugo, A. E., 1989. Biomass Estimation Methods for Tropical Forests with Applications to Forest Inventory Data. Forest Science, December, Volume 35(4), pp. 881-902.

3 Chave, J. et al., 2005. Tree allometry and improved estimation of carbon stocks. Oecologia, 22 June, Issue 145, pp. 87-99.

4 Chave, J. et al., 2014. Improved allometric models to estimate the aboveground biomass of tropical trees. Global Change Biology.

5 Komiyama, A., Poungpam, S. & Kato, S., 2005. Common allometric equations for estimating the tree weight of mangroves. Journal of Tropical Ecology, Volume 21, pp. 471-477.

6 Ong, J. E., Gong, W. K. & Wong, C. H., 2004. Allometry and partitioning of the mangrove, Rhizophora apiculata. Forest Ecology and Management, 5 February, 188(1-3), pp. 395-408.

7 Walker, S. M., Murray, L. & Tepe, T., 2016. Allometric Equation Evaluation Guidance Document. June.

8 Kato, R, Y. Tadaki and H. Ogawa. 1978. Plant biomass and growth increment studies in Pasoh Forest. Malayan Nature Journal 30(2): 211-224.

9 Kenzo, T., Furutani, R., Hattori, D., Kendawang, J., Tanaka, S., Sakurai, K., & Ninomiya, I. 2009. Allometric equations for accurate estimation of above-ground biomass in logged-over tropical rainforests in Sarawak, Malaysia. Journal of Forest Research, 14(6): 365-372.

4 References

Walker, S. M., Murray, L. & Tepe, T., 2016. Allometric Equation Evaluation Guidance Document. June.