ESPA p4ges PROJECT

Work Package Carbon (WP4-Carbon)

Manual for wood specific gravity (WSD) and wood density at 12% moisture content (D12) determination within the Ankeniheny-Zahamena Forest Corridor

(Manual No 4)

Period 2014 – 2016

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The lead of this survey was ensured by the" School of Agronomy - Department of Water and Forests" team and carried out with co-funding from other donors collaborating with this team (Francophone University Agency AUF, International Foundation for Science IFS). The purpose of this survey was to complete the national and international data on wood specific gravity (WSG), herein, particularly for accurate biomass (aboveground and root) and carbon accounting in the humid tropical forest.

All datasets which were generated by methodology process described within this manual have been archived at Environmental Information Data Centre - EIDC (http://eidc.ceh.ac.uk).

1- Field process : collection of wood samples

The main objective was to collect wooden samples in order to determine local values of wood specific gravity. Operating mode is :

- Discussion with local botanist about the studied species to determine if they exist locally and to verify if the local names match with the scientific names according to the botanist.

- Determination of the location/identification of trees by the botanist in the forest based on the species local names. Healthy trees, i.e. trees that were neither hollow nor suffering from decay inside the trunk were chosen.

- Collection of 15 mm-diameter wood cores by means of an electric drill powered by a generator (to avoid harvesting trees) on each tree selected. The samples were taken at 1,30 m above ground on each tree selected. In order to take account of wood specific gravity variation between trees, 10 trees per species were selected: 5 trees with diameter less than 15 cm and 5 trees with diameter greater than 15 cm.

- Filling holes with branch to avoid biological attack (fungi).

- Preservation of cores in bags.

- Collection of the *PHF* index, visual estimation of height and diameter breast height with a tree caliper.

- Collection of herbarium for each species (leaves, flowers and fruits if available), and storing them between sheets of newspaper

- Confirming species scientific names in collaboration with botanists from Herbarium of the botanical and zoological garden of Tsimbazaza (PBZT), Antananarivo.

2- Lab process: measurement of wood specific gravity and density at 12% moisture content based on wood cores collected

The objective was to determine the wood specific gravity (WSG) content based on the wooden samples collected. The operating mode is:

- Cutting one-centimeter long segment (without bark) from each core.

- Stabilization of wood segments in a climatic chamber at 20°C and 65% relative humidity for 7 days to obtain the 12% moisture content (MC) state. The samples were considered stable at 12% moisture content when the weight was constant for 3 consecutive days.

- Measurement of the volume at 12% moisture content (V12) using the Archimedes water displacement method[1].

- Measurement of the 12% MC weight (M12) using a precision balance with 0.01 g resolution

- Over-drying the wood segments in an oven at 103°C until reaching constant weight in an interval of 24 hours to obtain the anhydrous state (0% humidity).

- Measurement of anhydrous weight (M_{anhy}) using a precision balance with 0.01 g resolution.

- Immersion of the segments in a container filled with water for 3 days to obtain saturated state.

- Measurement of the saturated volume (V_{Sat}) by water immersion, using the Archimedes water displacement method.

Then, for each segment, density (D12) at 12% MC was obtained by dividing its weight (M12) at 12% moisture content by its volume (V12) at 12% moisture content, relative to the density of water. And WSG of each segment was obtained by dividing its oven-dry weight (M_{anhy}) by its saturated volume (V_{Sat}), relative to the density of water.

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[1] Williamson, G.B., Wiemann, M.C., 2010. Measuring wood specific gravity...correctly. Am. J. Bot. 97, 519–524.