Biogeosciences Discuss., 5, S924–S927, 2008
www.biogeosciences-discuss.net/5/S924/2008/

Biogeosciences Discussions

Interactive comment on "Branch xylem density variations across Amazonia" *by* S. Patiño et al.

Anonymous Referee #2

Received and published: 25 June 2008

Xylem density of branches is an important parameter for estimations of aboveground coarse live wood biomass, improving existing allometric models to estimate wood biomass and an indicator for ecophysiological parameters. This study present a large and original dataset on xylem densities from branches fitting in the scope of this journal, but there are severe problems in the methodology. Therefore I can not recomend the paper for publication.

Major concerns: In this study samples were dried at a temperature of 70-90 °C. But temperatures of 103-105 °C are necessary (Ketterings et al. 2001, Chave et al. 2005, Schöngart et al. 2005) to determine wood densities representing an oven dry mass with about 12% moisture content (the residual water in the xylem is mainly bound by capillary forces in the cell wall). However, drying at 70-90 °C results in higher moisture contents and thus the presented data have strong bias to overestimate xylem density (Dx). Even if the samples have been dried until achieving constant mass after 3-4 days, the moisture content is still much higher than a sample that has been dried for the same period by a temperature of 103-105 °C. It is not understandable that the same authors determine xylem densities of branches (this study) by another methodology as xylem density of the bole (Chave et al. 2005). Therefore the samples, if still available, should be dried at 103-105 °C and new data analysis should be performed.

The authors state at Page 2018 in the last paragraph that on the species levels the xylem density of the branches (Dx) is similar to those of the bole (Dw). I would expect much lower values in the xylem density of branches compared to those of the bole. Most tropical trees show density gradients from heartwood to sapwood (Wiemann and Williamson 1989; Fearnside 1997, Parolin 2002, Wittmann et al. 2006). This increase of specific wood density with increasing tree diameter can be explained by the incorporation of mineral salts and chemical substances (terpenes, essential oils, tannins, flavonoids, aldheydes, alcohols, and colored pigments) during the formation of heartwood to protect the wood against the attacks of predatory organisms such as fungi, insects, and xylophagous grubs. However branches of 1-2 cm diameter already have a wooden tissue, but still do not have heartwood formation and thus I am surprised that Dx and Dw are similar. This might be a hint that the xylem of the branch density is overestimated due to drying the samples at lower temperature as the samples used to determine the xylem density of the bole.

An impressive dataset of 1466 trees comprising 503 tree species from 80 plots across the Amazon basin have been analysed for this study. But about 20 trees greater than 10 cm dbh per plot (P. 2010, line 5) is not very representative to indicate the variation between stand levels across the basin or between families, genera and species. Tropical rainforests have high species diversities of up to 300 species per hectare cosidering individuals $>$10 cm dbh. 1466 trees samples divided by 80 plots yields in 18,3 trees per plot in average (not 20 trees). This number is by far not representative for a stand considering also that the majority of the sampled trees were chosen by the possibility to climb them.

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Interactive Comment

The analysis of the dataset considers only differences of xylem density between taxons (family, genus, species) and geographical regions, but none of the 50 authors started the attempt to relate xylem density of branches with environmental data such as edaphic parameters (nutrient-rich floodplains vs. terra firme) and climatic parameters such as rainfall patterns (these data are available in the RAINFOR program for the majority of the plots) or even successional stages (as they occur frequently in the high-dynamical floodplain forests) or aboveground wood biomass stocks and production (Baker et al. 2004, Malhi et al. 2004, 2006).

Some minor concerns:

Abstract: Density values should be expressed as g cm-3 not kg m-3.

Introduction: The first 30 lines about species distribution patterns should be shortened.

Methododogy

The 2 plots from the Paracou site (French Guiana) had another methodology, where only lower branches from subcanopy trees were sampled (Page 2010, line 26). This database should not be considered for this analysis. For instance, in the BCI 50-ha plot, large trees tend to have lower wood densities than small trees (Chave et al. 2004). Thus the data set from the Paracou site may overestimate xylem densities. When comparing the xylem density of branches exposed to light, mid-light and shadow, it is also not understandable why only 200 trees have been considered and not the whole dataset? How have the 200 trees been selected from the total dataset?

P. 2011, line 16: Units should be given in mm or cm, not meters.

Results

P. 2014, line 17: What is N for the Ecuador region?

P. 2015, line 3: Bignoniaceae (for instance the genus Tabebuia) also have species with very high density. The same holds for Euphorbiaceae, which have wood densities

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varying from 0.33 to 0.93 g cm-3.

P. 2016, lines 11-13: This sentence is not understandable.

Interactive comment on Biogeosciences Discuss., 5, 2003, 2008.