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# *Cedrella odorata* stand structure, carbon stocks, and understorey species diversity along topographic gradients in the deciduous forest zone of Ghana

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**Abstract**

Topographic heterogeneity often results in ecological gradients across geomorphological positions. Single species tree plantations established across different topographic positions may respond differently and exhibit varied stand characteristics. However, within West Africa, there is limited information on variability of plantation stand attributes along topographic gradients. This study examined the structural characteristics, carbon stocks and understorey woody species diversity of relatively older *Cedrella* plantations on three topographic positions within the deciduous forest zone of Ghana. About 15, $40 \times 40$ m plots were surveyed in 29-year-old *Cedrella odorata* plantations located on ridge summits, flat terrain and Valley-bottoms in the Tinte Bepo Forest Reserve, Ghana. Data were analysed using ANCOVA and Bayesian modelling of diameter distribution.

Diameter at breast height ($p < 0.0001$), total height ($p < 0.025$), and stem density ($p < 0.001$) were significantly different among the three topographic regions. Trees on the flat terrain had the highest diameter at breast height, stem density, basal area, biomass carbon and volume. Slope explained 63 % of the total variability in the *C. odorata* stem density . Bayesian modelling of diameter distribution revealed that the 3-parameter Weibull function better fitted the diameter distribution of the trees on the ridge crest/summit while the Johnson SB was more appropriate at the flat terrain and the valley bottom. Understorey woody species abundance and richness did not differ between topographic regions. Shannon H for understorey species were 1.90, 1.90 and 1.66 for the valley, flat terrain and ridge crest, respectively. *Cedrella odorata* was the most abundant species in the understorey of the ridge crest and flat terrain while *Mansonia altissima* was most abundant in the valley bottom. Aboveground biomass carbon stocks differences were relevant but not significant ($p < 0.05$) among topographic positions.

It is concluded that local topography can severely alter plantation stand structure, leading to different distribution models being adopted at different topographic positions. Furthermore, though understorey woody species diversity may be similar among topographic positions, species composition and functional/trait diversity differences reflect the microhabitat conditions resulting from topography effects. Climate mitigation benefits of these plantations are similar to existing natural forest. Hence, appropriate management at different topographic positions are required.

**Keywords:** Climate mitigation, plantation, topography, understorey, woody species

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