Influence of tree diameter, soil type, altitude, rainfall, temperature on the radial variation of wood density in a tropical rainforest of Madagascar

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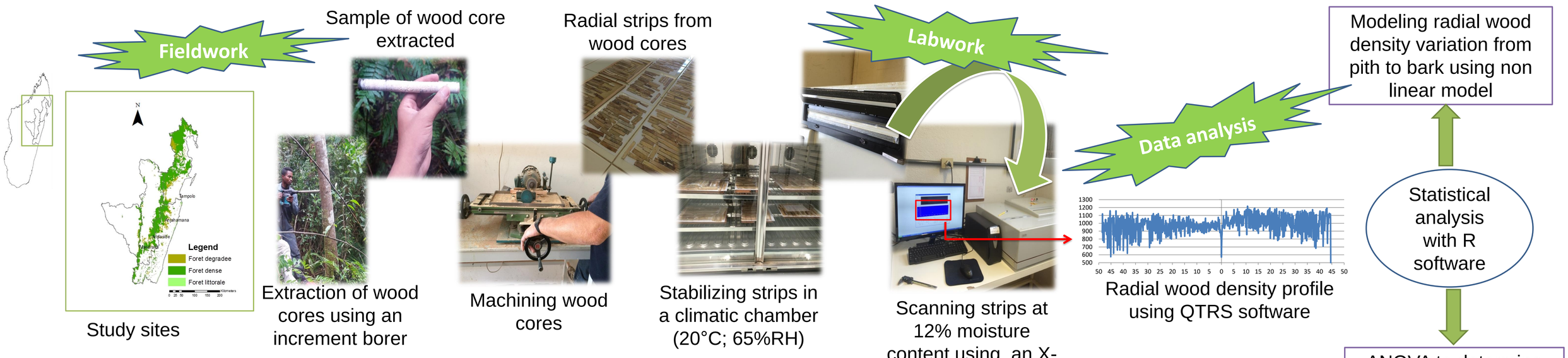
CONTEXT

Wood density is an important wood property as it correlates with several functional tree traits and mechanical wood properties. Studies on the radial variation of Madagascar wood density were only limited to 23 native species of a mid-altitude rainforest. This study aims to extend the investigation to a broader type of natural forest and to determine the differences of wood density and its radial variation within and between species related to the tree size and the environmental conditions.

MATERIALS AND METHODS



Sites	Mandraka	Andasibe	Anjahamana	Tampolo
Mean temperature (°C)	17.4	19	23	24
Mean rainfall (mm.year^{-1})	191.8	163.5	209	227.1
Altitude (m)	1200-1400	800-1200	100-500	0-50
Soil texture	Clay	Clay sand	Sandy Clay	Sandy

Four hundred tree cores or radial strips from discs of 56 species were collected in four areas within the Eastern tropical rainforest of Madagascar.

RESULTS

INTRINSIC FACTORS

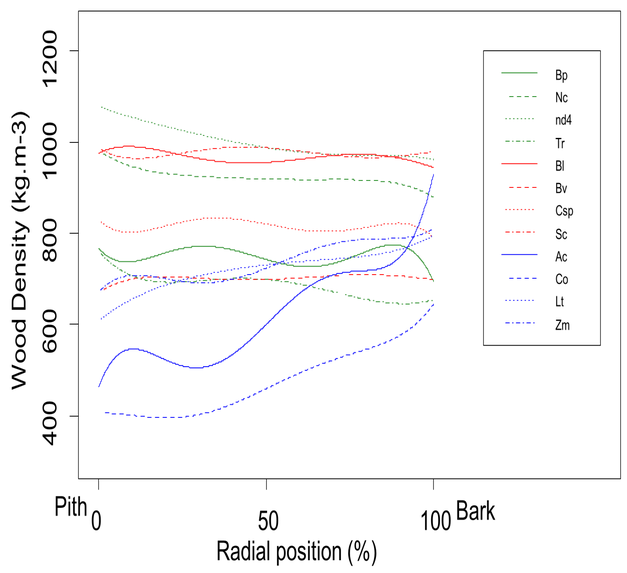


Fig. 1: Variation in wood density along the distance from pith to bark

Psp : Polyscias sp. ; Ea : Elaeocarpus alnifolius; Pv: Pittosporum verticilatum ; Csp : Craterispermum sp. ; Szsp : Syzygium sp. ; Wr : Weinmannia rutenbergii ; Xsp : Xylopia sp. ; Sd : Streblus dimepate

Radial changes in wood density follow a non-linear model (Fig. 1). A significant interaction effect on wood density variation is found between species and the distance from pith (P<0.001).

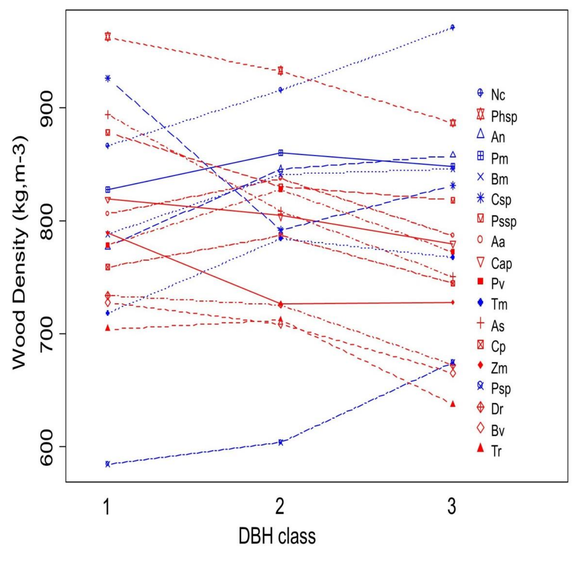


Fig. 2: Variation in wood density along the tree diameter class

Phsp : Polysphaeria sp. ; An : Allophylus nigrescens ; Pm : Peponidium micranthum ; Bm : Brachylaena merana ; Csp: Craterispermum sp. ; Pssp: Psorospermum sp. ; Aa: Allophylus aff. Arboreus ; Cap: Canarium aff. planifolium ; Pv: Pittosporum verticilatum ; Tm: Trilepisium madagascariensis ; As: Agauria salicifolia ; Cp: Clerodendrum petunioides ; Zm: Zanthoxylum madagascariense ; Psp: Polyscias sp. ; Dr: Dracaena reflexa ; Bv : Beilschmiedia velutina ; Tr: Taberna ritusa

Wood density differs significantly (P<0.001) among the diameter at breast height (DBH) class. They show different patterns (Fig. 2).

SITE CONDITIONS

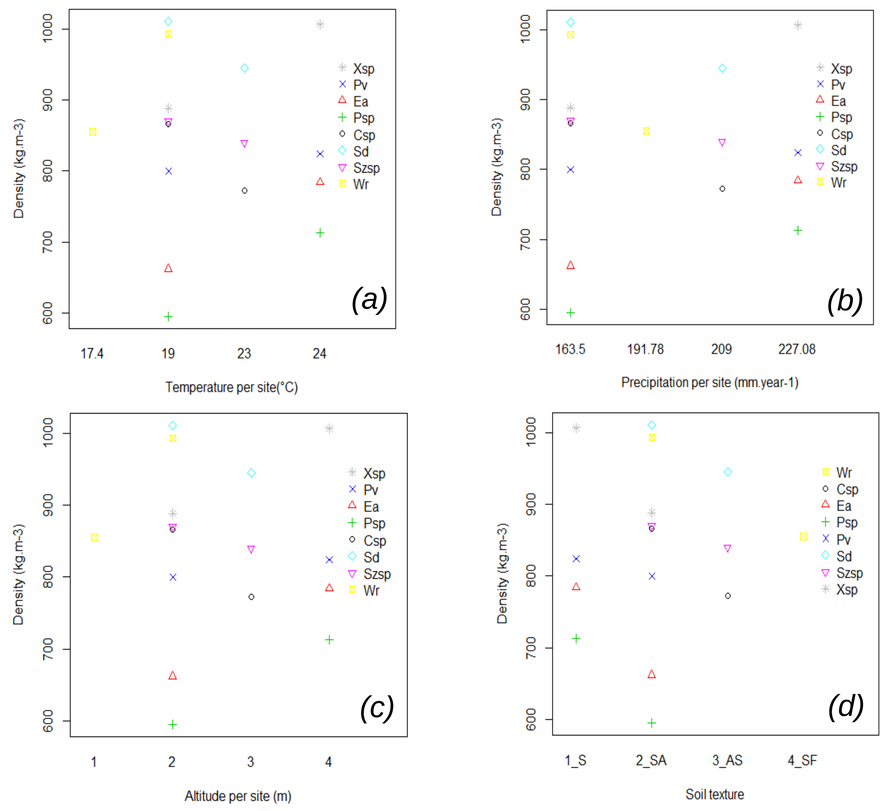


Fig. 3: Variation in wood density across site variables: (a) temperature; (b) precipitation; (c) altitude; and (d) soil type

Bp : Brachylaena perrieri ; Nc : Nuxia capitata ; nd4 : Tr : Taberna ritusa ; Bl : Bathiorhamnus louvelii ; Bv : Beilschmiedia velutina ; Csp : Craterispermum sp. ; Sc : Schizolaena cauliflora ; Ac : Albizia chinensis ; Co: Cedrela odorata ; Lt: Litsea tersa ; Zm: Zanthoxylum madagascariense

Site-specific differences on wood density variation are observed for 8 species growing in different site conditions (Fig. 3). They are attributed to variations in climate and soil.

CONCLUSION

Across the 56 species studied, species average wood density varies by nearly a factor of 2.5 from 474.7 to 1023 kg.m^{-3}. Radial wood density profiles of native species of tropical rainforest of Madagascar follow different patterns. Site conditions influenced average wood density.

ACKNOWLEDGEMENT

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