Supplement of

Savanna ecosystem structure and productivity along a rainfall gradient: the role of competition and stress tolerance mediated by plant functional traits

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Clustering of Species into functional groups

A hierarchical clustering process was used to group species into a different clusters based on similarity in plant strategies where species were progressively divided into functionally different groups. Initially, species were divided based on nitrogen fixation capacity, where only three species were identified as nitrogen fixers. Among nitrogen fixers, two species were identified as high-water-requiring species (C1: Nitrogen fixing Mesic Tree), and Acacia species was identified as intermediate water-requiring species (C2: Acacia-Nitrogen fixing intermediate trees). On another side, no-nitrogen fixers were savannas trees differing in height and leaf phenology (evergreen and deciduous). Firstly, savanna trees were divided into three groups based on height (height >25m as taller, 10-25 m as medium, and <10 as small trees). These trees were further divided based on leaf phenology, resulting in five different clusters, namely tall eucalypt, medium evergreen savanna trees, medium deciduous trees, small evergreen trees, and small deciduous trees.
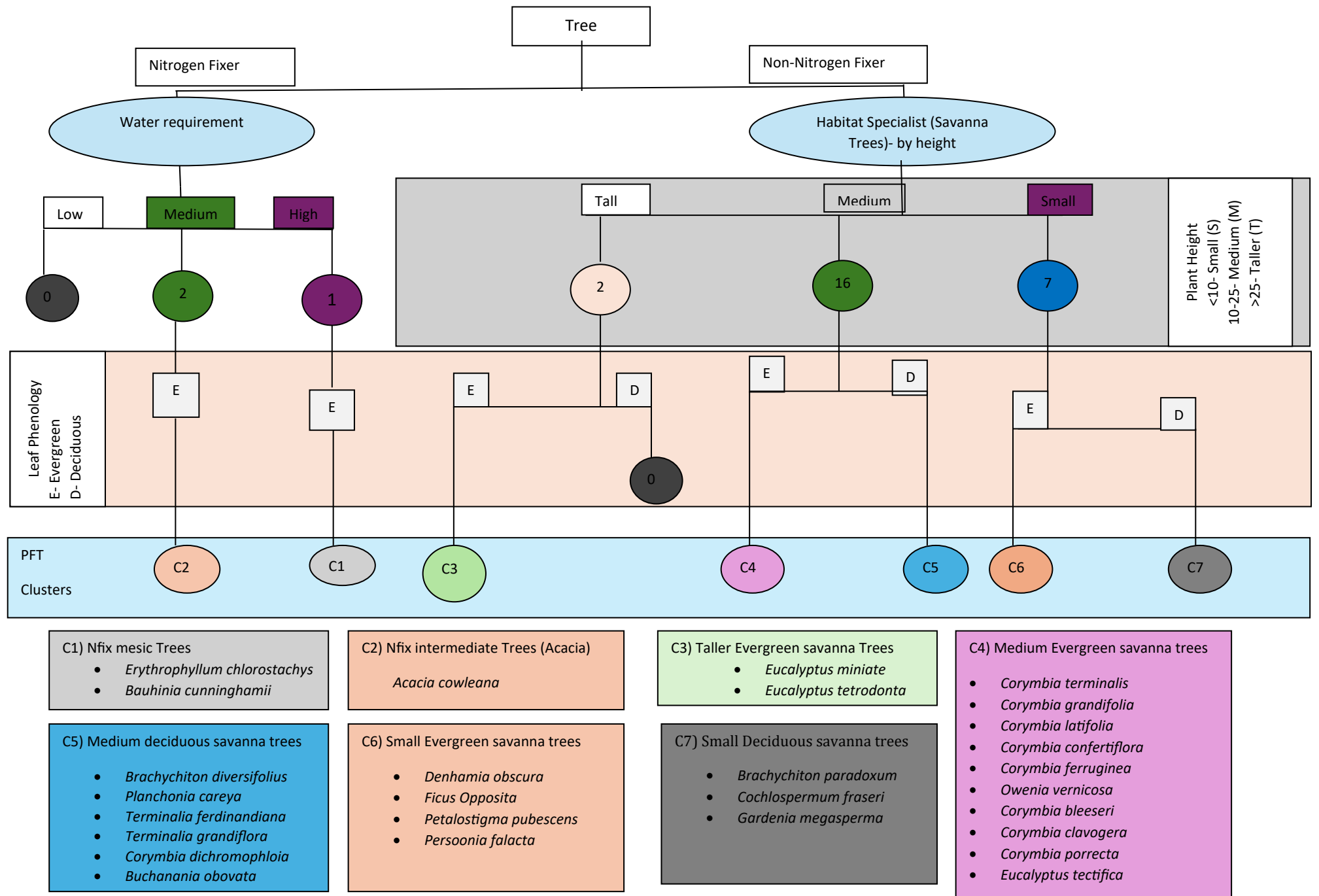
Figure S.1: Diagram showing hierarchical clustering of tree species into Seven clusters

Traits and parameter values

The compilation of species traits information (data) for all 28 species, including understory vegetation, from various sources such as AusTraits was done. Key traits such as leaf phenology, leaf longevity, wood density, nitrogen fixation potential, plant height, specific leaf area, shade tolerance, and leaf turnover rate were compiled. These traits reflect both the phenological and morphological characteristics of the species, as well as their ecological strategies. According to Williams et al. (1996), tropical savannas typically contain either tropical broadleaved evergreen or tropical broadleaved raingreen trees, which shed their leaves in the dry season, depending on the rainfall patterns and evolutionary history of the region. Additionally, data on the rainfall status at species occurrence sites and their responses to fire were recorded to provide a comprehensive understanding of their ecological roles. Following the compilation of species traits, these data were used to define the parameters for each Plant Functional Type (PFT). The parameters included leaf phenology (evergreen or rain green), leaf longevity, wood density, specific leaf area, shade tolerance, leaf turnover rate (calculated as 1/leaf longevity), and the ratio of leaf area to sapwood cross-section area (k_latosa). For each PFT cluster, the mean values of these parameters were calculated by averaging the recorded values of the species within that cluster.

Table S.1: Parameter and their values (field observation and adjusted) for all tree PFTs

Parameters	PFTs						
	Tall eucalypt (Tall_euc)	Medium evergreen (Med_eve)	Medium Deciduous (Med_dec)	Acacia	Small evergreen (small_eve)	Small deciduous (small_dec)	Nitrogen fixing mesic tree (Nfix_mecic)
Zone	Tropical	Tropical	Tropical	Tropical	Tropical	Tropical	Tropical
Leaf phenology	Broadleaved	Broadleaved	Broadleaved	Broadleaved	Broadleaved	Broadleaved	Broadleaved
	Evergreen	Evergreen	Raingreen	Evergreen	Evergreen	Raingreen	Raingreen
Shade tolerance	Intolerant	Intolerant	Intolerant	Intolerant	Intermediate tolerant	Intolerant	Intolerant
SLA (m²/kgC)	11	11	18	12	11	26	20
Wood Density (kgC/m³) (field observation)	425	350	360	355	320	355	500

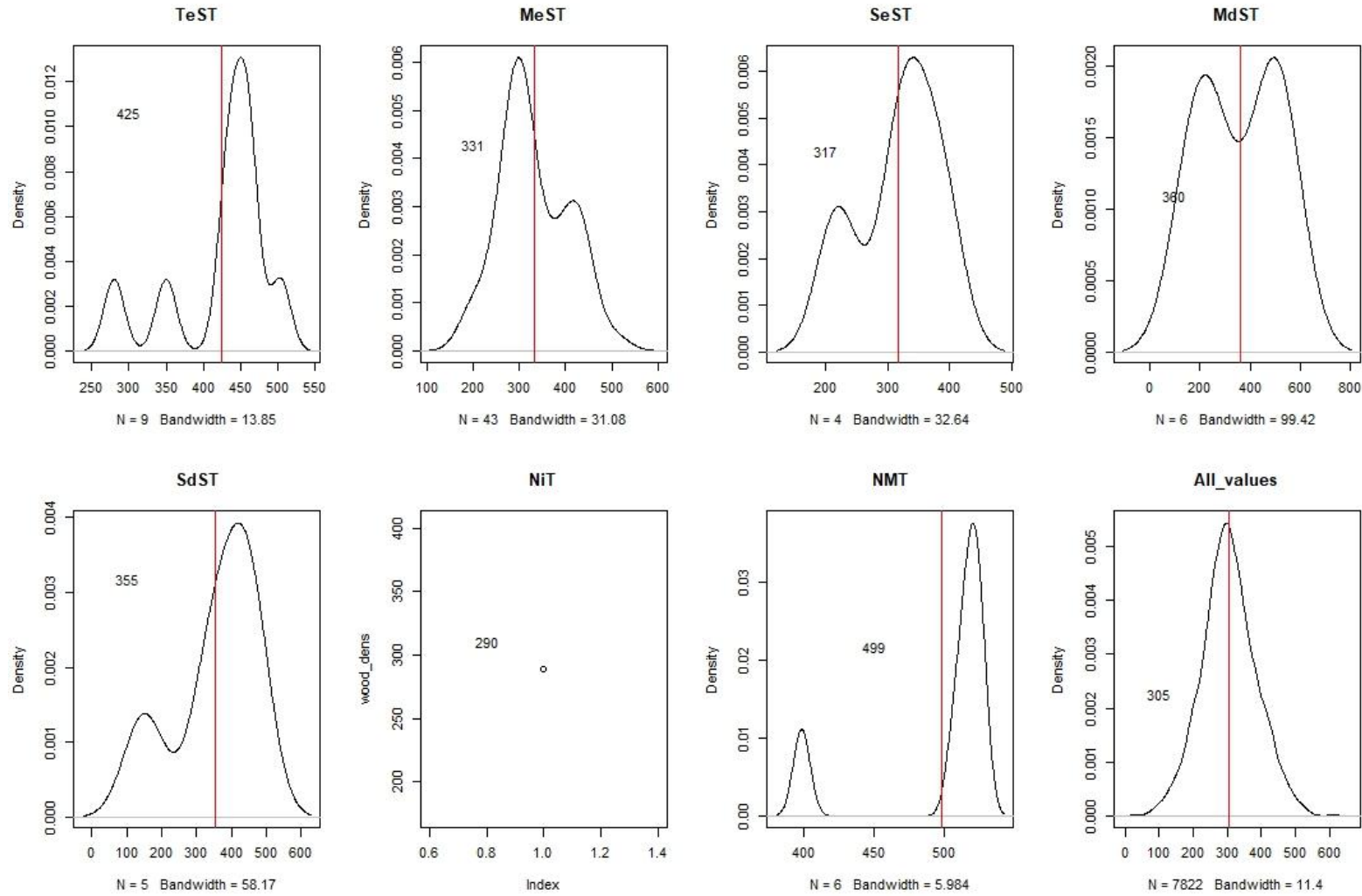| Parameters	PFTs						
	Tall eucalypt (Tall_euc)	Medium evergreen (Med_eve)	Medium Deciduous (Med_dec)	Acacia	Small evergreen (small_eve)	Small deciduous (small_dec)	Nitrogen fixing mesic tree (Nfix_mecic)
Wood Density (kgC/m^3)-(adjusted)	230	250	250	350	190	250	250
Leaf area to Sapwood cross-section area - (field observation)	5000	3900	3150	4600	3000	1760	3800
Leaf area to Sapwood cross-section area (adjusted)	5200	4500	4000	4500	4000	2000	3800
Leaflong (years)	1.5 (13-18 months)	1.5 (use from Tall_euc)	0.8 (9 months)	2	2	0.4 (3-5 months)	0.7 (9 months)
Turnover leaf (fraction/year)	0.6	0.66	1	0.5	0.5	1	1
Root in to 50 cm (%)	43.1	43.1	47.6	45	55	47.6	62.8

Figure S.2: PFT wise wood density from AusTraits
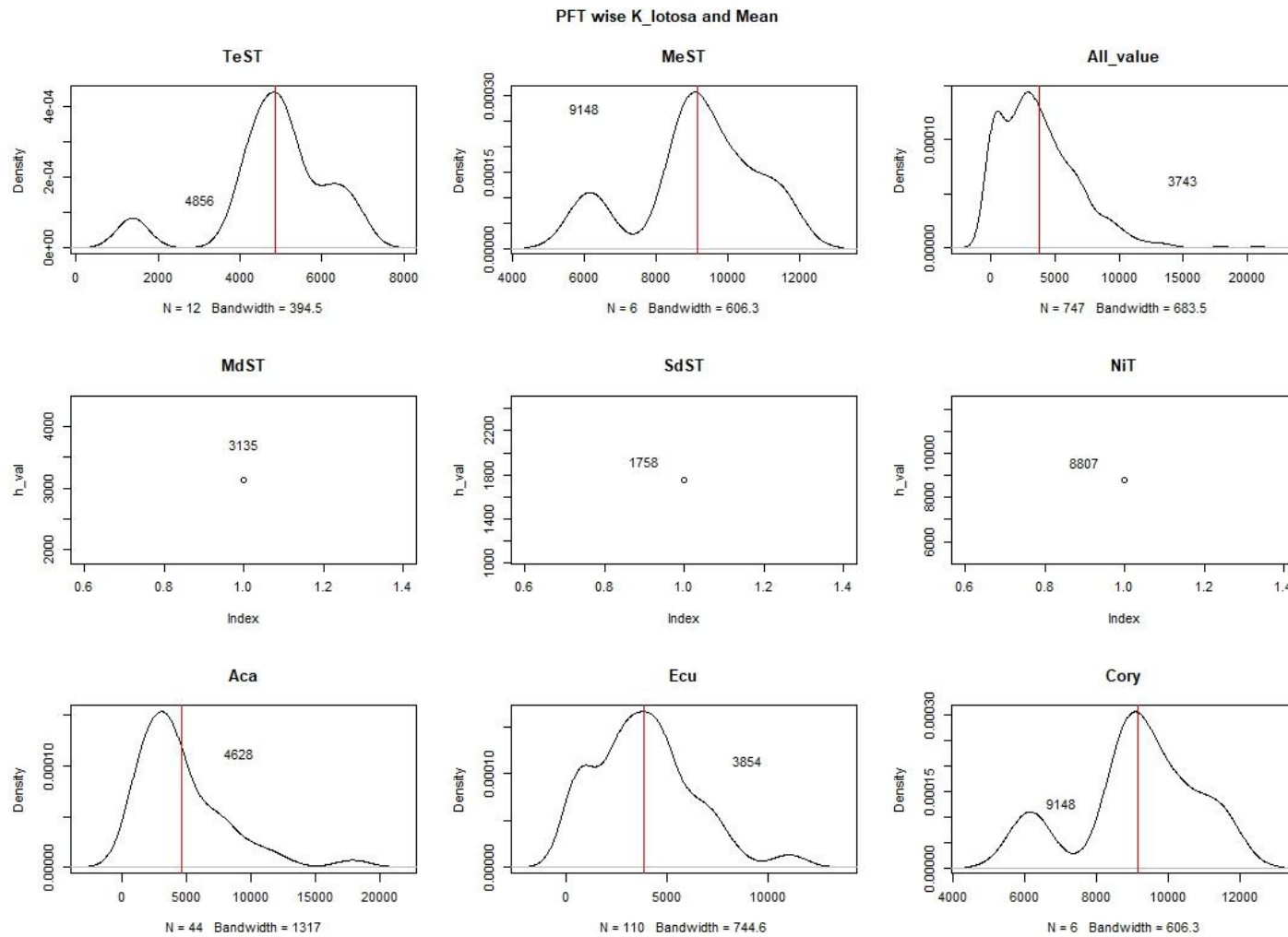
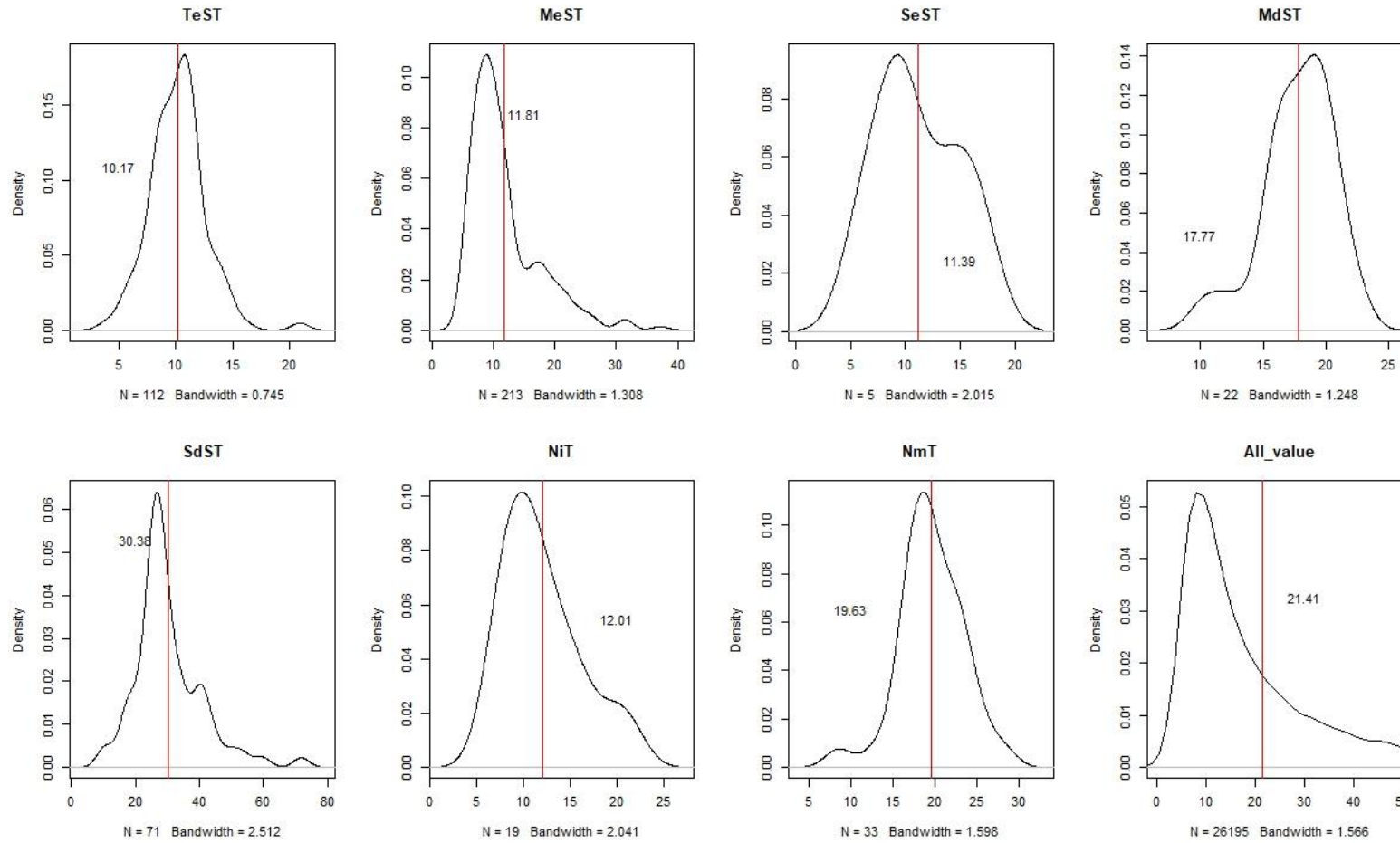Figure S.3:. PFT wise leaf area to sapwood cross section area (k_{latosa}) from AusTraits

Figure S.4 : PFT wise Specific lea area from AusTraits