Science of the Total Environment

Supporting Information for article: "Leaf age effects on the spectral predictability of leaf traits in Amazonian canopy trees".

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Supporting Information: 3 colour figures and supplementary methods

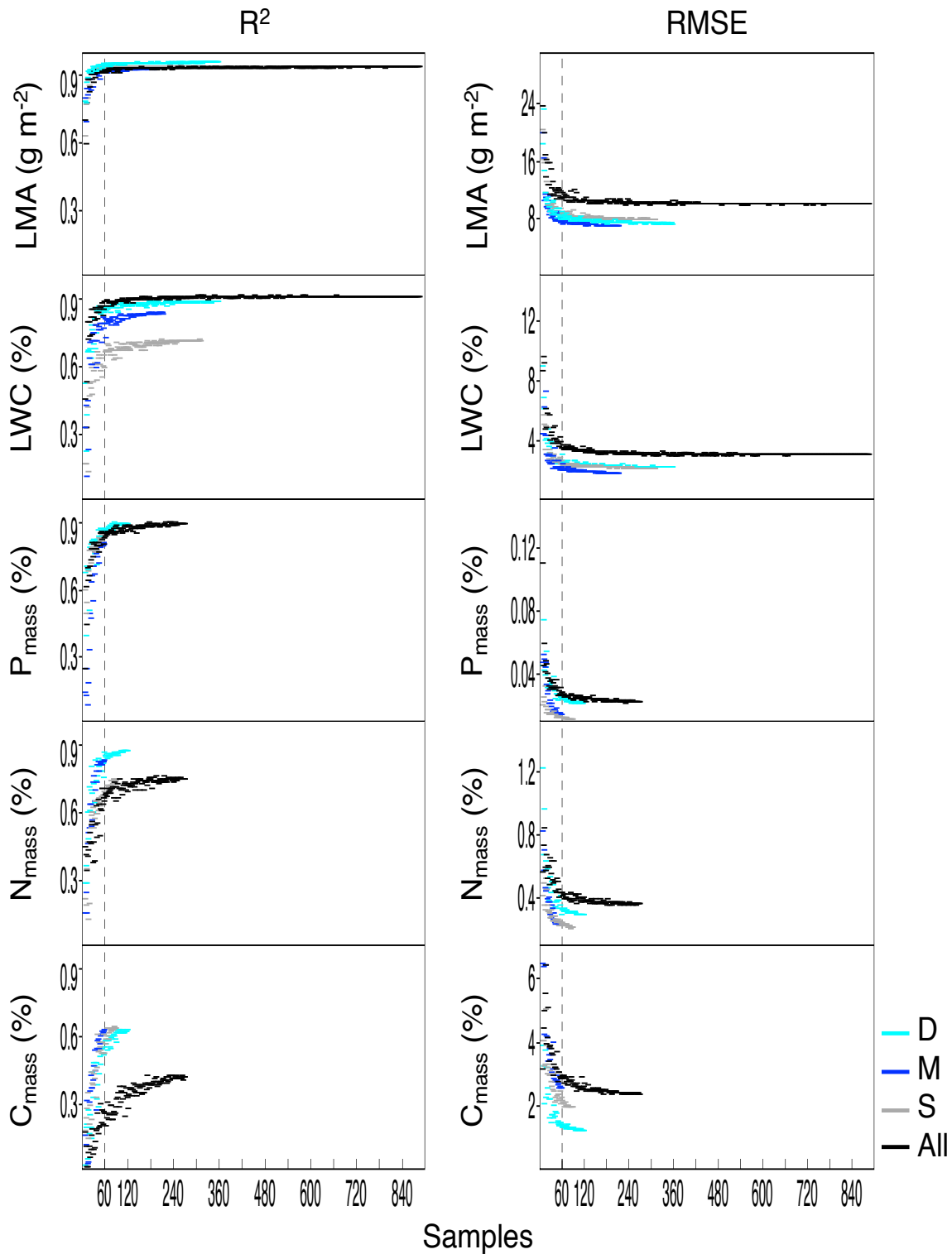

Fig. S1 Partial least square regression (PLSR) model sensitivity to sample size. Leaf traits measured by age groups: D= developmental, M= mature, S= senescent and All= mixed-age. PLSR models were run using six latent factors for leaf mass per area (LMA), and eight latent factors for all other traits. Model sensitivity results for area based traits displayed very similar results and are not shown.

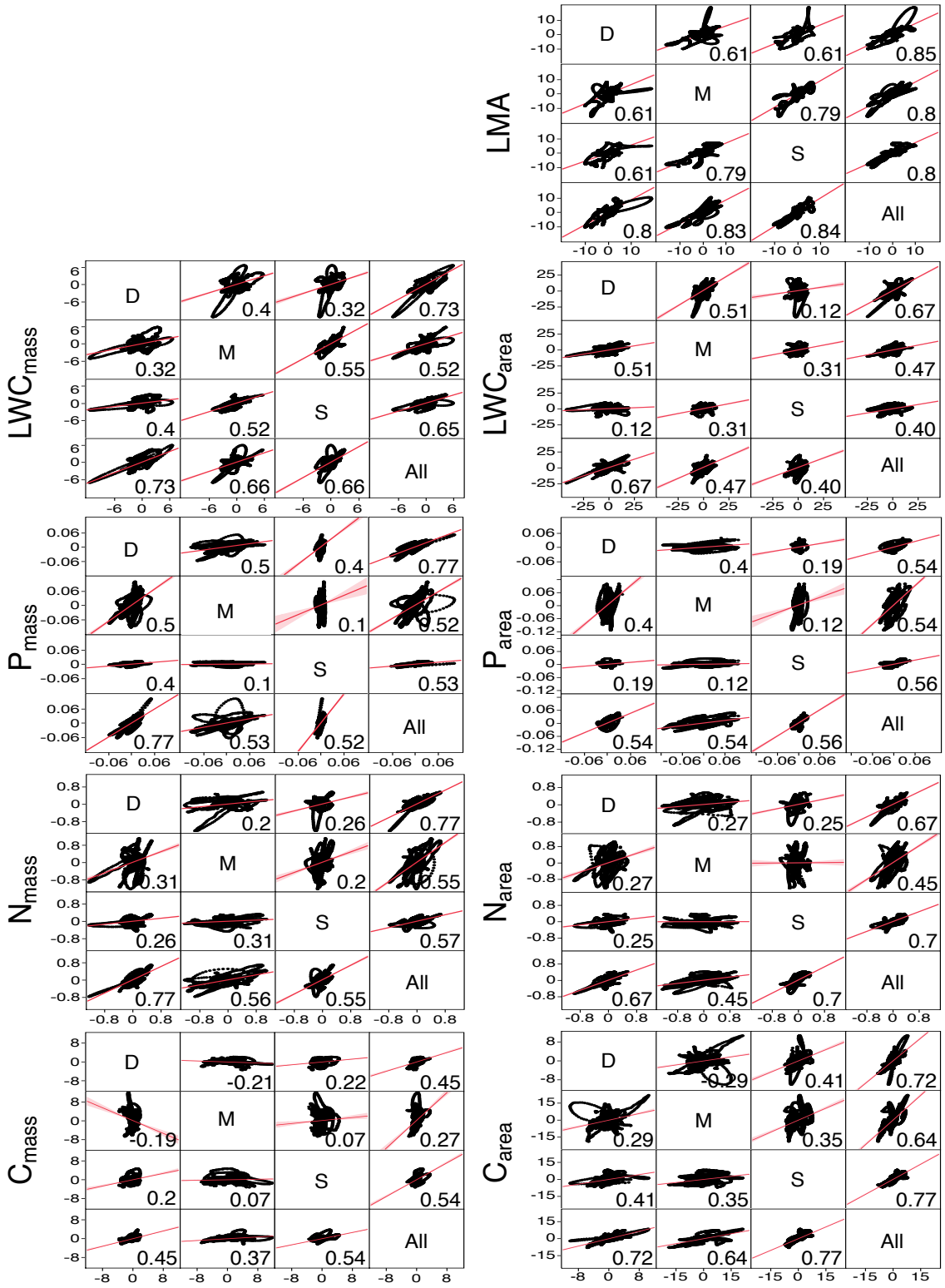

Fig. S2 Coefficients' correlations by leaf age group for both mass- and area-based partial least squares regression (PLSR) models. Numbers in graphs report the correlation strength (r) between PLSR coefficients for each pair of leaf age groups. Leaf traits: leaf mass per unit area (LMA), leaf water content (LWC_{mass}; LWC_{area}), phosphorous (P_{mass}; P_{area}), nitrogen (N_{mass}; N_{area}) and carbon (C_{mass}; C_{area}) content. Leaf age groups: D= developmental, M= mature, S= senescent and All= mixed-age.

Supplementary Methods

The following protocols from Chavana-Bryant *et al*. (in review) can be used to keep track of leaf age during field collection campaigns: (1) only leaves found after the closest growth scar to the end of a branch should be collected (except for species with successive leaf production, this will ensure that leaves have more or less the same age) and (2) to more accurately identify the leaf age class of the sampled leaves, laminated printed versions of **Figs. 1** and **S3** could be used as field leaf age classification guides and (3) a ranking system used to classify the general leaf age stage of the canopy from which leaves are collected (i.e. 1- leaves from canopies starting their life-cycles if young developing leaves are present in the canopy, 2a- leaves from early to mid- mature canopies if only fully-developed, healthy-looking leaves are present in the canopy or 2b- leaves from end of maturity to old canopies if fully-developed leaves show signs of aging but not abscission in the canopy; and 3- leaves from canopies coming to the end of their life-cycle if leaves show signs of senescence, epiphylls and abscission in the canopy).

Leaf developmental phase ending in maturity

	Age codes	Leaf description
	D1	**Developmental 1 –** recently emerged leaf, collected after ~1 week of active expansive growth. **Description:** leaf very fragile and thin, small in size, has no rigidity (folds when held up), its colour may be yellow or light green.
	D2	**Developmental 2 –** recently emerged leaf, collected after ~2 weeks of active expansion. **Description:** leaf still fragile and thin, hasn't achieved full size, has some rigidity (will not fold if held up), its colour is now light green.
	D3	**Developmental 3 –** recently emerged leaf, collected after ~3 weeks of active expansion. **Description:** leaf not fragile but still thin or close to achieving full thickness and rigidity, has almost achieved full size or has achieved full size, its colour is green.
	M	**Mature** – fully-grown and structurally developed leaf that has achieved fully darkened green colouration. Leaves in this age class are generally in good condition and show no signs of epiphylls or senescence. Newly matured, mid and end of maturity leaves are included in this age class.

Leaf senescent phase ending in abscission

Leaf in best condition	Leaf in worst condition	Age codes	Leaf description
		O	**Old** – leaf near the end of its life cycle (~2-3 months before senescence and abscission); distinguished from previous age class by darker (shade leaf) and/or yellower (sun leaf) colouration, and by initial signs of epiphylls and/or senescence.
		S	**Senescent** – leaf in the process of dying and abscising; distinguished by loss of chlorophyll and/or onset of decomposition. Senescent leaves starting to abscise through to advanced senescence (most canopy leaves abscised) are included in this age class.

Fig. S3 Leaf life-cycle of *Bertholletia excelsa* used to illustrate a field leaf age classification guide. A further **Young/Mature** (Y/M) leaf age could also be found in the field among trees for which D3 leaves still display a light green colouration. Y/M leaves are close to maturity, have achieved full size, full thickness and rigidity but their green colour is not yet fully darkened. For senescent leaves, an additional classification criterion is that sampled leaves are easily abscised with branch movement. Colour images (not to scale) show how leaves from 3 weeks old to senescent age (see leaves in best condition for both old and senescent leaves) could be mis-sampled in the field based only on leaf visual inspection.