A First (PCA) Pass at Grass in the Past: Eastern African Chemotaxonomy from Plant Wax n-Alkanes

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Background and Objective

Paleoecological proxies for the 'grassy' vs. 'woody' nature of C_3 landscapes in eastern Africa are extremely limited, especially at high spatial resolution. Consequently, ecosystem structures are not well understood prior to the onset of C_4 grassland expansion at 10 Ma. **We aim to use *n*-alkane chain length abundances as a proxy for plant functional types (PFTs).**

Data Compilation & Analysis Methods

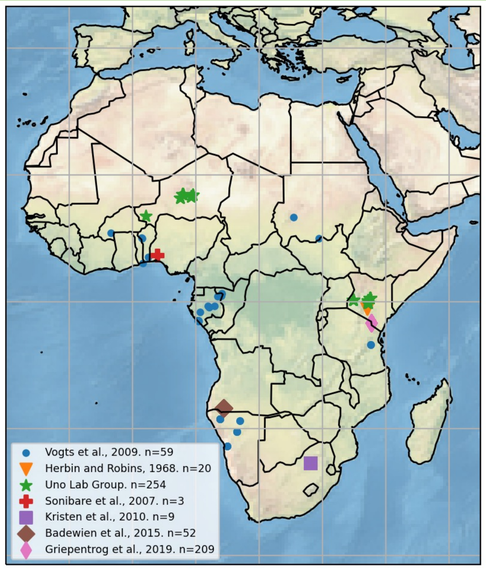
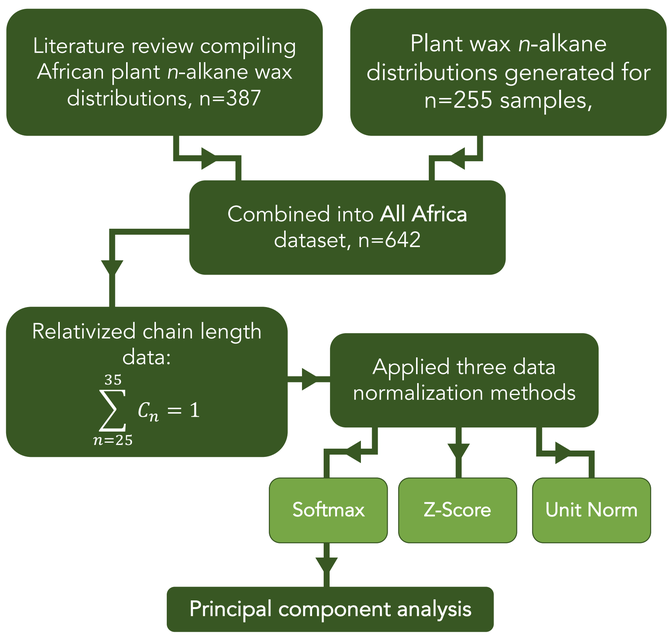


Figure 1 – Map of sampling sites across Africa.



Take Home Message:

Both C_3 and C_4 grasses produce longer chain lengths than 'woody' plant functional types. However, our data are non-linear and complex, meaning they are **not separable by PCA.**

Principal Component Analysis of All Africa Dataset

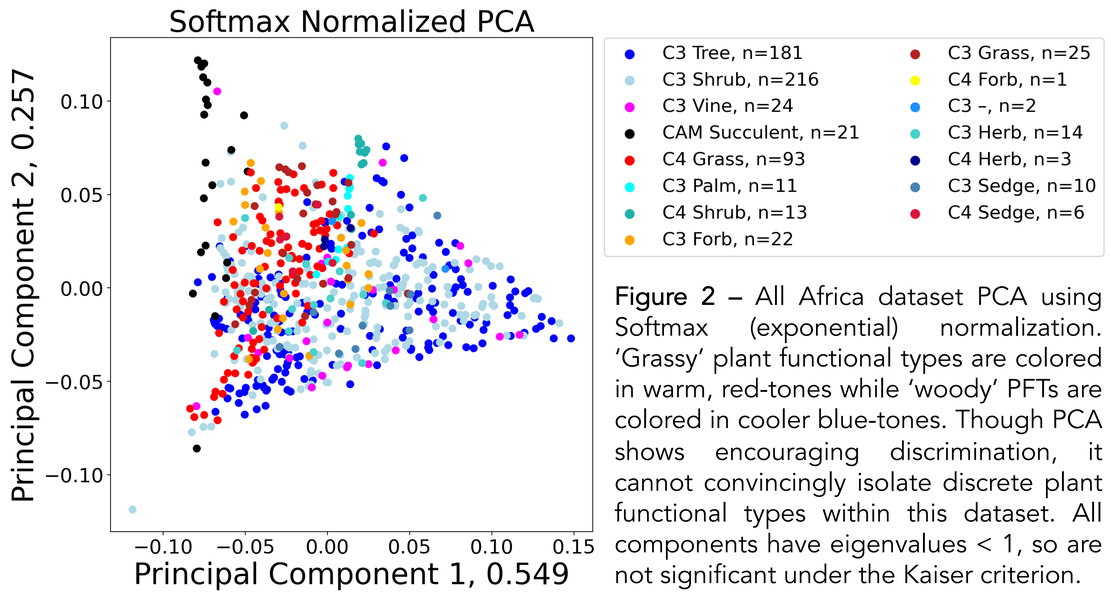


Figure 2 – All Africa dataset PCA using Softmax (exponential) normalization. 'Grassy' plant functional types are colored in warm, red-tones while 'woody' PFTs are colored in cooler blue-tones. Though PCA shows encouraging discrimination, it cannot convincingly isolate discrete plant functional types within this dataset. All components have eigenvalues < 1, so are not significant under the Kaiser criterion.

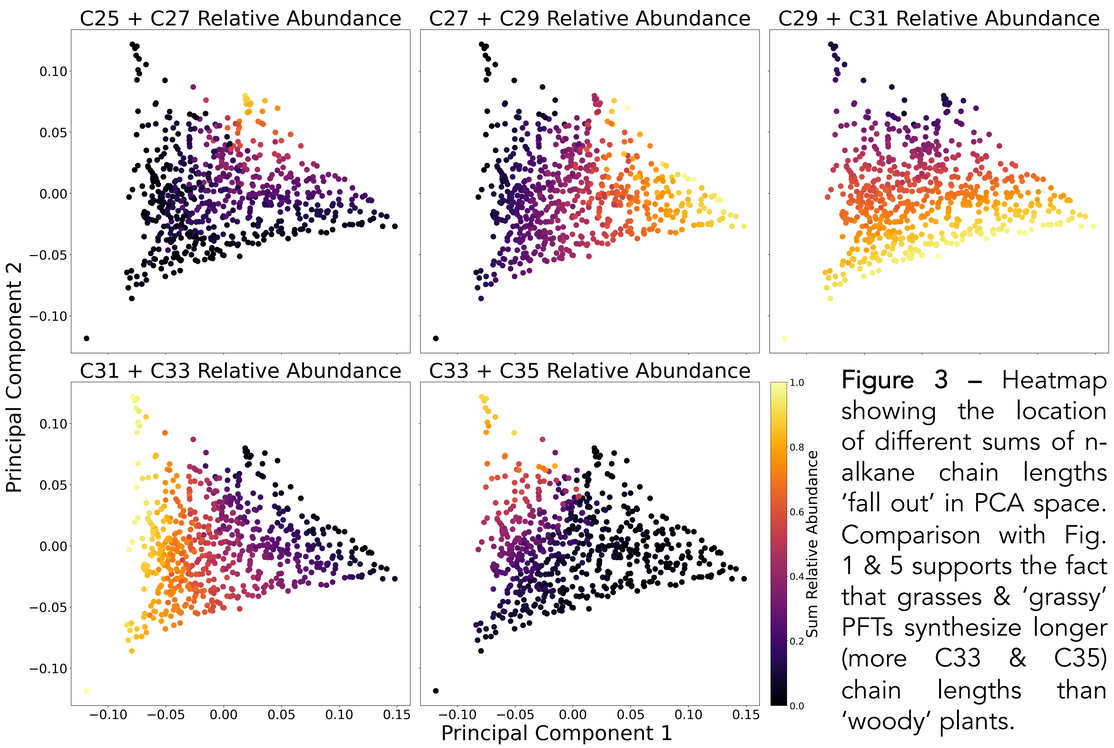


Figure 3 – Heatmap showing the location of different sums of n-alkane chain lengths 'fall out' in PCA space. Comparison with Fig. 1 & 5 supports the fact that grasses & 'grassy' PFTs synthesize longer (more C33 & C35) chain lengths than 'woody' plants.

Supporting Figures

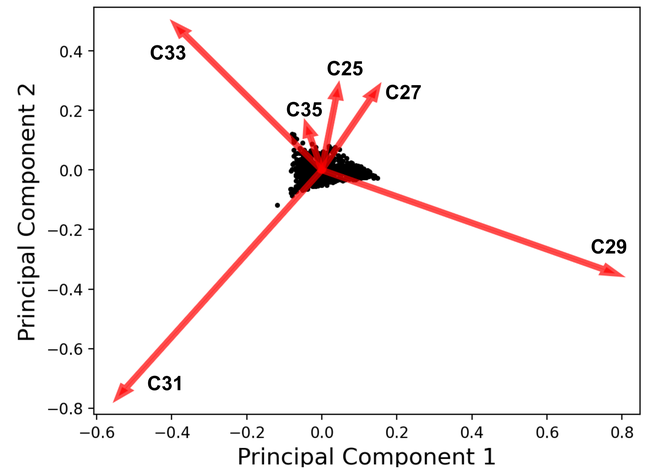


Figure 4 – 'Pure' homologue vectors (red arrows) overlayed with our dataset (black dots). C29, C31 and C33 vectors have the greatest magnitude due to their high relative abundances and increased variability within our dataset (note 1σ standard deviations in Fig. 5).

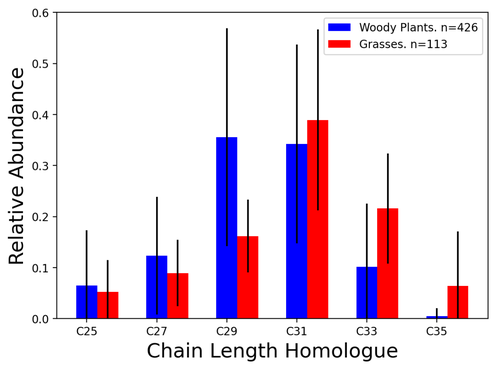
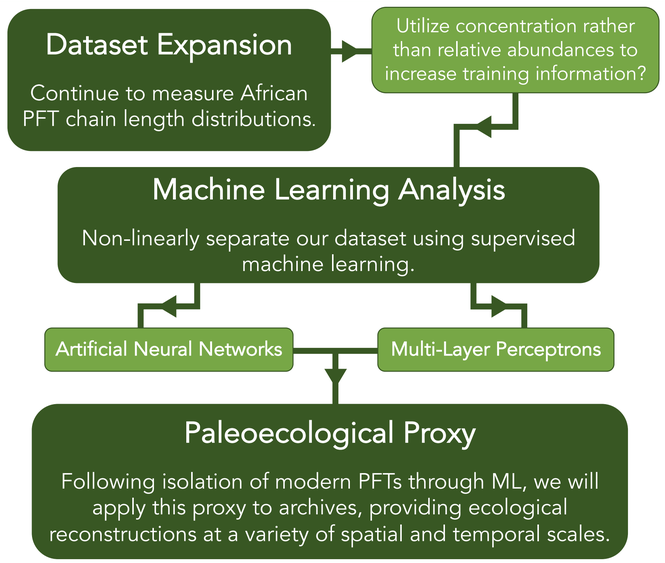


Figure 5 – Histograms of chain length abundances for 'woody' plants (trees, palms, shrubs, bamboo) vs C_3 and C_4 grasses. Grasses show longer chain lengths.

Future Work



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