“Plant functional types and plant trait measurements”

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Plant Functional Types and Plant Trait Measurements in the Eastern Ghats

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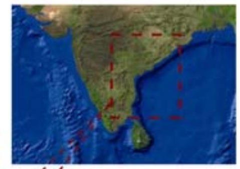

Classifying terrestrial plant species on the basis of function rather than on taxonomy facilitates addressing ecological questions at the scale of ecosystems, landscapes or Biomes. The concept of plant functional types (PFTs) helps handle taxonomic diversity, as it groups together species that share common attributes such as life-form, phenology and bioclimatic limits. For some time now, international efforts promoted by the IGBP-GCTE programme are underway to measure for a large number of species a shortlist of significant plant traits (Wright *et al.*, 2004) that would underlie such functional plant classification systems.

PFTs are the fundamental units of most biome models, which group plant taxa according to their ecological similarities rather than evolutionary heritage (Prentice *et al.*, 1992; Williams *et al.*, 1998) and functionally similar plant types that can be used in global ecological modeling (Box, 1996). Vegetation is defined in terms of plant functional types, PFTs; (Woodward & Cramer, 1996; Smith *et al.*, 1997); biomes are defined as the resulting combinations of PFTs (Steffen *et al.*, 1996).

PFT classification is an effective way of reducing the complexity of modeling ecosystem processes that will greatly enhance future vegetation-climate models (Wright *et al.*, 2005) and is based on a minimum set of functional attributes (traits) that are considered to be most critical in reliably predicting the present-day distribution of plants from climatic input variables.

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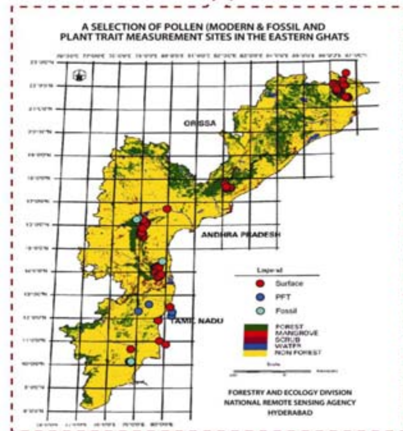

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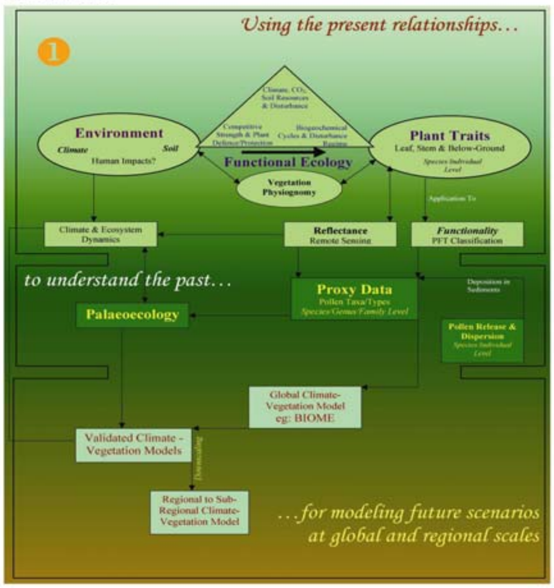

Such a classification obviously helps in the use of pollen assemblages to infer past ecosystem changes, especially ecosystem response to climate change, as this is more directly linked to changes in functional rather than taxonomic diversity of plants over temporal and spatial gradients.

In turn, modern pollen data offer several advantages for analyzing the relationships between traits and climate. In general, pollen samples are selected to provide a signal of the regional vegetation (Sugita, 1994), which is more likely to be determined by climatic gradients than local factors such as disturbance (Barboni *et al.*, 2004). Plant taxa identified in the palaeo record are assigned to one or more PFTs based on the knowledge of the basic biology (leaf form, habit, phenology) and the modern bioclimatic distribution of the species included within a functional group. A pollen taxon, consisting of several genera or even an individual species that has specific functional adaptations for different environments may be assigned to more than one PFT.

Here we focus on leaf traits that we measure using standard protocols with appropriate modifications for our field and lab contexts (Cornelissen *et al.*, 2003; Garnier *et al.*, 2001; Roderick *et al.*, 1999).

We present here: a scheme that illustrates various linkages from the present (data) to past (data) and then to the future (models); between climate & ecosystem dynamics, plant traits, palaeoecology and validated climate vegetation models (1); a map of our study area giving the distribution of our study sites in the Eastern Ghats (2); main results from our pollen and ecological studies - an illustrative example of pollen taxa from our database of surface samples from Eastern Ghats, to which PFTs are assigned using as a basis the attributions made for the Indian subcontinent level at the first INDSUBIO workshop in 2001 at Jena, Germany, to which we have added our field observations (3); variations in leaf trait measurements such as specific Leaf area (SLA) for selected taxa (4) & (5).

3

PFTs attributed to pollen taxa: examples

Pollen Taxa/Type	PFTs
Olea glandulifera	tr.e.mb.lhs;wt.e.mb.t;wt.e.sb.t;tr.e.mb.t;wt.e.mb.lhs;wt.e.sb.lhs
Holoptelea	tr-x.dd.b.t
Loranthaceae	tr.e.mb.lhs
Chenopodiaceae/Amaranthaceae	bo-di.fb;te-di.fb;eu-dt.fb;eu-da.fb

tr.e.mb.lhs – tropical evergreen malacophyll low or high shrubs; wt.e.mb.t – wet evergreen malacophyll tree; wt.e.sb.t – wet evergreen sclerophyll broad-leaved tree; tr.e.mb.t – tropical evergreen malacophyll broad-leaved tree; wt.e.mb.lhs – wet evergreen malacophyll broad-leaved low or high shrubs; wt.e.sb.lhs – wet evergreen sclerophyll broad-leaved low or high shrubs; tr-x.dd.b.t – tropical-xeric drought deciduous broad-leaved tree; tr.e.mb.lhs – tropical evergreen malacophyll broad-leaved low or high shrubs; bo-di.fb – boreal drought intolerant forbs and herbs; te-di.fb – temperate drought intolerant forbs and herbs; eu-dt.fb – eurythermic drought-tolerant forbs and herbs; eu-da.fb – eurythermic drought-adapted forbs and herbs

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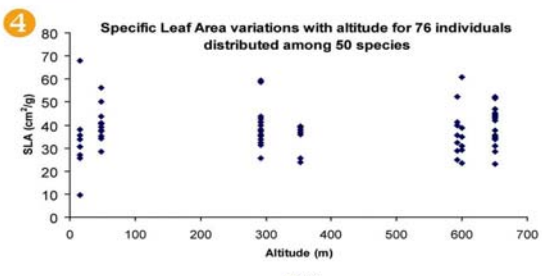
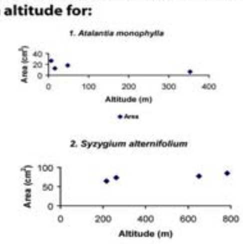


Individual variations in Leaf Fresh Area with altitude for:



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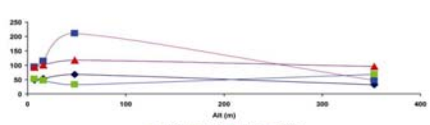
Individual variations in different leaf parameters with altitude for *Atalantia monophylla*



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