Abstract

Spatial patterns in species diversity are a consequence of several ecological processes related to successful dispersal. Utilizing a comprehensive national plant database generated through 'Biodiversity Characterization at Landscape Level' project, the congruence between plant dispersal and diversity with environmental heterogeneity was evaluated. An assessment of plant dispersal modes and frequency among four life forms and 13 major forest types showed the dominance of plant associated with biotic dispersers. Particularly, epizoochory and ornithochory (as biotic), and anemochory and hydrochory (as abiotic) disperser rule the plant dispersal in Indian mainland-island biogeography. Considering island plant richness, geographic area, and shortest distance to the nearest mainland pool, the generalized linear model (GLM, $R^2 = 0.85$) and multivariate adaptive regression splines (MARS, $R^2 = 0.95$) revealed high correlation at p-value < 0.01 significance level. The satellite-derived biophysical proxies (surface reflectance-SR-645nm and SR-858nm, Enhanced Vegetation Index-EVI, NDVI-Normalized Difference Vegetation Index, Fraction of Absorbed Photosynthetically Active Radiation-FAPAR, Leaf Area Index-LAI) that consider the variability in plant leaf traits, canopy structure, and phenology; are useful for retrieval of large scale ecological information. The congruence between plant diversity and satellite-derived biophysical proxies (monthly, post-monsoon, seasonal, annual) were analyzed using GLM and MARS, which derived FAPAR followed by LAI as suitable biophysical proxies for each biogeographic region. Artificial neural network (ANN) was used to model the plant richness with monthly FAPAR, where the correlation maximum of $R > 0.5$ was observed between simulated and reference data. Dynamic habitat index (DHI), an indicator of environmental heterogeneity representing the changes in habitat heterogeneity was calculated using monthly FAPAR, revealed an excellent correlation with plant diversity ($R^2 = 0.90$, p-value < 0.001 with DHI-Cumulative). This study is a maiden attempt to (i) depict the indicative plant dispersal map of India, and (ii) understand ecosystem processes both at ecological (plant diversity) and evolutionary (plant dispersal) timescales that could be possible with the availability of a systematic national database on plant species richness. Congruence of plant diversity with satellite-derived biophysical proxies (attributed due to environmental heterogeneity), especially FAPAR has potential implication as an essential biodiversity variable (EBV) for rapid/ indicative monitoring of plant diversity, thereby achieving various International commitments.

Keywords: Dispersal modes, Dynamic habitat index, Fraction of absorbed photosynthetically active radiation, Leaf area index, Plant diversity, Shortest distance to the nearest mainland