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The Dynamic Habitat Index derived from three decades of MODIS and AVHRR data and its relationship to global patterns on mammal species richness

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ABSTRACT:

Many wildlife species and populations are declining due to habitat loss, invasions, and climate change. In order to predict how species will respond to changing environments, biodiversity science needs better assessments of the current patterns of biodiversity, species distributions, and population densities. Indices derived from satellite data will be key for these biodiversity assessments. Our goal was to assess the usefulness of the Dynamic Habitat Index (DHI) to predict global mammal species richness. The DHI summarizes three key measures of vegetative productivity: a) overall, cumulative productivity, because sites where more energy is available are generally more biodiverse; b) the coefficient of variation in productivity over the course of a year, because sites with less intra-annual variability are generally more biodiverse, and c) minimum productivity throughout the year because sites that never drop to very low minima are more biodiverse. We calculated the DHI globally at 8-km resolution from three decades of AVHRR and MODIS fPAR data. Our mammal richness data were derived from IUCN species range maps, sharpened with information on habitat availability, elevation, and access to water sources. The DHI indeed showed the highest total productivity, least variability, and highest minimum productivity in the tropics, where mammal species richness is highest. Temporal variability in the DHI among years was notable, but did not exceed the spatial variability across the global gradients. At a regional scale, and among the three components of the DHI, total productivity was most strongly related to richness in the tropics, while variability was more important in temperate regions. Our results show that the DHI is particularly promising for biodiversity science and conservation, and is unique from other satellite data products and indices because it is well-grounded in ecology theory of biodiversity patterns.

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