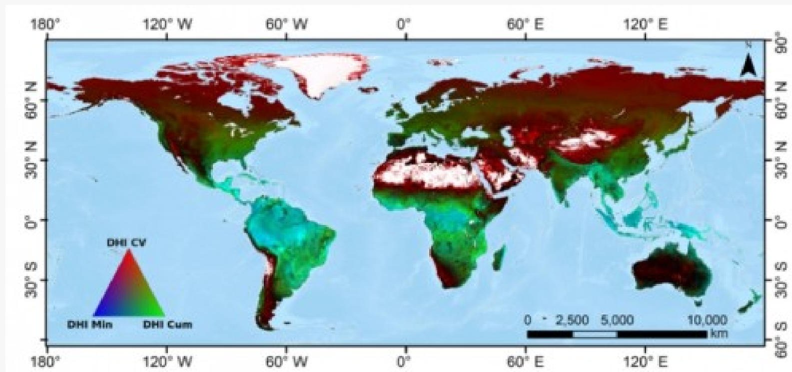
A new map for nature: using GPP to predict species richness from space

FAYETTEVILLE, GA, UNITED STATES, July 1, 2025 /EINPresswire.com/ -- A new global study introduces a satellite-based approach for monitoring biodiversity using Dynamic Habitat Indices (DHIs) derived from vegetation productivity data. By analyzing data from multiple satellite products and validating results with in-situ flux tower observations, researchers demonstrated that DHIs based on gross primary productivity (GPP) are powerful predictors of species richness across mammals, birds, amphibians, and reptiles. These findings offer a scalable tool for conservation planning.



Combined DHI where coefficient of variation DHI was assigned to the red band, cumulative DHI to the green band and minimum DHI to the blue band of the image. All the other colors show transition zones of mixtures of the different DHIs.

Biodiversity is under increasing pressure from habitat loss, climate change, and other human activities. While satellite remote sensing provides crucial insights into global environmental change, translating these observations into conservation-relevant indicators remains a challenge. Traditional methods often rely on indirect proxies like Normalized Difference Vegetation Index (NDVI), which lack precision in capturing true ecosystem productivity. More recently, Dynamic Habitat Indices (DHIs) have emerged as promising tools to link satellite observations to biodiversity. These indices integrate temporal variations in vegetation productivity—such as seasonal abundance, stress, and stability—and are grounded in three ecological hypotheses. Due to these unresolved challenges, more refined tools are needed to effectively link remote sensing data with biodiversity monitoring and conservation outcomes.

A team of researchers from Lanzhou University and collaborating institutions published a study (DOI: 10.34133/remotesensing.0624) on June 2, 2025, in the Journal of Remote Sensing exploring how satellite-derived vegetation productivity can be used to model species richness. The study assessed eight remote sensing datasets, including NDVI, Enhanced Vegetation Index (EVI), fAPAR, and gross primary productivity (GPP), to calculate DHIs and evaluate their correlation with biodiversity patterns at global scales. Their goal was to determine which satellite metrics best reflect global biodiversity patterns and how these tools can enhance conservation decision-making amid accelerating species loss.

The study found that DHIs based on gross primary productivity (GPP), especially those derived from the Vegetation Photosynthesis Model (VPM), significantly outperformed other satellite measures in explaining global patterns of species richness. These GPP-derived DHIs captured up to 84% of the variation in amphibian richness and 82% across all taxa. Compared to indirect measures like NDVI and fraction of Absorbed Photosynthetically Active Radiation (fAPAR), GPP provides a more direct indicator of available energy, environmental stress, and ecosystem stability—three key drivers of species diversity. Importantly, satellite-derived DHIs showed strong alignment with in-situ measurements from 124 FLUXNET sites worldwide, validating their accuracy. Protected areas were found to have higher cumulative and minimum productivity with lower variability, suggesting superior habitat quality. This confirms the utility of DHIs as practical, scalable tools for global biodiversity assessment and conservation planning.

"Our study bridges satellite remote sensing and biodiversity science in a practical way," said Prof. Xuanlong Ma, corresponding author at Lanzhou University. "By validating satellite-derived habitat indices with ground-based flux tower data, we show that it's possible to monitor global biodiversity patterns more accurately and cost-effectively. These tools can support urgent conservation efforts worldwide, especially in areas with limited field data. With more advanced satellite missions coming online, we anticipate even finer-resolution biodiversity monitoring in the near future."

With rising concern over biodiversity loss, this research highlights the potential of satellite-based DHIs derived from direct GPP measures as a standard tool for ecological monitoring. Future improvements may involve integrating higher-resolution imagery from emerging satellites, refining algorithms to reduce uncertainty in low-productivity regions, and expanding biodiversity metrics beyond vertebrates. Combining DHIs with other environmental indicators and species occurrence databases could further enhance conservation modeling. As global satellite infrastructure advances, these tools may enable real-time biodiversity assessment, guiding international efforts to protect critical habitats and meet targets under the UN Convention on Biological Diversity.

References
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