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## NASA Biodiversity Working Group Summary:
## Connecting Biodiversity, Geodiversity, and Remote Sensing Across Scales

15-BIODIV15-0016

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Biodiversity is essential for ecosystem functioning and the provisioning of ecosystem services. Currently, global change is threatening biodiversity in many parts of the globe. Thus, a major goal for society is to explain and forecast patterns of biodiversity. A key component of this goal is to determine how geophysical and biological drivers influence biodiversity across spatial and temporal scales – often through modeling. However, current modeling approaches lack crucial information. For example, most models forecasting changes to biodiversity assume coarse-scale climate and weather drivers – temperature and precipitation – are sole drivers and leave out other important geophysical and biological drivers. These drivers are inherently linked because the climate and the structure of the landscape – including the locations of geophysical features, topographic complexity, and habitat patch arrangement – mediate the importance of biological drivers like dispersal ability and biotic interactions (e.g., competition). In addition, the influence of these drivers may change from local to continental-scale biodiversity patterns, and over short vs. long timescales. Finally, different forms of biodiversity including taxonomic, phylogenetic, and functional diversity may exhibit different scaling relationships owing to a range of mechanisms.

**Objectives**: The working group will help fill these research gaps and address the following questions:
(1) How do the relationships between biodiversity and its geophysical and biological drivers change across spatial and temporal scales?
(2) What derived NASA data products at particular spatial or temporal scales would transform the use of geophysical data by biodiversity scientists?

**Scientific advance**: The working group will advance current and future predictions of patterns of biodiversity by identifying appropriate scales of geophysical and biological drivers, which will better align the framework for biodiversity modeling with ecological theory.

The working group will also identify geophysical data product needs and user-friendly data accessibility for the biodiversity science community. A key goal of the working group is to identify derived NASA data products and scales that will be of the greatest use and accessibility to biodiversity scientists.

**Implementation**: The working group will (1) review the state of the art approaches to modeling biodiversity across scales, (2) identify key biodiversity data sets providing in-situ validation of distribution models of biodiversity fit with geophysical and biological drivers at different spatial and temporal scales (e.g., Forest Inventory and Analysis, Breeding Bird Survey), and (3) meet with a wider group of biodiversity scientists to present results of scaling analyses and obtain recommendations for derived NASA remote sensing data products. Proposed outcomes include peer-reviewed publications that present the cross-scale biodiversity modeling analysis and identify remotely sensed products and their spatio-temporal scales that are most useful for biodiversity modeling.

**Significance to NASA**: A broad range of remote sensing products and derived datasets have the potential to be relevant to biodiversity studies, yet only a few are regularly used. In addition to the most common products (e.g., MODIS NDVI, EVI & LAI, Landsat reflectance), biodiversity research could consider climate data from MODIS and GPM, topography from SRTM, and soil moisture from SMAP. Future proposed systems will also be considered (e.g., HyspIRI, GEDI missions). Finally, higher resolution airborne imagery from multi-sensor campaigns (e.g., AVIRIS-NG, LVIS, NEON Airborne Observation Platform) may closely match the spatial scale of species occurrences. The working group will provide detailed recommendations for derived NASA remote sensing data products that will be of greatest use to biodiversity scientists.