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Plenary Symposium 2: Tracking changes from space: Advances of remote sensing in biogeography
Conveners: Mao-Ning Tuanmu, Kate He and Anna Cord

2.1 Remote sensing for biogeography: Networking our future

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Airborne and satellite remote sensing provide observations of key biogeographic patterns at multiple spatial scales. They also provide vital information about broad-scale environmental drivers of these patterns, e.g.: climate, land use, and sea surface state. Evolving remote sensing approaches and increasing computational capacity are greatly enhancing the utility of remote sensing to biogeography. Airborne spectrometers identify canopy vegetation and marine phytoplankton to ecological functional type or species and are now capturing intraspecific variation. Airborne lidars provide three-dimensional views of vegetation structure with implications for habitat characterization. Our current ability to process large volumes of satellite imagery allows development of global satellite products at landscape scale, i.e. with pixel sizes of tens of square meters rather than hundreds of square meters to square kilometers. In parallel with airborne and satellite developments, *in situ* observation approaches offer a suite of techniques to measure biogeographically relevant parameters at organismal scales. Camera traps, acoustic sensors, small drones, and environmental DNA directly observe organism distribution and abundance, as well as behavior. Citizen science can engage legions of new observers in crowdsourcing fine-scale biodiversity observations. Today, our primary challenge lies in creating frameworks for the integration of observations across scales that foster data interoperability and generate inputs for ecological models. Development and improvement of biogeographic models will allow us to understand changes in the distribution and abundance of organisms in relation to changes in climate or human action. Networks of multi-scale observations driving biogeographic models promise a revolution in our understanding and sustainable management of the living world around us.

2.2 Advances in estimating species diversity by remote sensing: a challenge for biogeography

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Many geospatial tools have been advocated in spatial ecology and biogeography to estimate biodiversity and its changes over space and time. Such information is essential in designing effective strategies for biodiversity conservation and management. Remote sensing is one of the most powerful approaches to identify biodiversity hotspots and predict changes in species composition in reduced time and costs. This is because, with respect to field-based methods, it allows to derive complete spatial coverages of the Earth surface under study in a short period of time. Furthermore, remote sensing provides repeated coverages of field sites, thus making studies of temporal changes in biodiversity possible. In this talk I will discuss, from a conceptual point of view, the potential of remote sensing in estimating biodiversity using various diversity indices, including alpha and beta measurements. I will also review case studies that have improved the quality of species distribution models using remote sensing data as predictors. Lastly, I will address the prospective of using spectral information to effectively detect spatial autocorrelation when estimating species diversity among sites.
Keywords: biodiversity; distance decay models; remote sensing; species distribution modeling; spatial ecology

2.3 Benefits of multi-sensor remote sensing and image texture extraction for biodiversity mapping in the High Andes of Ecuador

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The linkage between biodiversity and habitat heterogeneity in forests derived by remotely sensed data is challenging due to multiple vegetation layers. To date, studies using statistical models with either discrete-return Lidar variables

