Paper Number: 5645

Linking spatial and temporal biological diversity to megafan formations using remote sensing techniques space-based technologies

Mills, H.J.[1], and Wilkinson, M.J.[2]

[1] Space Technology and Advanced Research Systems, Inc., Houston Texas, USA hjmills@staars.space
[2] Texas State University, San Marcos, Texas, Jacobs contract, NASA–Johnson Space Center, Houston Texas, USA

Linking past geologic events and current, local biodiversity through the use of space-based observations offers a significant advance in biodiversity prediction at a regional scale. Understanding and predicting biodiversity efficiently, rapidly and remotely becomes important as human populations grow and shift during a period of enhanced climate change. Few places on the Earth have higher levels of biodiversity or remain as remote as the Amazon Basin. Previous biodiversity estimates here described a general northeast–southwest trend in faunal diversity with no commonalities between these regions in the top ten most frequently detected plant species. This large, basin-wide scale shift in diversity was linked to sediment ages and soil composition, with Cenozoic sediments in the northeast and Proterozoic/Paleozoic sediments in the southwest. These large-scale perspectives are the context for finer-scale geographic patterns in soils of similar geologic age that also explain local shifts in biodiversity. Soil type can then be used to predict biological compositions without direct sampling. But soil and topographic variations that are nearly imperceptible on the ground prevent understanding of local-scale shifts in biodiversity.

However, space-based topographic mapping data (SRTM--Shuttle Radar Topography Mission data) has enabled construction of new topographical roughness maps. These maps reveal many geomorphic discontinuities in western and central Amazonia. Combined with space-based infra-red maps and the SRTM topographic data of the region, the roughness maps strongly suggest discontinuities both in soils and sediment geochemical conditions and physical composition over 10^1-10^3 m scales. Based on a world geomorphic survey of megafans—large (>100 km long), fan-shaped, river-generated sediment bodies of very low declivity, processually different from smaller, better known alluvial fans—the Amazonian soil discontinuities are seen to accord with fluvial patterns that are common on megafan surfaces. Detailed topographic mapping based on data from sensors in space can make major strides in explaining changes in soil origin and relative soil age. By developing a space-based model for predicting biodiversity and soil composition, a significant impact on understanding multiple dimensions of biodiversity in the Amazon Basin can be achieved, at scales not physically possible to measure directly.