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Influence of landscape transience on plant biodiversity patterns in the Hengduan Mountains, China

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Mountainous regions are some of the most biologically diverse places on Earth and have exceptionally high rates of endemism. Global biodiversity studies indicate that mountain biodiversity is only partially controlled by global climate drivers and is primarily the result of topographic relief, which amplifies habitat complexity by generating temperature and precipitation gradients. However, climate and relief alone do not fully explain observed patterns of species richness in mountainous regions.

Here, we investigate the plant diversity of the Hengduan Mountains of southwest China, the main biodiversity hotspot outside the tropics, to demonstrate that the generation of this hotspot goes beyond habitat complexity. We mapped species richness patterns for seed plants across the entire Hengduan region and compared them to geomorphic characteristics of the landscape calculated using standard methods of digital topographic (DEM) analysis, including elevation and local relief (5 km radius). As we hypothesized, there is a strong, positive correlation between local relief and species richness generally. We also find large spatial anomalies among different families that may be fingerprints of older geologic processes. We hypothesize that other drivers, such as glacier extent, tectonic faults, and river capture, may explain regions of exceptionally high (resp. low) species richness.

To understand which geological events drove seed plant diversification in the Hengduan Mountains, we developed a generalized linear correlation model to determine the component of species richness explained by climate variables. We removed the component of species richness corresponding to contemporary climate and mapped the residuals to determine where climate underpredicts species richness. We correlated this spatial relationship to known geologic events, based on published thermochronological studies, fault displacement history, and glaciations. In particular, this allows the differentiation between diversification in response to late Quaternary climate change and older, tectono-geomorphic events. We examine patterns across different plant families (from lowland to alpine species) and observe similar adaptive patterns in response to

landscape transience.