Incorporating Soil, Geochemistry, and Topography, as well as Climate in to evolutionary models allows the identification of adaptive processes in plant diversification

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Soil, geochemistry, and topography are well known to be highly influential in mediating the diversity and distributions of many organisms, especially plants. But the data to explore these associations have typically been less accessible to biologists than climate data (e.g. via WorldClim).

Using recently available global SoilGrids250, USGS geochemistry data, and AdaptWest land facets we show that substrate plays a significant role in explaining much of the species composition and turnover (beta diversity) in the North American daisy family (Compositae).

Identifying which variables are significant and incorporating them into evolutionary and niche models allows us to identify previously obscured evolutionary processes. For example we show that similar morphotypes within the Hawaiian Silversword group of plants have evolved in parallel to occupy analogous environmental niches (common adaptive peaks), patterns that had been elusive under climate-only models. This highlights the importance of considering multiple forms of environmental data when exploring biological processes, and in continuing to work towards making harmonized, easily accessible, and interpretable soil and geochemistry data available for ecological analyses.