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Climate Change impacts on the biodiversity of tropical ecosystems

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Costa Rica's development goals are strongly linked to biodiversity, alternative energy and water. Consistent, nationwide, quality-checked climate data is relatively scarce and well-supported climate change adaptation and policy making remains a challenge. We calculated baseline- downscaled and calibrated climate data in combination with biodiversity indicators such as the Holdridge Life Zones. They can be projected into the future and facilitate decision-making to sustainably manage and protect biodiversity in Costa Rica in future climates. Daily precipitation and temperature climatologies (1971-2018) were produced on a $1km^2$ grid interpolating nation-wide observation station data, employing dynamic and self-selecting Multiple Linear Regression models and inverse distance weighting. The interpolated climatologies were used to further downscale GCM-CMIP5 ensemble data (RCP 4.5) from the Copernicus Climate Data Store that was previously bias-corrected to Hydro-GFD at 50km, to the designated spatial resolution ($1km^2$). Non-parametric quantile mapping was performed and the quantile-quantile relation between the observed and modelled timeseries of each gridcell of the 1971-2000 reference period calculated. The computation of future climatologies (2019-2040) was facilitated by interpolating the robust empirical quantiles of the modelled climate data. The reference and future climatologies allowed for the calculation of the Holdridge Life Zone biodiversity indicator. We could show a significantly increasing temperature trend projected at 1.5°C for the whole of Costa Rica until 2040. The precipitation trend showed generally wetter conditions, in particular in the Caribbean and south Pacific, but no drying in the North of Costa Rica. Shifting Life Zones could potentially occur mostly at climate sensitive high-elevation regions and ecosystems such as Paramos appear to be severely threatened. A projected reduction from 11 to only 6 life zones in the near-future using only a moderate emission scenario already indicated a likely loss of biodiversity. This is most likely attributed to the rising temperature trends throughout Costa Rica.