

Key risks associated with projected climate trends for the 21st-century include the prospects of future climate states with no current analog and the disappearance of some extant climate regimes. Because climate is a primary control on species distributions and ecosystem processes, novel 21st-century climates may promote the formation of novel species associations and other ecological surprises, whereas the disappearance of some extant climate regimes increases the risk of extinction for species with narrow geographic or climatic distributions. Here we analyze multimodel ensembles for the A2 and B1 emission scenarios produced for the fourth assessment report of the Intergovernmental Panel on Climate Change, with the goal of identifying regions projected to experience 1) high magnitudes of local climate change, 2) development of novel 21st-century climates, and/or 3) disappearance of extant climates. Novel climates are projected to develop primarily in the tropics and subtropics, whereas disappearing climates are concentrated in tropical montane regions and the poleward portions of continents. Under the high-end A2 scenario, 12-39% and 10-48% of the earth's terrestrial surface may respectively experience novel and disappearing climates by 2100AD. Corresponding projections for the low-end B1 scenario are 4-20% and 4-20%. Dispersal limitations increase the risk that species will experience the loss of extant climate regimes or the occurrence of novel climates. There is a close correspondence between regions with globally disappearing climates and previously identified biodiversity hotspots; for these regions, standard conservation solutions (e.g. assisted migration, networked reserves) may be insufficient to preserve biological diversity.