

The InSiGHTS modelling framework for projecting terrestrial species distributions based on socio-economic scenarios

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Global change is driving a massive loss and redistribution of biodiversity on Earth. This process is primarily fueled by land-use change — the most significant driver of biodiversity loss in past centuries — and by climate change, which is projected to surpass land-use change in the coming decades. In a world dominated by anthropogenic dynamics, these direct drivers ultimately depend on indirect drivers related to socio-economic trajectories, including changes in production, consumption, trade, and governance. Here, I present InSiGHTS (Integrated Scenarios of Global Habitat for Terrestrial Species), a modelling framework that projects how socio-economic trajectories affect the distribution of terrestrial species through the direct impact of land-use and climate change on species-specific habitat availability. Developed in my laboratory over the past 15 years, InSiGHTS combines climatic suitability envelopes based on climate projections with models of species' area of habitat derived from land-use projections. By using species traits to modulate responses to change, the framework produces species-specific maps of potential future distributions under various global change scenarios. Past research using InSiGHTS has demonstrated that societal decisions can make a substantial difference in the trajectories of terrestrial species distributions globally. While sustainability pathways can limit further habitat loss, species are projected to continue declining even under the most optimistic climate scenarios; thus, 'bending the curve' of biodiversity loss appears unlikely. Further scenario development is ongoing with InSiGHTS to explore the potential effects of the most recent models based on the IPBES Nature Futures Framework.