

Biodiversity-adjusted sovereign credit ratings

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The economic effects of climate change and biodiversity loss threaten sovereigns' ability to service their debt. Markets need credible, digestible information on how these threats translate into material financial risks. Countries' access to finance is mediated by sovereign credit ratings. Yet methodologies published by leading credit rating agencies do not explicitly incorporate biodiversity and nature-related risks. Omitting them may ultimately undermine market stability.

Matthew Agarwala, Matt Burke, Patrycja Klusak, Moritz Kraemer and Ulrich Volz (2022), in “[Nature Loss and Sovereign Credit Ratings](#),” estimate how credit ratings may develop under three increasingly devastating scenarios of nature loss. Under the most severe scenario, 58% of the sampled sovereigns would face a downgrade of one notch or more in their credit ratings by 2030. Annual interest payments of \$28-53 billion would have to be borne by these downgraded states.



The methodology is based on earlier work by **Patrycja Klusak et al.** (2021), “[Rising temperatures, falling ratings: The effect of climate change on sovereign creditworthiness](#),” which follows three steps. First, the authors train a random forest model on historical data to replicate sovereign ratings issued by S&P for more than 100 countries between 2015 and 2020. Their model of credit ratings is then further adjusted for climate change using the outputs from a climate-economy model run for multiple policy and warming scenarios (Kahn et al. 2021, see below).

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Finally, the authors calculate the additional cost of corporate and sovereign interest payments that can be attributed to climate-induced sovereign downgrades. E.g., under the worst-case scenario (RCP 8.5), climate change could increase the annual interest payments on sovereign debt by \$137-\$205 billion USD and on corporate debt by \$35.8-\$62.6 billion USD. Stringent climate policy consistent with limiting warming to below 2°C could nearly eliminate the effect of climate change on ratings.

Granular estimates of GDP growth response needed

Country-level GDP responses to climate change and nature loss are key to this exercise. Global Integrated Assessment Models (IAMs) are less useful in this regard, due to their high level of spatial aggregation. A younger strand of research combines climate data with long-run macroeconomic analyses to provide detailed relationships between temperature and GDP growth at the country-level.

Matthew E. Kahn et al. (2021), in [“Long-term macroeconomic effects of climate change: A cross-country analysis,”](#) develop a stochastic growth model that links deviations of country-specific climate variables from their historical norms to GDP growth. The authors compile a new panel consisting of 174 countries over the years 1960 to 2014. They find that output growth is adversely affected by persistent changes in the temperature above or below its historical norm (but not for precipitation). Following RCP 8.5 would reduce world real GDP per capita by more than 7 percent by 2100. The novel contribution of their climate-economic model is that it anticipates economic losses for countries at all development levels.

For the biodiversity-adjusted credit ratings, which require figures of GDP per capita and GDP growth arising from nature decline, the authors take estimates from the World Bank’s model, developed by **Justin Johnson et al.** (2021), on [“The Economic Case for Nature: A Global Earth-Economy Model to Assess Development Policy Pathways.”](#)



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