Climate-nature scenario development for financial risk assessment

Presentation of Final Results – Executive Summary

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Executive summary

The degradation of nature, including biodiversity loss, is a substantial threat to humanity, the economy and financial stability. Growing evidence shows that nature degradation poses a significant material risk to the real economy and financial institutions. The work of financial institutions to date has largely focused on climate, firmly establishing the relevance of climate-related risks for central banks and financial supervisors. It is imperative, however, that forward-looking risk assessments adopt an integrated approach, encompassing both climate and nature-related aspects, in order not to underestimate financial stability risk. A crucial step for financial stakeholders is to gain a comprehensive understanding of these integrated climate- and nature-related economic and financial risks through scenario development.

In response, the Potsdam Institute for Climate Impact Research (PIK), European Central Bank (ECB) and NatureFinance, have partnered to explore the feasibility of an integrated climate-nature scenario framework. The project marks evolving efforts to develop integrated scenario narratives and showcase their implications through a sophisticated modelling infrastructure that combines macroeconomic and biophysical models. The central question the partners sought to answer was whether integrating climate and nature-related risks into scenario analysis would yield a materially different assessment of these risks. The preliminary answer is a resounding yes. The findings confirm that an integrated approach to climate-nature scenarios provides a more nuanced and comprehensive understanding of biophysical and economic risks compared to analysing these factors separately. The integrated approach reveals material differences in estimated risks under varying climate and nature policy scenarios. In particular, the project shows that while integrated climate-nature policies still present risks, these risks are less pronounced than in scenarios where climate and nature are subject to siloed policies. These findings suggest that integrating nature and climate risks is not only an urgent priority for the risk assessment scenarios used by central banks and financial supervisors, as recommended by the Network for Greening the Financial System (NGFS), but also for broader policymaking and regulation aimed at guiding financial and economic transitions.

This project makes a signature contribution to the emerging field of advanced scenario development by building integrated climate-nature scenario narratives and a sophisticated modelling infrastructure. It demonstrates that the approach of modelling nature and climate risk together in scenario development is feasible and delivers a more rigorous and comprehensive scope of potential risks than existing approaches. The climate-nature scenario narratives build upon the established NGFS climate scenarios and align closely with its newly established recommendations for nature-related scenario development. By integrating existing climate and nature policies and ambitions in different combinations within scenario narratives, our framework simulates potential transitions to achieve specific environmental targets. This allows us to explore diverse pathways and outcomes that could arise from varying policy ambition, offering a comprehensive assessment of the interconnected risks and opportunities associated with both climate and nature protection.

The climate-nature scenario modelling framework focuses on modelling economic risks for the agriculture and land use sector globally from 2020 to 2050. This sector is chosen due to its direct dependencies on various Nature's Contributions to People (NCP) factors. Consequently, modelled changes in land degradation and NCPs are expected to significantly impact this sector. The developed modelling framework uses a wide range of spatially variable biophysical and socio-economic information to derive various indicators of physical and transition risks. **Within the framework, we assess the degradation of ecosystem services, focusing on two key NCP indicators: pollination insufficiency and soil erosion.** These two NCPs were selected due to robust scientific understanding and the availability of comprehensive, global data that underscore their critical role in agricultural production.

While this project marks significant progress in developing an integrated framework, there are several limitations to the modelling and its underlying assumptions. The model primarily focuses on the agricultural and land use sector, limiting its ability to capture the full propagation of climate and nature-related risks throughout the whole economy. **The exclusion of extreme weather events such as floods and droughts, as well as feedback effects of degraded ecosystem services on climate change and agricultural production, likely result in an underestimation of risks.** Additionally, the model relies on assumptions that may themselves become disrupted due to climate change and biodiversity loss, as well as other unpredictable factors. For example, it treats demand for agricultural commodities as inelastic and uniform across different income groups. This might lead to underestimating the socio-economic impacts of modelled risks on heterogenous households. Moreover, the modelling is constrained by its inability to capture local variations in certain transition risk indicators due to a lack of granular data. This shortfall prevents a full reflection of how transition pathways impact different sub-regions, potentially leading to underestimations of localised risks and impacts. Overall, this means that while modelling and related scenarios from this project help us to better capture and understand the scope of increased risks presented by integrating climate and nature, we are likely underestimating those risks overall due to a number of data and methodological challenges and contextual uncertainties.

Our research marks an important step towards developing a comprehensive quantitative risk assessment framework by illustrating the interconnectedness of nature and climate policies. Crucially, our findings indicate that **the business-as-usual scenario lacking both effective climate and nature protection measures leads to significant biodiversity loss and degradation of ecosystem services.** These insights hold true both globally and in the European Union, particularly in the context of land use. Furthermore, **climate protection alone does not safeguard biodiversity.** The scenario focused purely on climate policies may inadvertently create risks to biodiversity through interventions such as large-scale afforestation and monoculture bioenergy production. This underscores the need for dedicated nature protection measures alongside climate policies. Moreover, our findings reveal that the **climate-only scenario presents significant economic risks to the agricultural sector.** The risks stem from the abrupt and delayed implementation of climate mitigation policies, coupled with the introduction of greenhouse gas emission pricing for agricultural activities, which together result in substantial increases in production costs.

Key findings reveal that an integrated climate-nature equilibrium scenario promotes the strongest long-term agro-economic stability and sustainability by using resources efficiently and minimising environmental degradation. This is achieved through the synergistic effects of climate and nature policies. **These not only reduce greenhouse gas emissions while preventing biodiversity loss, but also enhance ecosystem services such as pollination and soil stability.** Our findings underscore the critical role of timely nature conservation efforts. By establishing biomes that enhance terrestrial carbon storage by 2030, the physical and transition risks associated with delayed climate action can be partly mitigated, paving the way for achieving long-term climate goals. Additionally, despite the need for investments in advanced technologies and infrastructure to increase agricultural productivity, the integrated scenario avoids substantial increases in production costs and prices of agricultural products. The incorporation of nature protection policies acts as a buffer against the cost of climate measures. Therefore, the integration of climate and nature protection measures reveals both trade-offs and synergies.

Financial institutions have made noteworthy progress in quantifying climate risks. Leveraging this knowledge can accelerate the adoption of enhanced climate-nature risk management frameworks. A determined effort is needed to connect this progress with emerging knowledge and data in the nature risk domain. This study offers foundational insights for central banks and financial regulators on the critical importance of understanding the connections between climate and nature policies when assessing future financial risks, and how to begin making those connections in practice. It highlights the critical role of biodiversity, soil health, and pollination in supporting European and global economies. The transition risk indicators in this report provide valuable insights into how policy ambitions affect land use and macroeconomic factors such as food prices. They are essential tools for evaluating the complex interdependencies between these policies and economic stability. By developing a comprehensive understanding of these interdependencies, policymakers can identify areas that require action and then implement suitable environmental and sectoral policies.

For financial policymakers, the report underscores the need for innovative modelling solutions, such as sensitivity analyses of banks' portfolios to biodiversity loss, in order to translate these findings into actionable, policy-relevant information. This is critical for developing robust financial policies that can address the risks posed by biodiversity loss and climate change, thus ensuring stability and resilience in the economy and financial system. Without adopting these integrated scenarios and increasingly deploying them through real time supervision and related requirements from financial institutions, central banks and financial supervisors risk running afoul of their mandates in pro-actively monitoring and addressing financial stability risks.

Creating a comprehensive nature-related stress test in the future will require an economy-wide modelling approach to assess financial risks associated with environmental changes. Further research is needed to develop dedicated financial tools to quantify physical and transition risks, contagion within the financial system, and the impact of the financial system on nature. The research should focus on improving modelling approaches to integrate diverse ecosystem services, addressing uncertainties in climate-nature dynamics and tipping points, and assessing the impact of degraded ecosystem services and natural capital on crop yields. Furthermore, expanding the modelling of the effects of climate and nature-related risks beyond agriculture is crucial to understanding economy-wide risks across sectors. This important step will enable models to quantify and assess the risks for the financial sector and develop resilient financial policies.

It is important, however, to recognise that waiting for exhaustive modelling is not necessary. Urgent action is needed by central banks and financial supervisors as delays could lead to further irreversible environmental damage. It is crucial for these actors to adopt heuristic approaches using existing knowledge, allowing them to act now, despite ongoing uncertainties and modelling challenges. This approach facilitates improvement and integration of new insights over time, rather than waiting for an all-encompassing model. The insights from this report provide a vital foundation for both immediate action as well as the continuous development of modelling frameworks, enabling financial supervisors and policy-makers to better address the deeply intertwined threats posed by global warming and ecosystems collapse.