

Climate-proofing the National Flood Insurance Program

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Reforms are required to maintain a healthy and robust flood insurance market under future climate conditions for the United States. Therefore, policymakers should implement premiums that reflect flood risk and incentivize household-level risk reduction, complemented with regional flood adaptation investments.

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The policy problem

Flood damage in the United States is expected to rise in the future due to climate change, population growth and economic growth in floodplains. One way to offset future flood damages is through proper insurance coverage. The main provider of flood insurance in the United States is the federally run National Flood Insurance Program (NFIP), a currently financially unsustainable insurance programme in substantial debt. Moreover, the NFIP insufficiently incentivizes policyholders to undertake flood risk reduction measures to limit flood damages, because insurance premiums insufficiently reflect flood risk and do not reward risk reduction actions satisfactorily. To address these issues, the NFIP is underway with implementing the Risk Rating 2.0 program, which aims at better premium differentiation through risk-based premiums and enhanced incentives for individual policyholder flood risk reduction. It is unknown whether these reforms are sufficient for future 'climate-proofing' of the NFIP or whether additional investments in flood protection are needed.

The findings

We show that risk-based premiums, which are spatially explicit on a household level, result in decreases for some households but substantial increases for others. Importantly though, we observe that offering premium discounts to incentivize building-level risk reduction measures decreases total residential flood risk across the United States by approximately US\$1 billion per year (–7.3%) by 2050 (Fig. 1). Combined, introducing risk-based NFIP premiums that incentivize household risk reduction will yield a positive societal net benefit (US\$10 billion in 30 years). Complementing this reform with pro-active government investments in large-scale flood protection yields an even higher overall societal net benefit (US\$26 billion in 30 years). In conclusion, to fully minimize future flood risk, investments in large-scale flood protection

are required in addition to NFIP rating reforms. Whereas our study specifically focusses on the United States, the concept of incentivizing risk reduction through risk-based pricing is highly relevant for adaptation planning globally.

The study

The study applies an innovative flood risk model that not only simulates coastal and fluvial flood occurrences and damages moving forward in time to 2050 for the conterminous United States, but also simulates government and household adaptation decisions interacting with the dynamic flood risk through their decisions on insurance purchase, building-level risk reduction and larger-scale protection for different climate scenarios. Floods are simulated stochastically based on their return period, influencing how households perceive their risk, which might deviate from true risk, and their perceived value of adaptive measures or buying insurance. Furthermore, governments can decide either to proactively (every six years or after a flood event) or reactively (only after a flood event) invest in regional flood protection infrastructure. In turn, these government investments will influence the flood insurance demand and risk reduction actions of homeowners.

Messages for policy

- Charging flood insurance premiums that reflect true flood risk incentivizes flood risk reduction by policyholders, thereby reducing residential flood risk across the United States moving forward in time.
- Risk-based premiums introduce substantial heterogeneity in premiums at a localized flood risk scale, which is beneficial for some households but implies unaffordability for others.
- The combined effects from introducing risk-based premiums to incentivize individual building risk reduction results in a positive societal impact.
- Complementing risk-based premiums with large-scale, regional adaptation investments by the government results in the highest societal benefit.
- Investing in flood protection infrastructure will reduce some of the equity issues that arise when solely moving to risk-based premiums.

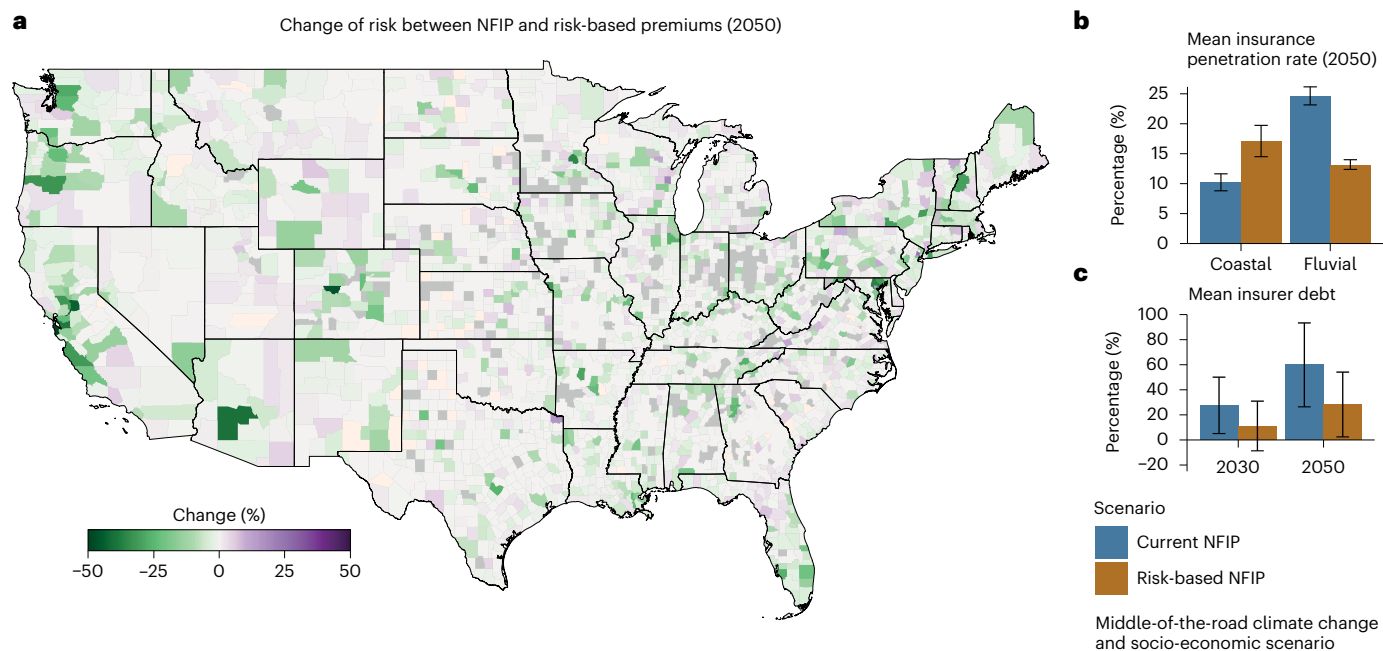


Fig. 1 | Effects of NFIP reform. a, Effects of moving NFIP premiums to risk-based premiums in terms of expected changes in residential flood risk by 2050, visualized as the mean percentage change on a county level. **b**, The mean change in insurance penetration rates between coastal and fluvial risk areas. **c**, NFIP debt

might still increase despite risk-based premiums (although at a lower rate than under current conditions). Error bars indicate the standard deviation. Publ. note: Springer Nature is neutral about jurisdictional claims in maps.

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Competing interests

The authors declare no competing interests.