

## Modernizing Post-NFIP, Climate-Change Flood Risk Management

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The recent forewarning by Moody's Investor Services, Inc. of climate change impacts on credit is a resounding alert that the sustainability stakes facing floodplain communities are poised to escalate dramatically. For half a century the National Flood Insurance Program (NFIP) has been the dominant framework for understanding and managing flood financial risk. But regardless of how the pending NFIP reauthorization plays out, that framework is woefully obsolete and counterproductive to meeting climate change threats. Thankfully, a major transformation is underway to modernize flood financial risk management. *To enhance sustainability, floodplain communities must embrace this post-NFIP approach.* First, let's get comfortable with the word "actuarial."

As long as there has been a desire to preserve and grow wealth, there has been consideration of risk. "Actuarial" refers to a branch of statistics that rigorously analyzes hazards and the odds of various harms. Actuarial analysis can be traced to the aftermath of the Great Fire of London in 1666. Centuries of progress have improved actuarial analyses for a variety of natural hazards—in addition to fire these include wind, lightning, hail, extremes in temperature and precipitation, and earthquakes. Today's actuarial analyses are highly sophisticated—employing "Big Data" and "Supercomputers" in detailed scientific investigations on the nature of hazards and in quantifying how various factors contribute incrementally to greater size and probability of loss. Besides financial loss, actuarial analysis is also used to study chances of death, illness, and injury associated with many conditions and activities.

With respect to financial risks, actuarial analysis produces reliable estimates of the total cost of losses for a large group with diverse exposures, over a long time. Very usefully, these projected long-term costs can be converted to an equivalent annual steady stream of dollars or a present lump sum value. Individual annual or lump sum cost can also be derived, reflecting the predictable effects of particular known exposure factors. Notably, estimates of individual versus aggregate financial risk have greater uncertainty, as the latter average the random aspects of individual risk over a large group.

Private insurers conduct actuarial studies to forecast claims and to develop a range of policies based on gradations in exposure factors, with income from premiums sufficient to cover claims. State insurance commissions conduct them to oversee insurance markets—to assure the financial soundness and stability of firms, ample competition and choice in policies, and fair premiums. Government assistance programs (Social Security, Medicare, Medicaid, Affordable Care, etc.) employ actuarial studies to estimate future payouts. And creditors rely on actuarial analysis to assess repayment risks.

By clarifying financial risk, modern actuarial analysis aids decisions about risk taking, mitigation, and insurance—and stimulates the development of better mitigation and insurance options. An obvious example is improved private and community fire protection decisions: including building designs and materials, codes, water infrastructure, and firefighting. The density of fire hydrants is optimized through actuarial analysis. Similar advances apply for wind risks. Actuarial analysis benefits our economy—and the quality of our lives—by simultaneously lowering losses and wasteful risk management, which allows more productive investment of limited resources.

Unfortunately, unlike fire and wind, for a long time flood risks in most places were not amenable to rigorous scientific and actuarial analysis. This, combined with the difficulty in assembling large diversified pools of insurance participants, led Congress in 1968 to create the NFIP. With detailed, full frequency spectrum flood hazard information largely unavailable, Congress opted to base the NFIP on estimating a *single flood probability threshold*. The threshold selected was the so-called 100-year

flood—the water level at a location expected to recur at 100-year intervals *on average*, (equivalent to a one percent annual chance). This threshold was thought to be reasonable for encompassing all property with high to moderate flood risk.

Congress authorized the NFIP to assist participating floodplain communities in mapping their 100-year flood hazard area. Over the ensuing five decades these NFIP 100-year flood maps became the driving framework for nearly all public and private flood financial risk management across the nation. They have been used to require/promote insurance participation, to set insurance prices, and to target flood loss mitigation measures—ranging from buyouts of flood-prone homes, to local development and building codes, to multibillion-dollar federally-supported flood protection projects.

However, what seemed like a pragmatic way to frame flood financial risk and initiate flood insurance 50 years ago has ossified into a false binary: step barely across/above the supposed bright line marking the NFIP 100-year flood zone and most people naively assumes there is *no* flood risk, flood related building codes are not necessary, and property-secured loans do not require flood insurance. In addition, under this framework, mitigation is overly focused on just the 100-year flood.

What the NFIP framework ignores is the simple fact that the odds of a flood with seemingly low single year probabilities grow substantially for longer, multi-decadal exposure. Over a typical 30-year mortgage, 30 repeated chances raise the odds from one-in-a-hundred for any given year to more than one-in-four for the full period. Over a 30-year period, the odds of a 500-year flood are one in seventeen—similar to those for rolling eleven with a pair of dice. The odds are even higher for a 1,000-year flood occurring over a lifetime.

Over longer risk horizons, areas well outside/above the NFIP risk threshold have significant flood probability. Proper flood risk management must address multi-decadal exposure and these more remote flood hazards. In addition, proper flood risk management must consider climate cycles—years with extreme floods clustered together—as well as long term natural and anthropogenic climate trends.

With the NFIP's oversimplification of risk, floodplain community growth has actually been incentivized to the margin of the 100-year threshold. The danger is exacerbated by false confidence in often outdated—and *moreover inherently imprecise*—maps of a single line. The consequences of the NFIP-driven distortion of flood risk and mitigation efforts have been repeatedly revealed with extensive, massive, uninsured flood damages outside mapped 100-year flood zones. The pending NFIP reauthorization will not fix this false binary and false confidence, the inflated value of development at the 100-year hazard margin, and the associated flood risk mismanagement.

But outside the purview of the NFIP things are changing. Remarkable advances in flood simulation technology now allow rigorous investigations into the full-spectrum of local 10- to 10,000-year hazards, enabling actuarial analysis of flooding to catch up with those long done for fire and wind. For businesses facing million-dollar exposures, projecting the chances for various flood damages and related expenses, and then estimating annualized cost, is becoming routine. These businesses together with their creditors and insurers are carefully examining flood risk for a wide range of scenarios, including climate change and mitigation options, to support better facility valuations and investment decisions. Just as they do with fire, wind, and other sources of financial risk.

Recently, private actuarial analysis of flooding has started to appear in the home market, especially in areas where the NFIP overestimates risk, overprices insurance, and/or underserves demand for more coverage options. The increasing availability of attractive, private flood insurance policies is stirring home owner interest in actuarial cost, which will accelerate with the pending removal of several legal barriers. At the same time, rising flood risk precipitated by climate change is rousing home buyer demand for better flood risk cost information. Home buyers naturally want to know property-specific flood risk costs—just as for they do for reroofing, central heat/AC upgrade, and other potential big ticket

items. Soon commercial websites will provide crude estimates of the annual (or lump sum) cost of property flood risk. And, as Moody's has announced, municipal bond markets will also soon be looking closely at the full community-wide actuarial flood cost—together obviously with the extent of community flood insurance coverage—to evaluate local government credit worthiness.

To best meet sustainability challenges, floodplain communities should expedite sound flood actuarial information and broad insurance participation through four simultaneous, synergistic steps:

1. Accept accountability for accurate local flood risk information—just as for fire risk. Complete high resolution full-spectrum flood hazard studies and then use these to provide an online parcel-level *Real Flood Risk Calculator*. Such a tool would allow the public to adjust flood actuarial cost estimates for property-specific details and depth-damage characteristics; key assumptions; scenarios for rising sea level and rainfall intensity; inclusion of indirect losses; and uncertainty.
2. Work with insurance regulators to stimulate a range of private actuarially-based flood insurance policies to address varying risks and preferences, as well as to enhance oversight of providers.
3. Work with financial regulators to eliminate the use of arbitrary flood hazard thresholds in credit decisions, and to require flood insurance for all property-secured loans with notable flood risk.
4. Explore ways of nudging all property owners and renters to carry flood insurance, which facilitates a fair sharing of responsibility for community flood resiliency.

Unfortunately, floodplain communities tempted toward the misguided and unsustainable path of denial and delay will be over-punished in the post-NFIP reality. Misinformed markets will no doubt overestimate flood risks, overprice insurance, and contribute to a spiral of excessive property devaluation, borrowing costs, and uninsured risk. For communities in moderate hazard areas—which could largely adjust to real actuarial flood costs—inflated actuarial flood costs would cause needless substantial economic harm.

Real actuarial cost information will enable more effective and efficient flood protection—just as it has for fire protection. Post-NFIP flood risk management will:

- Spur smarter land development and building practices accounting for full actuarial flood costs.
- Improve community planning for growth and infrastructure, and ensure proper review and control over impacts to existing neighborhood flood actuarial costs.
- Lower floodplain municipal borrowing costs—compared to not modernizing flood risk management.
- Better optimize public flood mitigation—stronger building elevation and flood-proofing codes; greater neighborhood stormwater detention; protection of key community assets; and investment in drainage systems, reservoirs, levees, etc. These efforts can be coordinated at appropriate watershed scales to maximize regional benefits and prevent adverse impacts. Truly viable flood reduction projects can be defined and implemented—with funding commitment on the part of project beneficiaries, particularly citizens with reduced flood insurance costs. And projects can target the best flood mitigation bang for buck, not an arbitrary flood threshold.
- Reduce costs for disaster response and recovery from unreasonable flood exposure.
- Clarify the true costs and benefits of government subsidies in flood insurance, mitigation, and disaster recovery, aiding prioritizing assistance to the most equitable and sustainable purposes.

Embracing the post-NFIP reality is the foundation for both personal and community flood resiliency. Modernized actuarial flood risk management won't be perfect—it does not simplify solutions for high hazard areas. But it will be progress—and it will be paramount for meeting climate-change flood threats.