Real Flood Risk: *The Grassroots Revolution*

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Background

Population, commercial, and industrial development has always been concentrated along coasts and rivers. In the US, flood risk affects a significant share of homes and businesses—and the economies—of these regions.

As we see with every major flood disaster, most citizens live in total ignorance of their REAL risk to extreme floods—(see *The Flood Risk Game*). Even many business and community leaders, and managers of critical infrastructure, are surprisingly under-informed. As a result, they do not make good flood risk management decisions and they do not demand effective flood risk management tools.

The nation's individuals, businesses, and their government currently manage property flood risk largely through a combination of:

- Coverage under the National Flood Insurance Program (NFIP)—since its inception the dominant source of flood damage coverage for residences and small businesses. The NFIP primarily relies on maps of a single hazard level—the 100-year flood—to set premium costs. Mortgage borrowers for homes exposed to the 100-yr flood are required to carry flood insurance.
- Private flood insurance—for higher residential and business coverage amounts not provided under the NFIP. Historically lenders have set insurance requirements, and insurance firms have set premiums, based on the NFIP 100-yr flood exposure.
- Self-insurance—lenders have historically not required home buyers and businesses located above the NFIP 100-yr flood to buy flood insurance. Furthermore, homeowners and businesses with 100-yr flood exposure who do not have a mortgage/loan often choose not to buy flood insurance.
- Local land development regulations—required of communities as a condition for participation in the NFIP, typically to prevent/reduce exposure to the 100-yr flood.
- Flood disaster recovery aid to property owners—typically very limited and for rebuilding above the NFIP 100-yr flood.
- Local, state, and federally funded flood mitigation projects and resiliency programs—including everything from drainage improvements to massive levees and river diversions. Most of these are focused strictly on reducing the NFIP 100-yr flood in target areas.

The NFIP and its delineation of the 100-yr flood are thus crucial to all of these forms of flood risk management. However, the NFIP drastically distorts perceptions of ***Real Flood Risk*** by:

- Placing excessive emphasis on mapping a single flood hazard—the 100-yr—resulting in a pervasive false binary: areas within the 100-yr flood zone have flood risk, those outside do not. This false binary is reinforced by the current lender practice of requiring flood insurance only for properties with exposure to the 100-yr flood.
- Relying on decades-old, obsolete maps of the 100-yr flood zone.
- Not indicating that there are large uncertainties in estimates of the 100-yr flood—even for the most recent maps.
- Under-pricing premiums in many high risk areas and over pricing them in others.

These distortions lead to monstrously counterproductive property valuations, land development, and infrastructure investments. Case in point: the expansion of bedroom communities into marginal floodplain areas around Baton Rouge Louisiana. The August 2016 Flood in this region resulted in the 4th largest number of claims in the history of the NFIP—but the majority of flooded homes and businesses

were not insured under the NFIP. This *man-made* disaster has not only displaced tens of thousands of families, it has cost the region billions of dollars in insurance compensation.

Over the last decade ***Real Flood Risk*** throughout the nation's coasts and in river floodplains has accelerated due to the NFIP's stimulation of development in marginal flood prone areas. With increasing recognition of the impacts of climate change, rising ***Real Flood Risk*** is being documented by the media—along with the failure of the NFIP to address it. (See: http://www.nytimes.com/2016/11/24/science/global-warming-coastal-real-estate.html?_r=0 .)

The Grassroots Revolution

In the face of these challenges, some property owners and insurance underwriters with significant flood exposure—in concert with a few private consulting firms—have begun a grassroots effort to develop better flood hazard information and risk management tools. They are capitalizing on four dramatic advances in *state-of-the-art* flood hazard analysis over the last twenty years:

1. Realistic, *high resolution models* of riverine and coastal flooding;
2. High resolution *Big Data* Geographic Information Systems to drive the models;
3. *Statistical methods* to address factors influencing flood probabilities and uncertainties; and
4. *Supercomputers* to simulate thousands of high resolution statistical scenarios.

Notably, for the first time, the state-of the-art facilitates examining a wide range of flood frequencies—return periods spanning 10 to 10,000 years, (or annual exceedance probabilities of 10 to 0.01 percent). By comparison, this kind of crucial *full-spectrum* hazard information, with uncertainties, has been available for decades for precipitation and wind (see Figure1).

While the NFIP has not kept pace with the state-of-the-art, innovative private firms adopting these advances are vastly upgrading the scope and quality of flood hazard analyses (see Figure 2).

Importantly, as shown in Figure 3, *full-spectrum* flood hazard analysis finally enables sound, standard, actuarial estimates for the cost of flooding over the life of a property/facility. These, in turn, enable estimates of ***Real Flood Risk***: *the equivalent Expected Annual Cost and Present-Value (PV)*. ***Real Flood Risk*** information now allows businesses to optimize their property-specific flood risk management decisions, flood insurance plans, and ultimately their fundamental business investments. Consequently, private flood insurance underwriters (see Figure 4) are also starting to use *full-spectrum* hazard analysis to serve clients with these needs.

Some private flood insurance underwriters naturally are using the new hazard analysis techniques to actively seek out markets in which the NFIP currently over-prices ***Real Flood Risk***. In addition, whole communities that question their flood risk pricing under the NFIP's antiquated approaches are pursuing re-evaluations and exploring alternative community flood insurance programs (https://californiawaterblog.com/2016/12/14/california-flood-risk-and-the-national-flood-insurance-program/).

In the future, some enterprising firms will provide websites (analogous to Carfax and Equifax) with *full-spectrum* flood hazard estimates for residential property—along with ***Real Flood Risk***. Flood costs for any address will be developed by mining data readily accessible on *the Cloud*. One can easily foresee a cell phone "App" that estimates the flood risk Present Value—*i.e., the "markdown"*—for any house, with options to adjust various assumptions and uncertainties, and to view current costs of NFIP and private flood insurance premiums. (Again, see *The Flood Risk Game*, attached.)

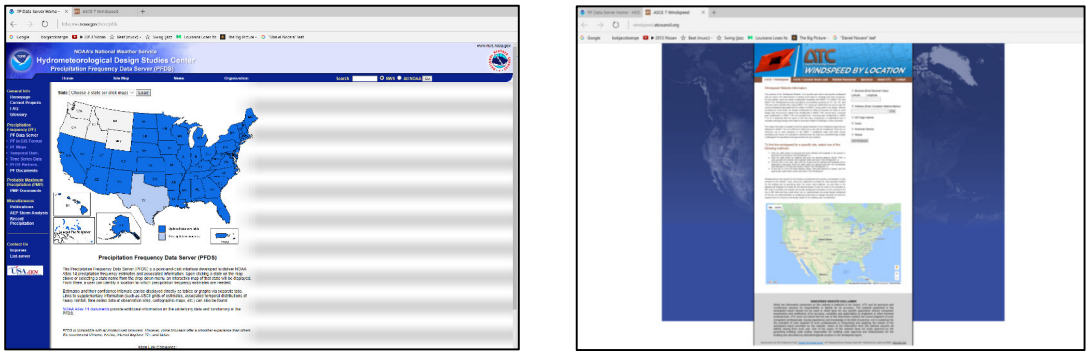

Figure 1. Examples of *Full-Spectrum* Information for Precipitation and Wind Hazards

Figure 2. Examples of Private Firms Beginning to Offer *Full-Spectrum* Flood Hazard Analysis

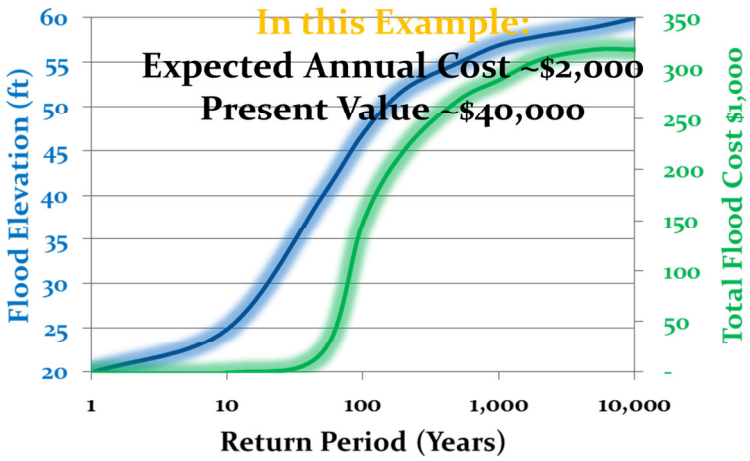

Figure 3, Example of Full-Spectrum Flood Hazard and *Real Flood Risk*

For a specific property with illustration of uncertainty bands. Total cost reflects damage to structure, contents, utilities, automobiles, etc.; lost income; temporary relocation; related health expenses; and other expenses.

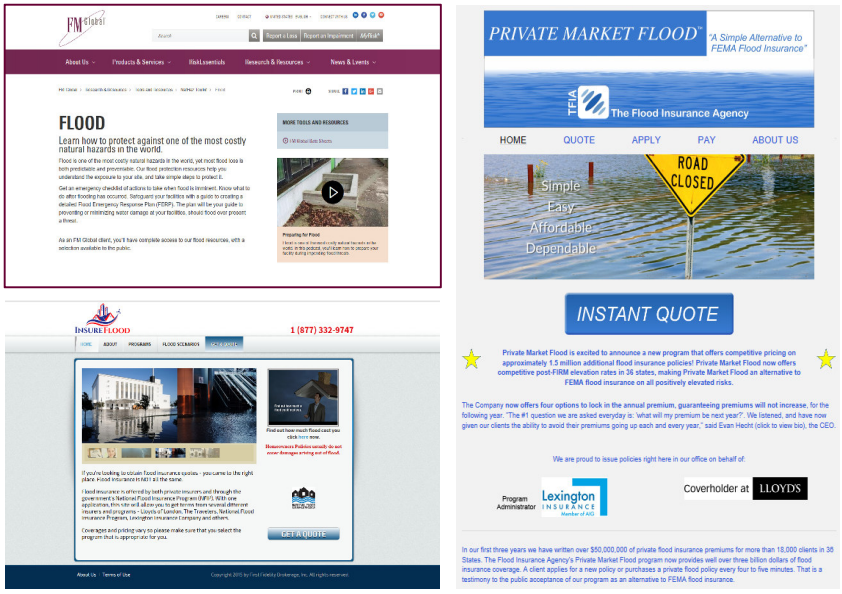

Figure 4. Examples of Private Flood Insurance

Implications of the Grassroots Revolution

The grassroots revolution will contribute to a vociferous debate during the 2017 NFIP reauthorization. The rising capacity for *full-spectrum* flood hazard analysis and ***Real Flood Risk*** valuations will lead many in Congress to champion the private flood insurance market and its capability to become increasingly efficient with diverse and refined products. Many will argue the benefits of maintaining a "single-payer" NFIP. Currently it appears inevitable that Congress will set a path towards greater privatizing of flood insurance, which will ultimately reorient the NFIP as "an insurer of last resort" for poorer communities in extremely high hazard areas.

With impending *full-spectrum* flood hazard analysis, ***Real Flood Risk*** valuations, and flood insurance privatization, the home mortgage *and commercial* banks will be moved to modify lending rules: to require all borrowers located near river and coastal floodplains to buy coverage for the *full-spectrum* of flood hazard—just as they do for wind hazard.

In the coming years, transformation in flood risk management will be the overriding issue for coastal and riverine communities. High hazard communities are already starting to confront expectations of escalating premiums and plunging property values. (See: https://www.bloomberg.com/view/articles/2016-11-29/the-areas-america-could-abandon-first .)

Faced with more clearly defined ***Real Flood Risk***, floodplain communities will pursue a host of initiatives, such as:

- New studies to correct perceived overestimates of flood hazard;
- Tighter regulation of private flood insurance companies to ensure fair premiums;
- Elevation and relocation assistance to vulnerable residence owners and renters;
- Increased regulation of development, including greater onsite rainfall detention;
- Flood control projects with positive benefit-to-cost ratios.

While floodplain communities will actively seek more federal support for such initiatives—as well as continuation of federally subsidized flood insurance—local cost shares will balloon.

Key economic and societal feedback loops will further accelerate the transformation. Communities with low flood risk will aggressively promote their attractiveness for growth and development. Advocacy organizations with agendas supportive of the transformation—such as environmental NGOs—will boost efforts to analyze full-spectrum flood hazard and ***Real Flood Risk*** in order to reduce riverine and coastal development; to revisit the benefit-to-cost ratios for controversial projects; and to increase investments in "green" flood mitigation, (for example, see http://livingwithwater.com/).

As populations and investments shift to accommodate this large-scale and rapid revolution in property flood risk management, there are certain to be widespread major economic impacts throughout the riverine and coastal flooplains across the nation.