



## **Integrating Natural Disaster Risks & Resilience into the Financial System**

**Concept Note**

**June 2014**

**Rowan Douglas**

**Chairman, Willis Research Network**

**Chair, UN Hyogo Framework for Action Renewal Consultation (HFA-2) Business & Financial Sector Working Group**

rowan.douglas@willis.com  
The Willis Building, 51 Lime Street, London, UK EC3M 7DQ

---

Note:

This concept note is produced for consultation and feedback among expert groups and stakeholders as part of the programme of open research, public science and discussion supported by the Willis Research Network (WRN). The WRN has grown to become a network of around fifty universities and science institutions worldwide. Natural disaster risk reduction and resilience has been a key focus of WRN programme since its foundation in 2007

This paper has been produced as part of the WRN's objective to support the better sharing of science, policy and capital expertise across communities and institutions. The WRN enables research to support society to achieve resilience at local and global scales, via public, private and mutual mechanisms as a platform for sustainable growth.

This is a working paper of the Willis Research Network. None of the ideas, concepts or themes contained herein should be interpreted to represent the views of Willis Group or any other organisation.

[www.willisresearchnetwork.com](http://www.willisresearchnetwork.com)

## Section 1: Summary & 2014- 2015 Context for Disaster Resilience and Financial Regulation

This concept note introduces a relatively simple intervention to deliver significant progress in natural disaster resilience and the protection of basic rights at local and global scales; via public, private and mutual sectors across immediate and longer term time horizons.

Integrating disaster risk and resilience into the financial system provides the structural and proportionate means of saving millions of lives and livelihoods in the coming decades and protecting US\$ billions in homes, assets, and property in a cost effective and rational way when weighed against competing priorities.

The solution links the combined power of financial regulation and accounting principles with the acute political priority and growing economic impact of natural disaster risk.

The simplicity derives from

- i) *Risk Disclosure*. Adopting the long accepted financial principle that material risks should be appropriately assessed, reported and communicated to stakeholders including investors, consumers and counterparties;
- ii) *Established Approaches*. Implementing well established natural disaster risk evaluation techniques have been applied by global financial markets, accounting authorities and regulators for over two decades.
- iii) *Effective Disaster Resilience Interventions*. Applying proven capital management and policy levers to drive consistent, evolving and proportionate levels of natural disaster risk resilience for exposed populations and assets in developed and emerging economies.
- iv) *Existing Institutions*. Employing the regulatory institutions and reform processes already in progress at national, regional and global levels

The techniques and approaches for this necessary reform have been acquired from the hard won lessons of the global insurance and reinsurance sector (collectively known as re/insurance), operating through public, private and mutual systems over the last quarter of a century. As the focal point for natural disaster risk it is unsurprising that the reforms were required in the re/insurance capital domain first, but now the growth in risk has led to associated pressures becoming a material risk across the mainstream business and public sectors and into the wider financial system. This growth in risk will persist and increase in coming decades due to fundamentals of demography, energy consumption, wealth accumulation and environmental change.

The essence of a response is that exposure to natural disaster risk will progressively *discount* the value of assets; while natural disaster resilience will progressively *increase* the value of assets.

Once applied, the influence of the *invisible hand* on natural disaster resilience will be profound, pervasive and sustained. Indeed it is difficult to identify another single intervention that could have a comparable impact on improved natural disaster resilience and related human well-being and security in the coming decades. It offers a structural intervention for resilience, sustainable growth and development of countries, corporations and individuals. In the 19<sup>th</sup> and early 20<sup>th</sup> Century insurance standards and related financial rules were critical elements in driving fire safety requirements, building codes, zoning laws, fire departments

and thereby, at last, overcoming the centuries' curse of city conflagration in the US and elsewhere. The rules of capital literally transformed urban landscapes between the 1880s and 1930s to become safe and secure settlements, we need to employ the same techniques to meet our own challenges.

With the progression of the physical, demographic and economic indicators around natural disaster risk the question becomes when, not if, this seemingly inevitable financial reform occurs and how it should be implemented. Once the influence of natural disaster risk on fiduciary responsibility is formalised it will presage a paradigm shift within resilience.

With the support of existing financial regulatory institutions and instruments there appears a robust but realistic prospect of undertaking the preparations necessary to adopt such reforms to financial and market practices by or around 2020.

The potential of accumulating overwhelming levels of natural disaster risk, across multiple geographies in the coming decades, heightens the urgency of commencing the preparations for such reforms.

The focal impact and choreography of the UN Climate Action Day in September 2014, the decadal renewal of the UN Hyogo Framework for Action on Disaster Risk Reduction in March 2015, the updated UN Millennium & Sustainable Development Goals later that summer and the UNFCCC Paris COP in December, followed by the World Humanitarian Summit in 2016 provides a unique opportunity to achieve significant progress.

This UN context is reinforced by additional and complimentary processes by other bodies around natural disaster resilience, financial stability and financial inclusion operating at global, regional, national and city scales. In many instances these interlinked processes include the same or related institutions, expertise and stakeholders across science, business, finance, regulation and public policy. These increasingly linked strands can now be drawn together for mutual benefit.

In advance of the UN Hyogo Framework for Action renewal in March 2015, a UN Climate Action Day initiative build around this paper has provided a vehicle with the attributes required to rapidly and effectively integrate the institutions and experts required to deliver the necessary preparations to make such a significant reform possible within the time scales an effective global response to natural disaster risk demands.

The mobilising and catalytic effect of the UN Secretary General's Climate Action Day has propelled and accelerated these developments around risk and established focus among key groups in sufficient time to achieve the outcomes required to support 2015 processes and save the lives, homes, livelihoods and economic prosperity in the coming years that now appear possible through this type of approach.

This document provides an outline of the guiding principles and practice behind this approach to inform sector experts and garner wider input in the coming months.

## Section 1.

### Background: The Insurance Sector & Natural Disaster Resilience, 1989 - 2014

The story of the global re/insurance sector's near existential crisis in the late 1980s and early 1990s, driven largely by natural disasters, and its long journey towards far greater structural resilience to natural disaster risk by 2012-2014 provides the essential ingredients to inform similar outcomes in the broader financial system, and through that mechanism, into the wider economy and society across public, private and mutual sectors.

Following a period of unprecedented losses in the 1980s, driven significantly by natural catastrophe events, the global re/insurance sector entered a period of crisis, culminating in unprecedented losses from Hurricane Andrew in 1992. There were many re/insurer insolvencies in Europe, North America and elsewhere: confidence in the global risk sharing system of insurance was in disarray. Private sector investment capital withdrew from underwriting risk, mutual capital could not be expanded and in most cases public sector solutions could not be practically applied. With this lack of capital, natural disaster insurance and reinsurance became unavailable, severely restricted or excessively expensive.

It was clear that the existing operating paradigm the global re/insurance industry had employed for around 300 years was no longer adequate to cope with the level of risks underwriters faced. Growing exposure to natural disasters, especially in the United States and other peak accumulation zones was the key focus of concern. Historic claims records alone were no longer a sufficient guide to current levels of risk. Natural hazard risks and the resilience of people and assets had to be better understood, evaluated, managed and shared or underwriting would become unsustainable. In short geography and engineering had to be integrated into finance, economics and regulation: but how could this be achieved?

During the decade from 1993 to 2003 three somewhat independent forces converged to transform the treatment of natural disaster risk within the global re/ insurance sector.

- i) *Smart Capital* entered either from new private sector investors, mutuals or even progressive state sector insurance systems. They were attracted by potential returns demanded that improvements be made to the way that underwriters evaluate and price natural disaster risk in their portfolios.
- ii) *A Scientific, data and analytical revolution* from the impact of mainstream data, software and technology trends of the 1990s on underwriting data management and analysis, to the arrival of a new breed of specialist firms known as catastrophe risk modelling companies augmented later by the growing involvement of mainstream public science, university and engineering expertise. Together these modelling platforms and information ecosystems began to translate science into practical underwriting tools, systems and outputs which evolved as knowledge and expertise grew in response to events.

Over this 20 year period, from 1992, the level of analytics of natural hazard risks employed in the sector went from relatively simple aggregate assessments undertaken by a single underwriter to industrial scale operations with large cross disciplinary analytical teams managing massive datasets on major IT platforms to assess flood, earthquake, windstorm and other perils to portfolios of homes and assets throughout the world. An information supply chain was created via the modelled and networked world

- iii) *Public policy and financial regulation.* Governments, through their insurance regulators, developed an emerging convention that insurance contracts should

deliver their commitments at a 1:200 year level of confidence. This meant in effect that an insurance company should have access to sufficient capital (either directly or through reinsurance) to remain solvent and pay all valid insurance claims when it experiences the worst combination of extreme events across the world over a 12 month period once every 200 years at current (not historic) levels of risk.

This level and style of multi-century scale risk management requirement was completely new within insurance as well as wider finance and it took some years for science, actuarial modelling and corporate management to respond to such requirements in an effective way. But slowly knowledge was acquired, techniques refined and general market practice transformed: initially in the technical sophisticated catastrophe reinsurance sector and then more widely across the sector. Unlike other financial sectors, re/insurance began to focus on managing extremes, in markets that tend obey the laws and parameters of physics.

This approach, driven by insurance regulators seeking policyholder protection was reinforced by re/insurer credit rating agencies who serve the demands of investors and creditors as well as providing metrics of financial strength employed by re/insurance counter parties and corporate insurance buyers.

While the journey was not smooth, these trends had brought a fundamental transformation in the market by the mid 2000s. In spite of growing losses, natural disaster risk became increasingly understood and more accurately evaluated. Sufficient amounts of capital were allocated to match levels of risk on a more efficient basis, failures became less frequent and the volatility in level of underwriting capacity and pricing in response periods of either high catastrophe losses or benign conditions steadily dampened. The market began to understand and manage this risk more effectively.

In 2005 Hurricanes Katrina, Rita & Wilma hit the Florida and the Gulf coasts causing major insured losses in excess of US\$50bn. While there were many challenges and hand wringing in the modelling of Hurricane Katrina and other specific events, at a macro scale the global re/insurance market was now sufficiently capitalised to pay these claims and there were few insolvencies. This was due to the steady integration of natural disaster risk science into insurance operations via applied modelling and analytics over the previous decade.

By 2011, techniques and wider adoption had further improved and the worst global natural catastrophe loss year on record with over \$120bn in claims across the developed and emerging economies was managed well within normal market operations; a trend that continued with the response to Super Storm Sandy in New York during 2012.

The insurance sector, with its science and regulatory partners, has now established a tried and tested operational system for rationally allocating capital, in a competitive market, in respect to disaster risks (at even very extreme probabilities). To support sustainability in the system, it has also developed insurance conditions and standards of behaviour among its customers which reduce overall risk and encourages and sometimes requires defined resilience as a requirement of access to the contingent capital that an insurance policy represents. In this way access to capital can be used as a means of incentivising and driving societal resilience.

While the insurance sector still has a long way to go on its own journey this story and the elements of science, capital and regulation it contains, identifies the essential ingredients and method to embedded disaster resilience through financial regulation and accounting to manage risk and foster desired and shared standards of resilience.

## **Section 2. From Insurance to incorporating natural disaster risk and resilience across the broader financial system to support improved resilience into wider society**

Insurance underwriting maybe important, but it only represents a relatively small proportion of the financial system. By far, the largest portions of the financial system are represented by:

- i) *Investments and Securities* such as company stocks or bonds issued by corporates and national and local public bodies which are often administered on behalf of investors by asset managers including pension funds under the rules of stock exchanges and other authorities.
- ii) *Credit and Debt*, including the roles played by banks undertake a range of services providing and managing credit to individuals, business and public entities.
- iii) *Taxation, Accounting and Reporting*. Accounting and reporting underpins the financial infrastructure and trade. A key requirement of accounting it to assess assets, liabilities and earnings (profits) on an annual basis for the evaluation to tax returns and liabilities.

Financial assets and liabilities are valued according to their expected risk and return. Increased risk tends to decrease the value of an individual asset or portfolio. Similarly a borrower will generally have to pay a higher level of loan interest if s/he exhibits higher levels of risk.

The validity of individual transactions and the financial stability of the entire system are dependent upon a sufficiently accurate assessment of risk and management of its accumulation within tolerable parameters. Risk management is fundamental to the sustainability of the system; over time ignoring materially increasing risk is unsustainable. This was true of natural disaster risk within the re/insurance market of the 1990s and indeed mortgage default risk in the wider financial market in the mid- 2000's.

The financial sector beyond non-life insurance generally does not take adequate account of natural disaster risk. Investors do not factor it into their valuations, creditors do not systematically assess natural hazards against their loans books and real estate markets largely ignore extreme event risk, even in highly exposed locations.

With accelerating accumulation of natural disaster risk the disconnection of asset valuation from this material (and growing risk) within a rational financial and accounting framework is untenable. Until this natural hazard risk is appropriately accounted for risk will accumulate around our coastlines, buildings will exhibit minimal resilience standards and companies will have limited incentives to drive continuity processes. Increasing levels of natural disaster losses in most parts of the world, combined with the growing frequency, intensity and duration of hydro-meteorological extremes renders the continued invisibility of this risk within financial practice unsustainable.

Natural disaster risk is now a material and increasing risk to many sectors, geographies and institutions. There is no free lunch, ultimately it is the owners and managers of capital (public, private and mutual) that carry these growing risks and will bear these losses. Without adequate management many will become unbearable, in many instances, for individuals and collective entities.

Investors, creditors and prudential regulators need to be informed of material risks to institutions, securities and commitments. In due course, appropriate natural disaster risk

factors will be inevitably be incorporated into banking and securities protocols to reflect the basic tenets of regulation, accounting and audit which are under pinned by the principle that liabilities and material risk should be identified and where appropriate evaluated and reflected in reporting protocols and financial returns.

Without these financial reforms millions of people will suffer in the decades ahead; many lives will be lost unnecessarily, and sustainable economic development will be hampered.

### **Section 3: Incorporating Natural Disaster Risks and Resilience into the Financial System: How might this work?**

Simplicity and consistency is an important element in effective financial regulation, accounting and reporting. Upon that principle, and borrowing from insurance experience, it is possible to imagine a style of basic metrics which might be applied to many securities and debt instruments. How could this work?

Increased disaster risk exposure will discount the valuation and attraction of assets while lower risk and reduced vulnerability will be positive. In short natural disaster resilience will be valued: a resilience intervention will act as a credit against the contingent disaster risk liability.

To avoid impairment to the valuation or liquidity of their assets, capital owners (from the smallest urban homeowner or cooperative farmer to the largest multinational) will become incentivised to avoid excess natural disaster risk or achieve adequate resilience via appropriate behaviours and interventions. Until this shift in financial practice occurs, achieving significant and consistent disaster resilience will remain significantly hindered if not impossible at a scale and timeliness required.

#### *Standardised Disaster Resilience Stress Tests*

For example, public companies listed on stock exchanges maybe required to publish their maximum probable annual losses to natural disasters against their current assets and operations at

*1 in 100 year return period* (which could represent a stress test to the company's solvency in an extreme natural disaster scenario)

*1:20 year return period* (which could represent a profit risk/earning event for a company in a given year.

*Annual Average Loss (AAL)* 9 a metric that conveniently describes and compares the economic disaster risk exposure across entities)

Against these metrics, key ratios can be developed to understand the relationship between these annualised risk corporates assets, annual earning and other indicators.

This reflects the basic and effective style of metrics (in reduced a tolerance requirement) that have evolved and driven financial resilience and capital efficiency within the insurance sector since the 1990s though consumption by investors, regulators, counterparties and rating agencies and well as internal management and operating processes. They have become embedded and normal elements of the financial lexicon.

A 1:100 annual return period stress-test may sound quite extreme but there is a 10% chance of such an event affecting a company once a decade. On average 1% of a stock exchange's listed securities would experience these level of losses in any one year. [N.B. The geographical concentration of many national stock exchanges means that a 1:100 year event could have a systemic impact across the market as a whole].

In essence, if two otherwise identical companies exhibit a marked different exposure to natural hazard risk which has material implications on their potential solvency or profit, the company with higher vulnerability to natural hazards should have a reduced valuation/share price and be a less desirable stock due to the reduced quality of its earnings. At present these risks or resiliencies are not evaluated or reported and related factors are largely by ignored analysts, markets and investors. As a result companies have limited incentives to compete by reducing risk and developing resilience.

However, following insurance experience the techniques for measuring the 1:100 / 1:20 year and AAL to natural hazard risk across exposed sectors and industries are well understood and could become established within standard corporate practice within a relatively short time at a fraction of the cost of natural hazard losses. It would take some time to refine and implement these approaches within wider financial practice, but this is an established body of knowledge and practice, which will save unnecessary fatalities and billions of dollars in assets and lost economic growth. Many companies already collect this information as part of their insurance or captive management function, but the information is not then applied more strategically.

Similar metrics could also be applied to the valuation of many other transactions and financial instruments from the interest charged on sovereign, corporate, municipal or personal bank loans, bond prices and credit ratings. To increase valuations, reduce interest rates or boost credit ratings, institutions could engage in increasing the physical, financial or operational resilience to natural disaster risk.

For example, a property portfolio may be refined to reduce the proportion of highly exposed locations unless properties focus on optimal building codes and resilience characteristics. In time, capital is generally allocated towards the more attractive and valuable assets with natural disaster risk and resilience properly incorporated within the valuation. In due course, asset owners will invest in resilience to remain competitive and, where necessary, undertake actions to reduce specific or systemic levels of risk towards tolerable levels.

## **Section 4. Financial Regulatory Institutions**

While national and regional institutions remain critical, the rules governing capital are increasingly framed, developed and even applied at a global level. This trend has increased since the financial crisis of 2008 and concerns over financial stability of major institutions and the system as a whole.

Natural disaster risk and insurance is captured within these overarching trends, due in part to its international and ultimately global scope, and its increasing capacity to pose a threat to the financial stability of countries, companies and individuals. The accelerating, long term, high profile and structural nature of natural disasters means that it is now a permanent and growing fixture on financial regulators' radar screen.

Meanwhile, the lack of financial inclusion, especially to insurance for many farmers, homeowners and small companies in developed and emerging economies is also seen as a major factor in increased levels of vulnerability to natural hazard.

The growing concentration of financial regulation is an important driver enabling disaster risk to be applied across the different elements of capital at a global scale but with local application via regional and national institutions. Following the financial crisis of 2008, the G20 under the auspices of the Financial Stability Board has set key aspects of financial regulation agenda operating through existing and often reformed institutions.

For example, the Bank of International Settlements (BIS) based in Basel, Switzerland develops the capital regulations for banks and related transactions; they are the authors of the Basel Rules. Operating from the same building (which also houses the G20 FSB) the International Association of Insurance Supervisors (IAIS) oversees the development of global solvency rules for re/insurers. The importance of natural disaster risk as a primary driver of capital adequacy requirements for insurers has led to the application of effective and evolving techniques to manage and oversee these exposures. In Madrid, IOSCO coordinates the rules for securities including public company stocks and bonds. The three groups come together in the Joint Forum which coordinates selected cross-body initiatives.

The three bodies work closely with banks, insurers, asset managers, national/regional regulators and accounting organisations to develop rules and integrated reporting standards which can then be implemented through the financial sector institutions at local levels with due lead-in and preparation.

The approaches and techniques developed over the last quarter century to evaluate and regulate the natural disaster risk contained within insurance organisations will provide the reference guide for banking, securities and accounting application. However, techniques will need some refinement to reflect the characteristics of these sectors and the relationship with this risk and also that proportionate level of resources that should be applied. One important area of efficiency may be appropriate data sharing between institutions.

For example, if properties or companies have been assessed for natural disaster risk for insurance purposes perhaps relevant data could be employed by banks or other financial institutions under appropriate protocols. This could save time, money and accelerate comprehensive adoption and best practice. To support these developments a corresponding science, information and analytics environment will be necessary for risk assessments and portfolio management in these markets. The platforms in re/insurance will likely be instructive and could possibly be shared.

After a quarter of a century the scientific and analytical techniques and data needed to assess risk have become far more open we are witnessing a transformation in the awareness and access to the informational ecosystem that will support and institutionalise these trends. All this is set to become a normal component of the financial information landscape in the years ahead, the adoption and integration has begun.

As with all regulatory change and innovation there will also need to be a period of trial, shadow assessment and professional training before new rules and standards are applied within formal regulatory and related accounting processes.

The process has commenced in 2014 with the mobilisation of leading organisations and experts to undertake the preparation for the UN Secretary General's Climate Action Summit in September. From this point a realistic timeline for the creation of new disaster risk standards, development of supporting facilities and services, testing and lead time through to formal adoption might be approximately five years, commencing in 2015 through to 2020.

As with much regulatory change, the preparatory phases tend to produce some of the desired changes before formal adoption as firms seek to adapt in the face of anticipated reforms. This may well be the case here, especially as it would be aligned with expected legislation and developments in related areas such as climate adaptation and resilience, sustainable development, human rights, financial stability and inclusion.

## **Section 5. Conclusion**

Growth in exposures coupled with respect of core financial principles indicate that natural disaster risk and resilience will be incorporated into the financial system. A more relevant question may be how appropriate policies may be developed and when the process may begin.

In the context of increasing natural disaster risk and losses; growing political attention; the various processes underway in relation to the international agenda in 2014 and 2015; a quarter of a century of re/insurance experience; the considerable preparation that has already been undertaken to underpin natural disaster resilience through the Hyogo Framework; and the growing demand for a stable, transparent and trustworthy financial system the moment and momentum to begin these reforms is now.

---

## **Author**

### **Rowan Douglas**

CEO Capital Science and Policy Practice, Willis Group  
Chairman, Willis Research Network

Chair, UN Hyogo Framework for Action Renewal Consultation (HFA-2) Business  
& Financial Sector Working Group

Rowan Douglas leads the Capital, Science and Policy (CSP) Practice at Willis Group. Willis Group is an insurance and reinsurance broker and risk management adviser with approximately 20,000 personnel operating in around 100 countries. The CSP Practice confronts large scale challenges of managing risk, resilience and sustainable growth at global and local scales through public, private and mutual mechanisms.

Previously Rowan served as CEO Global Analytics, Willis Re and then across Willis Group.

As Founder and Chairman of the Willis Research Network (WRN), Rowan oversees the world's largest collaboration between public science and the finance sector supporting around fifty universities and science institutions to improve policy making and capital management around the management of extremes.

He began his career underwriting reinsurance with Syndicate 1095 at Lloyd's before creating the risk information company WIRE Limited in 1994 which was acquired by Willis Group in 2000.

He has served on the UK Prime Minister's Council for Science and Technology since 2011 and the Natural Environment Research Council since 2008 and is a member of the Royal Society's Working Group for the Human Resilience to Climate Change and Disasters due to report in late 2014.

Outside the UK he chairs the United Nations International Strategy for Disaster Reduction Business and Financial Sector Working Group preparing the second UN Hyogo Framework for Action Agreement in 2015 and the World Meteorological Organisation Expert Advisory Group on Financial Risk Transfer preparing for the UN Agreement on Climate Services in 2015

He has also served as a also member of the Global Earthquake Model Foundation Governing Board, Pavia Italy; the Advisory Board of the Earth System Laboratory, NCAR, Boulder CO, USA and the Institute of Catastrophe Risk Management, NTU Singapore.

Rowan read Geography at Durham University (BA Hons); Geographical Sciences at the University of Bristol (M.Phil) and is a Fellow of the Royal Geographical Society.