# 2013 Gilbert F. White Flood Policy Forum

## Coastal Visioning and Resource Management



## Science and Systems



## The National Flood Insurance Program



## Resiliency and Sustainability

## Economics



## Policy Approaches



## State, Regional, and Local Strategies

**Climate Change and Adaptation**

# Strategic Coastal Retreat (Advancing in Reverse) through Property Buy Outs at the Local Level

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As I have watched the aftermath of Hurricane Sandy unfold on television each evening, as in the aftermath of Katrina, I am reminded again of the emotional trauma on local residents and their determined insistence of many local residents and communities to rebuild in the areas that have just been devastated. This understandable emotional and often economic decision to rebuild (with or without sufficient flood protection) is usually promoted by local, state and federal officials (in particular federal disaster mitigation policy) even though it is known with great certainty that these areas are at risk and will be devastated again. With sea levels predicted to rise 3-5 feet in the next 50 years the inevitability of another natural disaster becomes even more likely. I am also concerned with the calls resonating in the Northeast and gulf coast to use built infrastructure along the coasts to protect people and property from hurricanes, storm surge, and floods. We seem to learn nothing from our own history that time and again, built infrastructure fails, often with catastrophic costs to communities and to the economy.

Additionally, this single-minded approach to coastal management has significant environmental consequences, and degrades the ability of our coastal ecosystems to absorb storms, support fish and wildlife and provide other ecosystem services (ES) that add to the economic sustainability of our economy. What is needed is an approach to coastal management that considers natural resources, long term economic benefits and ways to reduce risk to public safety and property, while also protecting coastal ES benefits. However, current policies and institutions, focus on rebuilding in the devastated areas, repeating poor land use decisions that impede the efforts to consider multiple benefits and incorporate ES into coastal management and ignoring where to build and rebuild that makes sense in the long term from both a conventional economic and ES perspective.

There is much that has been written that I could repeat here on the value of, and importance of protecting the ES of our coastal floodplains by not rebuilding in at risk areas, but I will leave that for others. In this paper, I would like to focus on what might be done to convince individual property owners that have been devastated by a natural disaster, such as Sandy, that the best course of action may be to retreat from the coast. This type of persuasion is usually best when it is implemented at the local level (sometimes around the kitchen table), where most, if not all, land use decisions are made. However, it is unfortunate that there are only limited federal or state programs to assist local communities with buyouts of properties with willing sellers. Even for substantially damaged properties with willing sellers buy out options are limited. This leaves communities with limited options on the choice to rebuild or not. The best solution is to prevent development in high hazard areas to begin with; however this is not the reality that we face today. There are many coastal areas where large numbers of residential and business properties are in harm's way, such as the Jersey shore. After a disaster, such as

Sandy, property owners are usually incentivized to rebuild with some type of structural flood proofing, elevation of their structure, or to rebuild "as is". These three scenarios are predicated on the location of the property in relation to the coastal hazard zones and the zoning laws of the local community or state where the property is located. The best of these scenarios - proper elevation and flood proofing of the structure(s) - still have potential costs to the community in the form of utility and transportation infrastructure to serve these properties already in harm's way and the risk to emergency personnel if rescue (response and recovery) assistance is required. Acquisition of the property and complete removal of the structures is usually not a high priority with the community, or with the property owner, despite the numerous long term benefits. For the remainder of this paper I will highlight the property buy out programs used in Milwaukee, Wisconsin as an example of what worked well in the acquisition arena. The buyout program, for both developed and undeveloped properties was a primary tool in our flood management tool box for both current and future flood risk reduction. I will outline policies and guidelines that were used within the program to facilitate discussion on this approach and how it might be applied in coastal areas.

In the summers of 1997 and 1998, the Milwaukee Metropolitan area suffered two devastating flood events. These flooding events occurred despite extensive conventional flood management infrastructure, in the form of concrete conveyance channels and floodwalls constructed in the 1960s and '70s. In response to these events, the Milwaukee Metropolitan Sewerage District (MMSD) developed comprehensive watershed management plans for both flood management and water resource protection. The twin objectives of flood management and water resource protection, led MMSD on a path for restoring the connection between the river and flood plain, by removing the existing concrete channels and walls and purchasing at (flood) risk structures to make room for the river. MMSD also determined that purchasing natural floodplain and flood storage areas that still remained was far more cost effective than building infrastructure to replace the lost conveyance and storage to provide future flood risk reduction (MMSD's Greenseams Program).

For this approach to be successful extensive property buy outs were required. Initial attempts at property purchases were often met with, fierce resistance from the impacted property owners, many of whom had suffered flood damages and also from the local communities. MMSD staff had used a public meeting format that focused on the need for acquisition of properties to restore and protect value, of what we now term 'ecosystem services" and public safety, instead of a public information approach that would have allowed us to hear and respond to property owner or renter concerns. It was quickly apparent that this method, which focused more on public relations needed to be modified. The following changes were implemented, which, I believe, led to more success in property purchases and the overall acceptance of our flood management projects. I have highlighted recommendations for achieving property owner buy in for acquisition of coastal properties in harm's way, which was successful in Milwaukee.

A diverse stakeholder Committee was convened for each watershed to review the design and planning alternatives and to provide a recommended alternative for presentation to the public. This also promoted support from local communities who were invested at the beginning of the process in the desired outcome.

Public meetings were structured to minimize presentations (exemptions were a brief explanation of the project as a whole) and instead emphasis interaction between project staff and the public to receive information from the impacted residents and property owners after a. To emphasis public interaction the format of the meetings had project staff manning stations highlighting one or more aspects of the project. This format enhanced positive public feedback and interaction with MMSD staff and consultants.

Multiple methods of communication were used for those residents both owners and renters within the project area targeted for acquisition. Direct communication at a meeting or by phone call always preceded written communication regarding property acquisition.

Upon owner or renter notification of MMSD's interest to acquire the property. MMSD staff would attempt to meet with each property owner(s) or renter in person to discuss their concerns and provide information on the acquisition process to include rights and compensation. This had an invaluable positive impact on the success of our acquisition process in areas with a large number of income properties.

Neither the MMSD Greeenseam's nor the Flood Management Program use imminent domain for purchases but instead rely on voluntary sellers, which delays the schedule but enhances public confidence that each property owner is being treated fairly.

MMSD has a policy on compensation for both owners and renters to make them whole financially. MMSD provides funds in addition to the acquisition costs for moving costs, rental assistance, real estate and legal fees, mortgage rate buy down, additional funds for replacement housing, rental assistance, and flexibility in timing for the acquisition to accommodate personal concerns. The financial concerns of impacted property owners can be the biggest impediment to a buyout program if property owners feel they are not being dealt with fairly.

For appropriate projects, MMSD contracts for a neighborhood/community plan to highlight the potential economic, environmental and social resources to be enhanced by implementation of the project. This plan is then presented to the local municipality, neighborhood associations or community groups impacted by the project. Understanding what the impacts both negative and positive, economic and environmental impacts the project will have on the community are included within the plan.

It is my hope that these measures are currently being pursued in the coastal hazard areas or if not this will prompt discussion on how to proceed. I will end with a statement from a resident at one of our early meetings "It is OK to make a mistake, as long it is always a new one." The country as a whole seems to have trouble with this when it comes to natural hazards.

# Getting England to adapt at the coast: notes from a small island

## Nick Hardiman

**Senior Coastal Adviser, Environment Agency (England[1]), UK**

The force and impact of Hurricane Sandy – and the scale of the response needed – is a powerful reminder of the scale of weather events faced by the United States. Bringing a perspective from England, which is mercifully buffered from such extremes by a mild Atlantic climate, inevitably entails a shift in scale and impact. However, since Gilbert White expressed his principles surrounding human adjustments in the 1940s, there have been flood events that have shaken the English coast: the most significant, on the east coast in 1953, is prompting reviews of our current preparedness for similar or worse events by the Government as we enter its 60th anniversary.

The 1940s is also where our modern legal and policy framework for flood risk management at the coast essentially began – with the Coast Protection Act 1949. Since then, the underlying challenges of population dynamics, economic and social justice, environmental degradation and climate change have shaped the dialogue on human adjustment and adaptation. The scale or type of weather events is greater in the US than in England, but these underlying pressures are meeting points where we can find common ground in planning and implementing adaptive responses.

### England's coastal risks

**Flooding:** England has over 4000km of 'open' coastline[2], of which more than 2700km is at risk from flooding to varying degrees. As no settlement in England is more than 70 miles from the coast, this puts about 1.3 million people at risk from flooding from the sea, or from combined river and sea flooding[3]. The flood events experienced in 2007, which cost the insurance industry £3 billion and affected 55,000 properties as well as national infrastructure[4], demonstrated how the combined pressures of tidal, fluvial and pluvial flooding on ageing management systems could lead to catastrophic failure in cities like Hull.

The key message coming from those affected by this event was clear: flood water is devastating whatever its source, and management of all sources needs to be joined up between the big players - local authorities, water companies, the Environment Agency and others. This has become an important mantra as England has developed its strategy for 'Integrated Coastal Zone Management' in recent years, and alongside developments in marine planning, has informed a broader legislative view of how risks on the coastline interact with management of the marine and terrestrial environments[5].

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[1] The Environment Agency (www.environment-agency.gov.uk) is the principle regulating agency of the Department for Environment, Food and Rural Affairs (Defra), with a broad remit including flood risk management and pollution control. Created from the National Rivers Authority by the Environment Act 1995, it has covered England and Wales but from April 2013 there will be a new agency for Wales. This paper therefore focuses on England.

[2] Ordnance Survey Mean Low Water. Mean High Water extends further up estuaries, making the figure approximately 18000km.

[3] Environment Agency National Flood Risk Assessment database

[4] Sir Michael Pitt, 2008: Learning the Lessons from the 2007 Floods (Cabinet Office)

[5] Notably the Marine and Coastal Access Act 2009 and the Flood and Water Management Act 2010.

**Land instability:** As well as flooding, many other areas of England's coastline are subject to coastal erosion, often in combination with landslide events, which can involve complex interactions due to the relatively diverse geological nature of the British Isles. The Holderness coast in north east England has some of the highest rates of erosion in Europe, averaging 2m annually but involving frequent 'events' taking 20m of land or more. New data arising from a consistent and comprehensive model of erosion risk into the next 20, 50 and 100 years has recently been overlaid with property maps to arrive at predictions of how many properties we might expect to be lost under current UK Climate Projections[6]. Overall, 740 properties are considered at risk from erosion in the next 20 years, with the figure rising to over 5800 in 100 years time – *if* current management intentions are realised through funding.

**Population dynamics and economics:** Behind the simple numbers above lies a complex socio-economic picture. After the heyday of the seaside town in the 19th and early 20th centuries has come decline as international travel has become easier and cheaper, and much coastal investment has narrowed its focus to industrial development and the ports sector. 21 of the 88 most deprived communities in England are in coastal areas[7]: coastal towns are often disproportionately reliant upon a single industry, and topography or location can make them isolated from key transport networks.

This vulnerability and lack of prospects often leads to an exodus of young people, or transient populations. Notwithstanding a recent resurgence in coastal tourism and the enduring appeal of 'heritage coasts' such as South Devon or North Norfolk, a number of coastal communities remain in low-income brackets according to the Government's Multiple Indices of Deprivation, with poor understanding of coastal flood and erosion risks or what they can do about them. Conversely, high-income areas are often well-mobilised to challenge Government-led risk management activities that involve change, adaptation or sacrifice. This makes communication and engagement on coastal risks and adaptation to them a high priority.

**Environmental degradation in a dynamic system:** People and property are now more than ever part of the coast's dynamic environment, and it is understanding and working with that dynamism that is considered the key to successfully managing risk into the future. Some of the ecosystems that are a product of coastal evolution are also at risk: recent Environment Agency LIDAR surveys[8] have mapped the extent of inter-tidal salt marsh and improve our understanding of annual losses of this habitat to 'coastal squeeze' – the submergence of the habitat against sea defences as sea levels rise. The Environment Agency manages those defences, so we need to create 2240ha of compensatory inter-tidal habitat by 2015 to redress these losses in an attempt to maintain the many ecosystem services that we enjoy from such habitat – not least, more sustainable flood defence systems stemming from the wave attenuation that saltmarsh can provide.

**Making Space for Water**

[6] UKCP09 (UK Climate Impacts Programme) http://ukclimateprojections.defra.gov.uk/
[7] 2007 House of Commons Communities and Local Government Select Committee report 'Coastal Towns'
[8] Environment Agency, 2010: 'The Extent of Saltmarsh in England and Wales, 2006-2009'

The post-war period was characterised by a 'defend and drain' approach to managing water, drawing deeply on the cultural residue of wartime self-sufficiency, post-Victorian confidence in technological supremacy over nature, rapid urban re-development and the financial opportunities for the farming industry presented by the European Common Agricultural Policy's subsidy system. For some time, concrete was king at the coast and the 20th century has therefore left the densely populated coastline of England with an expensive maintenance legacy and high public expectations. Many retired to the coast with little inclination that the provision of flood and coastal erosion protection by Government is a permissive power rather than a statutory duty[9] and assumed that existing defences would be maintained in perpetuity. Meanwhile, the culture of direct engineered intervention with specific itemised benefits was deeply engrained among coastal managers and practitioners.

The tide of environmental awareness and improved understanding of sea level rise has brought the consequences of this approach into sharp focus since the 1980s. In 2005, Government produced an over-arching policy called 'Making Space for Water' that explicitly reformed the terminology of 'defence' to that of 'risk management' that involves a suite of response measures to be applied strategically, rather than a business-as-usual approach applied piecemeal. This was not new thinking, but it did serve to finally echo Gilbert White's multi-pronged approach in Government policy in England. The Environment Agency has since been handed a 'strategic overview' of all flood and erosion risk management in England, to avoid the disjointed management of different types of floodwater experienced in 2007, and to encourage the water management community to realise synergies between flood management, biodiversity, water quality, carbon sequestration and amenity objectives.

A swathe of research, planning, legislative and policy development for the coast (and inland) has followed Making Space for Water, alongside numerous practical pilots to ensure England is more resilient to coastal risk in the future. I will expand on some of these at the 2013 Forum meeting – they include:

**Coastal Groups:** The different management responsibilities of the Environment Agency (river and sea flooding) and maritime local authorities (coastal erosion) have caused a disparate and parochial approach to managing risk in the past. Seven strategic 'Coastal Groups' around the country now bring these bodies together to streamline coastal research and monitoring, join up short-term investment planning, discuss specific coastal issues with other stakeholders, and develop long-term 'Shoreline Management Plans' that set the direction of travel for managing stretches of coast over the next 100 years.

**Shoreline Management Plans (SMPs)[10]:** These were first trialled in the 1990s by local authorities, but tended to re-affirm the aspiration to defend the coastline unsustainably into the future. A second round was commissioned by Government in 2006, which have just been completed by Coastal Groups. Based on extensive local consultation, each of the 20 English plans (demarcated by sediment transport 'cells')

[9] Except in some parts of London
[10] http://www.environment-agency.gov.uk/research/planning/104939.aspx

ascribe one of four over-arching management options[11] to every stretch of coast for the next 20, 50 and 100 years based on detailed analysis of costs, environmental impacts, coastal dynamics and socio-economic needs. They are not statutory, but are a material consideration for spatial planners as they design the development of the coastal zone into the future.

**Coastal Change Management Areas (CCMAs)[12]:** National planning guidance now states that local authorities must designate CCMAs in areas at significant risk from coastal change, using the findings of SMPs. Such designations should fall along lines that make sense to the community in spatial planning terms, and should involve both restriction (time-limited planning consent, development type vulnerability assessments, development moratoriums etc) and opportunity ('sacrificial' amenity areas, environmental enhancement, and replacement development zones).

**Adaptation 'pathfinder' pilots[13]:** Government-sponsored schemes run by local authorities to trial adaptive responses to coastal erosion or anticipated permanent inundation. Communities and government have worked together to devise how existing footpaths, roads, caravans, farmland and homes might be adjusted now or in the future to accommodate change where no defence investment is planned. In some cases, homes have been demolished and residents relocated elsewhere; in others, local authority purchase and lease-back options have been explored or assets have been moved back in advance of change occurring.

**Communicating coastal risk:** Complementing the existing online Flood Map, the Environment Agency website now hosts a user-friendly coastal erosion map[14], showing long term predictions whilst explaining the legal context and Government support options available to homeowners at risk. This complements other developments such as initiatives to increase property-level resilience to flooding, and live flood warnings via text, phone and social media.

**Local ownership, local responsibility – sustainable coast?**

The rationale behind the many initiatives from the last 10 years is based on two crucial needs that can be difficult to reconcile:

1. the need for communities to take ownership of (and help design and pay for) their responses to coastal risk in dialogue with local government;

2. the need to take account of the wider and longer term financial, environmental and social impacts of these responses now.

Local must not mean piecemeal or parochial under 1), so communities must become better informed in order to do 2) successfully. Because climate change science involves high degrees of uncertainty, we

[11] 1) Hold the existing defence line, 2) advance the existing defence line, 3) no active intervention in the coastline, and 4) managed re-alignment of the coastline or specific coastal defences.
[12] www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf 2012, CLG: National Planning Policy Framework, s.105-108
[13] www.defra.gov.uk/environment/flooding/coastal-change-pathfinders/
[14] http://maps.environment-agency.gov.uk/wiyby/wiybyController?ep=maptopics&lang=_e

need to ‘design in’ risk management responses now so we can adapt them in the future to changing expectations.

England has negotiated some important stages in achieving this goal, through legislation, policy, communications and planning, but we are only now making the adjustments required on the ground – and even then only in isolated rural examples. Such measures are often unpopular: the assumption that defences are a statutory governmental duty leads to fruitless calls for compensation when defence provision is withdrawn, or outrage in response to property value decline when new risk information is released. In a country defined by the sea, coastal risk is therefore politically charged.

Changing the risk management culture and expectations of a country takes a generation of dialogue, engagement, research and development. Yet in recent years the east of England has narrowly missed a ‘perfect storm’ of high tides, storm surge and inland flooding that might have led to another 1953. We may not have the luxury of time to shift our perceptions of the scale of climate change impacts on England: sea level rise may ultimately force our hand.

# From Managing Risk to Ensuring Long-Term Resilience and Sustainability: A New Paradigm for the 21st Century

**John McShane**
U.S. Environmental Protection Agency

Since the passage of the National Flood Insurance Act in 1968 (NFIA) most flood hazard mitigation efforts have focused on managing risk rather than building resilience and long-term sustainability. In addition, the value of coastal floodplain resources, especially salt marshes and other tidal wetlands, have too often not been recognized as assets that provide numerous ecosystem services ("natural capital") that are of immense value to the nation. With the damages from recent storms capturing the attention of the nation, and the world, and with climate change being the most significant driver in our future efforts, now is the time to identify and address the barriers to achieving the goals of floodplain management in coastal communities.

We must first recognize that any measures to reduce flood losses and protect coastal resources must take into consideration the differences between densely populated urban areas, suburban shore communities, and rural or undeveloped areas. Mitigation efforts for high value real estate, such as lower Manhattan, will likely need to focus more on structural measures to reduce future flood damages while "green" infrastructure options should be the first consideration in less developed areas. Each has its place in working towards community resilience and sustainability.

**Barriers**

It took 26 years from the time of Gilbert White's dissertation on "Human Adjustments to Floods" to the passage of the NFIA, a significant achievement. However, although much progress has been made over the past 45 years with regard to achieving the goals and objectives presented in the NFIA, we are still discussing some of the same issues today as we did then. Clearly, a comprehensive analysis needs to be conducted that investigates all the barriers to achieving the goals of floodplain management and long-term sustainability. These include, but are certainly not limited to:

Financial

Technical

Political

Legal

Cultural

Sociological

Ecosystem valuation

Cost/benefit analyses

Development pressure

Communication

Once the major barriers at all levels of government, as well as the private sector, for a particular urban, suburban, or rural area have been identified specific recommendations need to be developed and actions taken. For each proposed action all the benefits of nonstructural measures and all the costs of structural measures (both economic and environmental) must be included in the analysis to determine the best course of action. Equally important is the extent to which the action contributes to long-term resilience and sustainability of the community. Before implementing any action consideration must also given to the dynamic interdependence of the complex economic, social, and ecological systems of the community and the region. In addition, mitigation measures have proven to be cost effective and are an excellent investment in the future; mitigation must be part of not only the post disaster recovery phase but also in the land use planning decisions made by local officials every day.

It is recommended that barriers at the federal level be addressed first as they have nationwide impacts. For example, those policies or programs that (perhaps inadvertently) provide incentives for the development of flood hazard areas or adversely impact the natural resources or functions of floodplains can be modified so that they are consistent with the provisions of Executive Order 11988, Floodplain Management. The agencies that have promulgated implementation guidelines for the Order should review their programs and policies as soon as possible to ensure that they are not inconsistent with the goals of floodplain management or long-term resilience and sustainability.

**The Future**

Achieving the goals of floodplain management is an important part of long-term resilience and sustainability in coastal communities with identified flood hazard areas. Mistakes that were made in the past must be recognized and not repeated, and an objective analysis of both good and unfortunate (in hindsight) decisions must be conducted to prevent future costs, both economic and environmental. When disasters do occur we need to redesign for sustainability.

Coastal storms will continue, but flood disasters are not inevitable. We need to think about, and work towards, what a best case scenario would look like in our communities, including the role of a fully functioning natural (or "near natural") floodplain environment in preventing flood losses. My vision for the future is one where a community experiences a storm surge similar to Hurricane Sandy but most homes would only experience minor damage and people will be able to return home and resume their lives within a few days, not months or years. Critical facilities, such as hospitals and water treatment plants, will continue to operate and function not just after but during the event. Utilities will have relocated or elevated their electrical substations so that power can be provided continuously throughout the community, and businesses disruption will be minimized by avoiding the flooding of vital equipment located in basements. Homes in V-Zones will have been relocated or not rebuilt and stable dune systems re-established to mitigate storm surges. Coastal wetlands will be restored wherever possible to reduce the surge and provide critical habitat for fish and wildlife. In addition, all the values

that floodplains provide, both coastal and riverine, will be included in cost/benefit analyses as well as the decision-making process.

Identifying and addressing the barriers to sound floodplain management will ensure that our coastal communities of the future will be resilient, able to continue functioning after a hurricane or Nor'easter. We will have also created a new paradigm of sustainability, both economically and environmentally, that will provide a quality of life for all people that will endure into the 22nd Century, and beyond.

# Hurricane Sandy Disaster Recovery Principles

## Adam Whelchel
The Nature Conservancy

**Utilize natural infrastructure as an effective long-term solution to make people, infrastructure and natural systems less vulnerable.** While risk reduction strategies will vary based on location, natural infrastructure can provide a cost effective means of reducing overall risk to infrastructure and people. Utilizing natural infrastructure for climate resilience can include augmenting existing habitats through conservation strategies; protecting and restoring habitats to enhance flood mitigation and ecosystem services; creating new habitat such as oyster reefs and artificial wetlands; and integrating natural systems into hard infrastructure (and vice versa) to provide long-term ecological and climate benefits. In addition to flood control, ecosystems provide many economically beneficial services that support and protect humans and nature such as filtering pollutants, erosion control, production of fish and shellfish, and clean drinking water. Moreover, natural infrastructure has lower long-term maintenance costs than "grey" infrastructure.

**Value and protect natural systems as a critical component of infrastructure.** Natural resources provide essential benefits to communities: clean water and air, significant economic activity, and a reduction in the overall damage from a natural disaster. While there are places along the Northeast coast that will need to build hard infrastructure, shorelines hardened by concrete walls, groin fields and other "grey" infrastructure can cause significant harm to valuable natural systems like barrier beaches that reduce the strength of storm surges and tidal marshes that hold flood waters. Unnecessary impacts to natural infrastructure should be avoided.

**Consider and integrate knowledge of likely future climate impacts when rebuilding infrastructure**. Existing infrastructure that failed and must be rebuilt (e.g. sewage treatment plants flooded in NY and NJ) should be rebuilt with measures in place to reflect future climate risks. Most power plants, hospitals, bridges, roads, sewage treatment plants and other public infrastructure have design lifetimes of decades. The best available science tells us that we should expect further rises in sea level and increasingly intense storms over those same timeframes. The Northeast will also experience more extreme rain events and severe heat waves. These changes should be reflected in the design and siting of rebuilt infrastructure.

**Anticipate and plan for changes in barrier beaches, dune systems and other natural risk reduction features.** Barrier beaches and dune systems are continuously changing. Major storms such as Sandy and sea level rise can accelerate inland movement and, if not planned for, decrease the ability of these natural features to protect houses, infrastructure and natural systems in flood zones and on or near beaches from wind and wave damage. Deliberate action is required during rebuilding efforts so that building siting and design standards take likely shoreline change and increased exposure into account.

**Clearly communicate and accurately portray risk and vulnerability**. With increasing coastal development and projections for both stronger coastal storms and increasingly rapid sea level rise, we need to fully understand the future risks and to plan with those in mind. This includes accounting for the

impacts of a changing climate –rising sea levels, changing precipitation patterns, increased droughts, and heat waves– and providing up to date information on the status of built infrastructure, natural resources and current vulnerabilities to flooding and storms. This information must be made available in easy to access data, tools and maps to allow state and local officials and private property owners information they need to complete hazard mitigation plans.

**Empower local governments and communities to address storm risk and vulnerability.** Local governments own much of a community's infrastructure, ranging from roads and bridges, to landfills and sewage treatment plants. Local governments must have the ability to plan, protect, mitigate, and recover from extreme storms. Federal and state agencies should provide local governments with training, up to date science and data, and decision support tools to properly guide storm related disaster decision making. In particular local communities need to be informed about the full range of solutions to protecting their coastal infrastructure, including the benefits of using natural infrastructure. Such information should inform hazard mitigation and land use plans and local ordinances.

# Coastal Challenge

## Doug Bellomo, PE

INTRODUCTION

Our Nations coastal areas are arguably some of the most valuable land in our nation. They provide an abundance of environmental, cultural, economic, and social benefits. Some of these benefits are easily measured, others can be qualified but difficult to quantify, and yet others simply cannot be measured.

CONSTANT CHANGE

These important yet fragile areas have experienced and are experiencing demographic changes at an unprecedented rate. In 1910, the population in Miami Florida was less than 6,000 people and within the span of about 100 years it grew to nearly 400,000. With that growth comes roads, bridges, buildings, water supply and treatment facilities, as well as other infrastructure needed to sustain and maintain a vibrant and healthy people and community. These changes have created stresses on the natural environment, which through a variety of feedback loops impact people, infrastructure, and the economy.

Our coastal areas are also very dynamic natural systems. Wind, water, sun, and other natural forces change the landscape sometimes over long periods of time, but in other cases in a matter of hours. Hurricanes Sandy and Katrina are prime examples of how within hours nature can re-arrange both natural and manmade landscapes in very significant ways.

THE RISK

While there have been great technical advances in helping communities and people understand the interplay between natural and human systems in these delicate areas, some coastal communities struggle to maintain a healthy balance. Long term more sustainable solutions are sometimes traded for near term economic gains. Our ability to collectively delay short term economic gratification in return for longer term non-monetary benefits is lacking in these areas. The result is a an ever increasing risk to losing the social, economic, and environmental benefits coastal areas have provided for generations.

OPPORTUNITY

Coastal disasters are devastating. The impact on humans and the environment is often difficult to comprehend as one scans the landscape after landfall of a major hurricane or in the wake of massive oil spill. Yet these events provide short windows of opportunity to make real and substantive changes – improving the way our human and natural systems interact. While data, technology, and science can inform the change process, the actual change itself must come from the people: manifest in the decisions they make as they begin the long and difficult road to recovery.

In many cases, the human response to the disaster follows a standard five stage grief cycle: denial (this didn't just happen), anger (who is to blame), bargaining (what can I do to fix this), depression (it's hopeless), and acceptance (time to move forward). Failure to recognize this very human response can result in a culture that simply repeats mistakes – particularly in a transient area where the people impacted by the event have never seen anything like it before. Somewhere between the bargaining and acceptance phase, people define successful recovery as putting things back to the way they were as quickly as possible. The thought of doing something differently to improve resilience or sustainability is just too much to bear and the sins of the past are repeated.

While there are a variety of things government can do to incentivize a breaking of the damage-rebuild-damage cycle, few will succeed over the long term unless they permanently reshape the way people think of their relationship with the natural environment. Changing that thinking is nearly impossible in the wake of a major disaster which means any hope for change must come prior to the event.

RISK, RESPONSIBILITY, REWARDS, RESOURCES

Performing risk assessments is a key first step in helping identify where vulnerabilities exist and importantly what lies at their root, but that is only the beginning. Effective risk management goes beyond knowing where the risks are and what drives them. Significant effort must be applied to map out how risk, responsibility, resources, and rewards (four "r's") are aligned or misaligned. Challenges will remain in areas where the risk is borne by one group, the rewards captured by another, and yet a third is responsible but lacks the resources to do so. Shining light on the r's though sharing of information and proper risk communication makes the change possible.

Assessing the risks, improving alignment of the four r's, developing a plan and sustaining action toward that plan every day is critical. Developing a recovery plan and being ready to make great strides toward increased resilience by contemplating catastrophe and knowing how to improve our relationship with the natural environment is one way of breaking the damage rebuild damage cycle, improving the quality of life, and sustaining the value of one of our nation's most treasured assets: the open coast.

# Demographic Changes within Coastal Flood Hazard Zones of the United States: A Comparison between the 2000 and 2010 Census

**Kevin G. Coulton, P.E., CFM , Mark Crowell , Susan T. Phelps, GISP, CFM**

## Introduction

How many people live in coastal flood hazard areas? With the growing concern about climate change and its potential effects on coastal ecosystems and infrastructure, information and data that can address and answer this question are undeniably important. Unfortunately, published data and information on coastal population is limited and usually represent the upper bounds of a wide range of possible coastal population statistics. Furthermore, a unique accounting of the nationwide population specific to FEMA coastal flood hazard zones had not yet been undertaken.

Beginning in 2007, FEMA initiated a series of studies to estimate the United States population subject to coastal flood hazards as mapped by FEMA. Each study progressively refined the previous one with the studies summarized by year as follows:

- 2007 Study - Presented a method to identify coastal counties and population based on the presence of V Zones only.
- 2008 Study - Refined the 2007 study to more directly estimate the U.S. population at risk from the 1% annual chance coastal flooding (V Zones and coastal A Zones).
- 2010 Study – Refined the 2008 study to include updated flood zones and demographics of 0.2% annual chance coastal flooding (coastal shaded X Zones).
- 2011 Study - Refined the 2010 study to estimate demographics with 2010 Census data, and demographic changes between the previously used 2000 Census data.

The focus of this paper is on the last study that incorporates population and housing unit data from the recently available 2010 Census. The findings from this study provide insights on demographic change within coastal flood hazard zones which may help to guide the development of future coastal flood risk management policies.

## Goal and Objective

The primary goal of all studies was to provide useful information to FEMA for identifying, mapping, and managing coastal flood hazard zones through the NFIP. The objective of the 2011 study was to replace the previous 2000 Census demographic data, which was used in all previous studies, with new demographic data from the recently available 2010 Census to assess demographic changes in coastal flood hazard areas of the U.S.

## Methods

The 2011 study built upon previous studies that followed a three-step process: (1) create a national digital flood hazard database by compiling the best available coastal-proximate, digital flood-hazard-

zone data using FEMA data sets; (2) develop a systematic method to separate coastal and riverine flood hazard zones and incorporate this boundary into the digital flood hazard database; and, (3) combine the year 2000 and 2010 census data with the digital flood hazard database using a geographic information system. This enabled estimates of the U.S. population subject to the 1% annual chance and 0.2% annual chance coastal flood. The analysis was conducted at the census block-group level, with census block-group populations (permanent residents) assumed to be uniformly distributed across each block group. Another assumption was that, while the population data provide information at two discrete points in time, 2000 and 2010, they are compared to one "snapshot" of FEMA flood hazard zones compiled from data available as of August 2010.

**Findings**

Based on the 2010 census data, approximately 8,623,000 people live in areas subject to the 1% annual chance (100-year) coastal flood hazard. This estimate includes the Great Lakes, but excludes U.S. Territories. This is approximately 2.8% of the total U.S. population of 308,745,538 (excluding U.S. Territories) according to the 2010 U.S. census. When the Territories are included, 8,788,000 people live in areas subject to the 1% annual chance (100-year) coastal flood hazard. Similarly, approximately 10,672,000 people live in areas subject to the 1% annual chance (100-year) and 0.2% annual chance (500-year) coastal flood hazards. This estimate includes the Great Lakes, but excludes U.S. Territories. This is approximately 3.5% of the total U.S. population. When the Territories are included, 10,876,000 people live in areas subject to the 1% annual chance (100-year) and 0.2% annual chance (500-year) coastal flood hazards. About 38% of the U.S. population lives in these "coastal" counties.

The replacement of the 2000 Census data with 2010 data, compared to similar coastal flood hazard zones (as of August 2010), resulted in an increase in population in coastal flood hazard zones, for example, from 8,268,000 to 8,623,000 in 1% annual chance coastal flood hazard zones. A notable exception to this average national increase is a 4.0% decrease in population on the Gulf of Mexico Coast. The coastal population decline along the Gulf Coast can largely be attributed to the effects of Hurricane Katrina. Louisiana experienced a 12.5% drop in one-percent annual chance (100-year) coastal flood hazard zone population, with significant declines noted in Cameron, Orleans and St. Bernard parishes. In Mississippi, which saw a 12.2% decline in coastal population, all 3 coastal counties (Hancock, Harrison, and Jackson) experienced population declines in one-percent annual chance (100-year) coastal flood hazard zones between 2000 and 2010.

Within individual FEMA coastal flood hazard zones, there is a 2010 total population of 2,088,000 in coastal shaded X zones (0.2% annual chance (500-year) coastal flood zones) compared to 8,123,000 and 665,000 in coastal Special Flood Hazard Areas (SFHAs; e.g., coastal A and V Zones), respectively. With the demographic changes from the 2000 to 2010 Census, this represents a 4.2% increase in population in Coastal X zones, a 4.7% increase in population in Coastal AE zones, and a 1.3% decrease in population in VE Zones.

# Managing Our Coastal Assets: A Systems Approach

**Sandra K. Knight, PhD, PE, D.WRE, D.NE**
President, WaterWonks LLC

To best manage America's coastal assets in times of change and uncertainty, it may be best to frame those assets as they contribute to US prosperity in the context of a system or system of systems. While individual coastal systems may be uniquely defined by a number of variables to include their geographic location and its characteristics, economic livelihood and social fabric, their long-term sustainability is dependent upon the ability to wisely manage and use key assets. The key assets are human capital, natural resources, physical infrastructure and financial capital. These assets are not mutually exclusive to each other, are interrelated and interdependent with the assets of other coastal systems, and are impacted and have impact nationally and globally. So, what approach can be taken to manage this complexity?

In considering the long view, as should be done particularly for climate change adaptation, one approach might be to tackle coastal systems as is done, or should be done, for our major infrastructure investments, by taking a life-cycle asset management (LCM) approach to analyzing the systems and their components. For purposes of this discussion, assets will be focused on physical infrastructure and natural resources. To begin, an inventory is needed and a value assigned to each asset within the system. An LCM approach also requires defining the assets acceptable level of service, assessing the conditions of and the potential risks to each asset, and setting up management strategies and a schedule for investing over the life expectancy of those assets. The types of investment strategies are typically directed toward maintenance, rehabilitation, replacement and disposal of the asset and/or its parts or components while balancing risk and managing to an expected level of service. While the terms used here are largely infrastructure centric, other management strategies could be defined and adopted for the other key assets and/or for the coastal system. In fact, much has been done regarding adaptive management of ecosystems and financial management that could be cross-walked with the LCM approach for coastal systems.

LCM is, by design, adaptive. As expectations for these systems evolve, new risks and uncertainties unfold and technology and innovation advance, the methods and means to manage the asset change and the investment decisions are modified. Since the availability of funding or other resources is often uncertain and investment decisions in one area can have adverse impacts in others, risk-informed decision making that analyzes trade-offs is a critical component of LCM. And, as in all management strategies, measuring performance is key to success. The coastal community or those that live within the coastal system should set the expectations and metrics necessary to meet or exceed an acceptable level of performance. LCM sounds simple in theory, but of course, is complicated not only by the shear enormity and complexity of a coastal system, but also by the complexity of our governance structures to manage these systems. Political boundaries do not follow coastal processes, ecosystems or watersheds. Ownership and control of assets can be at the individual level such as home owners, the infrastructure level such as utilities, or the state or federal level such as conservation areas and parks. Therefore

inclusiveness and collaboration are essential in setting the expectations of management of a coastal system.

While this seems overwhelming, it can be done. First, here is the good news. Much has been done in terms of inventories, condition assessments, and risk analysis, particularly as regards to our infrastructure, financial and natural capital. The US is data rich. Many of our infrastructure sectors, such as energy, transportation, cyber and water, have evaluated their assets at some level of systems or system of systems and are working to secure a sustainable investment strategy. Federal and state agencies and other private and non-profit groups have inventories and assessments of our natural resources and understand their value. As the US faces the need to replace aging infrastructure, recapitalization strategies can be considered that consider the impact of climate change and increasing hazard risk. The US has good census data and demographic information to plan for the future and to help identify and protect our most vulnerable populations. The US still has a strong economy and financial system, even on bad days. The ability to forecast future climatic conditions is unprecedented. Super Storm Sandy has reminded us yet again about the vulnerability of our nation and its assets to natural disaster and has exposed a reality about the increasing risks to our coastal systems, driving us to consider change. As a result, there is growing political will and individual desire to invest in infrastructure and address climate change. Elected officials are taking a leadership stance to build back stronger.

Now here is the bad news. Our assets are at or below acceptable levels of performance and in some cases at tipping points such as failing infrastructure and threatened and endangered species. The country is in a fix-as-fail mentality related to infrastructure. The recent ASCE report "Failure to Act" identifies a loss of $3.1 trillion in GNP, a $1.1 trillion loss in trade, and a $3,100 per year drop in personal disposable income if the US does not invest at least an additional $1.57 billion per year in infrastructure between now and 2020. And Building America's Future report 2012 Transportation Report, "Falling Apart and Falling Behind," further discusses that lack of strategic investment has moved US infrastructure from first place in the World Economic Forum's 2005 economic competitiveness ranking to number 14 today. Other complicating issues need to be addressed as well. Data are not collected, collated and analyzed in a way to communicate risk and best inform decision making. Qualifying and quantifying the interdependencies between assets and systems is not fully understood. Federal policies and programs are often conflicting and confusing to communities who need them most. Federal investments are not risk-informed and do not address the nation's greatest risks nor produce the best return on investment of tax dollars. Finally, the capacity of our citizens to understand complex problems and their ability to rally for change is underestimated. The public is smart, give them the information.

Is this all too complicated to proceed? No. Actions can be taken now based on what we do know. LCM strategies are available now. As a starting point 1) promote and enforce state and local land-use policies and building ordinance that enhance natural capital and mitigate hazards, 2) take advantage of federal and state funding and programs such as conservation easements, regulatory compliance, buy-outs, coastal zone management, etc. to enhance natural capital and preserve our environment, 3) make use of the federal and state funding that is provided post disaster to build back smarter and stronger, 4) use and adapt condition and risk assessment tools that exist across a variety of asset sectors, 5) capitalize on

the huge investments already made in existing data inventories, 6) mine the countless comprehensive community plans and strategic documents to set the vision, level of service and road map for what our nation and our public expects, 7) take advantage of shorter term and low-cost mitigation strategies that extend the useful life of the assets, and 8) push to completion the major projects that have been authorized and appropriated to harden critical infrastructure or provide risk reduction.

How can we do better? 1) Foster shared responsibility. There needs to be accountability and ownership at all levels by making climate change adaptation and hazard resilience implicit to the policies, planning, design and management of our assets. 2) Promote Innovation through investments in science and technology and empower change to create the tools to analyze complex systems and find innovative solutions to deal with the issues. 3) Demand action,

particularly in the investment in our critical assets, the natural and physical infrastructure that with or without climate change is already collapsing before our eyes.

The government and professional organizations and individuals represented at this Forum are essential to ensuring the credibility of the data, informing the public about the state of our assets and preparing our coastal assets for the future.

## Can the Cost of Insurance Drive Better Floodplain Management?

**Michael Buckley, PE**
Vice President Dewberry and former FEMA Deputy Associate Administrator for Mitigation

Within the last ten years, the United States has experienced two devastating coast storms with damages well into the tens of billions of dollars each, Hurricane Katrina (2005) and Super Storm Sandy (2012). These two events combined caused close to $25 billion in losses to the National Flood Insurance Program, in excess of the total claim payments in all the other years since the program began in 1968.

Rebuilding from Hurricane Katrina is still on-going and expected to take many more years, while recovery from Super Storm Sandy is just getting underway. In both of these events, FEMA issued Advisory Flood Maps and BFEs within weeks of the events to better reflect how these storms impact the statistical analysis of the 1% annual chance flood and the anticipated outcome of subsequent new detailed flood studies. This information will give communities the most current understanding of potential coastal flood heights for rebuilding purposes. In most locations, the advisory information showed BFEs that ranged from one foot to over ten feet higher than what was shown on the existing flood insurance rate maps. Nearly all communities impacted by Hurricane Katrina adopted higher standards, but not necessarily to the full extent of the advisory data. Both the State of New Jersey and New York are strongly encouraging their communities to build back stronger and adopt the advisory information. Failure to apply these higher standards will have significant cost implications to property owners.

Adoption of higher standards has taken on a new meaning with the Biggert-Water Reform Act of 2012. Over the next several years nearly all insurance subsidies will be phased out, including pre-FIRM non-primary residences, properties with grandfathered policies, business properties, severe and repetitive loss properties, properties that are improved more than 30% of their value, and property owners who refuse an offer of mitigation following a disaster. in addition, the rating of new policies, policies that lapse, properties newly identified in a Special Flood Hazard Area, and properties purchased after July 6, 2012 will be based on full-risk rating. Even subsidized policies for primary residences will be phased out when flood insurance rate maps are revised.

Property owners of structures with their lowest floor below the effective base flood elevations will see their premiums soar, in many cases by a factor of five or more. Even compliance with the minimum BFE standard does not ensure the cost of insurance will not go up, because a future map revision may establish a higher BFE. The cost implications in coastal areas can be even more dramatic when a Zone AE changes to a Zone VE, where rates are many times higher than in a Zone AE.

The cost of living in flood prone areas is going to rise and property values will be reflective of the true flood risk. Mortgage lenders will need to take into account the risk of flooding and the cost of insurance in determining the ability of a prospective buyer to pay the mortgage and the insurance, which could

add $1,000 to monthly payments. Communities can help to minimize the financial impact to property owners by adopting building standards that require new buildings and substantial improvements be built 1, 2, 3 feet or more above the BFE and V Zone standards in areas adjacent to A Zones in coastal areas. Significant outreach will be needed to ensure that communities are aware of the financial impact on property owners.

# Improving Community Acceptance of Flood Maps By Reducing Uncertainty

**Alan R. Lulloff, P.E., CFM**
Science Services Program Manager, Association of State Floodplain Managers

**Uncertainty**

Uncertainty in flood inundation mapping is caused by a number of factors including uncertainty in the flood volume, flood elevation determinations, terrain data, and accuracy of the techniques used for mapping the inundation area. These all effect the probability of a flood occurring and the accuracy of the flood inundation mapping that identifies where it will flood.

A common concern raised by communities and impacted property owners is that the areas mapped as flood hazard areas have never flooded. One way to address this issue is to use high water mark information and/or remote sensing technology to document the extent of flooding associated with flooding events.

High Water Marks - A high water mark, also referred to as a debris line, is the line left by high flows from floods and shows the height to which the water rose relative to surrounding land and infrastructure. Floodplain engineering modeling simulates flood events. To ensure their accuracy, model results need to be correlated to past flood events' high water marks. This is referred to as calibrating the model. The use of past flood event records helps link flood hazard maps to actual events that have caused flood damages. This reduces the uncertainty associated with the predicted flooding while establishing an underpinning of credibility that cannot be easily disputed. That link to historic flooding is usually the true test for residents.

Historic Flood Photographs – Flood photographs can help reinforce the fact that a community is flood-prone. It is not uncommon for homeowners to complain that an area shown in a mapped SFHA has never flooded. The availability of flood photographs is increased significantly today as smartphones enable everyday users to collect geotagged photographs.

**Improving the Communication of Flood Risk**

FEMA has implemented an initiative to address risks associated with flooding called Risk MAP (Mapping, Assessment and Planning). Risk MAP has the potential for making base flood elevations and the floodplain engineering models developed to generate them more readily available and accessible. According to FEMA's 2012 Report to Congress, one of the objectives of the initiative is the implementation of floodplain engineering model-based flood elevations to generate dynamic flood inundation maps.

By facilitating the streaming of regulatory flood data, efficiencies can be leveraged such that other federal agency Web services can provide this data to the insurance industry, lenders, state and local governments, commercial operations, and homeowners.

A key result is that this will force a dramatic improvement in the quality of the flood elevations and SFHA mapping in the National Flood Hazard Layer. Streaming regulatory flood data will allow flood elevations to be more easily compared to high water marks, location-tagged flood photographs and gages to identify inconsistencies and potential errors. Further, this will increase the potential for locating historic flood photos and high water marks to calibrate flood modeling. With the implementation of Risk MAP, the general public will potentially have regular access to FEMA flood hazard and flood risk data through a variety of mapping and other Web tools. General purpose mapping, real estate, lending, insurance, community, hazards, and public safety websites will all integrate FEMA regulatory flood data as part of the information they deliver on-demand. Users will be able to quickly input their location of interest and receive site-specific results. Digital mapping, data management, and Internet distribution will unlock additional value from the data collection and analysis that support flood risk studies. Improved data management standards will allow Risk MAP byproducts such as elevation data and H&H data to be integrated with other national and federal datasets for use in applications beyond the NFIP as well. Similarly, multiple Risk MAP partners and end users needing access to engineering data will be able to stream regulatory flood data into their Web services. Users will receive the regulatory flood data and the flood hazard and risk data they request through channels tailored to their specific needs rather than receiving a single universal map from FEMA.

**Summary**

People have difficulty in relating to once in 100 year or one-percent annual chance flood events. Strategies highlighted in this paper to improve community confidence and reduce uncertainty are to: 1) Ensure that regulatory flood data are calibrated against historic flood events, and 2)Improve the access to regulatory flood data and the floodplain modeling used to develop them.

Of particular interest is the geospatial vision FEMA has developed associated with the Risk MAP (Mapping, Assessment and Planning) initiative. If this can be effectively implemented, flood elevations and the floodplain engineering models developed to generate them would be made more readily available and accessible. Technologies are now available to disseminate and stream these critical datasets into Web mapping applications. This will allow FEMA to focus on the regulatory flood data and effectively fulfill its stewardship responsibilities associated with these data.

# Watershed Implications from the Mountains to the Coasts

**Bradley A. Anderson**
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**Introduction**

In the face of changing climate conditions and the increase in population from the headwaters to the coast, it is more important than ever to focus on a watershed approach to the development of adaptive management strategies for coping with the hazards and risks associated with the nation's floodplains. While it is acknowledged that coastal floodplains are not limited to riverine flooding, this paper focuses on the runoff generated within the watersheds and conveyed to the coastal estuaries. One only needs to look at the Mississippi River for an illustration of the inter-relationships of the coastal ecosystems to the runoff from the watershed.

**Water, Sediment, and Ecosystems**

Throughout many areas of the United States, drought conditions have prevailed much of the last decade. As experienced throughout the West, these conditions have exacerbated the number and magnitude of wildfires that threaten human life and safety. Following the aftermath of the wildfires, the potential risk continues. Low to moderate rainfall can produce flood flows from the runoff generated on the semi-impervious crust within the fire-ravaged watershed. Sediment and debris flows further increase the risk to the residents of the watershed and the downstream communities. Long after the wildfire, the impacts of subsequent runoff continue to pose risk to the health and welfare of the residents within the watershed. Communities that rely on water diverted from the river to meet the municipal demand encounter increased costs for water treatment. Irrigation diversions that are vital to the agricultural industry have been reduced until the clarity of the water improves following the runoff event. Wetland and riparian ecosystems have been reduced and those not immediately impacted by the wildfire may be impacted by the sediment delivery of subsequent runoff events. Similarly, aquatic life and habitat has been diminished within the watershed during and following the wildfire. Within Colorado, notable risks and hazards related to wildfires include Buffalo Creek Fire (1996), Hayman Fire (2002) and High Park Fire (2012) to name only a few.

**Collaborative Watershed Planning**

The above information is provided to demonstrate the connection between the water and sediment generated within the watershed and ultimately conveyed by the river system. It is important to recognize that the risks and hazards extend beyond jurisdictional boundaries and are more appropriately focused at the watershed level. The risk and hazards within the watersheds involve all stakeholders and includes Federal, State and local entities. Within the vision for Risk MAP, FEMA began addressing the risk to life and property on a watershed basis through the production of its mapping products. The goals for Risk Map relied on the collaboration with Federal, State and local stakeholders.

Minimizing the risk and increasing the sustainability and resiliency of the watersheds may require a more comprehensive strategy with all stakeholders.

For example, adaptive management on a watershed level should strive to integrate proactive participation and planning from all Federal stakeholders including, but not limited to:

- USFS (forest management plans),
- BLM (range management planning),
- USACE (waterway, flood control and navigation planning documents),
- NRCS (conservation plans),
- USBR (flood control management plans), and
- USEPA (watershed and wetland protection programs/plans).

Similarly, State, county and local stakeholders should consider the integration of watershed planning goals and objectives into their land use and mitigation planning to the maximum extent possible.

**Conclusion**

Planning for the hazards and risks within the upper watersheds of a flooding source will provide benefits to a reduction in the risk within the coastal floodplains as well as benefits to the coastal ecosystems. While population growth in the coastal zone is increasing, the adaptive management strategies to address the hazards, risks and challenges to the coastal ecosystem will undoubtedly rely on collaborative planning efforts throughout the entire watershed.

# Rebuilding Better: Protecting the Environment and Reducing Flood Damages

**Eileen Fretz**
American Rivers

**What is Rebuilding "Better"?**

After Superstorm Sandy hit, politicians and experts took to the press to urge the government to help communities rebuild "better". But what exactly does rebuilding "better" mean? To some it means rebuilding higher, stronger structures but in the same place. This is a short sighted approach that leaves communities susceptible in the face of stronger and bigger storms resulting from climate change. Rather, rebuilding "better" should mean rebuilding in safer places, with the right tools, and with the best science available.

Floodplains, wetlands, and barrier islands often receive the brunt of the impact from storms and floods because that's exactly how these natural defenses are supposed to work. When we alter and build on barrier islands and floodplains, we compromise these natural defenses and put lives, homes and businesses in harm's way. To truly rebuild "better", wherever possible flood-damaged communities should consider how they can preserve these natural defenses to provide flood protection.

**Rebuilding Better Can Protect Natural Resources and Development**

Management of our nation's floodplains is spread across a dizzying array of federal departments, agencies, programs, and policies. Keeping all of these programs on the same page is an ongoing challenge, particularly when programs can have competing goals. At a very basic level, this array of programs have one of two primary goals- protection of the natural resources of floodplains or protection of development. These two goals may at first appear to be at odds, but rebuilding better can in practice achieve both.

The goal of protection of natural resources means preserving or restoring floodplains to their natural state to maximize their natural beneficial functions- which indicates development should not occur on floodplains. Beyond protection from storms, floodplains provide many benefits and we are only beginning to grasp the many ways to calculate how they increase our quality of life. These benefits can come in the form of clean water supplies, recreational opportunities, spawning ground for commercial fisheries, habitat for endangered species, etc. These natural resource benefits make floodplains some of the most desirable places for protection and restoration by conservation and recreation groups.

The federal government has several mechanisms at its disposal for the purpose of natural resource protection. In general these mechanisms are aimed at protecting land for the protection of wildlife or recreation by designating National Wildlife Refuges or Wild and Scenic Rivers; or mitigation of damage to the environment by practices such as agricultural conservation easements or Corps of Engineers restoration projects. While these efforts are aimed at protecting or improving the environment, they also prevent development in harm's way.

The goal of protecting development can mean maintaining and enhancing the homes, businesses and infrastructure in the floodplain- which indicates building bigger and stronger structures to protect from flooding. It has become clear over the years that we can't keep trying to build our way to safety. The federal floodplain management vision is one of rebuilding better by using nonstructural flood management that relocates development out of harm's way. Several agencies, including the Corps and FEMA have the means to engage in these nonstructural approaches, which can preserve floodplain land as undeveloped. If this vision of wise floodplain management continues to be implemented many communities will achieve protection of the natural resources of floodplains and protection of development.

While protection of natural resources and protection of development may be two different goals, the actions taken to meet one often accomplish the other. Setting back a levee to allow more room for a river to accommodate flood waters can reconnect a river with floodplain ecosystems and reduce pressure on levees. Increasing the size of a culvert can improve fish passage and reduce the risk of the bridge being washed away during a flood. Prohibiting development on a barrier island protects the natural ecosystem and keeps people from living in harm's way. All of these efforts help to meet two goals, whether intended or not.

**Rebuilding Better Requires Coordination and Planning**

The Administration's proposal for rebuilding better after Superstorm Sandy offered an attempt to improve the region's resilience to future storms by bringing these two goals together. The President's proposal included not only investment in traditional flood control and nonstructural flood management programs, but also significant investment in protection and restoration of floodplain ecosystems because of their ability to buffer the coast from the impacts of storms.

Whatever your opinion of specific investments included in the Sandy proposal, what remains unclear is the overall plan for spending this significant investment in the Atlantic coast. Good intentions will only get us so far. An effective implementation plan is critical to ensure that billions of dollars given to the Corps of Engineers for beach nourishment and flood control will not be at cross purposes with billions of dollars given to NOAA for coastal restoration.

This criticism of the Superstorm Sandy recovery exemplifies the need for improved federal integration of natural resource protection planning and hazard mitigation planning. Planning for each of these causes individually occurs at all levels of government. Natural resources protection has a robust network of environmental groups planning the protection and restoration of floodplain ecosystems. Likewise, the floodplain management community has networks of practitioners engaged in hazard mitigation planning across the country.

Before the next Superstorm hits, the federal government should put in place mechanisms to ensure that natural resources and hazard mitigation planning are complimentary. Natural resources agencies and hazard mitigation agencies should work together to build upon each other's projects and meet the goals of both floodplain protection and restoration and to manage flood risk. There is also room for the environmental community and floodplain management communities to work together and learn from

each other. This increased coordination would allow communities nationwide to more efficiently rebuild better and increase resilience to the impacts of climate change.

# The Evolving Definitions of Resilience and Sustainability

**Larry Larson, P.E., CFM**
Director Emeritus – Senior Policy Advisor, ASFPM

Is community resilience different from community sustainability? Both resilience and sustainability are relatively new terms within the vocabulary of our profession – and it is with increasing frequency that I encounter discussions in which some see resilience as short term and sustainability as long term. Many terms continue to evolve as our knowledge and understanding grows, just as flood control is now evolving to flood risk management. As such, resilience and sustainability have come to describe how we want communities to either recover from a disaster, or how we want them to grow. Resilience and sustainability are the next steps beyond just hazard mitigation. It took decades to move from limiting assistance and funding for community recovery where the rebuilding was the same as they were before the disaster event, to suggesting and offering some funding assistance if they would mitigate when rebuilding. Now we are close to being able to mandate mitigation as a condition of receiving federal taxpayer money for rebuilding buildings and infrastructure.

Recognizing the importance of not only including mitigation in recovery, but of also ensuring that mitigation will take into account any changing future conditions, moves any such mitigation action into the realm of resilience or sustainability. In this regard, a clear example of flood hazard mitigation is to not only rebuild to the flood elevations from the currently adopted flood maps, but to also use the Advisory Base Flood Elevations (ABFEs) that the Federal Emergency Management Agency (FEMA) calculated after Katrina and Sandy. It is commonly agreed that use of ABFEs will make the structure and community more resilient. That being said, there are those who will argue that unless the full range of hazards, environmental, social, and economic conditions of the community are taken into account, the community may still not be sustainable. Is rebuilding, even to ABFEs, a truly sustainable option in a known high hazard area that is repeatedly flooded and subject to increased flood elevations in the future? Probably not.

Let's examine another flood hazard mitigation measure—a levee. Building a levee to protect a highly urbanized area will likely make that community more resilient. But if the levee fails or is breached, causing catastrophic damage in the community, can the community afford to rebuild it? Even if the levee has not yet failed, can the community afford the annual costs of operation and maintenance (O&M), necessary to keeping the levee up to its design level of protection? In other words, is this approach a sustainable option? I recall a California community that rejected a U.S. Army Corps of Engineers levee, because it was clear to this community that they could not afford the annual O&M costs. I'm also reminded of Soldiers Grove, Wisconsin. The people of Soldiers Grove rejected the levee option because, in their words, the levee would only, "change us from a dying run-down community subject to flooding into a dying run-down community not subject to flooding." That is to say, the community had many, many challenges to remaining a viable community – and flooding was only one of them. In their situation, the levee was not a sustainable solution. They needed a more holistic solution and approach, with the potential to address more of their challenges, as opposed to a solution that would only address one of them.

Napa, California, reached a similar conclusion and worked to not only incorporate a set-back levee, but to simultaneously address their challenges as opportunity for developing a more viable and sustainable community. If you are not familiar with the Napa success story, please click here.

Some of you may be thinking, "Don't tell me we need to do more. Many of us are still trying to get basic hazard mitigation included in recovery." However, let me suggest it is our profession that is most suited for leading the charge to establishing communities that are not just more resilient, but also more sustainable. While it is true that progress often comes one small step at a time - we, as leaders, must acknowledge the opportunity inherent to our role as long-term planners and strategic thinkers, such that we can maintain awareness of what lies ahead and more effectively guide the process and progress over the long-term.

# Sustainability Disconnect: A Case for Community Led Planning

**Doug Plasencia, P.E. CFM**
Vice President, Michael Baker Jr Inc

ASFPM Foundation Events Committee Chair

For years program managers at the local, state and federal levels of government have struggled with top down stove piped programs that typically do not fit neatly with local government structure. The US Army Corps of Engineers has made some limited headway with their Silver Jackets initiatives, and FEMA recognizes more and more the need to engage the community in the mitigation planning process. But in spite of these initiatives, local government remains the integrator or the "melting pot" of these programs.

If the nation's objective was to simply align program dollars via a federally directed planning process then perhaps the success achieved via these stove pipes would be deemed acceptable. Unfortunately as resources on all fronts shrink, and as the complexity of the problems faced by communities become more multi-faceted and inter-related, traditional approaches to federal planning and program delivery will continue to fall farther and farther away from meeting community needs.

While sustainability in coastal zones can be influenced by a variety of regulations, programs, and investments; perhaps the single largest factor influencing coastal sustainability are locally implemented plans that guides where development occurs, the character of the development, and the standards used to guide construction. At the community level, sustainability embraces the short and long term needs of the community and must balance economic, environmental, and the social needs of their citizens and businesses. At this time however, it is unclear whether current planning adequately considers natural hazards and the impact on the community and related the extent to which mitigation activities are considered, embraced, and implemented as the result of a robust community planning process.

As demonstrated over the past decade, our most significant flood related disasters are occurring as a result of coastal events, and demographic data and increases in valuation suggest that this trend will continue. Sea level rise will primary exacerbate this established trend. Following Hurricane Katrina and Hurricane Sandy, there is recognition that ill-advised development and redevelopment policy is a contributing factor however quickly the dialog reverts to getting people back to normal as quickly as possible and a focus on costly public works that certainly offer some protection but still leaves a community at risk.

Sustainability in coastal zones should not purely be a discussion about what else the federal government can do, but is a discussion that should emphasize how the community planning process is adapted to meet this changing risk and how the federal and state programs can better interface, influence, and support these local plans. Failure to make this adjustment will leave us in the unsustainable cycle of build, destroy, and lament.

# Post Sandy: An Opportunity to Reshape Disaster Policy and Spending Priorities

**Steve Ellis**
Taxpayers for Common Sense

The potential for Superstorm Sandy to have long-term and positive impact on floodplain and disaster policy is significant. People who were used to watching disasters on the weather channel and cable news experienced the storm in their front yard. These are people that are located in the prosperous economic heartland of the mid-Atlantic. But there is also great opportunity for Superstorm Sandy to have a legacy of decreased resilience and increased risk to property and lives through reinforcing our nation's current knee-jerk reaction-oriented disaster planning. It's up to advocates for wiser, safer, and less costly, flood plain management to ensure the right lessons are learned and the correct legacy created.

Not all large scale disasters have a lasting policy impact. Very little policy-wise came after Katrina and the storms of 2005. But like the Ash Wednesday storm of 1962, Sandy has real potential to affect policy. Fifty years ago, part of the response to the devastating storm was the federal government becoming involved in shore protection. It's up to advocates of smarter floodplain policy to make sure the policy changes emanating from Sandy recognize that in the face of sea level rise and climate change, rebuilding in the same manner and same place is not sustainable.

There have already been calls for buyouts and rebuilding smarter from New York and New Jersey elected officials. But at the same time lawmakers from the affected region have touted the success of U.S. Army Corps of Engineers projects like beach replenishment and constructed dunes and berms in reducing storm damage. This convenient explanation - damage would be have been worse without the constructed protection - fails to recognize that Sandy was not the worst possible storm and that there would have been even less damage if these areas had not been as developed.

Many in Washington are trying to write-off advocates of smarter flood plain management and disaster preparedeness claiming the choice is between retreat and reinforcement. But, the choice is not black and white. Retreat may in fact be the best choice in some locales. Reinforcing the flood protection for particular communities may be economical and efficient. Yet the corollary of ignoring what millions now know for the first time— that they are vulnerable to natural disasters—and continuing business-as-usual is the greatest danger.

Government has both a balkanized and myopic approach to disaster prevention/ mitigation/ response and climate change. The initiatives are spread across many different programs and agencies, and often times programs are not informed by one another. To make matters worse, some of our infrastructure and insurance policies are geared to not only encourage development in harm's way, but also to keep people in the same place even after the inevitable disaster occurs.

The federal government promotes high-risk development by removing much of the economic risks from the beneficiaries of development. The availability of subsidized (through the form of below market rates) federal flood insurance, predominantly federally funded flood and storm damage reduction projects, post-disaster funding assistance, and a litany of federal development programs from road-building to community development block grants all serve to shift risk to federal taxpayers, thereby encouraging more intensive development and rebuilding in high risk areas.

The federal funding provided in the recent supplemental appropriations bill had very little instruction as to how the funds were to be spent, or even that reconstruction would make communities, people, and property less vulnerable. Much of the funding was provided at full federal expense, removing local and state funding "skin" in the game that can serve as disincentive to simply rebuilding as before. This is akin to Congress is abdicating its oversight authority. Altering or removing cost share, eliminating cost share for “ongoing construction” projects—not defined and something the Corps said it may interpret as applying to projects that are still under study— and rushing to automatically authorize any project, currently being studied or not, that meets vague criteria all are pushing Washington to a wild, wild west scenario for flood plain management and disaster planning. Thus far, that is the greatest lesson of Sandy.

The inherently wasteful nature of the ad hoc, knee-jerk approach to post-disaster funding is colliding with the fiscal challenges facing the nation. And these fiscal pressures will mount. Local communities, state governments, and other non-federal entities are going to have to shoulder more of the costs.

This provides an opportunity to argue that a more consistent federal investment in prevention - would be both more fiscally prudent and preclude the need for emergency spending in all but the largest events.

In the coming months and years, Taxpayers for Common Sense will build on our years of experience with disaster response and infrastructure investments around FEMA, the National Flood Insurance Program, and Corps of Engineers funding to develop better policy solutions for pre-sponding and responding to disaster, better infrastructure investments to prevent disasters and increase resiliency, as well deal with the implications of climate change.

# Oikonomos: Adaptive Management and the Coastal Economy

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As of 2011, over half of the nation's population lived on the coasts in less than 20% of the total land area. Coastal counties on average have a population density of 319 people per square mile: five times the population density of the average inland county. This trend of coastal inhabitance is projected to continue. Recent estimates suggest a 9% increase in coastal populations by 2020. People move to the coasts because they provide productive economies, and they will continue to do so.

Concurrently, the nation's coasts are facing increased natural pressures. In the absence of development, shorelines naturally move. The gradual processes include reliction, erosion, or accretion of sediment. Barrier islands and river channels move to reflect changing seasonal wind and hydrologic patterns. On the other hand, severe weather events cause rapid and substantial avulsion of land. As the climate changes, these avulsive events will be more frequent and more severe.

The co-occurrence of these two processes, increasing coastal development and climate change, is likely to have exponentially dangerous and costly impacts to wildlife and people. At the same time, immediate-term job creation and economic benefit for private industry has become a superordinate national goal. This has resulted in a federal system of disaster finance rather than a system to better manage and mitigate risk.

An appropriate federal coastal risk management framework will instead take a holistic and long-term view of economic benefit with regional recognition of natural variation and pressures on a given ecosystem.

"Economy" comes from the Greek root words oikos, "house," and nemein, "to manage." Historically, the concept of economy related not only to short-term liquid assets, but long-term management of a household. Over the last few decades, however, economic considerations have been limited to private-sector economic benefit and job creation over relatively short time frames rather than a system for management of limited resources including non-monetary resources. We are no longer managing our coasts for long-term resiliency.

To support coastal economies, elected officials push for investment in coastal alteration: beach renourishment, seawalls, dikes, levees, and pumps. The intent is to fix coastlines to provide certainty in property rights to business and individual owners. The outcome is costly projects that require substantial annual operations and maintenance and can create unintended erosion or flooding problems elsewhere. Elected officials from developed coastal areas also face substantial pressure to artificially minimize the societal and personal cost of coastal development by providing subsidized infrastructure and insurance. These federal policies actually create a cycle of coastal management that ultimately leaves communities more vulnerable in the long-run.

# Calculating the Benefits of Risky Development Practices

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Summary:

In standard business-as-usual development practices, any property owner—home owner, developer, utility, builder, community organization or municipality—may perceive that it is in their own best interests to undertake construction that may eventually and quite possibly unwittingly risk harm to the public. Such practices too often externalize costs, to the federal, state, and local taxpayer; to the disaster survivors; and to the environment. On the other hand, the benefits of this development flow to others: developers, engineers, architects, builders as well as local and state government in the form of contracts, profits and tax revenue. Those charged with local land use regulation have a hard time saying "No!" to development which makes great local economic sense, provides tax revenues, satisfies personal relationships and results in greater local employment; even if that development may result in damages at some uncertain future date.

Such practices, one at a time and as an accumulating alteration of the land, may increase risks to everyone—property owners, building users and neighbors, authorities responsible for infrastructure, public health and safety, and the larger community—due to climate variability, uncertainty in calculations about the magnitude and frequency of future natural events, changes in the watersheds, aquifers, landscape, and, for coastal communities, the shoreline ecology of land and water. Such risks become real and evident when natural events such as earthquakes, wildfires, storms, floods, drought, hurricanes, and ice storms result in damage that could have been avoided or mitigated, had development been undertaken with due precautionary measures in the first place.

The focus of this short paper is the need to study and to correct and improve standard development practices, to understand better why foreseeable disaster losses continue to increase, even with planning regulations in place. We need to fully account for public (and private) risks that our business-as-usual land uses and development practices due to the consequences of extreme weather events. The risks of natural hazards are increasingly evident. Our planning, land use, building code and regulatory practices have to catch up.

The consequences of extreme weather events are becoming more and more severe: lives lost, property damaged, the environment despoiled. The National Oceanic and Atmospheric Administration [NOAA] published a study in 2010, which interviewed coastal planners about why communities were not doing a better job of reducing the consequences of natural events. [1] This study indicates two primary reasons that communities are not doing a better job regulating and restricting development in hazardous locations. The first reason was the fear of "takings" litigation based upon threats by developers to sue communities for depriving them of constitutionally protected rights to property. [2]

Economics play an incredibly important role on why we see areas developed in the first instance, and then built back to the same condition and in the same manner following a natural disaster event. We seem to want to live and work in three areas:

a) in or near water areas, which are subject to high winds & flooding;

b) areas subject earthquakes;

c) and/or areas subject wildfire.

Floodplain locations are particularly in demand. The water views and water rights attendant to those locations, because of that demand, make the property more valuable. More valuable property often attracts a well-heeled demographic group that pays higher real estate and other taxes, and usually demands fewer local services such as schools. This also makes the development of these floodplain areas extremely attractive from the perspective of local taxing authorities. Yet, those same local authorities are also charged with adopting and enforcing zoning and building codes in those hazardous locations.

A specific example of this paradox was reported in a recent first-page article of the New York Times. [3] The article reported on the decision-making by New York City's Electric Utility, Consolidated Edison, in considering whether to redesign its power distribution system to make that system more resilient to storms of the future of simply restore to pre-disaster conditions. The costs of constructing a more resilient system were estimated in the multiple billions of dollars versus hundreds of millions to rebuild as previously existed. Many insurance sources have reported that there were surprisingly high and mounting costs for business interruption following the Sandy disaster. If Consolidated Edison looks only at their costs of rebuilding they may well decide that it is a more sensible business decision to simply repair in kind. Yet, a very different calculation might well result, when we look broadly at the "whole community" cost of power interruption for weeks and months to society as a whole

Those of us who are involved in floodplain management, hazard mitigation, and climate adaptation should not be saying "no" to development. Rather, we should frame the negotiation as "yes" to good development and land-use processes that build a safer more sustainable future for the "whole community." Admittedly, we need to find new, improved, and better ways of communicating this idea to developers, utility officials, state and local regulators and officials.

One way, most helpful in this quest to communicate the practicality of developing a safer future is to develop a clear and convincing analysis of the benefits of safe development from the very beginning of planning, design, financing and approval processes.

Building codes have been incredibly effective in reducing losses from many types of hazards, particularly when accompanied by complimentary zoning provisions. Examples include life-safety and property protections of wind (when enforced); fire (both urban fire and also we are now seeing good results from zoning and building code reductions for wildfire in places like Colorado Springs); earthquake both in terms of reduction of damages (Chile vs. Haiti) & life safety (e.g., California).

However, codes and minimum NFIP standards have thus far not been as effective in reducing flood losses as we had projected and hoped. Flood losses are bad and rapidly getting worse. I suggest that we need to closely examine:

a) Why flood losses are increasing and

b) What we can do about that fact.

Mere adoption of codes or zoning will not work if the codes & zoning have insufficiently high standards or standards focused insufficiently on what works to reduce Flood Losses. [4, 5]

Starting with the idea of “stabilizing the patient.” by using planning and building codes to cease making the foreseeable consequences of natural events even worse, makes good public policy and good economic sense too. The most cost effective form of hazard mitigation is doing safe engineering, building and design right from the start. The payback for doing safe and sustainable development from the beginning of development has a payback of something like a hundred or maybe even one thousand to one. The AIR/NFIP Study and the Wharton School Study both lend credence to that concept. But we do not currently have clear and convincing evidence to support my assertion. We need that evidence to help convince skeptical developers, local officials and code organizations of the merits of higher zoning and building standards.

Yet, even there is "only" a 4-1 cost-benefit for safe building from the beginning along the lines of the cost-benefit for retrofitting to correct past errors in design and building, (that cost benefit is the well documented in the MMC Study) is still extremely worthwhile, especially if applied to development from its inception. A number of studies provide at least some support to a thought that there is more like a 100 to 1 payback for safe and proper construction from the beginning of development, as opposed to fixing past errors of design, engineering and or construction are more recent. [6, 7, 8]

I believe that correcting the past mistakes of planning, engineering and community development, post disaster is all too often the main focus of Hazard Mitigation Planning. As indicated in the University of North Carolina Coastal Hazard Center’s research findings on hazard mitigation policy, planning and implementation very few state or local hazard mitigation plans contain much about designing safe development through higher zoning and building code standards. [9]

Correcting past mistakes is certainly worthwhile, but keep in mind that, the foreseeable processes of nature do not cause misery to society, the environment, and the occupants. Human error in building location, design and construction are the real culprits.

When a state or community requires safe design standards, consider the savings to society as a whole and to the federal taxpayer from higher standards such as those contained in the California Earthquake code or in the Massachusetts State Building Code, which requires two feet of freeboard in the V-Zone. The builder or developer, who makes the profit, pays those higher costs of development and who makes the decision to develop in the first place; the payback is to society at large. That seems fair to me. It is also quite appropriate under the principles of morality and the law.

The solution to the mounting toll of disaster losses lies in planning, in law and regulation: we can create improved practices to assure the long-term value of both private and public development—through win-win approaches to build a safer, sustainable future. Or we can just keep doing what we have been doing and watch the toll of misery mount.

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The benefits of safe and proper construction are documented in the "4-1 study" by the Multihazard Mitigation Council (MMC), of the National Institute of Building Sciences. Note: while the MMC Study indicated that it covered both efforts to build safely from the beginning of a development, the study mostly focused on mitigation to fix damaged property. It can be found at:
http://www.nibs.org/client/assets/files/mmc/Part1_final.pdf

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# Mitigation Must Proceed In Steps: We Should Recognize and More Clearly Formalize the Process of Funding and Implementation of Hazard Mitigation before and after Natural Disasters

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By definition, major disasters are usually followed by times of much uncertainty and even a level of chaos while the society attempts to assess, respond, and start recovery phases. Lately, we have seen this repeatedly after a cascade of major coastal storms and hurricanes, as well as other large storms, floods and damaging events. At the same time, we have also witnessed the remarkable efforts of first responders to reach and secure victims and then restore basic functions, which continue to show that concerted government and private sector cooperation should be viewed as among the most valuable of society's assets to help individuals and communities in times of need. A next major challenge is to learn from these events and incorporate those lessons into the fabric of building and rebuilding of our communities smarter and more safely for the future.

An observation from the most immediate Congressional process of Hurricane Sandy response, however, is that while the nation is coming to more fully appreciate the need for – and serious imperative of – accomplishing long-term hazard mitigation in the face of accelerating damages and costs of natural disasters, we are stumbling to a degree over processes that we have established in the past to address disasters generally. While the current process of using "Emergency Supplemental" appropriations legislation as the principal source of response funding – rather than regular annual budgets – will likely continue to be a subject of mounting discussion as budget management s increasingly taking a center stage, it may be equally important to clarify an improved process for incorporating hazard mitigation investments into the overall scheme, no matter how disaster response funds are generated. It is important to recognize that critical community planning must be strongly supported within the disaster recovery process, and it may be valuable to build in a conscious "two-step" process to disaster funding to assure that hazard mitigation can be maximized.

One of the most encouraging aspects accompanying Hurricane Sandy's response has been the wide political spectrum that appears to support rebuilding "safer" and that recognizes the need to address real and increasing vulnerabilities associated with many low-lying coastal areas facing increasing development, accelerating sea-level rise and threats of more violent coastal storms. But concerns over the need for clearer plans for use of hazard mitigation funds to address the vulnerabilities and how costs should ultimately be shared and apportioned were among the issues that recently slowed Sandy aid legislation from being delivered.

The legislative process that began with state and federal needs assessments packaged into an Administration proposal for Congress' consideration was an important element of a rational process. The Administration included a discreet $15 billion proposal of primarily hazard mitigation activities; however, this proposal included both emergency planning funds and general mitigation implementation

funds. The debate that ensued over the mitigation implementation funding before many mitigation plans are formulated highlighted the need for a stronger, clearer process to assure that wise, farsighted mitigation will be accomplished based upon best available science and broad stakeholder involvement.

If Congress, the Administration and states had more confidence, first, that current Stafford Act state and community Hazard Mitigation Plans were of sufficient quality to be relied upon to help guide initial hazard mitigation efforts, and, second, that a built-in "follow-up" process, at perhaps 6 months to a year following the disaster, could also be relied upon for continuing federal support for hazard mitigation, once additional plans are completed, it is likely that the emergency supplemental appropriations process would not itself be as difficult and chaotic as the examples we have recently seen. The follow up process could be guided in an initial appropriation bill by setting certain deadlines and direction of reports to Congress on identified hazard mitigation needs following major disasters. Ultimately, the Sandy legislation did some of this, but in an often haphazard fashion that leaves a great deal of uncertainty over hazard mitigation planning going forward. What seems missing from the current process is a clear sense of reliable, planned follow-up by Congress and the Administration once communities and the affected areas can develop long-term, post-disaster hazard mitigation plans and submit them to states, federal agencies and Congress for further support.

It is interesting to note that in the period of 2005 – 2008, following Hurricanes Katrina, Rita and Wilma, Congress enacted eight separate bills with major Katrina emergency supplemental appropriations, totaling $134 billion in federal aid, not including other "authorization" bills impacting on programs affecting rebuilding and hazard mitigation efforts. Thus, the actual history of recent major emergency supplementals, should (but mostly has not) ameliorate the frenzied sense accompanying other recent disaster recovery legislation. The sheer costs, damages, and impacts on affected economies from recent major natural disasters – and, today, the growing need for major hazard mitigation investment – will likely continue as a large challenge to Congress, Administrations and all other levels.

# Low-Hanging Fruit Ready for Harvest: How Existing Policies and Programs Can Reduce Flood Risk

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Flood risk in the United States is projected to continue to rise due to persistent development in flood-prone areas and the impacts of a changing climate. This trend is particularly stark and undeniable along the nation's coasts, as illustrated most recently by Hurricane Sandy. Recognition of the lower costs, multiple benefits, and aesthetic advantages of green infrastructure has brought about renewed interest in alternatives to the costly and brittle approaches of levees and coastal floodwalls. However, significant policy and social barriers continue to drive unsound and unsustainable decision-making at the state, regional, and local government levels for all but a bold and brave few who adopt standards to prevent future flood losses and better prepare their communities for climate change impacts.

This paper focuses on three key federal policies and programs that exist today and are ripe for modernization to support efforts at all levels of government to prepare the nation for the impacts of a changing climate.

1. Technical assistance programs through the U.S. Army Corps of Engineers and other federal agencies provide critical support to state and local efforts to identify, characterize, and manage flood risk. These programs need to be expanded to meet the widespread need to support nonfederal innovation and initiative.
2. The Principles and Guidelines for Water and Land Related Resources Implementation Studies (P&G) are the rules that govern how Federal agencies evaluate proposed water resource development projects, and have remained unchanged for thirty years.
3. Executive Order 11988 was issued in 1977 to prevent federal investment and activities that increase floodplain development and occupancy where practicable alternatives exist. How do these broad statements of federal policy drive state and local decision-making? More importantly, how can they be adjusted to improve those decisions and encourage more states, regions, and local governments to take the lead in managing flood risk, climate impacts, and disaster costs?

**Communities are the first and last line of defense in reducing vulnerability to floods and the harmful impacts of climate change.** Although the Federal government plays an important role through making data and funding available to support decision-making, development planning and permitting is performed by States and, most often, local governments through comprehensive land use plans, zoning and land use regulations, and building codes. Technical assistance programs such as the U.S. Army Corps of Engineers programs for Planning Assistance to States, Floodplain Management Services, and the Silver Jackets program support innovative management of flood risk along with other water resources challenges. However, demand for this technical assistance far exceeds program capacities. Significant expansion of the authorities for PAS and FPMS would help promote SAGE concepts, educate local leaders on the benefits of green infrastructure strategies, and ultimately help reduce flood losses and costs to the nation's taxpayers in the form of disaster relief. Similar expansions are needed in other federal programs to support state, regional, local, and private sector innovation and initiative.

**Principles and Guidelines for Water and Land Related Resources Implementation Studies**

Federal water resources projects and planning have been guided by a process that has remained largely unchanged for thirty years, despite an increasingly dubious record of its efficacy. The first set of "Principles and Standards" was issued in September 1973 to guide the preparation of river basin plans and to evaluate federal water projects. Following a few attempts to revise those initial standards, the current principles and guidelines went into effect in March 1983 with economic development as the primary objective and environmental protection as a secondary constraint. The 1983 P&G guides the planning of four federal agencies: the Bureau of Reclamation, the Corps of Engineers, the Natural Resources Conservation Service, and the Tennessee Valley Authority. Over the past thirty years that the 1983 P&G have been in effect, numerous studies have noted its bias favoring structural measures, unwieldy treatment of environmental and social values that are difficult to qualify and monetize, and misalignment with national goals of public safety and environmental protection.

The Water Resources Development Act of 2007 directed that the 1983 P&G be revised for use in the formulation, evaluation, and implementation of water resources projects, and articulated the following National Water Resources Planning Policy:

> It is the policy of the United States that all water resources projects should reflect national priorities, encourage economic development, and protect the environment by—
>
> (1) seeking to maximize sustainable economic development;
> (2) seeking to avoid unwise use of floodplains and flood-prone areas and minimizing adverse impacts and vulnerabilities in any case in which a floodplain or flood-prone area must be used; and
> (3) protecting and restoring the functions of natural systems and mitigating any unavoidable damage to natural systems.

WRDA 2007 further required that revised principles and guidelines consider and address the following:

> (A) The use of best available economic principles and analytical techniques, including techniques in risk and uncertainty analysis.
> (B) The assessment and incorporation of public safety in the formulation of alternatives and recommended plans.
> (C) Assessment methods that reflect the value of projects for low-income communities and projects that use nonstructural approaches to water resources development and management.
> (D) The assessment and evaluation of the interaction of a project with other water resources projects and programs within a region or watershed.
> (E) The use of contemporary water resources paradigms, including integrated water resources management and adaptive management.
> (F) Evaluation methods that ensure that water resources projects are justified by public benefits.

In laying out these policy priorities and considerations, the Congress expressed its intent that a new direction in national water policy be developed and pursued. The inclusion of risk and uncertainty,

contemporary paradigms, and adaptive management considerations all point to the need to consider climate impacts in the revised P&G. This consideration is especially important in light of the expected hydrological impacts of climate change, where historical meteorological data may no longer be an accurate predictor of future conditions.

Since the adoption of the 1983 P&G, federal , state, regional, and local agencies have grown more technically sophisticated in their own engineering, environmental, public safety, and climate adaptation missions. Application of revised P&G across the federal family will help assure coordination and alignment among the many federal programs that support the state and local role in the identification and management of flood risk, floodplain and coastal resources, and human interactions with those resources. Principles and Guidelines can assure a unified and cohesive approach to accounting for uncertainties associated with climate impacts, while encouraging nonfederal leadership and initiative to adopt modern planning, standards, and codes.

However, updating P&G was not the only demonstration of recognition of the need to identify and address flood risks and the effects of federal policies and practices on escalating risk and disaster costs. WRDA 2007 § 2032 required that the President submit to the Congress a report on the nation's vulnerability to flooding, including risk of loss of life and property, and the comparative risks faced by different regions of the nation. Congress directed that the report include the following elements:

(1) an assessment of the extent to which programs in the United States relating to flooding address flood risk reduction priorities;
(2) the extent to which those programs may be encouraging development and economic activity in flood-prone areas;
(3) recommendations for improving those programs with respect to reducing and responding to flood risks; and
(4) proposals for implementing the recommendations.

Although that study is long overdue, it should provide valuable information also take into account the impacts of climate change, including sea-level rise and other hydrologic changes that are either underway or can be reasonably anticipated.

During the six years since WRDA 2007 was enacted, costly and disruptive floods have continued to plague the Mid-West, Mississippi and Missouri River Valleys, Gulf Coast, and Eastern Seaboard, with Hurricane Sandy providing the latest reminder of the extent of the nation's vulnerability. The nation can no longer afford to continue on its current path of authorizing and funding projects through a process that is so heavily biased toward structural approaches without comprehensive review of environmental impacts and consideration of nonstructural alternatives, and without fully leveraging state and local authorities in land use, infrastructure maintenance, and building codes.

**Executive Order 11988**

Executive Order 11988 seeks to minimize actions by federal agencies that result in "adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative." The order requires federal

agencies to avoid direct or indirect support of floodplain development when there is a "practicable" alternative, and applies to acquisition, disposal, or management of federal land, undertaking, financing, or assisting construction projects, and conducting activities affecting land use, including planning, regulating, and licensing. Recent research has identified a pattern of uneven and incomplete implementation of EO 11988 across federal departments and programs. While some federal departments have updated their guidance and regulations governing the protection of floodplains, others have adopted the view that the order does not apply to their programs or that their activities are exempt.

While some have called for a new Executive Order, the language of the order itself may provide an adequate framework for the substantive achievement of its stated goals and objectives. However, the guidance for its implementation has not been updated since 1978. New guidance to apply to all federal agencies would help ensure a unified approach to federal – and federally-supported – activities in flood-prone areas. It would also provide the incentives needed to drive responsible nonfederal action in those areas. Key areas for consideration include the following:

1. Definition of areas of flood risk need to apply best available data to account for sea-level rise and other hydrologic changes associated with climate change, as well as non-climate-related changes that are reasonably foreseeable.

2. Applicability for Publicly Owned Treatment Works. Federally funded water and wastewater facilities are often placed in special flood hazard areas. When these systems are damaged in flood events, populations lose access to potable water supplies and these systems require costly repair or replacement. To qualify for federal funding, these critical facilities need to be placed outside special flood hazard areas and floodproofed to be operable in flood events that exceed the 1%-annual-chance.

3. Applicability for programs that facilitate community development. Particular emphasis is needed on those programs that support transportation, housing, economic development, utilities, and other infrastructure that drive local planning and development decisions.

While land use and development decisions are largely nonfederal functions, Federal standards and funding – including the $50.5 billion aid package enacted for Sandy and other disasters - play a significant role in shaping those decisions. Federal policies and programs are already in place to prevent unwise use of the nation’s floodplains and coasts and to promote SAGE principles; they are only in need of modernization to apply the many lessons learned over a generation of mounting flood losses. Coastal and flood risk professionals across all relevant disciplines and levels of government stand ready to support the Administration in its mission to respond to Hurricane Sandy, while preparing the nation for the floods to come.

# Hurricane Sandy As A Focusing Event: Observations, Opinion, and Wishful Thinking

Matthew B. Miller

A "focusing event" is a crisis or disaster, natural or man-made, which changes the status quo. Hurricane Sandy made landfall along the East Coast of the U.S. in late October 2012, and will probably be the second most expensive natural disaster in U.S. history. This alone would make Sandy a focusing event. However, just over a year earlier, Hurricane Irene also struck the East Coast, and at the time was judged the sixth most expensive hurricane in history. This "one-two" punch appears to have made the residents of the storm-affected areas and the political leadership particularly attuned to the need to rebuild in a disaster-resistant manner, and not just to rebuild as quickly as possible to the pre-storm condition, which would leave them even more vulnerable to future damages as storm patterns change and sea levels continue to rise. These focusing events can also serve as a catalyst for policy development at the federal, state, and local levels that would result in greater disaster resistance for the Nation as a whole.

**Federal Disaster Assistance as an Entitlement**

It sometimes seems that funding for federal disaster assistance is only discussed at the national level after a major disaster, and then the debate is about the size and speedy approval of the Congressional appropriations, not so much the nature and effectiveness of the programs tasked with delivering it. Part of the reason for this may be that the need for disaster assistance is sometimes perceived by the public, our politicians, and some members of the media as arising from "Acts of God" and not from arguably ill-advised human actions in the face of predictable natural hazards, like flooding, sea level rise, and coastal erosion. Another reason may be that the payments tend to be sporadic and perceived as "one time only". Lastly, disaster assistance is considered an entitlement, i.e., "If you got it, we should get it." Traditionally, it has been hard from a political level, to object to the provision of federal disaster assistance.

**Hurricane Sandy Recovery Funding**

An interesting aspect of the Hurricane Sandy recovery appropriations process was that it took a long time compared to appropriations for other major disasters; it took almost three months for passage, as compared to the approximately one-week process for Hurricane Katrina. However, two appropriation bills, totaling approximately $60 billion, moved rapidly through the Congress once the delay became a political liability to the majority in the House of Representatives, which caused it. This delay was primarily due to the ongoing Congressional budget debates, and not the merits of the funded projects. Calls for offsets in the federal budget were the main source of delay, although there were objections to funding for non-Hurricane Sandy projects included in the second appropriation bill, as well as for projects not associated with immediate response and recovery.

The first Sandy appropriation approved by the Congress and signed by the President was for $9.7 billion and increased the borrowing authority of the National Flood Insurance Program to enable it to pay flood

insurance claims. The second appropriation was for $50.7 billion and included funding for public transportation, the federal disaster relief fund, and community development block grants. The latter bill includes funding for coastal construction projects and beach restoration.

It would be a real "game changer" if the lengthy (compared to past disasters) appropriations process for Hurricane Sandy became the norm for future disasters. If the public and its elected representatives were to perceive that there were inequalities, unfairness, or significant waste in the appropriations following major disasters, Congressional gridlock would take on a new dimension. Conversely, it might usher in a new era of federal disaster assistance where existing laws and authorizations are revisited for effectiveness in the light of climate change and the likely, increasing cost of disaster assistance.

**The Pressure is On**

There is tremendous pressure on elected leaders and public servants after a disaster to do something in response to it, or at least be perceived as doing something. This is a good thing in the early phases of a disaster in that it leads to the rapid provision of lifesaving services and requisite funding. It is a bad thing when it results in poor policy choices with costly, long-term impacts, e.g., funding costly, poorly thought out flood control projects or rebuilding public infrastructure and housing stock using an outdated flood map.

Major disasters like Hurricane Sandy provide an opportunity for government at all levels to "up their game" using existing authorities and resources, even in advance of changes in disaster assistance laws and delivery programs. Actions that might have been politically or administratively untenable before a major disaster suddenly become reasonable and doable.

Three months after Sandy made landfall in the northeastern U.S., some of the actions on the ground are very encouraging, For example:

- FEMA rapidly accelerated in-progress, revised flood mapping for the East Coast after Sandy's landfall and is issuing ABFEs (advisory base flood elevations) for impacted communities.
- Many impacted communities are requiring use of the ABFEs in the rebuilding process under their existing authorities.
- Communities are waiving zoning requirements to allow alternative, more disaster resistant construction, such as piling foundations for residential construction.
- States are proposing buyouts of damaged homes in the most flood-prone areas and converting the lots to permanent open space.

One area of concern with regard to the ongoing recovery activities is the public perception that dune and beach restoration as well as structural coastal engineering projects are cost-effective and desirable mitigation projects. Long-term maintenance costs for these projects have seldom been mentioned.

**Other Good Ideas**

The Association of State Floodplain Managers (ASFPM) recognized the need for timely reconstruction and policy guidance following Hurricane Sandy and released a paper on December 13, 2012, entitled "HURRICANE SANDY RECOVERY: Using Mitigation to Rebuild Safer and More Sustainable Communities". This paper outlines some of the specific actions that communities can take now to rebuild in a manner that reduces human suffering and property damage from future natural disasters. It also recommends policy initiatives to increase the Nation's disaster resiliency. One powerful recommendation is:

"6. Complete a post-disaster analysis of the Sandy event and track how the federal money is spent for this disaster. There is currently is no post-rebuilding analysis of major disasters to determine the cause of the disaster or what could have been done to prevent it or reduce the deaths, suffering, and costs. Only by tracking what is done and what is effective or not effective can we improve the disaster relief and mitigation process. We, the federal taxpayers will pay probably $80 billion or more for this disaster, just as we paid over $150 billion for the 2005 hurricane disasters. We deserve no less than a full accounting. This analysis would be similar to what the National Transportation and Safety Board (NTSB) does after each plane crash …"

**Concluding Opinions**

Damages to the U.S. from Hurricane Sandy reinforce what we already know: our coastal cities are very susceptible to damage from hurricanes. We know this fact from our coastal science. Perhaps it took a major hurricane for us to internalize what our science told us. Our science also tells us that coastal flooding events will cause increasing damages to our built infrastructure. Sea level rise will be a major driver of the increasing hazard.

As a country, we have the knowledge and resources to build more disaster-resistant communities. We have to act on what our science and focusing events tell us we must do.

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The New York Times provides a "daily diary" of federal, state, and local news pertaining to Hurricane Sandy before and after landfall. Go to http://www.nytimes.com/ and search on "Hurricane Sandy" for coverage of everything from sewage backups to Congressional debates over disaster assistance.

# The Communications Challenge –Risk and Policy for Property Owners and Communities along the Coast

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This paper is intended to be a simple thought piece to highlight the tremendous challenges we face as a nation in clearly communicating to those living along our coasts both the risk they face and the policies that exist to address that risk. If the right folks do not understand their risk or what to do about it, we will continue to struggle in achieving actions that mitigate the risk effectively and improve resilience.

My belief is that there is universal acceptance of the fact that if a community exists along the coast, there is a risk of damage and loss of life from coastal storm events. I believe that with the recent major events of Katrina, Sandy and other major storms, most home and property owners, as well as most communities, recognize that there exists some hazard associated with life along the coast. The challenge we face is finding a simple, efficient way to frame that risk in relative and simple terms so people understand the level of risk they face. A similar challenge exists in finding a simple, effective way to develop and communicate the policies and programs that exist to help mitigate the risk.

We tend (I am guilty myself being an engineer) to potentially overanalyze and complicate how we try to codify and communicate risk levels. Is there a balance we should be seeking between using complex scientific analyses to refine and support risk levels and having simple ways to effectively communicate the risk?

Here is an example to illustrate. We spend millions of dollars running complex coastal models to refine exactly where flood map zone lines should be drawn and what the elevation heights of water damage might be in certain locations. And yet we seem to get tongue tied when trying to defend the results for a specific community or homeowner, trying to describe statistical accuracy and the variability of models. Despite the science, it gets hard to describe and defend to a specific home owner or community when they have to balance development, tax base or rebuild costs. It just isn't very simple. If we placed a higher value on the need to be able to communicate the risk more easily and effectively, we might have decided much earlier on a simple method. We could take the storm of record and add a freeboard to it? My thought is that folks would understand this method much better, and maybe not even be able to argue much against it except to nitpick where the storm of record advanced to or what is a reasonable freeboard to account for stronger future storms. It would seem even those debates would be simpler.

So how do we measure the value of being able to clearly communicate the hazard vice the ability to support its depiction scientifically? As we look at future policy change and ways to improve property owner and community resilience in the face of increasingly hazardous storms, we should strongly consider how the new policy can be communicated as a key factor in decision making. My belief is that we should stop and ask the question "if we make this change, will it make it easier or harder to communicate with those who need to understand their risk and take mitigation action?" If the answer

is we are adding even more complexity, we should pause and perhaps reconsider, even if we believe the policy change is a good one. We have a lot of good policies now, but we seem to continue to struggle in improving resilience and in gaining understanding and acceptance of those policies from homeowners and community officials. We should think more, study more, and assess more how much the complexity of our well intended policies may be failing to achieve desired results because the folks most affected who can take action don't understand their risk or what to do about it. At least in part, the reason could be because our policies and approaches are just too complex. We need to give the communication challenge more value in the debate over what to do and how to do it.

# Ensuring Resilient Coastal Communities and Ecosystems: The Time Is Now to Act

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As 2012 was coming to a close so, too, were the United Nations' climate talks. These talks underscored the fact that the UN Intergovernmental Panel on Climate Change (IPCC) has, for the past two decades, underestimated the impacts of climate change. For example, the loss of the extreme melting of summer Arctic sea ice is now 50 years ahead of the schedule that the IPCC has been predicting; more current projections anticipate that the Arctic is likely to have completely ice-free summers within 20 years.[1] Such underestimations of the timing and impacts of climate change impede the ability of governments around the world to adapt to these changing conditions in ways that will properly safeguard communities and ecosystems.[2] Indeed, as we have seen most recently with Hurricane Sandy, Americans, particularly those living on the coast have been hit hard by extreme weather events. While the full cost estimates of Hurricane Sandy have yet to be finalized, preliminary data for 2012 indicates that there were eleven extreme climate events that were estimated to cost over $1billion in losses.[3]

The risks to, and the vulnerability of our coasts is significant and increasing. Some five million people live within four feet of the high-tide level along America's coastlines, and their population growth is rapidly outpacing other regions. Furthermore, sea level has risen over the last century at twice the rate that was projected by the IPCC, and storm surge and habitat loss are increasing.[4] Finally, coastal habitat provides a large percentage of ecosystem services, yet they are particularly vulnerable to sea-level rise and more severe storms.[5]

Coastal vulnerability has been exacerbated by previous impacts and alterations by human activities. In the United States, we have lost an estimated 0.4 million hectares of salt marsh over the last 200 years.[6] This is significant when we consider just one ecosystem service: buffering storm surge. Every loss of one to six miles of wetlands, costs a coastline its ability to survive another foot of storm surge.[7] These factors coupled with the recent devastation by Hurricane Sandy call for an immediate implementation of adaptation measures at all levels of government as well as the private sector.

So how well is the nation doing on adaptation? Only thirty-two states have completed Climate Action Plans and only fifteen states have completed Climate Adaptation Plans. Four states have plans in

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[1] Scherer, G. 2012. IPCC Underestimates Climate Risks. The Daily Climate.
[2] *See* The Daily Climate's article by Glenn Scherer: "Special Report: IPCC, assessing climate risks, consistently underestimates"
[3] *See* NOAA's "Billion-Dollar Weather/Climate Disasters"
[4] *See* National Climate Assessment Development and Advisory Committee's (NCADAC) release of The Draft Third National Climate Assessment Report p. 10, finding #11, and note 5, at p.4-1.
[5] M.D. Staudinger, Grimm, N.B., Staudt, A., Carter, S.L., Chapin, F.S., Kareiva, P., Ruckelshaus, M., Stein, B.A. 2012. Impacts of Climate Change on Biodiversity, Ecosystems, and Ecosystem Services: Technical Input to the 2013 National Climate Assessment. Cooperative Report to the 2013 National Climate Assessment. 296 p.
[6] *Ibid.*, 5, Table 4.1, (Sifleet and others, 2011) and (U.S. ACE 2006), respectfully.
[7] *Ibid.*, 3, Chapter 25. Coastal Zone Development and Ecosystems. Also see: Batker, D. I. De la Torre, R. Costanza, P. Swedeen, J. Day, R. Boumans, and K. Bagstad. Earth Economics. Gaining Ground. Wetlands, Hurricanes and the Economy: The Value of Restoring the Mississippi River Delta.

progress.[8] Moreover, many State Hazard Mitigation Plans are in need of significant improvement. The nation's experts agree that "*barriers to implementation of these activities are significant*" and that current efforts are "*insufficient to avoid increasingly serious impacts of climate change that have large social, environmental, and economic consequences*."[9] Generally, these barriers fall into three general categories: misguided or obsolete policy and legislation at the federal, state, and local levels; financial considerations; and shortfalls in disseminating the proper studies and other relevant data.

While the facts and figures are alarming, the good news is that there are many methods by which we can increase the level of adaptation to ensure more resilient communities and ecosystems along our coasts. The objective of the recommendations that are set out below is to ensure that planning and management of communities and ecosystems reflects the interdependence of coastal communities on their natural areas, the vital connections between riverine and coastal ecosystems, and the immense value that healthy coastal ecosystems provide to the economy.

**Increasing Financial Pathways**

- State legislatures should establish a "Rainy Day" Fund to ensure money is set aside for recovery and adaptation after extreme events. The North Carolina legislature passed such a fund in 1999 after Hurricane Floyd and appropriated $836 million to remap floodplains and to create open space, among many other measures.[10]

- States should pass constitutional amendments to establish a natural resources trust fund. The Iowa Outdoor Recreation Trust Fund Amendment passed successfully in 2010 and allows for the use of 3/8ths of one cent of the next sales tax increase. This could generate an up to $150 million a year.

- Because slowing and reversing habitat loss and fragmentation is one of the main goals to ensure fish, wildlife and ecosystems adapt to climate change, State legislatures should appropriate funds to conserve the priority habitats in their State Wildlife Action Plans (SWAPs).[11] An increase of the current $9 billion that is spent annually nationwide is needed to provide the funds to conserve an additional 12% which would protect all of the priority terrestrial habitat areas in SWAPs.[12]

- Cities should establish stormwater utility fees to help fund flood and coastal planning and adaptation measures.

**Strengthening Policy and Legislation**

<u>Federal</u>

- Congress should pass a stand-alone version of the natural resource adaptation provisions included in S.1881, the Safeguarding America's Future and Environment Act (SAFE Act), to establish a national

[8] *See* EPA and Center for Climate and Energy Solutions' State Adaptation Plans.
[9] *Ibid*., 3, Chapter 28. Adaptation
[10] Smith, G. 2012. State Disaster Recovery Planning Guide. UNC, Chapel Hill.
[11] *Ibid*., 5, p. 5.18, Box 5.1, Goal 7.
[12] *See* Our Nation's Wildlife Habitats: A Synthesis of Research Findings and Recommendations. September 1, 2010. Sponsored by Doris Duke Charitable Foundation.

adaptation strategy, to set planning requirements for all States to complete Climate Action Plans and Climate Adaptation Plans, and to identify specific federal programs to implement natural resources adaptation measures.[13]

- Congress should pass legislation to limit federal investment within our nation's floodplains and to assist in conserving, restoring, and planning for these sensitive and risk-prone areas, using the Coastal Barriers Resources Act (CBRA) of 1982, as a model.

- **Congress should direct NOAA to develop a "Riverine County Snapshots" similar to their "**Coastal County Snapshots**" and** should direct NOAA to formalize the Habitat Blueprint, a framework to improve habitat for fisheries, marine life, and coastal communities, in the Fisheries Habitat Policy.

- Congress must pass a Water Resources Development Act (WRDA) that safeguards communities and the natural ecosystems upon which they depend. In particular, language should direct the Corps of Engineers to improve flood recovery efforts by requiring the Corps to utilize PL 8499 funds for levee setbacks and nonstructural measures.[14]

- The Administration should update the Principles and Guidelines to prioritize federal investment in federal water resources projects that "work with nature", such as allowing room for rivers through levee setbacks.[15]

- The Administration should update Executive Order 11988: "Floodplain Management" and Executive Order 11990: "Protection of Wetlands" to respond to impacts from climate change and human activities in these sensitive and critical areas.

- The Federal Emergency Management Agency (FEMA) should comply with the Stafford Act and Disaster Mitigation Act of 2000 by approving only State Hazard Mitigation Plans that adequately address climate change. To clarify this, FEMA should also amend its regulations and release guidance to States.[16]

- **The Congressionally established Technical Mapping Advisory Council (TMAC) should provide recommendations to FEMA on improving flood insurance rate maps (FIRMs) including sea-level rise, erosion, and natural areas and should address all of the recommendations provided by the National Academies.**[17]

State

- States should pass legislation to limit hard coastal armoring and to favor nature-based flood control or "living shorelines", such as what Maryland did with its Living Shoreline Protection Act.

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[13] *Ibid.*, 5, p. 6-10
[14] *See* The Water Protection Network's November 29, 2012 letter from 95 Water Protection Network Members to Senate EPW Committee Urging Reforms.
[15] The Administration released a draft update of the Principles and Guidelines in 2009 but the Administration has yet to release the final guidelines.
[16] *See* NRDC and NWF's petition to FEMA dated October 2, 2012.
[17] National Academy of Science. 2009. Mapping the Zone: Improving Flood Map Accuracy.

- State legislatures should require agencies to link multiple planning efforts by 2015 to coordinate with the SWAP update deadline. This means linking the hazard mitigation, the disaster recovery operations, and wildlife planning through the implementation of the state's pre-existing state hazard mitigation plan.[18]

- State legislatures should require that local governments' comprehensive land-use plans be consistent with the state land use plan. Only four states—Hawaii, Oregon, Washington, and Florida— currently require this consistency.[19]

Local

- Cities and Counties should establish model sea level rise ("SLR") ordinances that should include the following components: (1) an expansion of flood boundaries that will increase with SLR to protect more effectively people living in harm's way and (2) different SLR zones so that communities in sensitive coastal areas provide incentives to induce retreat from the most sensitive areas to the less sensitive areas, as well as regulation directed toward fortifying infrastructure and other structures.[20]

**Accelerating Data and Communication**

- The Administration should establish a "Climate Ready Rivers" program similar to the Environmental Protection Agency's "Climate Ready Estuaries" Program.

- Congress should pass legislation to establish a national natural hazards, disaster-related database and website and should charge a taskforce with developing a methodology to document losses and damages from extreme events that includes the loss of ecosystem services. The website should be a one-stop shop for climate adaptation and natural hazards and should include other important resources such as adaptation case studies and model Hazard Mitigation Plans.

- The Administration should establish a national taskforce consisting of multiple agencies to continue the Technical Input to the 2013 National Climate Assessment work on ecosystem services to help communicate the cost effectiveness of investing in our natural areas.

In summary, the "new normal" of frequent and extreme weather events necessitates an expedited, all-hands-on approach to implementing adaptation measures. To make communities and ecosystems more resilient to the next extreme event, we need leadership at all levels of government to implement financial and regulatory incentives and state-of-the-art data and communication. While climate change, to some extent, is incremental, its effects are already measurable and producing impacts on our coastlines now. Prompt action is necessary to protect lives, property, and vital habitats.

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[18] Smith, Gavin. 2012. State Disaster Recovery Planning Guide. UNC, Chapel Hill. Also see Kihslinger, R., D. Salvesen, and T. Lee. 2010. Combining Habitat Conservation and Natural Hazards: Issues and Opportunities. The National Wetlands Newsletter.
[19] Van Hemert, J. 2010. FLOODPLAIN MANAGEMENT CIRCA 2050: The View from the Land Use Planner's Vantage Point. ASFPM GFW Forum.
[20] Georgetown Climate Center's ZONING FOR SEA-LEVEL RISE: A Model Sea-Level Rise Ordinance and Case Study of Implementation Barriers in Maryland.

# One Disaster, Two Disaster, Three Disaster…Four? Rhode Island's New Pattern of Natural Disasters.

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The State of Rhode Island and Providence Plantations is the smallest state in the nation and the second most densely populated. With over 400 miles of coastline, over 35 islands, the "Ocean State" as it is commonly called is blessed to be surrounded by one of most beautiful bays in the world, Narragansett Bay. This vast coastline, coupled with hundreds of riverine miles make Rhode Island quite vulnerable to natural disasters, namely Nor'easters, tropical storms, hurricanes and riverine flooding.

Historically, Rhode Island has seen its fair share of natural disasters; ten major disaster declarations have been declared since 1954. What is of particular interest is that four (4) of those ten (10) have been declared within the last five (5) years due primarily to severe inland and coastal flooding. More notable historic events include the 1938 Hurricane, otherwise known as the "Long Island Express", Hurricane Carol in 1954 and Hurricane Bob in 1991. While these storms were spaced relatively far apart, the new trend facing this State that has surfaced within the past few years is a bit alarming. While it could be nothing more than coincidence, the need to prepare for such events remains a high priority for the State and its 39 municipalities.

Beginning in 2010 Rhode Island witnessed the most severe flooding on a number of its major river basins such as the Pawtuxet, Pawcatuck, Moshassuck and Woonasquatucket. The "Great Floods of 2010" as they have been coined were triggered by a combination of causes. Record rainfall over a period of weeks from January through March, which occurred during 'leaf-off' conditions led to incredibly saturated ground. On March 15th, 2010 Rhode Island witnessed the first of two major flooding events within this two-week span. Record flood stages were set on a number of major rivers. Just shy of two weeks later on March 31st, 2010, additional rain fell which caused rivers to overtop their banks and find their own path of least resistance. New flood stage records were set, again. Twice in two weeks.

The State was inundated. No one was expecting this type of flooding to occur. Rivers carved their way through neighborhoods, making basements bathtubs and displacing hundreds of residents from their homes and businesses. Areas affected ranged from densely populated commercial areas to rural wooded neighborhoods. This event resulted in the States' first FEMA disaster declaration due to riverine flooding.

Roughly one and a half years later, in August 2011 Rhode Island was hit by Tropical Storm Irene. While the State was fortunate to have minimal coastal flooding which was limited to the southwestern portion of the State, the wind damage incurred throughout the State was unprecedented. Downed trees impacted power lines and cut power to thousands of homes, some for weeks. This event resulted in another Major Disaster Declaration for the State.

The most recent storm to make its way to the shores of Rhode Island was Super Storm Sandy in October 2012. Sandy was unusual in both her track and characteristics. Sandy retained the structure of a hurricane near its center (until shortly before landfall) while taking on more of an extratropical cyclone configuration as it made its way towards Rhode Island. This hybrid storm, containing both tropical and extratropical characteristics caused hundreds of homes all along the southwestern portion of the State to be evacuated.

The devastation caused by Sandy up and down the eastern seaboard was astronomical. Thousands of residents were displaced from their homes, with many still in shelters and hotels. In Rhode Island, nearly the entire shoreline experienced moderate to major coastal flooding. According to the National Weather Service, Taunton, MA office, this storm, especially destructive across shorelines in the Towns of Westerly, Charlestown, South Kingstown, Narragansett, and Block Island, rivaled the impact from Hurricane Bob in 1991. Fortunately the majority of homes that were impacted were secondary homes. While this doesn't make the destruction any less devastating, it does allow time for mitigation planning and smart rebuilding.

Of the four hardest hit communities, the Town of Westerly was impacted especially hard. Homes were inundated with waves. Bottom floors and breakaway panels on newer homes were blown out. Pilings were exposed and homes were knocked out of plumb. This storm not only affected residential structures, but businesses as well. One particular stretch in Westerly is home to long standing businesses including many restaurants, bars, and hotels. This is undoubtedly one of the largest tourist destinations in the State. Being a major tourist hub for both in and out-of-state visitors, there is a timely need for reconstruction. With Memorial Day only months away, the Towns are feeling the pinch to get back to preexisting conditions. While little reconstruction is going to be performed during the winter months in New England, this creates an even smaller window for rebuilding before the tourist season begins.

Another huge piece to rebuilding is the Town's ability to re-open state and local beaches. During Sandy, beaches not only lost valuable sand to both inshore and offshore areas, but the large rolling dunes which once graced these southwest facing beaches have been devastated and are no longer there. Wave action from Sandy ravaged these critical coastal features rendering them useless from wave action. What once offered a moderate to high level of protection from wave action and storm surge on the inland side of these dunes is no longer available. This underscores the intensity of this storm which was estimated to be a 25-year event by the National Weather Service.

Structures which were once situated directly landward of the fore dune are now more vulnerable than ever; providing little to no protection from future weather events, until a time when those dunes are reestablished. Redevelopment of these dunes is something that will take years to attain. There has been lots of activity to collect and move sand that was pushed inland during the event, and place it back to historically documented dune footprints. This piling or placement of sand, while it aesthetically appears to mimic a sand dune, doesn't come close to providing the level of protection that an established dune would. The lack of vegetation and stabilization will allow these piles of sand to be washed away during an even mild wave-action event.

Sand placement, reestablishment of dunes and permitting for rebuilding and construction are all issues which have arisen in the wake of Sandy. Rhode Island, while hit relatively hard for a small State, was quite lucky in comparison to New York, New Jersey and Connecticut. This event, similar to the Great Floods of 2010 and Tropical Storm Irene may be viewed as precursors as to what may be coming our way in the future. Although Major FEMA Disaster Declarations were declared for all three weather events, Rhode Island has been fortunate that these events were of relatively manageable magnitude.

It is too soon to tell just how the homes and businesses affected from Sandy will rebuild, however, just the thought of rebuilding immediately post disaster should give everyone pause. It's been 21 years since the last storm of this magnitude, Hurricane Bob, devastated the Rhode Island coastline. Given Sandy was categorized as a 25-year event when it hit the Rhode Island shoreline, this reinforces the reality that even storms of this magnitude can be just as threatening and devastating for coastal high risk areas.

If these weather events are indicators of what's to come in the future, then Rhode Island has plenty of work to do in preparation. Harnessing the public's interest on the heels of these types of events is crucial. Education and outreach forums are the best way to target property owners. Affected residents and business owners need to understand their options. Navigating the post-disaster minefield in itself is an arduous task. Making survivors understand what their options are right away is necessary for recovering quickly.

Before discussions of rebuilding should even begin, municipalities must look at both the local hazard mitigation and the long term recovery plans for their community. Buyouts and relocations of homes and businesses may be something that should be considered. While this hasn't been done before in the State, communities could consider offering incentives to relocate their properties out of these high risk areas. However, if rebuilding is going to occur, then information on how to rebuild using sound coastal construction techniques needs to be disseminated not only to property owners themselves, but to design professionals including architects and structural engineers. Starting at the beginning of the design phase of rebuilding is what is necessary to assure construction is happening in accordance with all local building code and National Flood Insurance Program regulations.

Whether this recovery window provides an opportunity for open space, reconstruction or a combination of the two, it's important to note that recovery from events like these takes time. Having not gone through these types of events regularly up until just recently, the State of Rhode Island and its municipalities should be aware that rebuilding is not something that can or should be rushed. As seen too often post-disaster, quick rebuilding results in the same devastation over and over again. Quick rebuilding does not create the best avenue for a strong and compliant recovery.

# Floodplain Policy in Real Time – Sandy Comes to Jersey

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**Floodprone New Jersey**

A string of major flood events imperiled New Jersey residents and businesses prior to the appearance of Hurricane Sandy in late October 2012. Since and including 2004, a Presidential Disaster Declaration related to flooding has been declared at least once per year with 2008 as an exception[1]. As the most densely populated state[2], flooding routinely plagues urban, suburban and coastal communities in several large river watersheds (Raritan, Delaware and Passaic) and along the Atlantic Ocean and Delaware Bay, bordering populous coastlines. Outside the Gulf Coast states, New Jersey leads in National Flood Insurance Program in total claim dollars paid[3], before any of the massive destruction attributed to Hurricane Sandy has even been tallied.

New Jersey Governors and the New Jersey Legislature have previously responded to flood events by forming fact-finding bodies and/or holding hearings. Following extensive flooding in September 2004 and April 2005 in the Delaware River Basin, Governor Richard Codey established the New Jersey Flood Mitigation Task Force to investigate the causation and response to flooding of the multi-state boundary water. A subsequent flood in June 2006, with inundation approximating the 2005 event, occurred prior to the release of the Task Force report[4]. In the fall of 2007, an Assembly Statewide Flooding Legislative Panel held hearings on damages caused by an April 2007 Northeaster impacting the Passaic and Raritan River Basins. In April 2010, Governor Chris Christie formed the Passaic River Basin Flood Advisory Commission following major Passaic River Basin flooding earlier that month. The Commission reported to the Governor just weeks before major flooding occurred in the Passaic River area again in March 2011, and a half year before devastating and long duration flooding in the summer of 2011[5].

**Pre-Sandy Actions**

Members of the Task Force and Commission included elected officials, state government and technical experts. Each body concluded that floodplains will continue to experience flooding, state regulations

1 http://www.fema.gov/disasters/grid/state/37?field_disaster_type_term_tid_1=All; multiple declarations in 2004 and 2011.

2 http://2010.census.gov/2010census/data/apportionment-dens-text.php

3 http://bsa.nfipstat.fema.gov/reports/1040.htm

4 http://www.nj.gov/dep/njflood/docs/finalnjtaskforcereport20060822.pdf

5 http://www.nj.gov/dep/passaicriver/

needed updating, mitigation of structures in the built environment needed greater emphasis and citizens required additional resources to understand flood risk. Significant actions continue today from the recommendations of the Task Force and Commission that include: higher standards added to regulations; updated studies and mapping, with the New Jersey Department of Environmental Protection (NJDEP) becoming a Cooperating Technical Partner; addition of stream gages, flood warning enhancement and forecast inundation mapping; substantial increase in mitigation planning and projects, with structure elevations and a large buyout program in the Passaic River Basin with the use of New Jersey Blue Acres (a subcomponent of the Green Acres state open space acquisition program coming out of the Task Force recommendation) to create state matching funds for FEMA mitigation grants.

**Sandy Response**

Hurricane Sandy made landfall on October 29, 2012, just south of Atlantic City, New Jersey. Sandy caused record flooding in Ocean and Monmouth New Jersey Counties[6] and caused widespread coastal and urban flooding in all eastern coastal counties (the remainder of the state was declared a major disaster area due to wind damage and extended electric power loss). Governor Christie was decisive in his storm preparation and response and had multiple daily conference calls with municipal officials that included updates from the National Weather Service (Mount Holly, New Jersey) and members of his cabinet for statewide situational awareness. Centralized control from the Governor's Office was exhibited in the days preceding and in the weeks following Sandy's landfall.

At least initially, there is a distinction in how New Jersey and New York are responding to Hurricane Sandy with regard to recovery and rebuilding. In late November, after getting "…advice of the governors of Louisiana, Mississippi and Florida who he said told him…a single point person is necessary to avoid matters falling through the cracks,"[7] Governor Christie appointed a cabinet level position to spearhead Hurricane Sandy Recovery and Rebuilding efforts in New Jersey. In contrast, New York Governor Cuomo established three large commissions to investigate preparation, response, and vulnerability and long term resiliency in mid-November to report to the Governor in early January 2013.[8] Unlike prior disasters, including his own initiative to appoint a Commission in 2010 for the Passaic River Basin, Governor Christie has chosen to proceed with addressing Sandy fallout within the Governor's Office.

New Jersey floodplain managers have discerned that Governor Christie and local leaders are leading an expedited restoration of the Jersey Shore by Memorial Day 2013 and aim to fully restore the important coastline economic engine within a couple years. There have been a number of signs that pace of restoration is being prioritized above increased storm resiliency for the future:

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6 Personal correspondence with USGS New Jersey Water Science Center staff; note that 1962 Northeaster was the record event for much of the New Jersey coast prior to Hurricane Sandy and remains for some southern coasts

7 http://www.nj.com/politics/index.ssf/2012/11/christie_taps_former_associate.html

8 Initial look at findings are here: http://www.scribd.com/doc/118862124/Ready-Respond-PPT

- NJDEP Administrative Order 2012-13[9] was issued on October 27, 2012 to replace public infrastructure (including restoring transportation) in-kind without local, county and state government construction commencement notice to the state or application for any state permit;
- At the time of this paper, there is no state directive on regional planning and rebuilding with resiliency. All land use decisions are being made at the municipal level (note there are 566 municipalities in New Jersey with varying degrees of NFIP standards knowledge or awareness of flood resiliency best practices);
- As of this paper's release, there are no state regulations incorporating the Advisory Base Flood Elevation mapping[10] that was released on December 15, 2012; municipalities are left alone to adopt these by ordinance at the community level;
- Despite having a point person for Sandy Recovery and Rebuilding within the Governor's Office, there have been no pubic releases detailing goals, strategies or milestones ahead;

**Post-Sandy Outlook**

New Jersey is a home rule state, meaning that land use decisions are made at the local level, which can result in the lack of consideration of natural hazard risk at that scale in municipal Master Plans. There have been regional modifications to home rule (in response partly or entirely to natural resources threats) that established overarching regulations, such as the Meadowlands Commission, Pineland Commission and Highlands Commission. Governor Kean in 1988 called for a Coastal Commission to regulate development along the shore – this was not well received by the New Jersey Legislature (the Coastal Area Facilities Review Act survives today administered by NJDEP).

Tax base loss (damage reassessments performed by tax assessors) with resulting temporary redistribution of the tax burden will be a driving force in the haste to rebuild. So too will the push to restore a functional vacation destination with beaches, rental properties and boardwalks for the purpose of maintaining economic health and maintaining critical employment. It remains to be seen how floodplain policy implementation will evolve during the critical time of reconstruction. Sandy may be an opportunity to incorporate coastal risk adaptation, or it may become a case study in shortsighted return to normalcy. This is playing out in real time as the State of New Jersey progresses from recovery through rebuilding.

9 http://www.nj.gov/dep/special/hurricane-sandy/docs/ao20121105.pdf

10 http://www.region2coastal.com/sandy/abfe

# Human Adjustments in Coasts- Adaptive Management in Response to Changing Hazards, Risks, and Ecosystems

**Deborah G. Mills, CFM**

As a lifelong Mid-Atlantic resident, I sometimes feel as if my whole life has been framed by flood emergencies and coastal disasters. One of my earliest memories features an early summer visit to Ocean City MD following the 1962 Ash Wednesday nor'easter. I still remember my parents pointing out unrepaired boardwalk and other damages, and the awe I felt at the power of such a storm.

Through the decades I've either watched transfixed as CNN and The Weather Channel bring approaching storms into my living room. Eventually, my state career led me to activations in the State Emergency Operations Center, damage assessments, deployments to FEMA-State JFOs, speaking assignments at angry community Town Halls in impacted areas, and finally, the nightmare of post-Katrina Mississippi.

As I've personally observed, studied or actually experienced storms as diverse as Juan, Hugo, and Opal. Fran, Floyd, Allison, Andrew, Isobel, Charley, Gilbert, Katrina, Rita, Isobel and now "Frankenstorm" Sandy, it seems the immediate impacts to devastated coastal communities are similar in the short-term but vastly different over time.

First, some observed commonalities:

1. Whether citizens, operators of critical infrastructure or community leaders, usually many interviewed coastal disaster victims who failed to evacuate or otherwise prepare state that *I never thought…it would be this bad.* With the emergence of 24/7 news coverage during the past generation, it's somewhat ironic that with more information than ever on impending storms, we've cultivated a sense of false expertise with those living in high hazard areas.

2. *We'll rebuild stronger and better than ever.* Community and state leaders, even Presidents comfort coastal communities with these words, yet what does "stronger" and "better" really mean?

3. Coastal wind impacts from downed trees and debris are catastrophic, but because these damages are more completely covered by property insurance, coastal storms manifesting more toward wind damage seem to have immediate and more comprehensive recovery than those with catastrophic surge and prolonged flooding. I'm admittedly over-simplifying, but compare 2003 Hurricane Isobel's and 2004 Hurricane Charley's high impact areas today – largely there is very little evidence of the widespread devastation homes, businesses and infrastructure severely damaged or destroyed. Yet the communities impacted by Katrina, Rita and Ike's floodwaters throughout coastal Louisiana, Mississippi and Texas have not bounced back. Vast expanses of formerly vibrant communities remain largely deserted.

It has been estimated that one-third of the United State's population lives in a coastal region. Yet we continue to under estimate economic, ecological and recreational value of our coastal areas, we also hugely under-estimate the natural and human-caused risks to our coastal communities.

Using some of the basic planning behaviors that we've applied to hazard mitigation planning during the past decade, it may be appropriate to apply these principles to addressing the nation's coastal hazards:

1. **Hazard Identification:** While we know the approximate cycle of tropical storms, the intensity and nuances of coastal weather events is not understood or appreciated by the public. While statics can be skewed to make about any point one cares to make, it is obvious that increasing low probability, high consequence coastal storm events have exponentially hurt people and communities during the past three decades as costs escalate to breathtaking levels.

2. **Risk Assessment:** Coastal communities in the United States were largely fishing or commerce-based until the past century when the "shore" became a place to escape in fair weather. Rapid growth and coastal amenities has resulted in significant increases of risk to the people, businesses, governments, critical infrastructure and natural environmental systems from hazard events. Demographers and modeling can better depict what is at risk in a coastal community at very discrete levels.

3. **Vulnerability Analysis:** Overlay of full coastal hazard analysis to what is at risk gives you a view of whom and what is vulnerable to what degree. We have sophisticated GIS systems which allow "plug and play" viewers so that all coastal community stakeholders can view layers of information. It is imperative that we use the same technologies to crate tablet platform mages and views to better communicate risk to residents, businesses and community leaders. We cannot expect coastal communities to take responsibility for their risks if we do not fully express and communicate that risk.

4. **Mitigation Action and Strategy Development:** Coastal risk must be communicated to all coastal societal concerns to facilitate a meaningful conversation about coastal risk exposure and what do about it. We must be open to a range of solutions with real evaluation of probability of success to better manage coastal environments in a way that will attenuate risk. This means applying policy, operational as well as engineered solutions to all things exposed to risk. It also means teaching our coastal residents to take responsibility for their own family and property. That will require simple tools that work and are available and affordable for everyone.

5. **Push the Envelope and Celebrate the successes:** In many aspects of American culture, we embrace mentoring particularly in schools or sports. We find it in the workplace. Yet not so much for communities. Imagine the forward positive coastal movement if we could partner successful coastal communities with those desiring to implement new ways of doing business. Motivation and forward movement to enable such partnerships might increase if we had greater awareness of the successes. What if we brought community officials in from the Gulf Coast of Florida, North Carolina's Outer Banks, Texas to mentor and support Sandy-impacted

communities so that coastal community restoration is holistically approached beyond the looming 2013 Memorial Day Weekend target to get the beaches "open for business?"

**Opportunities before Coastal Communities:**

1. Is it possible to take an entrepreneurial view of managing coastal communities for enduring prosperity and resilience, fueled by innovation, common sense and a lack of fear to try new approaches to integrate the built environment with restoration initiatives?

2. Thousands of acres of areas choked by invasive phragmities can be converted back to more vibrant functioning wetlands which can better absorb coastal flood and surge impacts in tidal estuary systems.

3. How about looking at a blend of the best new development techniques such as use of green infrastructure in coastal re-development and recovery instead of the federal program prescriptive practice of repairing or replacing infrastructure as it was the day before the storm event?

4. The pre-approved FEMA Public Assistance Program Section 406 hazard mitigation measures should be re-examined to assure that sensible, highly effective infrastructure measures appropriate for coastal environments and geographies, such as tidal gate values, are included.

5. Continue to implement high performance standards to coastal buildings, infrastructure and drainage systems in high risk coastal areas. Encourage investment in these techniques through incentive programs.

6. Model long-term advertising campaigns such as Smokey Bear, MADD and cell phone use to direct long-term, multi-generational education of the coastal populace on self-directed protection and responsibility.

Call me ridiculously optimistic, but Sandy just seemed different. Different in that in today's edition of USA Today I sadly read of a four-tent support center staffed by volunteers in Staten Island still feeding and housing victims who have nowhere warm to eat, sleep and simply spend time away from their severely damaged homes while they wait for insurance payments and aide. Different in that New York City leaders are tying emerging hazards like sea level rise to an expanded understanding of risk. Different in that a Governor readily adopted Advisory Base Flood Elevations. Different in that Congress has been unprecedentedly slow to enact the Sandy Recovery Act. Perhaps so many contrasts in Sandy recovery, that make this storm different, will serve as a turning point in development of a wise, enduring national coastal management policy. The 2013 Gilbert White Forum is uniquely positioned to serve as the catalyst for action to protect our unique coastal heritage.

# Sandy Response and Recovery in New York State

**William Nechamen, CFM**
Chief, Floodplain Management Section

Bureau of Flood Protection and Dam Safety

New York State Department of Environmental Conservation

The hurricane that has come to be known as Superstorm Sandy struck the New Jersey coast with historic destruction on October 29. The path of the storm, its diameter, and its timing resulted in extreme storm surges across the New York City and Long Island coasts, also pushing a storm surge up the Hudson River and into Long Island Sound. Train and auto tunnels under the East River between Manhattan and the boroughs Brooklyn and Queens were inundated by seawater, as were commuter train tunnels between Manhattan and New Jersey under the Hudson River. Many were without power for weeks. Hundreds of buildings were destroyed and thousands were damaged. The cost of the storm is still rising, but will be the nation's second most expensive natural disaster after Katrina.

New York State has not been immune from major floods in recent years. Tropical Storms Irene and Lee hit areas of upstate New York weeks apart in 2011 and caused flood damages beyond mapped 500 year floodplains in some locations. At least one "100-year" storm hit some location in New York State every year since 2004. But Sandy hit the most densely populated part of the United States, a major economic center, and its major media center. This would not mean business as usual.

Given the value and density of development in the New York metropolitan area, one would not be surprised to hear powerful calls to rebuild quickly; to put it back and get back to normal. While coastal residents generally do not want to move, we do hear time and time again that they do want to build smarter … and higher.

The day after the storm hit, New York's Governor Cuomo famously said "Anyone who says there's not a dramatic change in weather patterns, I think is denying reality." He referred to a "100-year flood" occurring every two years. He talked about a "new normal" affecting an "old infrastructure." On November 15, 2012, the Governor announced the formation of three commissions to help the state prepare for future storms. The three commissions are NYS Respond, focused on response actions; NYS Ready, focused on vulnerabilities in health care, transportation, communications, and other systems; and NYS 2100, focused on improving the resilience and strength of the state's infrastructure, and including areas of insurance and risk management.

The focus of my presentation is on the NYS 2100 commission, and current rebuilding efforts and discussions. This remains a moving target, as state and local agencies continue to assess their options.

The Commissions' recommendations were due to the Governor on January 3, 2012. Given the short turn around, and the high profile Commissioners named, many in the disaster response and flood protection community frankly had doubts that the commissions would be able to do a thorough job, or would have time to call on professionals in the field and within state and local government. To their

credit, the Governor's advisors working with the commissions called on the appropriate state agencies on a daily basis during the rapid development of the reports, and since the reports have been released.

One reason for the short turnaround is that the Governor was scheduled to deliver his State of the State address on January 9, and wanted recommendations for his address. From the perspective of the writer who is the state's floodplain manager, the process was pressured but as thorough as possible. First, staff was asked to develop a list of "risks." For example, a risk may be threats to waste water treatment systems due to more frequent and severe coastal storms. Then, a set of "mitigation actions" was requested for each risk. In all, about 160 items were filled out. Then agency staff working through the Governor's office developed a narrative which was used by the Commission staff.

The NYS 2100 report ("NYS 2100 Commission: Recommendations to Improve the Strength and Resilience of the Empire State's Infrastructure," NYS 2100 Commission, **www.governor.ny.gov/assets/documents/NYS2100.pdf**) was indeed issued in early January and the State of the State address utilized many of the recommendations. The report focused on transportation, energy, land use, insurance and infrastructure finance. Possible approaches include changes to the state's building codes, which already require two feet of freeboard for residential construction in Special Flood Hazard Areas, targeting elevations and buyouts, scenario planning on how and where to build, use of green and natural infrastructure, creating regional pools of equipment for infrastructure repairs and improvements, integrated capital improvements planning across agencies, improved data collection and mapping, incentives for more sustainable development, and increased training and education in recovery and resilience building activities.

The report does not directly advocate retreating from the shores. However, it does make many common sense recommendations, including restoring beaches, dunes and barrier islands, protecting water supply and wastewater infrastructure, protecting and restoring wetlands, small stream protection, expansion of green infrastructure and urban forests, strengthening existing dams and levees, and protecting and securing petroleum, chemical and hazardous waste tanks. With respect to insurance, the report recommends state-level risk management and options to pre-fund disaster recovery and transfer catastrophic risk to capital markets. The Commission recommends establishing an infrastructure bank to coordinate, allocate and maximize investment. Data from the New York ClimAID report regarding ranges of sea level rise and temperature and precipitation changes is incorporated. A significant recommendation is to update the state's Environmental Quality Review Act to incorporate resilience, including mitigation of climate change, as part of environmental reviews.

The media paid a great deal of attention to massive schemes to build sea walls to protect New York City. The Report does not ignore the massive engineering approach, but its focus is more on softer approaches. In referencing the idea of giant sea walls, the authors note that a New York Harbor system would be much more complex than any such system anyplace else in the world, such as The Netherlands, London and St. Petersburg, Russia. It adds that barriers would not mitigate freshwater flooding from extreme precipitation events, and could worsen flooding in areas outside of the barriers, including parts of Westchester County, Long Island, Connecticut and New Jersey. The authors also note that the barriers would do nothing to protect against inundation of low lying lands from sea level rise.

The specific recommendations are too detailed for this summary. In general, the report makes broad recommendations rather than setting specific targets. The Governor's State of the State is somewhat more specific. He proposes updating the state's Building Code to "promote smarter, resilient building performance, as well as increased survivability." There are also proposes to help home- and business-owners mitigate their properties or sell them and relocate. To his office's credit, he uses the term "substantially damaged" and states that substantially damaged structures are likely to be elevated. He proposes state programs to assist in mitigation and relocation. With respect to infrastructure, he proposes taking steps to flood-proof subways, mitigate scour on roads and bridges, replace culverts, provide pumps and tide gates for airports, docks and terminal facilities, and upgrade the state's locks and dams to allow for enhanced water level management.

The hard work will come in coming years. As I write, the New York State government is already working to fine tune the details. Many recommendations mirror ASFPM approaches for NAI and non-structural solutions. There are many areas where professional floodplain managers, through the New York State Floodplain and Stormwater Managers Association, the ASFPM and the ASFPM Foundation can offer support.

# Is It Time for "Government" to Get (Whole Heartedly) into the Risk-Reduction Business?

**Terri L Turner, AICP, CFM**

The first ten months of 2012 found a political agenda void of any mention of climate legislation – there were no congressional proposals or congressional hearings on the matter and it did not come up on the Presidential campaign trail either; surprisingly, for the first time in decades. Probably the biggest success of the early part of 2012 within the climate arena was that the debate over whether or not "change" was occurring had pretty much subsided – everyone had resigned themselves to the fact that some sort of climate change was occurring even if they couldn't agree on what, where, or how much.

Yet, in the quiet before the storm, Mother Nature was sending a pretty persistent message to the United States that no one was paying much attention to. Cold and heat records were being replaced with new "all time highs and lows". While extreme flooding was occurring in parts of the nation, most of the United States was crippled with back-to-back months of extreme drought – what some refer to as "the Great Drought". Wildfires devastated 50 percent more land area than the preceding 10 year average, scorching more than 9 million acres nationwide. Meanwhile, the volume of sea ice in the Arctic was plunging to record lows and Greenland's glacial melt exhibited a 500% increase as opposed to the melt within the same area in the mid 1990's. (*Climate a Quiet Issue This Year*; Katherine Bagley; McClatchy Newspapers; Dec 30, 2012)

And then…… October 29, 2012 - the wake-up call of all wake-up calls. Referred to from everything as a Hurricane, to a mega storm, to a "Super Storm", and even a "Frankenstorm", Sandy, one of the most damaging (if not THE most damaging) storms in the nation's history, hit the coast of the Northeast, unleashing 9 foot storm surges pushed by 70 mile per hour plus winds. "Parts of New York literally disappeared underwater" making predictions from climate scientists as recent as five years ago about "global warming", not seem so absurd and outlandish, after all.

Let the media frenzy begin…….Bloomberg Businessweek proudly proclaimed, "It's Global Warming Stupid", the Cape Cod Times described it as "A Sandy Mess" (which I personally feel is a really bad pun!), and the Star Ledger described it as "Pummeled" and in another edition as "Pure Hell".

Oh-h-h-h, now suddenly people are paying attention again!

Battle cries of "we will build back" could be heard on any media outlet willing to give some of these devastated communities air time or a front page spread (above the fold!). Organizations like the Association of State Floodplain Managers (ASFPM) were quick to respond and encouraged the affected communities and their leaders to "Don't Just Respond and Replace: Respond, Replace and Make Resilient!" and the experts at the Natural Hazard Mitigation Association (NHMA) charged our beleaguered communities' citizens to "Build Back Safer & Smarter". (*Sustainability and Resiliency: Lesson to Be Learned from Sandy*; Terri L Turner; Welcome to the Flood Zone; 2013)

Talks of post-Sandy "fixes" for the many devastated communities that dot the New Jersey and New York coastlines became a dime a dozen. Proposals of billion dollar seawalls and miles of beach

renourishment.....projects that throw a lot of money at the problem of demolished homes and businesses and water logged communities, but projects that really don't offer a guarantee against the devastation of the next catastrophic storm. (And we all know that it is sure to happen.....it is not a matter of "if" the next storm of Sandy's magnitude (or greater) will hit, but only a matter of "when".) (*In the Aftermath of Sandy, the Northeast Needs to Pause and Take a Few Baby Steps*; Terri L Turner; Utah Hazard Mitigation & Recovery Blog; Jan 7, 2013)

So what, as a beleaguered nation, are we to do?

Attempts from climate researchers to educate many of our nation's leaders have apparently fallen on deaf ears and that is why, perhaps, several of the nation's climate skeptics within Congress found themselves without a job after the election. Our President has said "Climate change is a threat to our children's future, and we owe it to them to do something about it."

Currently, and due largely in part to Sandy, there is obviously a great deal of public awareness of the climate, the issue of climate change, climate sciences, and the need to transform the debate on whether or not global warming and phenomena like sea level rise are actually even occurring. But let's face it, every single day that we get away from the actual catastrophic event, in this case, Sandy, we lose some of that positive momentum – the momentum for change in how we, as a nation, do business in relation to risk-reduction.

I, for one, do not understand why this dialogue has to be so hard.

We have approached other natural and man-made threats to our society head on. As far back as 1894, the nation saw a need for safety analysis of the nation's many new technologies, specifically electrical devices and components, and thus the Underwriters Laboratories (UL) were established. A company, which I might add, is one of several "approved to perform safety testing by the US federal agency Occupational Safety and Health Administration (OSHA)". (Wikipedia) We have the International Building Codes, which can trace its history back to the early 1900's and three legacy codes (three regional model codes) and while a large portion of this code deals primarily with fire prevention and protection, it deals with everything from plumbing to building "green". Additionally, accessibility standards are included – subject to the American's with Disabilities Act (ADA) – which is a civil rights requirement. The Federal Aviation Administration's (FAA) goal is to reduce the fatal accident rate by 10% over 10 years (2009-2018) among its 300,000 general aviation aircraft. It is doing this by using data to identify risk and then developing safety strategies to combat that same risk. This agency has had a track record of success – reducing disasters at the same time as the number of flights is dramatically increasing nationwide.

As a nation, we owe it to our people, to explore some of those tried and true disaster reduction strategies.

Now is the time to prepare for the storm of greater and higher magnitude. This is a "whole community" process – a process that "leverages all of the resources of the collective team in preparing for, protecting against, responding to, recovering from, and mitigating against all hazards" and which includes "meeting the needs of the entire community in each of these areas". This involves all of the

stakeholders in and surrounding the community and includes "federal, state, territorial, local and tribal partners, non-governmental organizations like faith-based and non-profit groups, private sector industry, businesses, groups, families and individuals". "Engaging the whole community and empowering local action will better position stakeholders to plan for and meet the actual needs of a community and strengthen the local capacity to deal with the consequences of all threats and hazards." (Fema.gov)

Community preparation for the storm of greater and higher magnitude can be achieved through processes such as writing and adopting higher community standards (strong Stormwater Regulations and Flood Damage Prevention Ordinances), community participation in the Community Rating System (CRS), participating in community Mitigation Plans, incorporating hazards into the overall community planning process and incorporating Best Practices, such as No Adverse Impact (NAI) Floodplain Management into the community's framework.

Truly enhancing our communities' resilience to natural hazards will not be an overnight process, nor will it be easy. We are talking about a wholesale change in how our nation, and its communities, deal with disasters – going from just responding to and recovering from tragic events, to actually planning for their arrival. This shift in philosophy, however, is paramount to keeping communities and those that live there safe, not only now, but more importantly, in the future, when we can better arm ourselves and fortify against the inevitable.

At the end of the day, the ultimate goal is actually quite straightforward – It is to reducing the human misery and suffering, or, perhaps, better put, the loss of life and property, caused by future hazard events on the citizens of this great nation." (*Sustainability and Resiliency: Lesson to Be Learned from Sandy*; Terri L Turner; Welcome to the Flood Zone; 2013)

The state and federal government plays a role here, as well and their importance cannot be understated in the overall process as climate-related events, serious enough to cause property damage, are becoming the standard instead of the exception. And what about the "safety factors" that engineers architects and planners have previously built into structures – will they be sufficient to withstand the devastation of our ever changing and "extreme" weather patterns?

> "Your own perception that there are more storms and more flooding causing damage — that is extremely well documented," said Peter Hoeppe, a meteorologist who is the head of Munich Re's Corporate Climate Center. "There is definitely a plausible link to climate change."
>
> "As we get more extreme events, that absolutely changes how we design," said D. Wayne Klotz, president of the American Society of Civil Engineers, who has raised the topic repeatedly at the society's meetings. "We could stick our heads in the ground and say nothing is changing. But it is."
>
> Mr. Klotz, a water engineer in Houston, said his professional colleagues look carefully at the changing statistics about factors like weather, and over time alter building methods

> and plans accordingly. Engineers design for the biggest flood or highest winds that seem plausible at a given time. The drainage systems Mr. Klotz builds now are different from those he engineered 20 years ago, because he knows that the Gulf Coast now has much heavier storms.
>
> Unfortunately, he said, the municipal building codes that govern minimum standards for many structures often lag behind "what is happening in the real world," because of the slow pace of lawmaking. At the same time, a bad economy makes countries, companies and individuals disinclined to invest in higher levels of protection.
>
> "I'd like to tell you there is a vigorous forum where we've locked arms and are trying to scientifically figure out how to respond to the predictions," said Mr. Klotz. "But there is not yet a concerted effort to change design codes to accommodate them." (*Huff and Puff and Blow Your House Down*; Elisabeth Rosenthal; The New York Times; Feb 12, 2011)

Carl Safina, president of Blue Ocean Institute, gives us another perspective as he writes for CNN, "….with two damaging hurricanes two years in a row, and with what science is telling us, this does not feel like a once-in-a-lifetime event. It feels like a trend." He also describes Sandy as "a harshly spoken word to the wise." Safina describes the "timelessness" of the coast – "the coast changes, the coast is what remains. And yet it moves." And finally, "Sandy told us that the "coast" is a wider ribbon than we thought it was……"

Safina also cuts straight to the point, "I have federal flood insurance, thank you. But really, it's time you considered cutting me off. I am not against people taking their chances along the shore. Risk is part of what draws us. But the risk should be ours to take and bear if we want to." Safina goes on, "Federal flood insurance is a counterproductive way for the rest of the country to subsidize people -- putting billions of dollars and millions of lives at continuous risk, encouraging wholly inappropriate development. And it encourages larger, more expensive homes (often second homes) than fewer people would build if their insurance premiums reflected real risk." Safina's message for the government: "The government should at this time help victims get their lives back on track. But no federal dollars should magically appear for rebuilding in flood-prone areas. The spots that flood will take repeated hits. Everyone knows this. To help people rebuild in those places is to help put lives and investment in harm's way. It's foolish."

Mr Safina is not alone in his views on the subject: "If we simply build it back in place, we are setting the stage for the next major, costly, disruptive, tragic disaster", Sam Medlock, Policy Counsel for ASFPM tells Joe Palca of NPR in an interview published Nov 4, 2012, only days after the monstrous Sandy made landfall in the Northeast. (*Sustainability and Resiliency: Lesson to Be Learned from Sandy*; Terri L Turner; Welcome to the Flood Zone; 2013)

I have to agree with my esteemed colleagues.

It is easy for me to say that insurance premiums should not go for rebuilding. I don't live there, I wasn't raised there, and my ancestors didn't forge a family legacy there. Some may say that I am devoid of a soul or lack a sense of community or "have no roots" for making such a cold-hearted statement. However, setting all of the emotional and sentimental factors aside, rebuilding after Sandy is just too big of a risk. Instead of issuing insurance payments for rebuilding, that money should be "redirected toward relocation and resettlement. That is easier said; for many, relocation would be wrenching. But losing your home or your life can be wrenching, too.", Safina, who he himself lives on the coast, states for CNN.

Yet with all of the media coverage about building wisely and all of talk of sustainability and resiliency, wise choices are NOT being made in the aftermath of this storm – people are choosing to rebuild at the same location, in the same manner, and often to the same elevation all under the pretense of "returning their lives to a sense of normalcy".

Horse-hockey!

Is the 120 lives lost during this most recent catastrophic event considered "normal"? Is living with the threat of the next devastating event brought about by the relentless battle between nature and man "normal"? Is the potential of losing everything you ever owned and worked all of your life for in a matter of minutes "normal"? Is days without power, cell phone service, heat, and the ability to adequately take care of yourself and your loved ones "normal"? Is the $50 billion being requested by President Obama or the $664 million that is having to be poured into New York in federal aid "normal"?

There's nothing "normal" about this, nor should it ever be considered to be anything close to that. One elderly gentleman caught in the mammoth storm described it as "waking up from a nightmare". After being rescued by an ingenious family network and safely deposited on his son's doorstep in Boston, along with his 90+ year old wife, after nothing short of the complexities of the underground railroad, his worry-ridden son corrected him, "it's not a nightmare, he said, "it's for real". (*Resilience – What I Learned from Hurricane Sandy*; http://www.barrfoundation.org/news/resilience-what-i-learned-from-hurricane-sandy; Dec 17, 2012)

Our nation has been battling this "real" threat for far too long now, and a new direction is needed to keep from replaying the Sandy scenario into our futures.

NFIP Reform went in the right direction, but we are still not there yet……

Someone – federal, state, local governments – is going to have to bite the bullet and regulate us out of this perpetual (and insane) cycle of build-destruction-rebuild. I don't think that emotion-ladened home and business owners can rationally do that for themselves. Not now, maybe not ever……..

Just in case you doubt my perception on the issue, let me quote from a latter part of the blog that described the perils of one 90+ year old Long Island couple that I mentioned earlier: (http://www.barrfoundation.org/news/resilience-what-i-learned-from-hurricane-sandy)

> "For weeks after the storm, the same network that helped rescue my parents has remained active on text, email, and social media. They have taken and posted pictures of the damage to my parents' home (including three feet of flooding in their first floor), registered them with FEMA, and helped them begin the recovery process. I had hoped this experience might convince these two nonagenarians it was finally time to give up living alone on an isolated island, but… no chance. Right away, my father, an avid striped bass fisherman, was on the phone with the Coast Guard to launch a search for his beloved 17-foot Whaler. It doesn't seem to matter that his short-term memory is going or that there are days when he loses track of where he is. He is a man on a mission.
>
> In similar fashion, my mother has been directing clean-up crews by email via her iPad even though her fingers are so arthritic she has to use a stylus. She doesn't see well and can barely hear any more. But her mind is keen and she is making sure she gets estimates in advance. Each morning this old couple huddles together to plot the day and to scan the news for indications they can return to their home."

This elderly couple appears determined to put themselves back in harm's way and, worse still, their family appears eager to let them go……..

> "Their resilience is a result of both their supportive network and their own agency. Without the network to help them navigate the maelstrom of plumbers, electricians, demolition crews, oil burner replacements, insurance companies, and FEMA (to say nothing of their daily needs), they would be lost. But just as critical is their ability to shift their thinking – to see themselves not as helpless victims of great trauma, but as agents of their own destiny. With the elderly, it is all too easy to do things for them or just tell them what to do. Left to their own devices, they are often agonizingly slow. They get things mixed up. Their inefficiency tries our patience. It is hard to favor their agency over their fragility. Yet, that agency, that frame of mind is paramount if they are to weather whatever disruptions lie ahead.
>
> This kind of resilience for absorbing and reacting to disruption is as important for individuals as it is for cities and communities."

Really?

For "the health, safety and general welfare of the public at large", a public who seems hell-bent to put themselves (back) into harm's way, we (those with the power to do something) MUST do something!

I equate it to regulating speed limits – can you just imagine the consequences if we, as federal, state and local governments just let people drive in any manner that suited their personal whims? Chaos, pure chaos.

But that is exactly what we have, right now, post-Sandy, in some Northeast coastal communities. Pure chaos.

(And, let us not forget that it is the same type of scenario that played out in Gulf Coast communities after Katrina.) I see a dangerous (and costly) pattern developing here…….

"We can do better; as a nation, we have to do better. Already millions of Americans live in areas subject to harm from a mere repetition of actual historic floods (earthquakes and wildfires). Many more people are expected to move into these areas in the near future. While the debate about climate change rages on, flood heights are increasing, levees are overtopping, catastrophic flood events are occurring, and documentation of sea level rise continues. Development in at-risk areas, especially in high-risk coastal areas and in highly sought after locations "near the water," continues at an alarming rate. If communities continue to encourage at-risk development and ignore their effects on others, can we accept the consequences . . . and, are we willing to pay for them?

In my opinion, the loss of even one life is much too high a price to pay." (*Climate Change and Emergency Management: Adaptation Planning;* ABA - State and Local Law News; Edward A Thomas and Terri L Turner; April 2011)

*Terri L Turner, AICP, CFM, the Development Administrator for the City of Augusta, Georgia is no stranger to disaster. In fact, she knows all too well the devastating impacts of disaster – the human and physical toll it takes on a community. That's why she works tirelessly to ease the misery and human suffering for residents of her community, by engaging in a robust Flood Buyout Program, participating in the City's Sustainability Initiatives, and leading the community's participation in the Resilient Neighbors Network (RNN). In her "spare time", Terri travels around the nation speaking on No Adverse Impact (NAI) Floodplain Management, Climate Change Adaptation and sound Floodplain Management.*

# Changing Shorelines: The Economics of Adaptation for Mid-Atlantic Protected Areas

**Carolyn Kousky**
Joint work with Rebecca Epanchin-Niell and Margaret Walls

Resources for the Future

Natural lands in coastal areas, including beaches, dunes, wetlands, and forests, provide a range of ecosystem services, such as storm surge attenuation, floodwater storage, temperature regulation, and water quality improvements. With changes in climate, these services will become even more valuable by increasing the resilience of coastal communities. At the same time, however, these natural lands are at increased risks from erosion, saltwater intrusion, inundation, and changing storm patterns. Higher temperatures and precipitation changes will further stress these systems.

Climate adaptation strategies for coastal protected areas are thus critical, and becoming more so, as Hurricane Sandy recently demonstrated. As the climate changes and weather patterns shift, coastal protected land managers will increasingly need to move from the planning and scoping stages of adaptation into the difficult implementation questions: what, where, when, how, and how much. This will require making decisions about priorities, evaluating trade-offs, potentially re-considering missions and objectives, and choosing where to invest scarce dollars: all decisions economics can usefully inform.

There are a range of adaptation options available to protected areas, depending on the projected impacts of most concern. Some strategies may be viable for low levels of sea level rise, for example, but not possible for high levels of rise. Some primary adaptation approaches including the following:

- *Beach nourishment* adds sand to beaches in order to prevent erosion and maintain the beach's elevation and width. Often done in areas with high levels of beach recreation, this maintains the beach for visitors as well as maintaining other benefits of the beach, such as habitat and storm mitigation. Nourishment also can be implemented to prevent loss of built infrastructure located just behind an eroding beach. Projects typically last 3-10 years and can be quite expensive (Hedrick 2000). Sources of sand must be identified.

- *Living shorelines* can help mitigate the effects of erosion by establishing plants, rocks, shells, and other natural materials along an eroding area. In the Chesapeake Bay, for example, over 300 sites of living shorelines have been established over roughly the last two decades (National Research Council 2007).

- *Dune restoration,* which can be a part of the previous two approaches, seeks to stabilize dunes through additions of sand or planting dune grasses. Dunes can provide protection from storm surges and slow erosion.

- *Wetland accretion* is a natural process, whereby sediment input is trapped by marsh grasses, raising the wetland surface. Wetland accretion can be aided by ensuring sediment transport to wetlands, by trapping sediment, or by reintroducing sediment to systems (U.S. EPA 2009).

- *Acquiring lands to allow for migration* of ecosystems inland can help preserve ecosystems and the services they provide when threatened with inundation or erosion (e.g., Kreeger *et al.* 2010). Wetlands, for instance, for lower rates of rise, can accrete vertically and migrate inland, but such migration can only occur if the land behind the current wetlands is open space into which wetlands can freely migrate. Open space for migration must thus be identified and protected in advance.

- *Reducing other stressors*, such as water pollution or invasive species, can help ensure ecosystems are healthy enough to be resilient in the face of climate changes. Policies already known to reduce these other stressors and can thus improve adaptation (Glick *et al.* 2009).

- *Installing protective structures*, such as seawalls, can protect property, but often at the expense of the beach or coastal ecosystems. This action is thus unlikely to be widely undertaken in conservation areas, although areas with high recreational use may consider them in certain locations. Dikes can be created to prevent flooding or bulkheads established to prevent upland erosion.

Protected lands managers thus have a range of adaptation options available to them. Once the projected climate impacts have been established for a region and the possible adaptation options identified, mangers still face the difficult questions of which options to choose, when, and at what intensity. Economists have grappled with the many challenges that face managers in making these decisions, such as:

- *Uncertainty* – Managers face substantial uncertainty about the magnitude and impacts of future climate change at a local level, the costs of adaptation, and the effectiveness and value of different adaptation options. It may be difficult, if not impossible, to resolve some of these uncertainties, thus decisions must be made taking uncertainty into account. Managers may prefer options with some degree of robustness across plausible future scenarios, as opposed to simply optimizing expected values (Lempert and Schlesinger 2000; Hallegatte 2009). Uncertainty also raises questions of optimal timing, the value of information that may be resolved in the future, and the role of adaptive management (Williams *et al.* 2011). In addition, attitudes toward risk will play a role in how uncertainty is incorporated into decisions.

- *Long time horizons* – Climate changes are occurring across much longer time horizons than most management decisions, and many impacts will not be felt for decades. In such a setting, adaptation investments that are long-lived should be evaluated differently from those that need to be continually revised. It is also the case, however, that decisions made today could "lock in" certain policies for many years or could narrow the range of future policy options. There is a so-

called option value to ensuring future flexibility to respond to changes that may occur (Dixit and Pindyck 1994).

- *Inter-temporal tradeoffs* – The costs and benefits of different adaptation strategies can have very different profiles in terms of when in time benefits and costs are borne. The most commonly discussed trade-off is the difficulty of paying costs now when benefits will not arrive for years or generations. How to appropriately discount is critical in such settings.

- *Sudden versus gradual changes in conditions* – Some changes, such as changes in mean temperature, occur gradually, whereas other impacts are experienced suddenly and with uncertain timing (e.g., collapse of an ice sheet; experience of a major storm).

- *Non-linearities in costs and benefits* – The costs of climate change and the benefits of adaptation may not progress gradually over time or across possible future scenarios. There may be points where costs or benefits jump dramatically. One example may be sea level rise, where impacts are relatively minor until a particular elevation where they become severe, or a particular rate of rise at which point wetlands cannot keep pace and are lost.

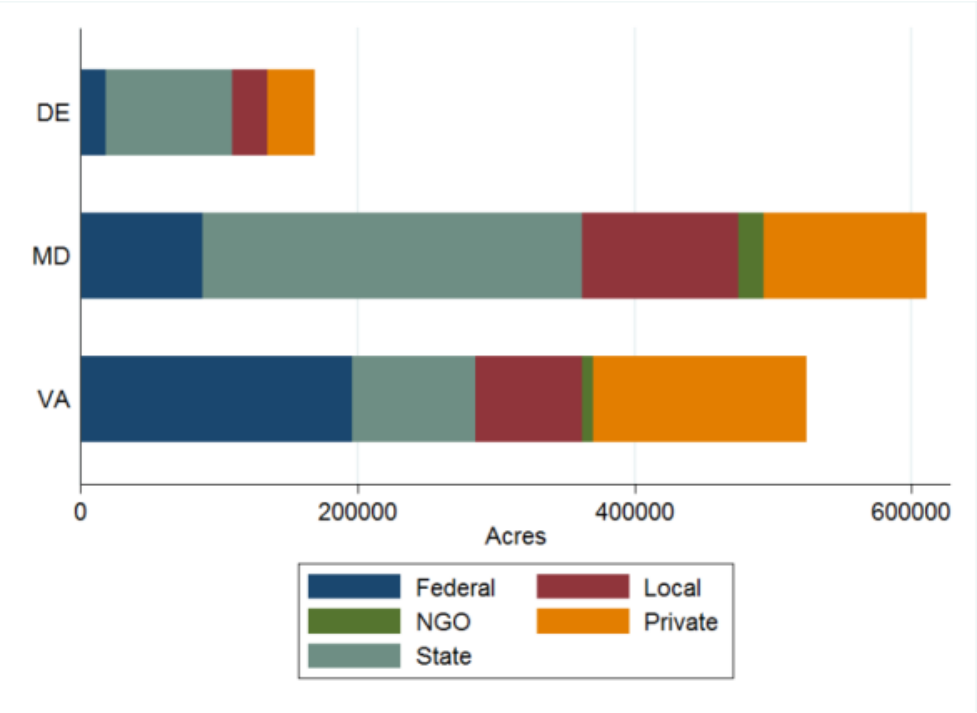
- *Spillover effects and externalities* – Decisions made by a protected area manager can affect the benefits experienced by stakeholders outside of the protected area boundaries (e.g., recreational access, storm surge protection, or water quality). These are sometimes referred to as "spillover effects." Likewise, decisions and policies made outside of the protected area can affect the benefits accrued locally (e.g. adjacent shoreline protection can affect local erosion rates).

- *Conflicting objectives* - The protected area's mission or objectives may or may not coincide with the objectives of a broader range of stakeholders or seek to maximize social welfare. As such, the optimal strategy for the manager, the optimal strategy for nearby residents, and the optimal strategy for society at large may not coincide.

- *Budget constraints* – Rarely are sufficient funds available to implement all worthwhile adaptation measures. There are two aspects to this issue: (i) cost-effective targeting is required so that limited financial resources are put to the best use (Kousky *et al.* 2011; Boyd *et al.* 2012), and (ii) limits on borrowing and capital constraints might limit the possibilities for land managers

A study team at RFF is beginning to explore these issues to develop economic guidance for protected lands managers. Such guidance must take into account the different institutional constraints and opportunities faced by different managers. For instance, Figure 1 shows the acres of protected areas owned by various groups in the mid-Atlantic states of Delaware, Maryland, and Virginia. Any adaptation guidance needs to recognize this variation.

**Figure 1: Protected Area Acres by Owner**

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# Government Liability for Failing to Reflect Climate Change in Flood Related Activities

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Association of State Wetland Managers

**Climate Change and Increased Flood Damages**

Climate change will cause coastal flooding where no flooding has occurred before such as flooding due to sea level rise. In other circumstances, climate change will exacerbate flood, erosion, and other natural hazards that are already occurring such as storm surge. It will be a contributing factor and will add to the areal extent, depth, and velocity of flooding.

Despite the prospect of worsening flooding and erosion problems due to climate change, only a small portion of governmental units in the United States are, apparently, reflecting climate change in their flood loss reduction programs including the design calculations for flood loss reduction measures such as dams and levees and in their regulation and permitting of residential, commercial, and industrial development in the floodplain.

With increased hazards and continued and intensified occupation of floodplains will come with additional flood, erosion and wind damage to private and public property.

Are governmental units potentially liable for failing to take into account flood and erosion damages caused by or exacerbated by climate change?

No court has yet so held. But ……

**Legal Liability**

Property owners damaged by failure of governmental units to consider climate change-related flooding and erosion in their policies and programs could potentially sue governments for such omissions under a number of legal theories such as nuisance, trespass, strict liability, negligence, and riparian rights. Failure to consider climate change could increase flood damages in the design, construction, maintenance and operation of flood control structures (e.g., overtopping of dikes, dams, levees, groins, and sea walls); in the design and construction of highways (bridge apertures and culverts); in the management of public lands (e.g., flash flooding where campers may be using public lands); in the construction of residential, commercial, and industrial development, and in a variety of other contexts. The likelihood of successful suits increases as the scientific support for human-induced climate change increases and climate changes and potential flood losses are quantified.

All levels of government may be sued in certain contexts under common law or Constitution theories for causing or exacerbating flood problems but local governments are particularly vulnerable as they design and operate stormwater systems and undertake other activities (dams, levees, fills, ditches, culverts, highway construction) where they may increase flooding and erosion on some private lands while reducing it on others. Their failure to take into account climate change may be considered

"unreasonable" and "negligent" by a court, particularly where there is a high concentration of risk factors.

Successful common law (tort) liability suits based upon more traditional flooding have become increasingly common and expensive to governments. For example, in 2003 the California Court of Appeals upheld a damage award against the State of California for flood damages. See Paterno vs. State of California 113 Cal.App.4th 998 (Calif., 2003. The settlement total in this suit is $464 million dollars. Much larger amounts of money are at stake in the law suits filed by private landowners in Louisiana and the neighboring states of Florida, Alabama, and Mississippi after Hurricane Katrina struck the Gulf on August 29, 2005. More suits may be expected in the wake of Hurricane Sandy.

Landowners damaged by flooding and/or erosion due to climate change may sue governments for failing to take into account climate change based upon a number of constitutional and common law legal theories. "Negligence" involving "unreasonable" conduct is the theory most commonly argued by private landowners in traditional flood and erosion cases. It may also provide the basis for successful suits in a climate change context.

In a negligence-based flood liability suit, landowners need to show that governments have a duty to undertake or avoid actions which increase flood damages, that increased flooding has occurred, that they have been damaged, and the damages have been caused by government action or inaction.

Governments, and more broadly landowners as a whole, have a duty to exercise "reasonable care" in their actions in order to avoid injury to others. Unlike nuisance and trespass which involve damages to land, negligence is much broader and applies to many types of activities which may damage others including but not limited to damages to land.

Governments may defend themselves in a negligence, riparian, or "surface water reasonable use" suit by arguing that they have acted "reasonably" in the circumstances. The claimant in a successful negligence suit must establish that a government has failed to conduct himself or herself as a hypothetical "reasonable man" in the circumstances and this resulted in damage. What a court or jury decides is "reasonable" conduct with regard to climate related hazards and the reflection of these hazards in policies and project designs will depend upon the circumstances. A variety of factors are relevant to the "reasonableness" of conduct and negligence in a specific circumstance. Some of these include:

- The severity of the potential harm posed by a particular activity. Where severe harm may result from an act or activity, a "reasonable man" must exercise great care.
- Knowledge of the danger. A reasonable man is responsible for injuries or damages which he or she knows or should know.
- Standard of conduct in the community. The standard of conduct is that of a "reasonable man" in the community.

- Foreseeability of the harm. A "reasonable man" is responsible for injuries or damages which are or could be reasonably foreseen. The foreseeability of natural hazard events has been dramatically increased in the last two decades not only by documentation of past events but through development of various prediction models for floods, earthquakes, volcanoes, hurricanes, and virtually all other hazards. Courts do not require that events be specifically predictable (e.g., date, place) to be "foreseeable". It is enough that the event could have been anticipated in a more general sense.

**Looking to the Future**

Taking climate change into account in establishing flood loss protection standards will require partially changed flood assessment methods. Floodplain regulatory and management agencies have, to a considerable extent, based their flood calculations on historic flood and rainfall data. Taking climate change into account will require new assumptions and more reliance on model projections than historical records. Because flood hazard management agencies have difficulty in accurately predicting the magnitude and location of climate changes does not mean that they cannot predict “probabilities” and “ranges” of likely increases. And, there are a variety of “low risk” options for simultaneously addressing climate change and achieving other objectives such as providing urban greenways and recreation areas in a particular circumstance.

To date, governmental entities have not been successfully sued for causing climate change or for damages for failing to take into account climate change in their policies and programs including flood plain regulatory standards and floodplain maps. This is understandable given the uncertainties in projecting climate changes and impacts on flooding and erosion. However governments have been held liable for increasing flood damages on private property in thousands of cases involving more traditional flooding and erosion. And, successful suits with climate-change elements or based primarily on climate change where flooding and damages would not ordinarily occur may be expected in the coming years. This is particularly true where climate change scientific studies quantify climate changes and increases in flood damages.

Over time, climate-related natural hazards will be increasingly quantified, forseeable and predictable with improved computer models and global and regional monitoring. As this occurs, governments may be held liable for failing to anticipate flooding in areas which have not previously flooded and/or for exacerbating existing flood problems. Governments need to be particularly careful with their policies for areas behind dikes, dams, and levees where catastrophic losses may occur if design frequencies are exceeded and the legal doctrine of “strict liability” may apply.

## Views of the National Association of Home Builders

### Tabby Waqar

The National Association of Home Builders (NHAB) is a trade association, based in Washington, D.C., that helps promote policies that make housing a national propriety. NAHB has been serving its members, the housing industry and the public at large since 1942. NAHB's mission is to enhance the climate for the housing and the building industry.

With regard to climate change mitigation strategies, the NAHB encourages the executive branch and state and local governments on any efforts on implementing market-driven mechanisms to encourage greater efficiency in the housing industry while preserving housing affordability. The NAHB supports reasonable, fairly apportioned and cost-effective climate change mitigation strategies implemented through local, state, or regional governmental bodies acting within the scope of their authority. It is the NAHB's resolution that any federal climate change mitigation strategy must not create requirements or mechanisms that duplicate conflict with or are inconsistent with measures enacted by other levels of government. NAHB also recommends that any federal climate mitigation strategy must avoid disproportionate penalties on new home construction.

NAHB supports climate change mitigation proposals that are: determined by local or state authorities or climate programs; based on climate zones and current building codes; and those that are based on sound science and research on land-development patterns. In addition, mitigation strategies should be accompanied by meaningful incentives for increased costs.

Climate change can affect the home building industry in several ways. Of importance and relevance is that the floodplains will be expanded and floods could become more extensive and more frequent. This will affect where and how development may occur. Already global climate change has resulted in new laws, policies, regulations and other programs. NAHB has also joined this effort by advocating energy efficiency and housing affordability. In addition, NAHB has committed to research, development and implementation of cost-effective products and building techniques.

NAHB supports congressional efforts to ensure the financial stability of the National Flood Insurance Program (NFIP). NAHB, however, opposes expansion of the regulated floodplain, or changes to the number, location or types of structures required to be covered by flood insurance (including those sited behind flood protect structures), unless and until Congress and/or the Federal Emergency Management Agency (FEMA) demonstrate with appropriate documentation that the risk and hazards justify the costs incurred. Such documentation should include the regulatory, financial and economic impact of reforms on FEMA, local communities and local land use, and should consider in particular: the liability on lenders to comply with any new regulations; the burden on building officials and flood plan managers to implement regulations in any new or expanded area; the impact on FEMA to make determinations on exemptions to the floodplain and approval of local decisions; the burden to existing policy holders of floodplain properties; the increased cost to home construction; reduced housing affordability; and reduced land availability.

In response to the concerns of population growth, NAHB maintains that it is it is important to understand where and how people want to live and the types of homes they want; this will facilitate finding a common ground and help build political consensus. Such a discussion should start in each local jurisdiction – city, county or township – because the politics of growth are uniquely local and because the authority to determine land use is vested in local government. While general planning principles are useful, the actual planning tools and strategies selected will vary according to the local market conditions.

In addressing the role of the government, it must strike a balance between competing and often conflicting public priorities. All levels of government have an obligation to advance the goal of providing safe and affordable housing for all Americans. Governments also have an interest in promoting economic development and protecting the environment, but these goals must be balanced with meeting the nation's housing needs. In order to avoid unintended consequences solutions that are not economically viable or that inadvertently deflect growth to other areas, public policy must be supported by sound science and empirical data. Moreover, as solutions are developed for a community, it is important to acknowledge the role and power of the market and of consumer choice.

Any federal mandate, which dictates location, place and form of development, does not respect local circumstances and is not appropriate. Policies that work in one region may have serious unintended consequences in another. The U.S. is far too diverse demographically, geographically, and economically to successfully implement a "one-size-fits-all" program. The federal programs intended to address growth-related challenges should not limit housing choice or drive up the cost of housing. More importantly, resources provided by the federal government to state or local governments should not limit local authority to dictate particular planning mechanisms.

NAHB urges that housing affordability must be considered as part of any plan to counter climate change, which increases in the cost of housing, as a result of the adoption of climate change mitigation strategies, should be accompanied by meaningful incentives for such increased costs.