

Homeowners Insurance Changes in Coastal Virginia

Causes and consequences for shoreline communities

AUTHORS

Skip Stiles, Executive Director, Wetlands Watch

Shannon Hulst, Assistant Director, Wetlands Watch



Acknowledgements

Wetlands Watch thanks the Virginia Environmental Endowment for direct grant support for this study. West Wind Foundation has provided ongoing support for our climate change work.

About Wetlands Watch

Wetlands Watch is an environmental non-profit located in Norfolk, VA and operating statewide to conserve and protect wetlands through education and advocacy. Since 2006, we have been working to help the tidal communities of Virginia adapt to sea level rise and conserve our coastal ecosystem - the only environmental nonprofit working at the local government level on sea level rise adaptation.

Wetlands Watch, Inc. 2013.

www.wetlandswatch.org

Cover Photo: by Skip Stiles

SUMMARY

Insurance along the coast is increasingly expensive and undergoing rapid changes in coverage and availability. These changes are driven primarily by the higher risk associated with coastal storms, impacts on profitability from the recession, and insurance company fears of lawsuits such as those that occurred post-Katrina along the Gulf of Mexico. However, we found the cost and availability of property and casualty insurance to homeowners is not presently affected explicitly by current or projected impacts from human-induced (anthropogenic) climate change.

Despite reports linking insurance company behavior to a realization of anthropogenic climate change impacts, we found no such linkage. Similarly we found no evidence that homeowners insurance could drive adaptation, at least without some significant changes in actions being taken by the insurance industry and without changes in the way that rates and underwriting are conveyed to policyholders.

At the same time, insurance cost increases along the coast, from whatever sources, will bring changes. These private insurance cost increases and underwriting changes, combined with cost increases projected for the National Flood Insurance Program (NFIP), reflect more realistic risk and price signals being sent into shoreline communities. These corrections will place economic pressure on shoreline homeowners, pressures that will fall hardest on those with fixed or modest income.

Increased private and NFIP insurance costs may cause those homeowners to sell coastal residences, perhaps having the unintended consequence of the “gentrification of the coast”, where those homes that

become unaffordable to the middle class will be purchased by the wealthy or for rental or investment properties. In areas not along oceanfront coasts, where property demand is lower, these forces could cause the “hollowing out” of other tidal communities.

The shoreline insurance changes being observed call for a coastal adaptation strategy coordinated between the public and private sectors, and across the various layers of government. If increased insurance cost becomes significant, private insurance companies and government regulators will need to develop an understanding of acceptable insurance costs and underwriting. The NFIP will also have to be part of this discussion.

If these insurance costs begin to drive changes in homeownership patterns, there will need to be public conversations on what constitutes acceptable changes in those patterns. Without these conversations and understandings, we risk a chaotic, expensive, and unproductive transition along our coasts.

Study Overview

In both underwriting and pricing decisions for multiperil homeowners insurance, a multitude of factors is considered, many involving the insured individual and his/her personal circumstances. In addition, most homeowner insurance policy coverage includes risks other than physical damage, such as personal liability. Because of these factors, homeowners cannot make a direct connection between climate-related risk and insurance price and availability. Without this climate risk signal linking homeowners insurance with the increasing danger

associated with living on the coast in a changing climate, policyholders are not incentivized to take adaptive actions to lower premium costs and risk exposure on their properties.

There is a discernible climate signal in the increase in Atlantic tropical storm system frequency/intensity in Risk Management Solution’s (RMS) 2011 hurricane model. This model is used by many insurance and reinsurance companies and RMS projects greater tropical storm impact on the Atlantic and Gulf Coasts over a multi-decade time

frame. However, the shift toward greater storm frequency/intensity is difficult to attribute exclusively to anthropogenic climate change because there has been a recurring, 20- to 40-year cycle of Atlantic tropical storm intensity over the last century, with the current higher intensity storm cycle beginning around 1995.

Although climate change impacts cannot be directly correlated to current insurance price and underwriting practices along the Virginia shoreline these insurance practices could provide opportunities for the industry to drive adaptation. Actions that reduce “normal” storm risk, taken in response to the increase in storms, can also reduce climate change impact exposure. However, there are a number of challenges that make this adaptation effort more difficult.

In some states, structural adaptation strategies are incentivized by insurance companies (e.g. hurricane straps in Florida), however, very few Virginia companies offer similar incentives because the risks these strategies address are not considered a major threat here. Furthermore, unless many homeowners take the same adaptive action or such action is mandated in local government building codes, insurance companies are unlikely to offer significant discounts for those actions without a guarantee of a widespread adoption of these actions that would significantly reduce risk exposure for the insurance companies.

Given the cost of many adaptation actions, it would take large insurance premium price discounts to incentivize homeowners to take those actions, discounts companies are unlikely to offer in the near future. Given

the lag time in accumulating the necessary loss data for a number of storm seasons and updating actuarial databases, it will take time before any risk-reducing adaptation changes are reflected in premiums and/or discounts. This delay could be shortened by accepting the risk reduction of some proven structural adaptations, such as hurricane straps, that might be immediately incorporated, based on actuarial data from other locations and from laboratory testing.

In short, on insurance price and availability, we found no clear indication that a homeowner could find and understand the impacts of climate change on his/her insurance. On the issue of price and availability spurring adaptation, we found a range of confounding factors that prevent a clear motivation for adaptation, even if a climate signal could be detected in homeowners insurance.

The homeowner’s insurance industry is doing little to drive climate change adaptation at this point. Insurance rates and coverage have begun to make coastal living more expensive but there is no detected anthropogenic climate signal in those changes. The industry has the power to influence building codes and encourage adaptive actions to increase resiliency on individual homes, but as of now companies in Virginia are not acting to either alter building codes or incentivize adaptive actions for individual homeowners.

Moving forward, the private insurance industry in Virginia may contribute to a long-term adaptation strategy of retreat from the coast if insurance costs and availability continues to be an issue. Studies have shown

the “negative capitalization” of insurance costs in coastal properties (houses are more expensive to live in near the coast/less attractive as a result of insurance costs). While using the insurance industry to encourage adaptation is a good idea in theory, it must be approached carefully and include consideration of all potential outcomes.

While future storm damage may spur the industry to action in coming years, reforms to the National Flood Insurance Program (NFIP) may be more successful in driving adaptive actions such as increasing flood resiliency and moving people away from the coast. The 2012 Biggert-Waters Act (Public Law 112-141) reauthorized the NFIP and produced numerous changes that will increase costs and limit coverage for many homeowners in tidal flood zones.

Limited availability, reduced coverage, and/or higher cost of homeowners insurance, combined with changes in the NFIP will be experienced differentially by homeowners on modest or fixed income. Increased private and NFIP insurance costs may cause those homeowners to sell coastal residences, having the unintended consequence of the “gentrification of the coast”: homes that become unaffordable to the middle class will be purchased by the wealthy or for rental or investment properties. In areas not along oceanfront coasts, where property demand is lower, these forces could cause the “hollowing out” of other tidal communities.

For a variety of reasons, homeowners insurance is more costly along the shoreline and will spur change. However, without a coordinated public-private approach, the

unanticipated consequences of private and public insurance could disrupt coastal communities. If state governments respond to pressures to lower homeowner insurance premiums below market rates and/or actuarially sound rates or to induce coverage, the private insurance industry will react negatively. Taxpayers in coastal states could become ensnared in subsidizing insurance and assuming greater risk exposure.

A lack of coordination across sectors would risk disruption and backlashes against coastal adaptation efforts and a public conversation is needed about the future direction of Virginia’s coastal communities.

Background on Wetlands Watch’s Sea Level Rise Adaptation Work

Wetlands Watch began sea level rise adaptation work in late 2006, realizing that with predicted rates of relative sea level rise in Virginia (estimated then at roughly 2.5 feet per century; now set at 3-4 feet), we could lose between 50 and 80 percent of our tidal, vegetated wetlands.¹ If allowed to adapt naturally, vegetated wetlands can accrete material to move vertically and/or “migrate” inland onto new intertidal habitat on what is now dry land behind current wetlands, as the sea level rises. However, hardened and developed shorelines and/or accelerated rates of sea level rise will prevent this natural adaptation. Therefore, limiting wetlands loss from sea level rise depends, in large part, upon keeping

shorelines behind existing wetlands open, resilient, and undeveloped without hardened shorelines.² A vast majority of the tidal shoreline in Virginia is privately owned, and hardened shorelines (e.g. bulkheads, and rip rap) are often the preferred method of shoreline protection.

To ensure survivability of tidal wetlands and the sustainability of coastal communities, adaptation to sea level rise requires placing conditions on land-use and development along the tidal shoreline. Local governments control land-use planning, policies and development decisions, leading Wetlands Watch to focus its sea level rise adaptation efforts at the local government level.

Adapting to sea level rise and storms in coastal communities involves a combination of approaches that vary with conditions in any given location. These approaches can be clustered into three main categories, arranged in ascending order of cost and political difficulty:

- Protect – build sea walls, replenish beaches/dunes, build storm surge structures, etc.
- Accommodate – raise/harden buildings and infrastructure, build bridges and roads higher, prohibit new development and redevelopment in high hazard areas, etc.
- Retreat/Relocate – move buildings to safer locations, purchase private property and raze existing buildings, remove/relocate public infrastructure, limit public support (utilities, road maintenance fire,

police, emergency services) in retreat zones, etc.

Along a reach of tidal shoreline, any or all of these approaches may be feasible depending on topography; rate of relative sea level rise; current use of shoreline properties; local government land-use, economic, and public policy goals; landowner preferences; available legal tools, financial resources; and a host of other factors.

In the course of this adaptation work, it became apparent that private property owners (particularly affluent residential and business owners), business leaders, and the development sector significantly influence local government land-use and development decisions regarding tidal shoreline properties. Finance and insurance sectors are directly tied to development decisions and are a significant part of the equation on sea level rise adaptation along Virginia's tidal shoreline. This has led us to explore the private sector's role in sea level rise adaptation, with a special emphasis on the insurance industry, since their main concern should be the emerging risk due to sea level rise and climate change.

Both public and private insurance contribute to the set of incentives/disincentives for development along the tidal shorelines of Virginia. Private homeowners insurance covers wind damage from storms while flood damage is covered by the National Flood Insurance Program (NFIP). This public insurance program was established in 1968 by the federal government to fill the void left by the private sector as they withdrew from offering flood insurance. The

NFIP will have a more direct impact on sea level rise adaptation choices, since floodplain management plans are required before a locality can receive flood insurance coverage. (Recent changes in the NFIP are leading us to explore that program and its influence upon adaptation in a separate inquiry.)

The role of the private insurance availability and price as incentives/disincentives is changing and expected to be a major factor in adaptation choices, particularly accommodation and retreat. For example, restricted availability and/or higher prices for homeowner's insurance in coastal areas may discourage development or redevelopment in zones where accommodation or retreat is the designated adaptation option. A recent study shows that higher insurance costs can lower the value of a house, as those higher costs are "negatively capitalized" into the house.³ As insurance rates reflect the risk expected from climate change impacts and as those costs are reflected in coastal property premiums (lowering the attractiveness and property value of high-risk coastal properties), this could reinforce government efforts to slow further development and even clear existing development from those high-risk zones.

If conveyed by insurance providers early in the adaptation process, risk and price signals could gradually discourage shoreline development and redevelopment. This gradual retreat is a more desirable approach to adaptation than a massive or sudden retreat decision following a catastrophic storm event. This gradual process of discouraging development and

redevelopment also leads more directly to Wetlands Watch's goal of seeing shoreline land kept open, resilient, and undeveloped without hardened shorelines. This led us to a closer examination of private property and casualty insurance coverage in coastal areas.

Initial Assumptions on Private Homeowner Insurance

Starting in late 2006, Wetlands Watch noticed changes in private homeowner insurance underwriting along the tidal shoreline in Virginia.⁴ It seemed that much existing insurance coverage was being withdrawn or significantly modified. Accumulating anecdotal information and press coverage, we estimated the withdrawal or modification of up to 60% of the private insurance market in tidal Virginia.⁵ This followed previous changes in other states that occurred after 1992's Hurricane Andrew and then Katrina in 2005.

We also heard complaints in coastal communities of higher insurance premiums being charged, again an action in common with other coastal regions. One estimate suggests homeowner insurance rates have risen about 40% in coastal areas since Katrina.⁶

We reviewed reports by the H. J. Heinz Center, Ceres, Lloyd's of London and others noting that the insurance industry is beginning to take notice of climate change. As a result, Wetlands Watch assumed the coverage changes observed in coastal Virginia were a clear signal that increases in

coastal risk caused by climate change and consequent sea levels and storm patterns were causing insurance companies to modify their underwriting practices.⁷ We saw confirmation when Munich Re, one of the world's largest reinsurers, released a report in October 2012 to support underwriters in North America in managing the increase in climate-related natural disasters.⁸

If insurance availability and price was changing as a result of coastal climate risk, some held that insurance could be used to speed climate change adaptation by sending risk and price signals into coastal communities, thereby creating disincentives for building in increasingly dangerous coastal areas and advancing the accommodation and retreat adaptation options outlined above. A few statements to that effect from Harvard Law School, Ceres, and Lloyd's of London, respectively:

(I)nsurers have the potential to drive significant changes in behavior towards greater climate change adaptation because they can induce behavioral changes through financial incentives.⁹

As the risk to a property grows because of location or other climate related factors, the associated insurance premiums will increase because of the greater likelihood of damage, providing an incentive to build in less risky areas and/or build or retrofit properties to higher standards.¹⁰

Insurers can play a positive role in adaptation by enabling individuals to understand the risks they face and promoting adaptation investments. Property insurance can encourage adaptation only if premium prices first reflect the risk to which properties are actually exposed, i.e. risk-based pricing. Then an insurer can incentivize measures taken to reduce risk by correspondingly lowering insurance premiums. For an insurer this could have the direct advantage of lowering the volatility (frequency and severity) of claims.¹¹

With much of Wetlands Watch work focused on encouraging local governments to plan for sea level rise adaptation through changes in shoreline land-use decisions and policy, we saw a potential to use this perceived change in insurance coverage to reinforce our efforts. We followed the logic laid out above *that risk and price signals could be sent directly to shoreline homeowners through their insurance*, which would create disincentives for tidal shoreline development.

In addition, we noted that some insurance companies encouraged the insurance industry to play a more active role in speeding up adaptation in other ways including:¹²

- Partnering with governments and sharing data and modeling;
- Lobbying for updated floodplain management regulations and stricter building codes;

- Influencing state regulation that allows actuarially sound rates that increase with elevated risk;
- Encouraging modification of state-backed programs to reduce taxpayer liability for disaster relief, increasing dependence on insurance coverage; and
- Leading long-term efforts to reduce greenhouse gasses since the insurance industry would be seeing the effects of climate change in their bottom lines.

Given all these assumptions we envisioned that adaptation efforts would be recognized by insurance underwriters and result in lower insurance costs for those communities that implemented climate change adaptation measures. We assumed adaptation measures would be written into local building codes and ordinances to convince insurers to offer lower premiums in those localities. We agreed with the argument made by one insurer, “the real claims lessons from [destructive storms] lie not so much in insurers’ response to disaster as in their preparations for the storm – and for similar events which seem to be occurring with greater and greater frequency.”¹³

The same logic held that individual homeowners could see the value in adaptation measures that employ more resilient building methods and materials to lower insurance rates. These homes would be safer and would become more valuable than less resilient homes:

Household and business property valuations should take account of levels of future risk. A property that has been adapted is more valuable than one that hasn’t because the risks for the home or business owner are reduced.¹⁴

All of this might result in individual homeowners taking adaptive actions to increase the resiliency of their home to lower rates, be approved for a particular policy, or comply with mandated, industry-influenced updates to building codes.

Adaptation might also involve moving inland where insurance is more readily available and at a lower cost.

We began using concern about private insurance underwriting changes and withdrawal as part of our social marketing messaging on the issue of sea level rise in coastal communities and convey a sense of urgency to the issue. We saw a private sector message, “State Farm/Allstate/Nationwide/USAA is taking this seriously and so should you,” as amplifying our own messages. We used the assumed validation of climate risk, inherent in insurance company underwriting changes, in our business sector messaging to urge adaptation.

In summary, we assumed a sequence of events from risk perception to insurance rates incentivizing adaptation as represented in Figure 1, below.

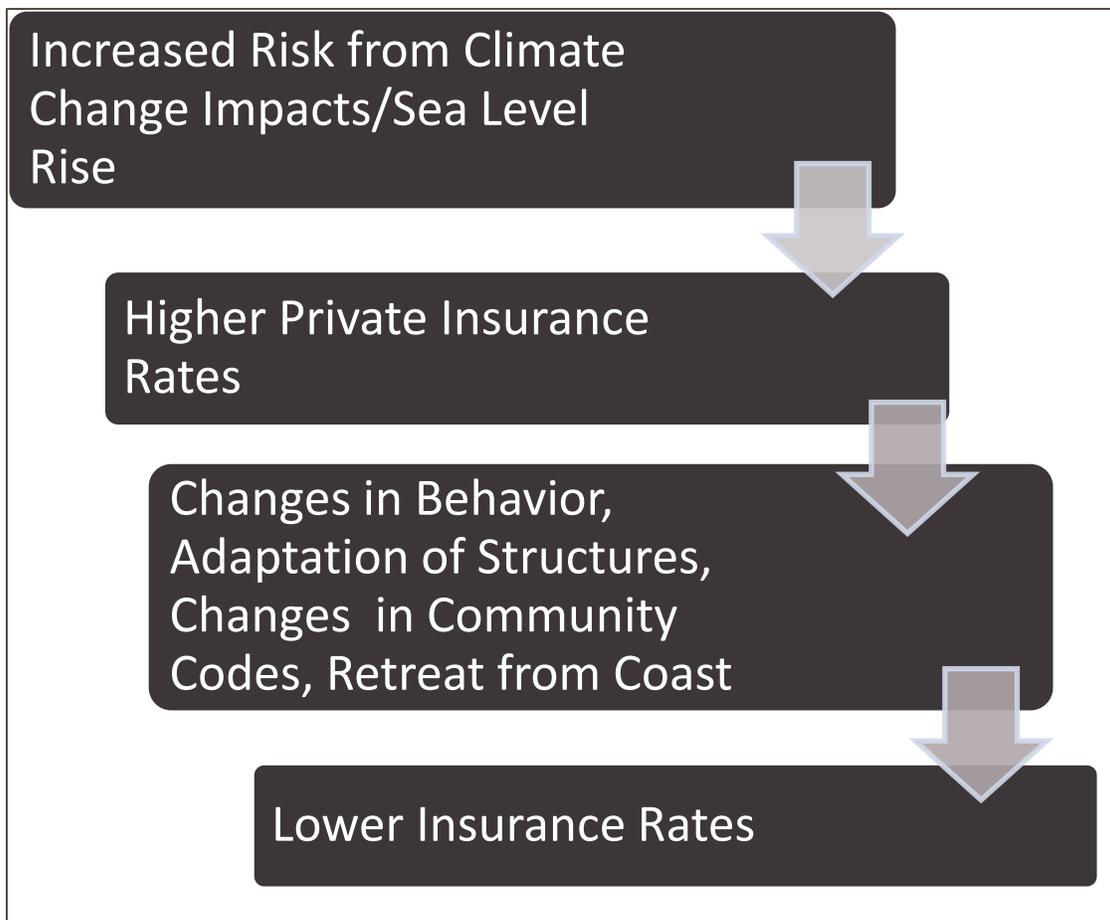


Figure 1. Schematic of price dynamic on homeowner insurance and climate change impacts as an incentive for adaptation

The Private Sector and Insurance

In 2012, Wetlands Watch secured a grant from the Virginia Environmental Endowment to explore private sector attitudes about and willingness to engage in sea level rise adaptation. Assuming that commercial insurance underwriting would be sending price signals into the business sector, especially those water-dependent operations, like shipbuilding, ship repair, and shipping, we began a series of informational interviews.

We interviewed a number of senior managers in businesses operating along the tidal shoreline in southeastern Virginia. We also conducted a focus group among senior business leaders across a range of non-shoreline dependent businesses (residential real estate, commercial real estate, accounting, consulting, and engineering sectors were represented).

An interview with the vice-president for facilities of a Fortune 500 transportation company with major shoreline shipping operations resulted in the same finding: sea

level rise is not an issue and they are not getting any messages from their insurance provider to suggest otherwise.

We interviewed the chief operating officer of a major provider of marine insurance in the port of Hampton Roads, and confirmed that there was no climate change/sea level rise risk factored into insurance offerings in the region. He also stated that he had not observed action being taken on climate risk in the London insurance market, through which this provider operated. He had seen withdrawal and changes in underwriting in Virginia, but his information indicated the changes were due to concerns about wind damage and driven by large losses in the Gulf of Mexico region with Katrina and Rita.

We interviewed the vice-president of a residential real estate firm active in the southeast Virginia region. She stated that flooding and sea level rise do not seem to be affecting real estate sales in areas prone to flooding. Furthermore, when flooding risks to shoreline properties are fully disclosed, they do not seem to dissuade potential buyers who want waterfront views and access. (Wetlands Watch notes that this information conflicts with our own observations – that homes in areas frequently and increasingly inundated are difficult to sell, many owners have given up on sales, and now rent their houses. The apparent contradiction bears further study and examination. It may also be that these earlier experiences were due to the temporary, wholesale withdrawal of coverage in 2006-7 - a situation that has subsequently changed.)

In its local adaptation work, Wetlands Watch staff heard reports that the lack of private insurance availability in the tidal regions of Virginia has complicated real estate transactions. However, according to the real estate professionals contacted, these changes were not seen as a contributing factor. Similarly, insurance agents stated that while some better-known insurance companies are not writing new homeowners policies in some coastal areas, there are still a variety of options available from lesser-known companies.

In our adaptation work, we heard concern among the general public throughout the region about the availability and price of private homeowner's insurance coverage. While these concerns may be "echoes" of the earlier wholesale withdrawal of coverage, these insurance-related issues in the tidal regions of Virginia indicate the need for additional research.

All of this work with the private business sector led us to single out the private insurance sector for closer examination. We began a series of interviews and initiated research specifically on private insurance, its underwriting practices, pricing policies, and other factors influencing price and availability along Virginia's tidal shoreline.

This study reviews the extent to which the private insurance industry may influence adaptation to climate change along Virginia's tidal shoreline through homeowners insurance.

The study examines whether predicted climate change impacts (increased rate of relative sea level rise, increased tropical

storm intensity and frequency in the Atlantic Ocean, etc.) are factored into insurance price and availability in coastal Virginia. The study explores how changes in insurance price and availability affect adaptation measures designed to reduce the vulnerability of coastal homes to coastal storms. These adaptation measures include building code changes, structural adaptations such as installing storm shutters or hurricane strapping, elevating or armoring the home, among other approaches. Adaptation may also involve retreat from the coast by selling a home (to another homeowner or to a government buyout program) and moving inland.

Homeowner Insurance: Price, Availability, and Climate Change Signals in Virginia

We met or spoke with a series of agents representing private residential insurers present in Virginia such as State Farm, Allstate, Alfa Alliance, Travelers, Hanover Insurance, Fireman's Fund, AIG, Chubb, and others. We also spoke with representatives from the Virginia State Corporation Commission's Bureau of Insurance. Our aim was to find out what the current underwriting policies, price and discount structure were for private homeowners insurance and whether any climate change signal could be detected that could then be used as an incentive for adaptation.

After many hours of interviews, we found that the expected private insurance/climate

adaptation feedback loop illustrated in Figure 1 does not exist today among providers of homeowner's insurance in Virginia. Regarding insurance price and availability, we found no clear indication that a homeowner could find and understand the impacts of climate change on his/her insurance. On the issue of price and availability spurring adaptation, we found a range of confounding factors that prevent a clear motivation for adaptation, even if a climate signal could be detected in homeowners insurance.

Insurance Price and Availability

On the issue of insurance price and availability, we found that it is very hard to clearly detect climate change drivers of risk or price signals in the private homeowner's insurance. Private homeowners insurance covers a range of risks, including structural damage from storms, fire, broken pipes, etc. as well as personal liability and theft. All of these risks are combined into the bottom line premium and usually not itemized for the policyholder. Even within the structural risk portion of a policy, the portion of the total premium associated with increased coastal risk is not distinguishable from the premium cost of other risks covered by a policy. What can be determined is:

- Insurance coverage for shoreline homes is becoming more expensive and underwriting practices are changing due to higher coastal loss exposure.
- Extreme weather and increased storm activity in the Atlantic since

1995 is a factor in that changed exposure.

- Extensive coastal development over the last 30 years, much of this development during a prior period of fewer coastal storms, has increased insurance companies' catastrophic cost exposure to the current cycle of more frequent and intense storms.

However, we are still some time away from being able to clearly state that climate change impacts (especially anthropogenic climate change impacts) are a factor in private homeowner's insurance price and availability in Virginia.

Through our research, we found that three primary factors influence policy price and availability for private insurance companies:

- The costs involved in servicing the policy (including the cost of reinsurance),
- The state of the economy and return on investments, and
- Underwriting, or the risks inherent in an insured property/insured individual (developed using actuarial data, financial and other personal data, and other information run through increasingly sophisticated algorithms to determine risk factors).

Cost

The direct costs of servicing the policy include items like agent costs, claims paid, underwriting costs, reinsurance costs, etc. The goal for the insurance company is to

minimize these costs by lowering claims (reduce risk, exempt high risk events from coverage, increase deductibles to increase policyholder responsibility for costs, etc.) and by reducing the cost of reinsurance (purchase the minimum necessary reinsurance, etc.).^a Reinsurance costs are higher along the coast than elsewhere, due to the higher exposure to coastal storms and resulting higher risk of catastrophic losses.

In addition, there are unanticipated costs related to servicing the policy, such as lawsuits. A major factor driving some change in coverage and cost of insurance in coastal regions seems to be a result of legal costs arising from lawsuits in the Gulf of Mexico following Hurricane Katrina. The most significant underwriting changes along Virginia's tidal shoreline seem to involve those companies heavily involved in the post-Katrina lawsuits and a desire on their part to avoid any future suits.

Economy

The state of the economy is a significant factor in setting premiums, since insurance companies invest the funds not required to be held in reserve to pay anticipated claims. Like all investors during and after the Great Recession, insurance companies are no longer able to achieve high returns on their investments, and when the return on these investments decreases, something else must make up the difference. That "something

^a *Reinsurance is insurance purchased by an insurance company to partially cover its catastrophic losses. The cost of reinsurance affects the rates charged policyholders.*

else” is either rate hikes, changes in underwriting designed to reduce risk and payout, or both as diminished return on investment causes companies to alter pricing and reassess risk in order to maintain profits.¹⁵

Another factor influencing the economic return for private insurance companies is an increase in the percentage of capital reserves required to be held back in order to cover potential claims. For companies insuring coastal properties, recent pressure from private firms rating corporate financial strength has increased this capital reserve amount from reserves sufficient to pay a 1% storm probability event (a 1-in-100 year event) to twice that amount. Holding this money back reduces the amount of money available to invest.

The recession has had a double impact on publicly traded insurance companies by diminishing the company’s value. Mutually owned companies, companies “owned” by the insured population, were less affected.

Catastrophe bonds, purchased to assist companies with disaster, are another market that could be influenced by climate change and extreme weather,^b However, these sales are strong even post-Sandy and are not considered to be a factor in changing coastal markets.¹⁶

^b *An entertaining explanation of catastrophe bonds can be found at*
http://www.nytimes.com/2007/08/26/magazine/26neworleans-t.html?pagewanted=all&_r=1&.

Risk Minimization

Private insurance underwriting practices are the most complicated but strongest driver of change in insurance coverage. Underwriting considers the “insurability” of the client and his/her property to determine whether a company will write a policy and at what price. With so much more data available on individuals and with increasingly complex algorithms on how those data sets can be used to predict behavior, insurance companies are able to target risk potential more effectively.

The determination of “insurability” is based on conditions such as home status (primary or secondary), credit history of the insured individual, and claims the insured has made in the past. Personal information such as level of education, occupation and/or military rank has a strong influence on underwriting decisions. For example, a millionaire doctor will be preferred over a millionaire contractor or an admiral over a lieutenant’s son, because the personality profiles are indicative of highly respected and responsible individuals more likely to maintain their homes and less likely to file claims. These and other factors are combined into an “insurance score” to determine whether the company will write a policy for that client and at what price.

Other considerations such as the company’s relationship with the client and value of the property are made in determining pricing. Homeowner insurance is less profitable than other lines of insurance and homeowner coverage availability is often directly or tacitly related to a client having multiple lines of coverage with the company such as

automobile, theft, and personal liability. A recent indication of this is the decision by one insurer to cancel homeowner policies for those clients in a rural Virginia county that did not have additional lines of insurance coverage with that insurer.¹⁷ Some smaller regional companies will only write for properties under \$400,000 because they need to limit their exposure. Conversely some larger companies will only write for properties over \$500,000 or for clients that pay premiums of \$10,000 or more.

Government intervention is also a factor; companies are less likely to write in areas where regulations may adversely affect their business model. For example, after Hurricane/Superstorm Sandy, the governors of the hardest-hit states declared the storm was not a hurricane at the time of landfall and therefore hurricane deductibles could not be applied. This makes the insurance company liable for more of the damages and discourages companies from writing in such locations in the future.¹⁸

Factors Unique to Coastal Insurance Coverage

Insurance companies writing policies in coastal regions recognize the coast as a high-risk area with increased exposure to coastal storms. To reduce exposure, some companies minimize the number of coastal policies they write. This trend is reinforced by insurance company rating agencies and reinsurance providers. The financial strength of private insurance companies is rated by a handful of independent rating agencies that factor risk exposure into ratings. The higher the financial rating the more attractive the insurance companies are to investors and

potential insured individuals. These ratings are especially important for many smaller companies that need to maintain a high rating in order to procure new business. The ratings agencies will downgrade a company with too much coastal exposure due to the potential for losses. Similarly, the cost of reinsurance increases with higher levels of exposure to losses - coastal properties are considered especially risky. Also rating agencies ask insurance companies to retain more capital against potential loss claims when they insure higher risk properties, such as those along the coast, further increasing costs.

Nearly all companies use some form of geocoding to help determine the risk of the property.^c If a property is in a high-risk location, insurance is more costly, has limited coverage, or may not be available. Some companies use zip codes, some use GPS locations, some use simple distances to the nearest water body. Proximity to the coast and tidal water bodies is a major consideration in all geocoding because those properties are more likely to suffer losses as a result of coastal storms. Many companies have been using some form of geocoding for the last five to ten years, but in the last two or three years companies have increasingly adopted advanced modeling techniques.

Another area of change for coastal insurance risk calculations is the inclusion of sophisticated weather modeling in

^c *In insurance underwriting, geocoding uses property location to assess place-specific risk such as coastal storm, earthquake, or landslide exposure.*

estimating exposure to losses. As a result of the recent increase in extreme weather, with higher incidences of hurricanes since 1995, most companies are including weather modeling in their underwriting. Major catastrophe modeling companies, like Risk Management Solutions (RMS), have begun to develop advanced modeling and predictive capabilities. In 2011, RMS projected a cycle of increased tropical storm activity along the Atlantic Coast, changing risk exposure calculations for insurance companies offering homeowners insurance along that coast.¹⁹ Many companies now use this model in their underwriting.

The changes to the RMS model were made with an observation that, “(C)urrent levels of offshore activity remain above the long - term historical average, with larger increases for the more intense storms.”²⁰ However, there is some debate over whether this change is a natural climate cycle or part of a larger, human induced (anthropogenic) climate change. Scientists have observed climate change cycles in the Atlantic with alternating periods of more frequent storms and quiescence, periods that have historically lasted from between ten and forty years. Now some scientists are linking the cause of our current period of storminess to anthropogenic change.²¹ Regardless, all agree that the North Atlantic has entered a period of increased hurricane activity starting around 1995.

The withdrawal and modification of homeowner insurance coverage along the tidal shoreline is not directly linked to increased risk of flooding due to sea level rise. The federal government covers flood

risk through the NFIP, so private sector insurers are not affected by that risk directly. Still, the risk of flooding and storm surge has played a role indirectly through lawsuits.

For some major companies, limitations on shoreline coverage are in part a consequence of large losses and legal battles that took place along the Gulf of Mexico coast, following Hurricane Katrina. Many insured homeowners returned to find only concrete slabs remaining where their house had been and insisted that the wind destroyed the homes before the storm surge hit (private wind insurance pays a more generous claim than federal flood insurance, thus the homeowner preference for a wind claim over a flood claim). Private insurers denied these claims and many homeowners sued their insurance companies. The resulting lawsuits cost the insurance companies hundreds of millions of dollars. In order to avoid future costs on these “slab suits,” insurance companies directly impacted by the claims made changes to their insurance underwriting.

Initially, many of these companies withdrew coverage completely in lower lying coastal areas, not renewing policies and/or not writing new policies. This initial withdrawal of insurance was the phenomena first noted by Wetlands Watch in 2006-7. Following this withdrawal, many companies returned to offering homeowner coverage in coastal areas but with many underwriting and pricing changes (no policies in category 1 hurricane zones, etc.). Some companies used more sophisticated geocoding to precisely target areas within which new policies would not be offered. Companies began

partnerships with other carriers to provide coverage where the parent company was no longer willing to write policies. Changes in underwriting practices brought new deductibles and exceptions. Finally, some companies returned to high-risk coastal states with new legal structures, operating subsidiary “limited liability corporations” to protect parent companies from catastrophic losses in those states.

As many large companies are altering coverage along the coast a tier of regional insurance companies is moving in to provide insurance to homeowners in areas where the larger companies have withdrawn or modified coverage. While they offer coverage, the exclusions, deductibles, and cost may not be what many homeowners are used to from the larger companies. These companies may operate only within a single state, with a fairly narrow geographic base on which to spread risks, and recognize that one catastrophic storm could destroy their company. In fact, a senior officer at one of these “residual risk” carriers admitted that if Sandy had hit Virginia, the claims would have bankrupted his company. However, for these companies the benefits outweigh the risks and, in turn, they fill a market niche and meet regulatory standards.

While the changes outlined above might be considered indicative of the impact of climate change on underwriting, (and while the net effect of these practices is to increase insurance costs in high risk coastal areas) they are among many factors considered in writing insurance policies and are not necessarily primary considerations. Every insurance agent and company interviewed

for this study stated that they could not identify the specific, quantifiable increase in cost of insurance due to weather and climate change concerns, though they know these factors are responsible for premium increases and underwriting changes in coastal insurance coverage. They stated that so many other factors go into insurance pricing and availability that it is impossible to identify the specific increase linked to weather/climate modeling changes. If the agent cannot identify the cost of increased weather and climate risk, it cannot be communicated to the policyholder.

Impact of Insurance on Adaptation

Changes in homeowner’s insurance coverage are sending increased cost and risk signals into shoreline communities; however, the portion of that increase due to storms, sea level rise, and/or climate change is difficult to isolate. Without a clear distinction between the various sources of risk incorporated into insurance premiums, there is no homeowner understanding of risk nor an incentive to undertake expensive adaptation measures under present conditions.

Building codes play an important role in adaptation and the insurance industry has played a vital role in the establishment of stricter, more effectively enforced building codes in hurricane prone areas. Before Hurricane Andrew in 1992, building codes in Florida were generally weak, inconsistent, and poorly enforced. Andrew, which still stands as the second most costly insured

storm in the U.S. (Sandy is third²²) served as a wake-up call for government and the insurance industry in realizing better codes and code enforcement were crucial for reducing damage. With stricter codes and enforcement, 25% of insured losses from Andrew could have been avoided.²³ Following Andrew, Florida enacted statewide building code reforms (some of which are considered adaptation methods for climate change²⁴) including the requirement to tie roofing to the rest of the structure and to have storm shutters or impact-resistant glass.

Moving forward, it is possible that climate change impacts and damage associated with major future storms will prompt other building code reforms. But at this point, insurance companies operating in Virginia do not consider projected future storms enough of a threat to cause them to pressure the state into further strengthen existing codes. Furthermore, Florida and Virginia are currently tied for the best code system that incorporates adoption, enforcement, training, certification, and contractor licensing.²⁵

On an individual policy level, discounts for adaptive action also could help to promote adaptation; however, most companies in Virginia offer little or no discount for adaptive actions partially because the risk associated with not taking these actions is not particularly high. In addition, agents and companies interviewed stated that even if adaptation measures would result in lower risk and might result in an insurance rate discount, the discount alone would probably

not be enough to motivate adaptation by a private homeowner.

For example, for many people, a premium discount for hurricane shutters of \$200 a year is not incentive enough to offset the \$2,000 cost and additional work (finding contractors, getting bids, etc.) of installing shutters. To incentivize adaptation, the insurance policy premium discount would have to be substantial enough to overcome this type of disincentive. Insurance companies are unlikely to offer a large enough discount without assurance that the adaptive actions will limit claim losses over a large geographic area and across a number of policies. Given the lag time in accumulating loss data and updating actuarial databases, it would take time before any risk-reducing adaptation changes are reflected in premiums and/or discounts. (However, if risks were to drastically increase, data to support immediate implementation of discounts may come from other states or lab storm simulations.)

The agents interviewed did say that requiring some adaptation as a determination of “insurability” might work, such as a company requiring storm shutters before writing a policy. However, even that might not bring about widespread adaptation unless all insurance companies use this same determination. Otherwise, a homeowner might shop for the lowest priced policy with another company willing to write coverage without shutters, choose the cheaper policy and avoid adaptation costs even though the policy requiring shutters might provide more extensive and complete coverage. The agents interviewed felt that most people are

unaware of what their homeowner insurance coverage provides, until they have a claim, and that broad consumer education on insurance policies, rates, perils/risks, and coverage is needed before policyholders can be engaged in a discussion on adaptation measures.

Another complication noted by agents and companies interviewed is that individual homeowner's adaptation efforts would not be sufficient to bring about change in the industry because insurance is the "business of large numbers." In other words, many people would have to implement a risk-reducing adaptation measure before those adaptation measures would be accounted for actuarially. In addition, mandatory, enforceable risk reduction measures versus voluntary measures are more quickly recognized and accounted for by insurance companies. Therefore, enforceability through local codes and ordinances may provide the strongest decision-related incentive for insurance premiums and discounts. For example, if a state required hurricane shutters in coastal regions, and had a record of stringent code enforcement, that might bring about reductions in premiums in that state.

For Virginia to adopt such requirements (either through the government's own decision or pressure from the insurance industry), significant changes in weather patterns and associated damage within the state would likely need to occur. Even with current storm modeling that incorporates predicted climate-related changes, insurers in Virginia do not see the need to pressure government to change existing building

codes or to encourage policyholders to increase the resiliency of their homes.

Even without an overt policy on climate change and adaptation, price increases in private insurance may result in retreat of the middle and lower socio-economic class from the coast. Many policies do not cover high-risk perils and include named storm and/or wind-speed deductibles with riders that require homeowners to assume a greater financial burden for resulting damage. If a storm is a declared hurricane or has a set wind speed, the homeowner with riders addressing those events assumes a higher deductible. Sandy, at landfall no longer a hurricane, was still a "named-storm" and companies with a hurricane deductible were forced to pay regular coverage for wind damage. Because of this, more companies are likely to change their hurricane and wind deductibles to named-storm or wind-speed deductibles. The exclusion of some perils and higher deductibles may force some people to abandon or sell homes that have suffered damage because they do not have the means to rebuild. For residents in coastal communities on the edge financially, especially for retired residents, insurance increases may tip a decision to move inland to a more affordable location. It also may draw further government intervention, the drawbacks of which are discussed below.

We anticipate that increased insurance costs may increasingly drive the sale of shoreline property as storm damage continues along the coast over time. While this is a slow and limited effect of changes in private insurance underwriting, changes in the NFIP are likely to compound the effect. Rate

increases and other changes associated with the 2012 Biggert-Waters Act, which sought to make the NFIP financially sound, have already begun to go into effect. In addition, updated flood rate insurance maps are being released and may change flood zone designations. Some homeowners required to carry flood insurance may become financially challenged because of increased cost of private and NFIP premiums.

If enough people leave the coast due to increased insurance costs, home values and housing demand in those areas decline.²⁶ Home values also drop when the repair costs for storm damage are high, as we are observing in New York and New Jersey in the aftermath of Superstorm Sandy.²⁷ This has the adaptation benefit of moving people away from the most hazardous areas (presuming insurance costs are tied substantially to risk), but differentially targets those that cannot afford the costs. This uneven demographic impact is discussed further below.

In summary, the homeowner's insurance industry is doing little to drive adaptation at this point. It has begun to make coastal living more expensive but there is no detected climate signal. It has the power to influence building codes and encourage adaptive actions to increase resiliency on individual homes, but as of now companies in Virginia are not acting to either alter building codes or incentivize adaptive actions for individual homeowners. While future storm damage may spur the industry to action in coming years, the NFIP will be more successful in creating adaptive actions

through increasing flood resiliency and moving people away from the coast.

Cautionary Notes on Insurance Pricing and Undesired Outcomes

The insurance industry is a powerful candidate for driving adaptation because of its hold on many pocketbooks; however, this financial influence can have a number of negative and unintended consequences when it is used for adaptation purposes.

In the course of its work, Wetlands Watch has reached out to other organizations in other states for information on adaptation efforts. One of these contacts led to a report on social research on sea level rise adaptation in Florida conducted by an environmental group. In the report on this effort, the summary of a focus group looking at homeowners insurance and attitudes toward sea level rise was titled, "Insurance is not a way in to the sea level rise debate," and concluded:

Once the link between SLR (sea level rise) and people's homes is established, homeowners quickly become concerned about insurance rates. Feelings toward the home insurance industry in Florida are so strong and so negative that they can quickly turn a discussion about SLR into a tirade about the property insurance industry and negate the believability of SLR messages.²⁸

In fact, when the moderator introduced the link between sea level rise and insurance rates, the participants began to express the opinion that the focus group was being paid for by the insurance industry. This type of focus group work needs to be replicated in other regions, given the unique animosity between the public and the insurance industry in Florida, to see if those views are widely held.

Another challenge comes from using insurance price signals to encourage retreat from the coast or to influence development patterns along the coast. The impacts of increased insurance premiums (both private insurance and flood insurance under the NFIP) will be felt differentially depending upon household income. If the middle and lower class retreat from attractive coastal areas due to storm recovery costs or insurance related financial pressures, this leaves room for the wealthy to buy up more properties and/or expand their homes, an outcome already observed in some places devastated by Superstorm Sandy.²⁹ It also creates openings for investors to purchase homes to be used as rental properties. Such a demographic shift has been termed the “gentrification of the coast”, where the wealthy acquire both the benefit and the cost of living on the coast when those with less means are forced to leave for financial reasons.³⁰

In tidal shoreline communities less attractive than those on oceanfront coasts, insurance cost pressures can have a different effect, potentially “hollowing out” those areas. Fixed income and middle/lower class homeowners cannot afford to stay in these

areas, yet unlike beachfront property there is not a large demand for houses as investment and rental properties. This lowers home values, reducing property taxes and public services, making these areas even less attractive.

Gentrification of the coast is not an ideal form of adaptation because of the social inequalities it perpetuates. Fixed income homeowners, especially retirees, can be priced out of shoreline communities. The potential for “hollowing out” communities is a real concern. And, this gentrification does not remove everyone from harm’s way and still requires public funding for infrastructure and services in hazardous areas.

On the other hand, at least for high-demand oceanfront areas, if multiple middle class families are replaced by a single wealthy family or by a group-owned rental home that can only be occupied by one family at a time, it reduces the number of people in harm’s way. Newer homes built as investments may be more resilient, use modern building materials and techniques and held to higher flood risk standard. However, there is insufficient experience with this to allow any conclusions yet.

Need for Coordinated Public/Private Adaptation Strategy

Significant political fallout is likely to accompany increased insurance rates and any trend toward coastal gentrification. An anticipated government response may be to further regulate insurance companies and put a price cap on insurance rates, seeking to relieve pressure on fixed income

homeowners. However, this kind of market intervention makes it difficult for private companies to make a profit and can cause insurance companies to pull out of coastal areas altogether. Price increases and/or reduction of insurance options often results in a call for a state-backed insurance pool, which is a backward step in the adaptation process that not only removes the appropriate risk/price signal, but also requires even more public funds to deal with the fallout from coastal disasters. This will be discussed further below.

In summary, while using the insurance industry to encourage adaptation is a good idea in theory, it must be approached carefully and include consideration of all potential outcomes. Any adaptation strategy must consider what outcome is most desirable over the short, medium, and long term and should be guided by government policies to focus all the partners in an adaptation strategy on the socially acceptable outcome. This need for coordination across public and private sectors is more critical given the potentially compounding impact of reforms to the federal NFIP over the next few years.

Moving Ahead: Challenges and Modifications Needed to Strengthen Adaptation Signals

Stronger adaptation signals may come as increases in storm events more clearly reveal a longer term, anthropogenic climate trend that increases exposure to losses by insurance companies. It may come as a

result of further incorporation of climate change into weather modeling and resulting estimates of higher risk exposure requiring higher premiums. Eventually, it may come from a direct acknowledgement by the insurance industry that anthropogenic climate change poses a challenge for homeowners insurance.

When an anthropogenic, long-term climate signal can be detected on the risk side of insurance, it can be translated into adaptive measures that will reduce risk and reduce policyholder premium costs. With a clear climate signal, insurance in coastal areas will become even more expensive, have greater limitations on coverage/increasing deductibles, and/or be more difficult to obtain. In response, insurers can require certain structural improvements as a prerequisite to coverage to reduce vulnerability of a structure. Further, insurers can lobby for changes in building codes that would increase structural resilience.

The feasibility and outcomes of some of these adaptive actions will require further study. For example, while strengthening building codes results in more resilient buildings, it has no impact on existing structures. Because the average life expectancy of a house is on the scale of a century, it will take many years for new code changes to be significantly incorporated into the building stock. The only way these changes might come about more quickly is if a large part of the housing stock is destroyed by a few major storms. If this were to happen, zoning changes could be used to limit or prohibit reconstruction in

the damaged areas, leading to a retreat adaptation approach.

Reduced availability of insurance and increasing prices may lead to a negative affect of gentrification of the coast, as discussed above. This is potentially disruptive, unintended consequence of insurance pricing on adaptation and merits further study. This outcome could lead to hollowed out coastal communities or could drive governments to get involved in further regulating the insurance industry, removing the free market, risk-based pricing and disrupting risk signals being sent along the shore.

Government is involved in the rate-setting process for insurance companies to ensure prices are fair to consumers. In some states, there are price-ceilings for rates that limit the maximum amount insurers are allowed to charge. Although currently not an issue in in Virginia, price ceilings in other states have kept rates from being actuarially sound, and could become even more problematic if not adjusted according to increased risk associated with climate change. Insurers often react to price-ceilings and other restrictions by leaving the state altogether, or by limiting coverage to lower-risk perils. If insurers cannot charge actuarially sound rates or if they leave a region, they will not encourage adaptation through risk-based pricing.

A loss of private insurers and/or restricted coverage reduces availability and competition in that location and may result in pressures to create government-subsidized programs such as wind and catastrophe pools (the creation of which often prompts

still others to pull their business from the state). These types of pools have been shown to be ineffective in other locations³¹, obscure the true risk and create a false sense of security by allowing habitation in increasingly hazardous areas. Worse, all policyholders (not just those in the wind pool) are responsible for these pools³², and the amount of public money spent on disaster recovery increases or remains the same rather than decreasing with adaptive actions.

In 2011, state governments were responsible for a total of nearly \$900 billion in exposure. In Virginia's Fair Access to Insurance (FAIR) plan, exposure is nearly \$3.5 million.³³ Rather than turning to government pools in high-hazard situations, continuing to employ hazard-specific deductibles and pricing accordingly in the private insurance industry will have more desirable results by sending the appropriate risk signals, but not requiring government coverage. Still, governments will likely be called on to regulate such deductibles, so finding a balance to keep the private industry in coastal markets is imperative.

In the long run, for the private insurance industry to drive adaptation not only do the risk signals need to be recognized by the industry, companies must convey the risk increase associated with climate change to their agents and policyholders. This means that climate risk signals need to be identifiable in underwriting practices and clearly linked with pricing and availability, so that the company can identify climate hazards as an increased risk and convey this to policyholders either through sharing

information or by requiring structural upgrades to increase resiliency against climate threats as a prerequisite for renewal. While such requirements and educational efforts will convey the risk signal to the policyholder, adaptation actions will only be successful if the majority of companies take such measures (and there is not a tier of smaller companies willing to pick up policies with higher risk, as is the current situation).

The potential for disruptive unanticipated consequences from these private insurance changes, combined with the complications coming from reforms to the NFIP, call for a coastal adaptation strategy coordinated between the public and private sectors, and across the various layers of government. If increased insurance cost becomes significant, private insurance companies and government regulators will need to develop an understanding of acceptable insurance price and underwriting. The NFIP will also have to be part of this discussion. If these insurance costs begin to drive changes in homeownership patterns, there will need to be public conversations on what constitutes acceptable changes in those patterns.

Without these conversations and understandings, we risk a chaotic, expensive, and unproductive transition along our coasts.

Next Steps

The next steps in understanding economic signals in coastal communities will begin with understanding the impacts of the

Biggert-Waters Act and the ways in which these changes to the NFIP are likely to influence adaptation to sea level rise and tropical storms. Private homeowners insurance does not currently provide an adequate climate risk signal by itself, but changes being made to the NFIP will add to the existing price signals being sent by private insurers. We are starting a more in-depth inquiry into that program and its relationship to private insurance and the potential for the NFIP to spur adaptation.

Part of this further study will include reactions to the Act. We are already seeing anecdotal evidence of strong negative reactions by those affected. Because the reforms will make the cost of insurance difficult for some, there will be many emotional appeals to make exceptions to allow affected homeowners to remain in their homes. Such appeals and other negative reactions to those affected by higher prices may result in a political debate that leads to yet another NFIP reform that, if it caters to the negative reactions, may render the program less effective at addressing coastal risks in an actuarially sound manner.

We are monitoring the rebuild after Superstorm Sandy and evaluating early signs pointing toward the “gentrification of the coast” in New York and New Jersey. Political reaction to this situation will provide guidance for future actions.

Conclusions

This purpose of this study was to explore, at the community level, whether private insurance shifts were a harbinger of anthropogenic climate change concern and a driver for climate change adaptation, as outlined in national level studies.

Throughout the course of this study we have found that no anthropogenic climate change risk signal exists in the private homeowners insurance industry and no adaptation signal is being sent to policyholders. Any risk signal that does exist is obscured by the complexity and multitude of factors in modern underwriting and pricing. Although no climate adaptation signal is being conveyed to homeowners, some unintentional adaptation is occurring through more restricted availability and/or high cost of insurance along the coast. Some homeowners may no longer be able to afford the costs, and may be forced to retreat from the coast. This situation is likely to be exacerbated by future damaging storms and with the impacts of the NFIP.

In order for the insurance industry to drive adaptation actions in the future, the industry must accept that the risk associated with climate change is increasing and clearly translate that risk to its policyholders. They must accurately price risk and charge that rate rather than removing their business from a high-risk region, and they should encourage or require structural upgrades to increase resiliency. Additionally, governments would need to minimize actions that alter the expected business

model of the industry (resulting in companies pulling out) and encourage risk-based pricing rather than restrict it. The industry can also get involved in updating building codes, sharing models and predictive capabilities with governments, shaping public perception of adaptation from the private-sector perspective, and encouraging reform of high-risk state-run insurance pools.

There are many challenges remaining in using the insurance industry as a driver of adaptation to the effects of coastal climate change. There will likely be negative consequences, including the gentrification of attractive coastlines and hollowing out of other coastlines, but these consequences are likely unavoidable. Government intervention will be a particularly significant challenge, as those whose lives are affected by adaptation turn to the government to protect them.

At the same time, the rest of the country is seeking to reduce disaster taxpayer expenditures that exacerbate the national debt and can be avoided through adaptation.³⁴ As storm intensity and related damage increase, it will become obvious to the public that retreat and increased resiliency are often unfortunate and unwelcome, but necessary actions to reduce future devastation, unnecessary public expenditures, and preserve the coast for all to enjoy.

REFERENCES

- ¹ Stiles, William. “Wetlands Watch letter to Governor Tim Kaine,” *Wetlands Watch*, May 31 2007, http://wetlandswatch.org/Portals/3/WW%20documents/kaine_letter_053107.pdf
- ² Titus, J. G., Park, R. A., Leatherman, S. P., Weggel, J. R., Greene, M. S., Mausel, P. W., Brown, S., Gaunt, G., Trehan, M. and Yohe, G. “Greenhouse effect and sea level rise: The cost of holding back the sea,” *Coastal Management* 19 (1991): 171–204.
- ³ Dumm, R, Nyce, C., Sirmans, G.S., Smersh, G. “The Capitalization of Homeowners Insurance Premiums in House Prices,” White Paper, *Florida Catastrophic Storm Risk Management Center*, April 2011.
<http://www.stormrisk.org/sites/default/files/Capitalization%20of%20Homeowners%20Insurance%20Premiums%20in%20House%20Prices.pdf>.
- ⁴ See Smitherman, L. “Insurers shrink from coasts,” *Baltimore Sun Times* (Baltimore, MD) Feb. 18, 2007. See also Associated Press. “Allstate’s ‘Good Hands’ Wave ‘Bye Bye’,” *Associated Press*, Dec. 21, 2006. See also Fleishman, S. “Sea Change In Insurers’ Coastal Coverage: Many Firms Opt to End or Limit New Policies,” *Special to the Washington Post*, Dec. 30, 2006.
- ⁵ *Ibid.*
- ⁶ Waggoner, J. Davidson, P., Frank, T., Heath, B., and Schmit, J. “Insurers, Property Owners Tally Sandy’s Damage,” *USA Today*, Oct. 31, 2012.
- ⁷ The Heinz Center and Ceres. “Resilient Coasts: A Blueprint for Action”, *The H. John Heinz III Center for Science, Economics and the Environment and Ceres*, 2009. See also McHale, C. and Leurig, S. “Stormy Future For U.S. Property/Casualty Insurers: The Growing Costs and Risks of Extreme Weather Events,” *Ceres*, 2012. See also Lloyd’s of London and Risk Management Solutions. “Coastal Communities and Climate Change: Maintaining Future Insurability,” *Lloyd’s 360 Risk Project Report*, 2012. See also Allianz Group and World Wildlife Foundation. “Climate Change and Insurance: An agenda for Action in the United States,” 2012. See also Mills, E. “The Greening of Insurance,” *Science*, 338 (2012): 1424-1425.
- ⁸ Kuczinski, T. and Irvin, K. “Severe Weather in North America: Executive Summary,” *Munich Re*, 2012.
- ⁹ Lou, R., Fort, S., Goho, S., and Jacobs, W. “Municipal Climate Adaptation and the Insurance Industry,” Harvard Law School, Emmett Environmental Law & Policy Clinic, Cambridge, MA, 2012.
- ¹⁰ *Supra* note 7, McHale and Leurig, “Stormy Future For U.S. Property/Casualty Insurers”.

¹¹ Lloyd's of London and Risk Management Solutions. "Coastal Communities and Climate Change: Maintaining Future Insurability," *Lloyd's 360 Risk Project Report*, 2008.

¹² Environmental and Energy Study Institute. "Insurance Industry Perspectives on Extreme Weather Events," *Environmental and Energy Study Institute*, 2012. See also Tate, R. "How Insurers Can Foil the Next Hurricane Sandy," *Wired Business*, Oct. 31, 2012. See also Deloitte Center for Financial Services. "2013 Property and Casualty Insurance Industry Outlook," *Deloitte*, 2012, p.15. See also Travelers Institute. "Highlights and Lessons Learned from a National Symposium Series on Coastal Insurance Issues," *Travelers Institute, Travelers Insurance*, 2009, p.3.

¹³ Costonis, M. A. "Mitigating Loss From the Next 'Sandy'," *Property Casualty 360*. Jan. 4, 2013.

¹⁴ *Ibid.*

¹⁵ Rousseau, B. "Interest-Rate Environment, Not Storms, Driving P&C Rate Increases, CFO Says," *Property Casualty 360*. Dec. 28, 2012. See also, House, A. "Insurance Basics," *Value Line*, Apr. 28, 2010, http://www.valueline.com/Tools/Educational_Articles/Stocks_Detail.aspx?id=8495.

¹⁶ Mortimer, S. "Cat Bond Sales Finish 2012 Near Record High," *Property Casualty 360*, Jan. 2, 2013. See also Mortimer, S. "Cat Bond Sales Near \$6B in 2012 Despite Sandy Loss Threat," *Property Casualty 360*. Dec. 14, 2012. See also Deloitte Center for Financial Services *supra* note *xii*, p.15.

¹⁷ Hamilton, S. "Concerns Brought Up About Possible Impending Insurance Crisis," *Gloucester-Mathews Gazette Journal*, (Gloucester and Mathews Counties, VA), June 7, 2012.

¹⁸ Postal, A. D. "More Industry Reps Express Concerns to States About Hurricane Deductibles," *Property Casualty 360*. Nov. 5, 2012. See also Deloitte Center for Financial Services *supra* note *12*, p. 16.

¹⁹ Napco LLC. "The Impact of Changes to the RMS U.S. Hurricane Catastrophe Model," *Napco LLC*, 2012.

²⁰ Muir-Wood, R. "2012 RMS ClimateWise Disclosure," *Risk Management Solutions*, 2012, <http://www.climatewise.org.uk/storage/fifth-year-review-member-reports/RMS.pdf>.

²¹ Goldenberg, S.B., Landsea, C.W., Mestas-Nunez, A.M., Gray, W.M. "The Recent Increase in Atlantic Hurricane Activity: Causes and Implications", *Science*, Vol. 293. no. 5529 (Jul. 20, 2001), pp. 474 - 479. See also Lepore, F. and Gillis, C. "Agreement Among Some NOAA

Hurricane Researchers and Forecasters,” *National Oceanic and Atmospheric Administration*, Nov. 29, 2005, <http://www.magazine.noaa.gov/stories/mag184.htm>.

²² Gusman, P. “Sandy Set to be 3rd Costliest Hurricane, but Storms of the Past Offer Perspective,” *Property Casualty 360*, Mar. 22, 2013, http://www.propertycasualty360.com/2013/03/22/sandy-set-to-be-3rd-costliest-hurricane-but-storms?utm_source=PC360DailyNews&utm_medium=eNL&utm_campaign=PC360_eNLs.

²³ Kunreuther, H. “Mitigating Disaster Loss through Insurance,” *Journal of Risk and Uncertainty*, 12 (1996): 171-187.

²⁴ Simmons, J. “Hurricane Andrew: 20 years later, Florida Building Code “really made a difference,” *ABC Action News*, Aug. 20, 2012, <http://www.abcactionnews.com/dpp/news/state/hurricane-andrew-20-years-later-florida-building-code-really-made-a-difference>.

²⁵ McChristian, L. “Hurricane Andrew and Insurance: The Enduring Impact of an Historic Storm,” *Insurance Information Institute*, August 2012, http://www.insuringflorida.org/assets/docs/pdf/paper_HurricaneAndrew_final.pdf, p.16.

²⁶ Dumm et al, *supra* note iii.

²⁷ Cheslow, D. “On battered Jersey shore, Sandy victims struggle with costs of climate change,” *The Christian Science Monitor*, Jan. 28, 2013. See also Cowan, A.L. “Towns’ Next Hit From Hurricane Is to Tax Revenue,” *New York Times*. Jan. 24, 2013.

²⁸ Cosgrove, T. and Goux, D. “Listening to Conservatives: Floridians on Sea Level Rise: A Report to the Florida Wildlife Federation,” *The Cosgrove Group*, 2012.

²⁹ Harris, E. “In Rockaways, Marketing Hurricane-Wrecked Properties ‘As Is’,” *New York Times*. Jan. 28, 2013. See also Osborne, J. “Many at Shore will be forced to raise their homes to protect against future storms,” *Philadelphia Inquirer*, Jan. 25, 2013.

³⁰ Rosenberg, A. “Panel Takes Sobering Look at Future of the Shore,” *Philadelphia Inquirer*, Mar. 13, 2013, http://articles.philly.com/2013-03-13/news/37685436_1_buffer-zones-panel-discussion-hazard-mitigation.

³¹ Shean, T. “General Assembly 2010: What’s on Tap for Business?: Insurance: Windstorm Pool,” *Virginia Pilot*, Jan. 10, 2010, <http://hamptonroads.com/2010/01/general-assembly-2010-whats-tap-business>.

³² Bannister, M. “Letter to Senator Frank W. Wagner Re: Senate Bill No. 318,” *State Corporation Commission Bureau of Insurance, Property and Casualty Division*, Jan. 15, 2008.

³³ Hartwig, R. and Wilkinson, C. “Residual Market Property Plans: From Markets of Last Resort to Markets of First Choice,” *Insurance Information Institute White Paper*, July 2012, <http://www.iii.org/assets/docs/pdf/ResidualMarketWhitePaper-2012.pdf>, p. 2, 13.

³⁴ Krosnick, J., MacInnis, B., Howe, L., Abeles, A., Markowitz, E., and Socolow, R. “2013 Stanford Poll on Climate Adaptation,” *Stanford Woods Institute for the Environment*, March 2013, <http://woods.stanford.edu/research/public-opinion-research/2013-Stanford-Poll-Climate-Adaptation>.