Agents of Change: How Collaboration Among Insurers and the Public Sector Can Manage Risk and Foster Climate-Neutral Behavior

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INTRODUCTION

The alarming trends in catastrophic events[1] and the *unequivocal* fact of anthropogenic (that is, caused by human activity) global climate change have led insurers to become increasingly engaged in evaluating climate change risks and solutions.[2] Climate change poses numerous unprecedented risks to the insurance sector, policyholders, and the uninsured and has become a top concern within the insurance industry.[3] According to the Chairman of Lloyd's of London, climate change is the biggest issue facing the insurance market.[4] Ceres, a national coalition of investors, environmental groups, and other public interest organizations collaborating with companies to address climate change, stated that climate change is "likely to be the biggest challenge facing the industry in its history."[5] A manager of global insurer Munich Reinsurance recently noted that losses to the industry of $40 billion in 2008 from Hurricanes Ike and Gustav alone were not an anomaly, but a continuation of "the long-term trend we have been observing."[6] No industry is more attuned to catastrophic risk management—when insurers are bracing for the worst, it is wise to follow suit.

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[1] The term "catastrophe" as used in this Article refers to a high-severity, low-frequency loss event.

[2] "Warming of the climate system is *unequivocal*, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level." INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: SYNTHESIS REPORT 30 (Core Writing Team, Pachauri, R.K. & Reisinger, A. eds., 2007) [hereinafter IPCC FAR] (emphasis added), *available at* http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf.

[3] *See* EVAN MILLS, FROM RISK TO OPPORTUNITY: 2008—INSURER RESPONSES TO CLIMATE CHANGE ii (2009), *available at* http://insurance.lbl.gov/opportunities/risk-to-opportunity-2008.pdf.

[4] *Id.* at 9.

[5] *Id.* at 12. *See generally* CLIMATEWISE, http://www.climatewise.org.uk (last visited Nov. 20, 2011). ClimateWise, formed in 1997 by forty-one insurance companies worldwide, is another initiative through which the sector aims to respond collaboratively to the risks and opportunities of global climate change.

[6] MILLS, *supra* note 3, at ii.

The insurance sector as a whole is particularly vulnerable to increases in catastrophic losses. Thus, assuming a proactive role in addressing climate change is essential for the viability of the sector. In addition to presenting novel challenges, the growing risks present opportunities for insurers to be part of the climate change solution by managing, mitigating, spreading, and adapting to the risks.[7]

For its part, the public sector must collaborate with insurers to enact legislation aimed at mitigating sources of climate change and adapting to its risks to reduce losses and ensure continued access to insurance. Access to affordable insurance during the transition to a climate-safe economy will help reduce overall societal vulnerability. If the increasing risks become uninsurable, individuals, businesses, and governments will be forced to develop novel and untested mechanisms to manage risks in the new climate.[8]

I. Climate Change Drivers, Projections, and Impacts

Scientific consensus is that anthropogenic climate change is occurring, and that it will have far-reaching and potentially devastating effects.[9] The Intergovernmental Panel on Climate Change[10] concluded in its 2007 Fourth Assessment Report that climate change is "unequivocal" and that human activity is its main driver.[11]

A. Causes and Effects of Anthropogenic Climate Change

Global temperatures increased by 0.5°C during the twentieth century, and are continuing to rise at an increasing rate: over half of that change occurred in the past thirty years.[12] Observed global temperature increases correspond to a 36% increase in global greenhouse gas (GHG) concentrations since the industrial revolution, primarily due to burning of fossil fuels and land-use changes such as deforestation and urbanization.[13]

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[7] *Id.*

[8] Sean B. Hecht, *Climate Change and the Transformation of Risk: Insurance Matters*, 55 UCLA L. Rev. 1559, 1563 (2008).

[9] *See generally* IPCC FAR, *supra* note 2.

[10] The IPCC was established by the United Nations Environment Programme and the World Meteorological Organization in 1988 to review and assess worldwide, mostly peer-reviewed scientific data relevant to the understanding of climate change. *Organization*, IPCC, http://www.ipcc.ch/organization/organization.htm (last visited Nov. 20, 2011) (on file with the Harvard Law School Library). The IPCC shared the 2007 Nobel Prize with Al Gore for their climate change work. Press Release, Norwegian Nobel Comm., The Nobel Peace Prize for 2007 (Oct. 12, 2007), http://nobelprize.org/nobel_prizes/peace/laureates/2007/press.html (on file with the Harvard Law School Library).

[11] IPCC FAR, *supra* note 2, at 30.

[12] Allianz Group & World Wildlife Fund, Climate Change & Insurance: An Agenda for Action in the United States 12 (2006) [hereinafter Allianz], *available at* http://www.climateneeds.umd.edu/pdf/AllianzWWFreport.pdf.

[13] *Id.*

Global sea levels are rising along with the temperature, attributable to thermal expansion (increases in oceans' volume as they warm) and melting of glaciers and polar ice sheets.[14] Over the twentieth century, sea levels rose about 1.5 to 2.0 mm/year (15 to 20 cm total), and satellite measurements indicate that over the past decade, that rate increased to 3.1 mm/year.[15] Reduction in ice and snow cover amplifies the effects of climate change, as these surfaces reflect incoming solar radiation.[16]

B. Climate Change Projections

Atmospheric concentrations of heat-trapping GHGs have been rising steadily over the past two centuries and are predicted to continue to grow.[17] Based on current modeling scenarios, global average temperatures are predicted to rise between 1.4 and 5.8°C by the end of the century.[18] This may seem like a negligible change from the perspective of daily temperature variations, but it is not, given that the difference between the Earth's current climate and an ice age is only about 5°C.[19]

Because GHGs persist in the atmosphere long after they are emitted, even an immediate stabilization in GHG concentration would not prevent a continued rise in temperature and sea levels over the next several centuries.[20] Thus, climate change mitigation must be accompanied by adaptation in order to minimize the economic consequences of climate change. The insurance and public sectors have a pivotal role in both strategies.

C. Impacts on Insurable Risks and Insurers

Discernible effects of anthropogenic climate change extend beyond average temperature and sea level increases to temperature extremes, increased erosion, and changes in wind patterns and the hydrologic cycle.[21] These effects have already translated into massive economic losses, both insured and uninsured. Economic impacts from catastrophic events increased by fifteen

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[14] *Id*. at 14. Satellite data show that Arctic sea ice has shrunk by an average of 2.7% per decade since 1978. IPCC FAR, *supra* note 2, at 30.

[15] *Climate Change and Sea Level Rise*, CLIMATE INST., http://www.climate.org/topics/sea-level/index.html (last visited Dec. 10, 2009) (on file with the Harvard Law School Library).

[16] Melting of polar ice with concomitant increase in global temperatures is known as the Ice-Albedo Feedback, one of several feedback loops that amplify the impacts of climate change. Pew Ctr. on Global Climate Change, *Global Warming and the Arctic FAQs*, CTR. FOR CLIMATE & ENERGY SOLUTIONS, http://www.pewclimate.org/arctic_qa.cfm#9 (last visited Dec. 10, 2009) (on file with the Harvard Law School Library).

[17] IPCC FAR, *supra* note 2, at 44.

[18] ALLIANZ, *supra* note 12, at 12.

[19] *Id.*

[20] IPCC FAR, *supra* note 2, at 66; *see also State of Knowledge*, CLIMATE CHANGE DIV., U.S. ENVTL. PROT. AGENCY, http://epa.gov/climatechange/science/stateofknowledge.html (last updated Nov. 29, 2011) (on file with the Harvard Law School Library).

[21] IPCC FAR, *supra* note 2, at 40–41.

times between 1950 and 1998.[22] Many of those impacts, such as flood and fire damage, were insurable risks borne by the insurance sector. An increase of 1°C over a period of fifty years could cause up to $214 trillion in global damage.[23]

Precipitation in the United States has increased over the past century, with the most dramatic effects in the South, Southwest, Midwest, and Great Lakes regions.[24] More severe storms punctuated by longer periods of light or no rain are expected, leading to more frequent droughts.[25] Rising sea surface temperatures make more water vapor available for extreme precipitation events, and changes due to sea-level pressure add intensity to precipitation in the northwestern and northeastern United States.[26]

Costs from flooding have risen steadily over the past century and particularly over the past few decades.[27] Annual average flood damages in the top fifteen flood-prone states reached nearly $6 billion starting in 1999, and $7 billion starting in 2004.[28] Higher sea levels produce more violent storm surges and greater coastal erosion, which diminish the natural protection provided by coastlines.[29] Earlier snowmelt, forest fires, erosion, and loss of protective wetlands due to development also exacerbate flooding.[30]

Hurricanes have become more frequent and longer-lasting, fueled by warmer sea temperatures and more moisture.[31] Hurricane Andrew in 1992 caused a record-breaking $45 billion in damage.[32] Three of the strongest ten

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[22] Claudia Kemfert, *The Economic Costs of Climate Change*, 1 DIW BERLIN WKLY. REP. 43, 45 (2005), *available at* http://www.diw.de/documents/publikationen/73/diw_01.c.42861.de/diw_wr_2005-2.pdf. This dramatic increase is also attributable to the increasing population density along coastlines. *Id.*

[23] *Id.* at 43. As discussed above, global average temperatures are expected to rise between 1.4 and 5.8°C by the end of the century. ALLIANZ, *supra* note 12, at 12. These figures were arrived at using the global WIAGEM simulation model, which estimates the economic effects of climate change by combining detailed economic and trade models and a climate model. Kemfert, *supra* note 22, at 46. The WAIGEM model takes into account economic effects on energy production, agriculture, industry, as well as ecology (e.g. increase in forest fires and extinction) and human health (e.g. the spread of disease). *Id.*

[24] *See generally* Pavel Ya. Groisman, et al., *Contemporary Changes of the Hydrological Cycle Over the Contiguous United States: Trends Derived from In Situ Observations*, 5 J. HYDROMETEOROLOGY 64, 64–85 (2004), *available at* http://journals.ametsoc.org/doi/pdf/10.1175/1525-7541%282004%29005%3C0064%3ACOTHC%3E2.0.CO%3B2.

[25] *The Current and Future Consequences of Global Change*, NASA, http://climate.nasa.gov/effects (last visited Dec. 10, 2009) (on file with the Harvard Law School Library).

[26] *Id.*

[27] ALLIANZ, *supra* note 12, at 22.

[28] *Id.*

[29] *Id.* at 14.

[30] *Id.* at 14, 20–22.

[31] *See generally* P. J. Webster et al., *Changes in Tropical Cyclone Number, Duration, and Intensity in a Warming Environment*, 309 SCIENCE 1844, 1844–46 (2005), *available at* http://www.sciencemag.org/cgi/content/full/309/5742/1844.

[32] JANE STRACHAN, WALKER INST. FOR CLIMATE SYS. RESEARCH, WHAT THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE FOURTH ASSESSMENT REPORT SAYS ABOUT THE INSURANCE SECTOR 2 (2007), *available at* http://www.met.rdg.ac.uk/~jane/documents/IPCCAR4_Insurance.pdf. *See also* ALLIANZ, *supra* note 12, at 6. Several recent studies urge that climate change is more likely to blame for these effects than natural oscillations, as was previously believed. *Id.* at 23. Economic figures were adjusted to 2006 prices. *See id.*

hurricanes ever recorded in the North Atlantic occurred in 2005, the hottest year in over a century (now tied with 2010).[33] Projected costs from Hurricane Katrina, the worst natural disaster in the United States to date, are projected to be more than double that amount, including about $40.6 billion in insurance claims.[34]

Property damage in the wake of wildfires has also been rising astronomically. Structural damage from wildfires tripled in the nine years between 1985 and 1994 compared to the previous three decades.[35] Fires also cause indirect insurable damage, such as increased flooding and erosion, damage to infrastructures, and business interruption.[36] Seven times as much forest area burned from 1987 to 2003 compared to the previous sixteen years.[37] In 2003, two fires in California alone caused $2.1 billion in insured losses.[38] Higher temperatures and drier conditions are expected to lead to even more intense, uncontrollable fires in the future.[39] Forest fires in turn release more carbon into the atmosphere, causing further climate change.

Other effects of climate change on insurable risks outside the scope of this article include effects on health insurance from increasing heat waves and the spread of infectious diseases caused by the billions of predicted climate refugees.[40]

II. The Role of the Insurance Sector in Evaluating, Mitigating, and Adapting to Climate Change-Related Risks

The insurance sector "links up the two ends of climate change (causes and impacts) by bearing the costs of the impacts and by insuring . . . some of the primary causes of human-induced carbon dioxide emissions" such as transportation and structures.[41] It is also the world's largest industry, generating over $4 trillion in premium revenue in 2007.[42] It is thus uniquely

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[33] Allianz, *supra* note 12, at 12, 23; *see also* James E. Hansen et al., NASA Goddard Inst. for Space Studies, Global Temperature Trends: 2005 Summation, http://data.giss.nasa.gov/gistemp/2005/ (last visited Nov. 20, 2011). 2010 tied 2005 as the hottest year on record. Richard Harris, *Last Year: The Warmest on Record (Again)*, Nat'l Pub. Radio (Nov. 5, 2011), http://www.npr.org/2011/01/12/132865502/last-year-was-the-warmest-year-on-record-again (on file with the Harvard Law School Library).

[34] Allianz, *supra* note 12, at 25.

[35] *Id.* at 19.

[36] *Id.* at 17, 20, 25 n.2.

[37] *Id.* at 17.

[38] *Id.* at 18–19.

[39] *Id.* at 18. In 1992, Swiss Reinsurance indicated that climate change may influence the frequency and severity of wildfires in the future. *Id.* at 20.

[40] A recent interdisciplinary study found that climate change poses the biggest threat to human health of the century. Catharine Paddock, *Climate Change Biggest Threat to Health, Major Study*, Med. News Today (May 14, 2009), http://www.medicalnewstoday.com/articles/150107.php (on file with the Harvard Law School Library).

[41] Allianz, *supra* note 12, at 36.

[42] Butch Bacani, United Nations Env't Programme Fin. Initiative, Insuring Climate Change and Sustainability: Unleashing Innovation and Intelligent Partnership 175, http://unepfi.org/fileadmin/documents/bacaniarticle.pdf (last visited Nov. 30, 2011).

poised to encourage large-scale behavioral change by evaluating the true risks of climate change, distributing that risk among policyholders, and educating policymakers about the risks and cost-effective risk mitigation strategies.

A. Evaluating Climate Risk: Integrating Climate Science Into Catastrophe Modeling

Catastrophe modeling is used by insurers to support risk-management decisions and insurance pricing.[43] Insurers could provide an invaluable service by integrating the impacts of climate change into traditional risk modeling in order to drive informed change in behavior and policies, thus mitigating risk exposure and reducing future climate change-related losses.[44]

Most risk modelers rely on past trends (typically over the past 50 to 150 years) for future risk modeling despite the fact that the climate is undergoing dynamic change.[45] The inherent uncertainty of the risks presented by an unprecedented rise in global temperatures makes estimating future losses a challenging task. Yet, some insurance companies are working to better integrate climate change into catastrophic risk models.[46] One response to the underlying uncertainty regarding impacts on insurance losses is that of AIR Worldwide Corporation, the founder of the catastrophe modeling industry, which has provided its clients with two credible estimates of future hurricane risk.[47]

Insurance regulators have mandated that large insurers adopt a more progressive role. The National Association of Insurance Commissioners (NAIC) now requires insurers with annual premiums over $300 million to complete an annual Insurer Climate Risk Disclosure Survey.[48] The stated goal of the survey is to provide domestic regulators with "substantive information about the risks posed by climate change to insurers and the actions insurers are taking in response to the understanding of climate change risks."[49] As discussed *infra* in Section III(A), it is critical that regulators facilitate the use of catastrophe-risk modeling as part of responding to the challenges of the new climate.

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[43] *See generally* JAYANTA GUIN, CATASTROPHE MODELING IN AN ENVIRONMENT OF CLIMATE CHANGE (2008), *available at* www.air-worldwide.com/download.aspx?id=15690.

[44] *See generally* ALLIANZ, *supra* note 12.

[45] GUIN, *supra* note 43, at 3.

[46] MILLS, *supra* note 3, at 17.

[47] GUIN, *supra* note 43, at 9, 14.

[48] *Adopted Version: Insurer Climate Risk Disclosure Survey,* NAT'L ASS'N OF INS. COMM'RS, http://www.naic.org/documents/committees_explen_climate_survey_032810.pdf (last visited Nov. 20, 2011).

[49] *Id.* at 1.

B. Education and Public Policy Formulation

The insurance sector is uniquely able to collaborate with the government and the public to minimize the impacts of climate change. As expert risk messengers, insurers can play an important role in educating policymakers about the need to proactively adopt mitigation and adaptation techniques.

Insurance companies have historically been active in informing sound, risk-reducing public policies. For example, widespread endorsement from the sector was instrumental in providing increased driver safety through seat belt and airbag requirements.[50] Safer work and home environments provided by strengthened building codes are also largely attributable to the influence of the insurance sector.[51] The risk management data routinely gathered by insurers would likewise be invaluable to informed policymaking in the area of climate change mitigation and adaptation.

A prominent catastrophe modeling firm, Risk Management Solutions, recently created a dedicated climate change function and actively participates in the public policy debate, fostering disaster resilience and modeling insurable risks arising from a low-carbon economy.[52] A study of damages to commercial locations within the path of Hurricane Katrina conducted by FM Global, one of the most profitable insurers in the U.S. following the disaster, provides an illustration of the insurance industry's unique expertise in loss prevention.[53] FM Global found that policyholders who had implemented loss prevention recommendations suffered 85% less in losses than those who had not.[54] One model of flood losses by American Business Insurance found that emissions reductions were more effective at reducing losses than improving flood defenses.[55]

In recognition of recent increases in catastrophic losses, some insurers have begun to lobby for energy-saving and disaster-resilient practices. For example, insurers support, and sometimes require as a condition of coverage, use of hurricane shutters, wind-resistant glass, fire-resistant tile, and metal or slate roof tiles.[56] One Canadian insurer collaborated with the Institute for Catastrophic Loss Reduction to build a disaster-resilient home.[57] Insurers

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[50] *See, e.g.*, *Automobile Insurance*, AM. INS. ASS'N, http://www.aiadc.org/aiapub/landing.aspx?m=2&v=50&docid=308390 (last visited Nov. 20, 2011) (on file with the Harvard Law School Library).

[51] *See* Marc Gunther, *Insurance Companies Take on Global Warming*, CNNMONEY.COM, Aug. 24, 2006, http://money.cnn.com/2006/08/22/news/economy/pluggedin_gunther.fortune/index.htm (on file with the Harvard Law School Library).

[52] *Risk Management Solutions Develops New Climate Change Risk Screening Device*, RISK MGMT. SOLUTIONS, http://www.rms.com/models/ (last visited Dec. 22, 2011) (on file with the Harvard Law School Library).

[53] MILLS, *supra* note 3, at 20.

[54] *Id.*

[55] *Id.*

[56] ALLIANZ, *supra* note 12, at 31.

[57] *ICLR's Designed . . . for Safer Living Program*, ICLR.COM, http://www.iclr.org/homeowners/newhomes.html (last visited Nov. 20, 2011) (on file with the Harvard Law School Library).

also widely support GHG reduction in the form of energy-efficient building codes, higher fuel economy standards, and tighter federal controls on speed limits.[58] The American Insurance Association advocates telecommuting and public transportation.[59]

C. Incentivizing GHG Mitigation by Policyholders

Insurers are increasingly using market signals to encourage adaptation and mitigation by policyholders by aligning terms and conditions with risk-reducing behavior. For example, many insurers are offering reduced rates for energy-efficient buildings and vehicles.[60]

Climate-change-mitigating behavior provides a benefit to insurers in addition to decreased risk of climate-related losses. In a type of reverse adverse selection,[61] policyholders who adopt green technology have what some insurers call a "halo effect" of tending to present better risk profiles.[62] These indirect benefits to insurers may help explain the recent proliferation of "green" insurance products and services.[63]

1. *Green Building Insurance Products*

Many insurers are encouraging green building and equipment, the benefits of which include risk management in the form of reduced carbon emissions, in addition to disaster resilience.[64] For example, solar-powered buildings are unaffected by electrical outages (which can also reduce losses from business interruption), foam-insulated buildings are less prone to moisture damage after flooding, and compact fluorescent light bulbs pose a lower fire risk since they emit less heat.[65] Additionally, increasing the energy efficiency of buildings has been touted as the fastest and most economical way to decrease global GHG emissions.[66] Investment in green building construction is expected to reach $140 billion by 2013.[67] Twenty-two insurers currently offer insurance products and services for green buildings and

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[58] ALLIANZ, *supra* note 12, at 31.
[59] MILLS, *supra* note 3, at 49.
[60] *Id.* at 3.
[61] In adverse selection, individuals with above-average risk disproportionately purchase insurance, thus making overall premiums insufficient to cover the eventual claims.
[62] ALLIANZ, *supra* note 12, at 33.
[63] From 2007–2008, the three leading insurance trade journals dedicated special issues to climate change issues and green insurance products. MILLS, *supra* note 3, at 12. Additionally, Carbon Reinsurance, which focuses on GHG risk solution and touts a "visionary fostering of sustainable development" emerged in 2003. CARBON RE, http://www.carbonre.eu/ (last visited Nov. 30, 2011) (on file with the Harvard Law School Library).
[64] Green buildings are proven to be less prone to water damage and fires. ALLIANZ, *supra* note 12, at 33. This "halo effect" has caused insurers such as Fireman's Fund to offer a discounted rate for green buildings. *Id.*
[65] MILLS, *supra* note 3, at 22.
[66] *Id.* at 15.
[67] *Id.* at 32.

equipment.[68] As of 2008, nineteen insurance companies are members of the U.S. Green Buildings Council.[69]

Most existing insurance products focus on rebuilding with green features to replace pre-existing features, green feature upgrades, or preferential lending terms.[70] Fireman's Fund, for example, offers a Green Upgrade Form which allows policyholders to upgrade damaged systems with energy- and water-saving technology, and in the event of a total loss the insurer will rebuild to certified standards of Leadership in Energy and Environmental Design (LEED) or Green Globes.[71] Affiliated FM, an international company specializing in commercial property insurance, offers a green coverage endorsement that includes replacement of damaged property with green alternatives, sustainable disposal of damaged property, and hiring of an accredited green consultant.[72] Current methods are inadequate and new insurance products are needed to address coverage gaps, such as liabilities unique to energy auditors, green builders, and energy-performance testers and raters.[73]

2. *Pay-As-You-Drive (PAYD), Fuel Efficiency, and Low-Emission Auto Insurance and Financing*

Driving presents numerous risks in addition to environmental ones: one estimate was that driving imposes a $300 billion per year cost upon society in the United States.[74] Moreover, motor vehicles emit about a quarter of the total U.S. GHG emissions.[75] A reduction in miles driven would thus not only reduce the risk of insured losses from accidents (and, more indirectly, health impacts of air pollution), but would also mitigate a major source of GHG emissions.

Unlike the traditional approach where mileage makes up only a small component of a policyholder's risk, PAYD insurance encourages efficient driving by basing premiums on mileage that is either self-estimated or

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[68] *Id.* at 3.

[69] *Id.* at 46.

[70] Fortis offers beneficial financing for energy-efficient homes, and Fireman's Fund offers a premium credit for policyholders who use green products for building or replacement after a covered loss. *Id.* at 5, 33.

[71] *Id.* at 33.

[72] *Affiliated FM's Green Coverage Endorsement*, AFFILIATED FM, http://www.affiliatedfm.com/products_green.asp (last visited Nov. 20, 2011).

[73] MILLS, *supra* note 3, at 32. The first "green building litigation" was filed in 2008. The contractor on a condominium project in Maryland filed a mechanic's lien and the owner countersued for lost tax credits for failing to construct green buildings that conformed with the LEED rating system. Stephen Del Percio, Shaw Development v. Southern Builders*: The Anatomy of America's First Green Building Litigation*, GBNYC (Aug. 20, 2008), http://www.greenbuildingsnyc.com/2008/08/20/the-anatomy-of-americas-first-green-building-litigation. The case apparently settled out of court. *Id.* Because commercial general liability policies held by contractors generally only cover property damage, it seems unlikely that the owner's claim would have been covered. *Id.*

[74] MILLS, *supra* note 3, at 25.

[75] *Id.* at 15.

tracked with a device such as a MileMeter.[76] The National Association of Insurance Commissioners encourages insurers to give greater weight to mileage in the underwriting process.[77] The estimated reduction in miles driven and accident rates from PAYD insurance could translate into a savings of $52 billion per year and provide reduced premiums to two-thirds of households.[78]

At least twenty-six insurance companies now offer PAYD insurance products and some offer discounts of up to 60% for driving less or driving fuel-efficient vehicles.[79] Massachusetts recently proposed a PAYD pilot program as part of its Clean Energy and Climate Plan for 2020.[80] The state anticipates that full-scale implementation will result in a 2.1% reduction in GHG emissions, as well as substantial fuel savings, accident savings, and congestion savings (reduction in lost time), providing $5.3 billion in cumulative net benefits.[81]

Some insurers also offer reduced premiums or preferential financing terms for low-emission and fuel-efficient vehicles.[82] Fireman's Fund Insurance introduced the first hybrid vehicle upgrade endorsement.[83] German insurer, Allianz, is cooperating with the World Wide Fund for Nature to bundle carbon offsets with its auto insurance policies.[84] By providing such incentives, insurers reward policyholders for risk-reducing behavior with lower premiums.

3. *Climate-Related Microinsurance*

Microinsurance, which is characterized by low premiums and low coverage, is an efficient mechanism for climate change risk-pooling in developing nations. It is one of the fundamental injustices of climate change that developing nations are the most innocuous GHG emitters, but suffer disproportionately severe impacts.[85] Residents of developing nations are seventy-nine times more likely to be struck by a climate change-related disaster than

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[76] *Id.* at 26; *see also* MILEMETER, http://milemeter.com (last visited Nov. 30, 2011) (on file with the Harvard Law School Library).

[77] MILLS, *supra* note 3, at 26.

[78] *Id.* at 26. This figure presumably applies to the U.S. *Id.*

[79] *Id.* at 3, 24.

[80] IAN A. BOWLES, SEC'Y OF ENERGY & ENVTL. AFFAIRS, MASSACHUSETTS CLEAN ENERGY AND CLIMATE PLAN FOR 2020 61 (2010), *available at* http://www.mass.gov/eea/docs/eea/energy/2020-clean-energy-plan.pdf.

[81] *Id.*

[82] MILLS, *supra* note 3, at 5.

[83] *Id.* at 3, 23.

[84] Breda O'Hara, *Carbon Neutral Car Insurance*, ALLIANZ (Nov. 30, 2008), http://www.knowledge.allianz.com/search.cfm?255/ecomotion-carbon-neutral-car-insurance. Carbon offsets add future reduction in climate risk to the traditional function of merely spreading risk that insurance provides.

[85] The notable exception is China, a "Newly Industrialized Country," which produces 15% of the world's GHG emissions. KEVIN A. BAUMERT ET AL., WORLD RES. INST., NAVIGATING THE NUMBERS: GREENHOUSE GAS DATA AND INTERNATIONAL CLIMATE POLICY 11 (2005), *available at* http://www.wri.org/publication/navigating-the-numbers. Treating the European Union as one country, the four largest emitters are the United States (21%), China, the EU,

residents of developed nations.[86] They are also less likely to be able to afford adaptation measures or climate-risk insurance.[87] Small island developing states in particular collectively generate relatively inconsequential levels of GHGs and yet are among the first to suffer from the effects of climate change, such as rising sea levels.[88]

Approximately seven million low-income individuals, many of whom are in South America, Africa, and Asia, are currently insured by microinsurance products against drought and famine.[89] Expanding the market for microinsurance products would assist developing countries in adapting to climate change risks more efficiently than traditional disaster assistance.

Insurance and mitigation mechanisms, unlike post-event mechanisms such as government relief, are advantageous because they are capable of influencing risk and reducing total losses.[90] For example, catastrophic crop-loss risk insurance, provided by AXA Insurance to farmers in Ethiopia through the United Nations World Food Programme, pays claims once rainfall drops below a particular trigger, rather than after the catastrophe.[91] Participants estimated that claims paid totaled only about 0.7% of the estimated cost of conventional post-event relief that would have been required.[92]

Micro Insurance Agency (MIA) is a pioneer in insuring farmers in developing countries against drought. MIA pays claims based on data received from nearby weather stations, eliminating the need for a costly claim and verification process.[93] In addition to lowering the overall costs of the event to both insurers and the public, paying claims based on a loss trigger rather than after the catastrophe also averts substantial human suffering.

Russia, and India. *Id.* Most of the remaining countries contribute little to the overall buildup of GHGs. *Id.*

[86] UNITED NATIONS DEV. PROGRAMME, FAST FACTS: CLIMATE CHANGE AND UNDP 1 (2009), *available at* http://www.undp.org/publications/fast-facts/FF-climate.pdf.

[87] *See* STRACHAN, *supra* note 32, at 7.

[88] *Govt Encouraged to Welcome 'Climate Change Refugees,'* ABC NEWS, July 14, 2008, http://www.abc.net.au/news/stories/2008/07/14/2302737.htm. Small islands such as Kiribati and Tuvalu are already sinking into the Pacific and their residents are beginning to seek refuge in Australia and New Zealand. *Id.* Forty-one Small Island Developing States are parties to the United Nations Framework Convention on Climate Change (UNFCCC), and twenty-nine are signatories to the Kyoto Protocol. UNFCCC CLIMATE CHANGE SECRETARIAT, UNITED NATIONS, CLIMATE CHANGE: SMALL ISLAND DEVELOPING STATES 2 (2005), *available at* http://unfccc.int/resource/docs/publications/cc_sids.pdf. Eleven are considered least developed countries. *Id.*

[89] MILLS, *supra* note 3, at 4.

[90] *See* STRACHAN, *supra* note 32, at 6, 8.

[91] MILLS, *supra* note 3, at 37.

[92] *Id.*

[93] *Weather Index Crop Insurance*, MICROENSURE, http://www.microensure.com/products-weather.asp (last visited Nov. 20, 2011).

III. The Role of the Public Sector in Managing and Mitigating Climate Risks

In order to mitigate future causes and effects of climate change, the government must expand its role in protecting society and ensuring the continued availability and affordability of insurance. In addition to enacting GHG-limiting legislation and signing binding international treaties such as the Kyoto Protocol, the public sector should mandate free market insurance pricing, provide financial incentives to policyholders, and implement international insurance mechanisms.

A. Facilitating Free Market Underwriting

Insurers can make an enormous impact by indirectly disseminating their expertise about climate change impacts and the solutions they espouse through underwriting, like determining whether to provide insurance and under what terms.[94] However, public policy often prevents underwriting from reflecting the true risk of behavior, while simultaneously encouraging unsustainable development.

The escalating losses from floods seen in the past few decades are attributable to both climate change and increasing development in flood-prone areas.[95] Moreover, public insurance programs, such as the taxpayer-funded National Flood Insurance Program (NFIP), have exacerbated insured losses by encouraging development and rebuilding in these high-risk areas through artificially low premiums.[96] Double, triple, and quadruple payments are commonly made to the same policyholder, providing no disincentive to continue rebuilding in flood-prone areas.[97] These multiple claims cost the NFIP in excess of $200 million annually.[98] As global sea levels continue to rise, property near the ocean will be at increased risk of damage from storms, storm surges, waves, and wind.[99] Nevertheless, coastal populations in the U.S. are expected to grow by twenty-five million in the next thirty years.[100]

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[94] *See generally* Bureau of Labor Statistics, Occupational Outlook Handbook 2010-2011: Insurance Underwriters, http://www.bls.gov/oco/ocos026.htm#nature (last visited Nov. 5, 2011).

[95] *See* Kemfert, *supra* note 22, at 45.

[96] Allianz, *supra* note 12, at 29. The NFIP is a publicly run insurance program established in 1968 and administered by the Federal Emergency Management Agency (FEMA). Premiums cover only approximately 60% of the program's costs. *Id.*

[97] *Id.*

[98] *See id.* The NFIP was bankrupted in 2005 after Hurricanes Katrina and Rita, forcing Congress to provide a $23 billion dollar loan to pay claims. *Id.*

[99] *Id.* at 16.

[100] *Id.* A recent study showed that ten percent of the global population currently lives in a coastal zone less than ten meters above sea level, placing them particularly at risk from rising seas and increasing cyclone activity. *Climate Change: Study Maps Those at Greatest Risk From Cyclones and Rising Seas* (Mar. 28, 2007, 3:24 PM), Int'l Inst. for Env't & Dev., http://www.iied.org/general/media/archive-media/climate-change-study-maps-those-greatest-risk-cyclones-and-rising-seas.

While insurers typically send risk signals through premium rates, rates are often suppressed by insurance regulators, forcing insurers to exit high-risk markets and placing the burden of unsustainable development on taxpayers.[101] Some states also prohibit the use of catastrophic risk modeling in underwriting.[102] Although the goal is to provide the public with affordable insurance, the harm done to the public through unsustainable development and correspondingly high claims payouts from state-run insurance programs outweighs the intended benefit in the long run.

Legislative reforms aimed at correcting some of the market distortions created by the NFIP, such as prohibiting duplicative claims, have been proposed but not enacted into law.[103] As climate change impacts escalate, public subsidies for development in areas particularly exposed to natural disasters should be curtailed. Insurance pricing (and unavailability) should evidence the magnitude of risk associated with investment in particular activities or regions. Where there are remaining coverage gaps, state-run residual market insurance may be necessary but pricing should be based as much as possible on realistic risk assessments.[104] As discussed in Section II(A), *supra*, insurers can promote this market realism by providing catastrophic-risk data to policymakers.

B. Government Incentives

Governments may also incentivize climate change-mitigating behavior by policyholders by providing or mandating incentives. For example, the Federal Housing Administration (FHA) allows homeowners across the U.S. to finance the cost of adding energy efficiency features as part of their FHA-insured loans.[105] Massachusetts requires that insurers provide premium credits for policyholders who use primarily public transit to commute to work.[106] An Oregon statute offers a $100 per policy tax credit to insurers who offer PAYD insurance.[107] More such tax incentives and legislation should be directed at encouraging climate change- and risk-mitigating activities.

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[101] *See* STRACHAN, *supra* note 32, at 3.

[102] *Id.*

[103] *See generally* AM. ACAD. OF ACTUARIES FLOOD INS. SUBCOMM., THE NATIONAL FLOOD INSURANCE PROGRAM: PAST, PRESENT . . . AND FUTURE? (2011), *available at* http://www.actuary.org/pdf/casualty/AcademyFloodInsurance_Monograph_110715.pdf.

[104] For example, Florida resisted allowing premium increases after Hurricane Andrew, which led to unavailability of insurance. *See* ROBERT W. KLEIN, CTR. FOR RMI RESEARCH, HURRICANE RISK AND THE REGULATION OF PROPERTY INSURANCE MARKETS 9, 19 (2009), *available at* http://rmictr.gsu.edu/Papers/WP09-1.pdf.

[105] *Energy Efficient Mortgage Program*, U.S. DEP'T OF HOUS. & URBAN DEV., http://www.hud.gov/offices/hsg/sfh/eem/energy-r.cfm (last visited Nov. 20, 2011).

[106] MILLS, *supra* note 3, at 49.

[107] *Id.* at 25.

C. International Insurance Mechanisms

While microinsurance is effective as a type of ex-ante self-insurance, it fails to address the intrinsically widespread risk of climate change impacts facing developing nations. The goal of risk-spreading should be publicly promoted by the international insurance mechanism envisioned in the United Nations Framework Convention on Climate Change (UNFCCC),[108] which was signed by the United States in 1992 and entered into force in 1994.[109] The preamble of the UNFCCC recognizes the unique susceptibility of developing countries and the need for developed countries to provide resources for their mitigation and adaptation strategies.[110] The UNFCCC mandates that the parties consider insurance as a way to assist developing countries address the impacts of climate change.[111]

Several proposals for insurance instruments have been proposed in international climate negotiations, including an international insurance mechanism that would provide a pool of funds to assist small island states after extreme weather events.[112] The Copenhagen Accord ("Accord") provides a potential source of funding for such a program—the developed country parties to the Accord committed to mobilize $100 billion per year by 2020 to assist developing countries.[113]

An international insurance mechanism within the frameworks of the UNFCCC and the Accord could catalyze risk management and adaptation if risk reduction were properly linked to climate risk management strategies. In other words, for international insurance to provide effective climate change planning, insured states should be incentivized by benefits to adopt climate mitigation and adaptation strategies. In order to promote effective use of insurance payouts, participating governments should establish a climate change fund governed by an independent, multistakeholder committee.[114] Of course such a program will come at a cost to taxpayers. Moreover, costs will rise as climate-related risks continue to increase. However, as discussed in Section II(C)(3), *supra,* an ex-ante insurance mechanism is preferable to ex-post disaster relief, which is often exponentially

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[108] *Introduction to the Convention*, UNFCCC, http://unfccc.int/essential_background/convention/items/6036.php (last visited Nov. 20, 2011).

[109] *Status of Ratification of the Convention*, UNFCCC, http://unfccc.int/essential_background/convention/status_of_ratification/items/2631.php (last visited Nov. 20, 2011).

[110] UNFCCC pmbl., Jun. 12,1992, S. Treaty Doc No. 102-38, 1771 U.N.T.S. 107, *available at* http://www.un-documents.net/unfccc.htm#preamble.

[111] *Id.* at art. 4, para. 8.

[112] *See* Joanne Linnerooth-Bayer et al., Climate Insurance as Part of a Post-Kyoto Adaptation Strategy 18 (2008), available at http://www.germanwatch.org/klima/insur08.pdf.

[113] UNFCCC, Copenhagen Accord of 18 December 2009, 3 (2009), *available at* http://unfccc.int/files/meetings/cop_15/application/pdf/cop15_cph_auv.pdf. The United States is a signatory to the Accord. *Copenhagen Accord*, Climate Inst., http://climate.org/climatelab/Copenhagen_Accord (last visited Dec. 22, 2011).

[114] *The Next Time the Water Rises*, Climate Action Network–Int'l, (Oct. 6, 2010, 6:38 PM), http://www.climatenetwork.org/blog/event/703?page=1.

more expensive and does not provide the opportunity to incentivize risk-reducing strategies.[115]

Conclusion

Sophisticated and thoughtful engagement by the insurance industry and public sector is essential to confront the challenges posed by climate change and for the continued availability of insurance. Given the recent advances in climate science and international attention to climate change issues, the prospect of continued innovation by insurers and government collaboration is promising. There is immense, largely untapped potential for insurers to leverage both their expertise and their portfolios to ensure the survival of the industry and of society itself. Indeed, in this rapidly changing environment, for those in the business of risk management, green is the new black.

[115] *See, e.g.*, Strachan, *supra* note 32, at 6.