

CLIMATE CHANGE ADAPTATION

The Impact of Law on Adaptation in the Private Sector

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Introduction

While the political discourse on addressing climate change remains at a stalemate in the United States, the global scientific consensus is clear: Emissions of greenhouse gases by humans are causing the climate to change.¹ Already the U.S. Global Change Research Program has observed climate change impacts across the country and in coastal waters. These impacts include heavier than average downpours, rising temperatures and sea level, rapidly retreating glaciers and thawing permafrost, and earlier snowmelt and alternations in hydrological patterns and circulation.²

Preparing for these impacts will require strategic planning and comprehensive action by both the public and private sectors, and each sector influences the other. For example, the private sector generates the overwhelming majority of economic output in the United States and is regulated for health, safety, and environmental purposes by all levels of the government. Landownership is also largely in private hands: roughly 70 percent of the land in the United States is held privately, and the government owns the remaining 30 percent. Effective climate change adaptation cannot happen without the cooperation of both sectors.

On March 30, 2012, an interdisciplinary group of academics, non-profit and business representatives, and government officials³ gathered to discuss this question: how can the government facilitate good adaptation in the private sector? All participants first discussed economic considerations for private-sector adaptation and a set of guiding goals and principles for governmental involvement in climate change adaptation. The participants then divided into four groups to discuss specific *areas of law* (insurance law and laws that affect the built environment) and specific *resources* (privately held natural resources and other private resources). Ultimately this workshop represents the beginning of a longer and long-term discussion about how the government can encourage, facilitate, and even demand adaptive actions from the different parts of the private sector and how the government can shape the private sector response in a positive manner. This workshop summary provides a starting point to further explore these topics.

This workshop was sponsored by: the Center for Law, Environment, Adaptation, and Resources (CLEAR), University of North Carolina; Emmett Center on Climate Change and the Environment, University of California, Los Angeles; Georgetown Climate Center; The George Washington University Law School; Vanderbilt Climate Change Research Network; and the Center for Progressive Reform (CPR).

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Adaptation and Mitigation

The mainstream discussion of climate change has long focused on *mitigation*—that is, what humans can do to reduce the sources of or increase the sinks for greenhouse gases.⁴ The ultimate goal of mitigation strategies is to reduce the ambient concentration of greenhouse gases in the atmosphere, thereby attenuating adverse climate related impacts.

More recently, however, discussion of *adaptation* has been added to the policy mix. Adaptation is defined by the Intergovernmental Panel on Climate Change (IPCC) as “the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects.”⁵ Because adaptation accepts that climate change impacts will occur, the goal of adaptation efforts is to lessen the magnitude of these impacts on humans and the natural environment through proactive or previously planned reactive measures. **As the IPCC said, “[M]itigation will always be required to avoid ‘dangerous’ and irreversible changes to the climate system. Irrespective of the scale of mitigation measures that are implemented in the next 10-20 years, adaptation measures will still be required due to inertia in the climate system.”**⁶

Despite the overwhelming consensus on certain effects from climate change, the process of climate change adaptation presents a number of challenges for both the public and private sectors. From a scientific and technical perspective, many of the specific, localized impacts of climate change are uncertain. Models cannot make long-term predictions about specific flood or other extreme weather events. The rapid, unpredictable impacts from climate change also undermine the reliability of historical data in predicting future weather phenomena. Planning amidst this uncertainty is crucial but inherently difficult. Choices made in climate change adaptation may also have other effects on the environment and society, including climate change mitigation.

Institutionally, governmental adaptation efforts may suffer from a lack of long-term funding and a lack of political will to support the necessary but longer-term changes. The private sector faces information problems as well but will make whatever decisions are perceived as beneficial to adapt to climate changes. Thus, successful climate change adaptation will depend upon public education and outreach and strong advocacy efforts by grassroots organizations, as well as leadership in both the public and private sectors.

Focusing on adaptation is imperative because of what scientists call the “inertia” of the climate. Past and current emissions have set into motion a series of changes that will very likely occur regardless of future reductions in emissions because of the long-lived nature of greenhouse gases, in particular carbon dioxide, and the absorption of heat by

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the oceans.⁷ Mitigating emissions to lessen additional impacts remains a priority, but communities must also prepare to address the changes that will result regardless of future mitigation efforts.

Adaptation in the Private Sector: What is the Private Sector?

The private sector, or the part of the economy that is not run by government (public sector), contributes over 90 percent of economic output in the United States. For land resources, private landownership constitutes roughly 70 percent of the total land area in the United States. Outside of governmental policy, individuals and groups in the private sector will need to make changes to enhance their own well-being and, in many cases, the general public good. Thus, adaptation in the private sector and decisions by individuals will play a significant role in maintaining the ecosystem services and attendant societal benefits needed to help buffer the impacts of climate change.

Adaptation in the private sector can be divided into two categories for considering the role of law in such adaptation:

- (1) Adaptation that is or can be *influenced, motivated, or in certain cases prevented or constrained* by the government, through laws, regulations, incentives, and policies with direct or indirect affects; and
- (2) Adaptation that is *motivated by forces other than the government*, recognizing that the private sector responds to signals from the market, utilities and commodities prices, public opinion, and other sources.

The workshop discussion focused on the first category: adaptation that is influenced or motivated by the government, recognizing that what motivates or dissuades the government to act or respond is related to what will happen absent government influence (the second category). While workshop participants did not focus primarily on how the private sector responds to climate change absent what it means for law and government, it is understood that this adaptation has occurred and will occur in some way, for better or worse, without government intervention.

Professor Michael Vandenberg presented empirical research to show how private sector decisions are so important. A survey conducted by Vandenberg and his colleagues showed that 38 percent of those surveyed would pay more for gasoline to prevent climate change. For the public sector, governed by the majority, 38 percent falls short of what is needed to

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take action. However, for the private sector, that same percentage of people represents a potentially lucrative market share that private businesses could target. Thus, the private sector may be motivated to take actions for profits, for public relations benefits, for creating a market niche, or for corporate responsibility purposes—motivations that the government does not have. Vandenberg also pointed to private labeling initiatives, such as the Marine Stewardship Council for sustainable fisheries or the Forest Stewardship Council for paper products, that demonstrate the private sector’s desire to adopt ecofriendly practices without being prodded or required by the government.

Because government policy can and does touch multiple areas in the private sector, government can intervene even in what had heretofore been private sector initiatives. The workshop participants did not assume that government intervention is either good or bad. Rather, they examined whether it meets needed and agreed upon adaptation goals.

Economic Considerations for the Private Sector

Economist Andrew Keeler discussed three important ways in which the government can have major impacts on private sector actions: the timing of government actions and what would otherwise occur and when for the private sector; the need for balance between consistency and flexibility; and the ethical case for compensation.

The timing of government actions and climate change impacts will affect how the private sector responds. Having a better sense of this timing is important for the private sector to weigh the cost of investing in an adaptive response. For example, dramatic action—such as a zoning code that requires a hotel to be immediately relocated or retreat from a beach that is experiencing gradual sea level rise—may not be practical for the hotel owner, who stands to lose significant revenue in the short-term. If the code instead recognizes that sea level rise will occur gradually and therefore goes into effect in 20 years, the hotel owner can take adaptive actions to prevent flooding in the interim and retreat when the code takes effect. Overall, government commitments and policies can greatly impact what measures the private sector takes to adapt and its level of investment.

Government actions that affect private-sector climate change adaptation will also need to balance the tension between consistency and flexibility. The private sector generally prefers some certainty on which to base its investments, but this preference does not match the unpredictable climate change impacts and the need for flexibility and flexible systems to deal with those impacts. One solution is to create a system with contingent triggering

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mechanisms that automatically activate a pre-determined action or decision-making process. For example, a house that is severely damaged or destroyed by flooding twice within 10 years could trigger a no-build provision or disqualify the owner from participating in publicly subsidized flood insurance. These types of trigger mechanisms will only work in changing private sector behavior, of course, if the government can credibly commit to following through with the triggered action. According to Keeler, experience indicates that governments rarely do so.

Finally, to encourage actions by the private sector that produce positive externalities for others, government action should consider the ethical case for compensation not only across the economic divide among countries and within societies but also between current and future generations. Because compensation has complex effects on incentives, it should be designed so that individuals and the private sector respond to actual, rather than theoretical, risks. Compensation should not encourage inefficient behavior. For example, the government could set a baseline date in order to receive compensation for rebuilding along the coastline, rather than making all buildings eligible for compensation. Buildings constructed past that date, and thus with the knowledge of sea level rise impacts, would be ineligible for compensation. This policy would then influence a private developer's decision to begin construction or relocate elsewhere.

Role of the Government

The federal, state, tribal, and local governments interact with the private sector along a spectrum of cooperation to coercion. As government actions progress from cooperation to coercion, resistance may increase in proportion, depending upon the perceived burden or fairness of a policy. On the cooperation end of the spectrum, the government can provide information to the private sector and help coordinate private sector actions. It can also help fund adaptation actions and provide other forms of assistance for the private sector to take voluntary action.

In most instances, the private sector does not have access to the same extensive government network of monitoring stations, data, and resources that exists in the government. For example, John Dorman of the North Carolina Department of Environment and Natural Resources demonstrated the state's forthcoming model that localizes climate change impacts. The IRISK model integrates many risk variables and thus allows users to develop a customized risk assessment of particular property parcels. The government can also help

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disseminate information from different sources. One example of information dissemination in the private sector is the Georgetown Climate Center's Adaptation Clearinghouse, which compiles adaptation resources by location and sector.

Further along the spectrum, the government can be a market participant and influence private adaptation through its purchases. After all, the federal government is the largest employer in the United States, so the decision to purchase certain products that benefit adaptive efforts is likely to have ripple effects throughout the economy. The government can also establish a marketplace that reflects the risk of climate change impacts and the risk of not adapting to those impacts.

On the coercion end of the spectrum, the government can assume the role of a direct regulator by mandating certain actions, such as disclosing information or putting strict conditions on public funding. While this role may be the least politically palatable role, it may become necessary to protect public health, safety, and welfare and the environment.

Working Principles for the Government Role in Private Sector Adaptation

One goal of the workshop was to develop a list of principles and outcomes for the government's role in facilitating private sector adaptation. The list below summarizes some of the principles and outcomes from the group discussion for which there was general agreement, though it does not represent a full consensus of the participants. In facilitating private-sector adaptation, the government should:

- ***Manage change in a way that contributes to or does not undermine institutional resilience.*** For example, government agencies should work together and share information when facilitating adaptation in the private sector.
- ***Minimize negative externalities from private sector adaptation actions.*** Government facilitation should ensure that private sector adaptation actions do not have negative spillover effects or unintended consequences for other parts of the private sector, for the public, or for the environment.
- ***Facilitate adaptation actions that are efficient, cost-effective, and politically viable.*** The potentially contentious nature of government-facilitated actions can be avoided when incentives and support are aligned.

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- ***Ensure that as it acts to facilitate adaptation it does not undermine mitigation efforts.*** Adaptation actions should not lead to the false belief that mitigation efforts are unnecessary. The government should continue to simultaneously support both types of action.
- ***Identify leverage points within the private sector to maximize the reach of its influence.*** Rather than facilitating adaptation in a piecemeal fashion, the government should strive to promote cohesive, coherent, and holistic private sector adaptation through common leverage points, such as insurance.
- ***Be sensitive to cultural and social values, including the importance of time and place to communities, and strive for equitable outcomes.*** Climate change impacts will have deeply personal effects—for example, extreme weather events that destroy historic and cultural buildings and homes—and will cause distress at both a societal level and on an individual level. Government facilitation of private sector adaptation must be aware of these impacts.
- ***Facilitate interactions and coordination that capitalize on social forces.*** Government can help insure that private sector adaptation fosters positive interaction and social cohesion, building and enhancing the adaptive capacity that arises from community.

The remainder of this paper summarizes the four small-group discussions about insurance law, laws that affects the built environment, privately held natural resources (including agriculture, forestry, and aquaculture), and other privately held resources. Each group was asked to answer a series of questions: What are principles for good private sector adaptation in this sector? How does existing law affect these best practices? How can the legal framework be improved to facilitate adaptation in this sector?

Private Sector Adaptation: Insurance Law

Insurance pervades nearly every aspect of the private sector and is an important leverage point for facilitating adaptation. Because they bear climate- and weather-related risks, both private and public insurers are well-placed to incentivize behavior that will reduce climate-related losses and build resilience, at least in theory, as well as to finance adaptation measures and to compensate for climate change-related losses.

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This group noted that in some contexts, including federal crop insurance and flood insurance as well as state-run residual insurance markets, the price of property and casualty insurance tends to be subsidized and does not reflect the actual risk of loss. Here, government policy may be encouraging negative adaptive actions. Moreover, in some regulated contexts, state insurance regulators regulate the private insurance market to promote affordability and availability of insurance, which results in underpricing of some risks. The systemic problems that result from mis-pricing of risks must be recognized in any government attempt to facilitate adaptation through reforms to insurance law and regulation.

Insurance companies themselves are among those in the private sector raising awareness about climate change impacts. The 2011 tornado season in the United States was the deadliest in more than 85 years with 551 fatalities as a result of tornadoes.⁸ Thunderstorm-related insured losses in 2011 amounted to roughly \$26 billion, illustrating an upward trend in these losses over the past 30 years.⁹ Munich Re attributes these extreme weather-related damages to both climate change and increased development overall and higher property values.¹⁰

The insurance group identified several overarching principles and goals for climate change adaptation in the insurance sector:

- ***Remove subsidization of the insurance market and make sure that regulation does not provide perverse incentives.*** In general, insurance premiums that are priced to reflect risks as accurately as possible will provide incentives to reduce or mitigate weather-related losses. In some cases, this might mean taking adaptive action to reduce structural risks; in others, it might mean retreating or refraining from building, or rebuilding, in areas where high premiums or lack of availability of insurance reflects extreme risks. For example, under the National Flood Insurance Program, 38 percent of all claim costs have been due to repetitive loss properties.¹¹ Although the NFIP is a public insurance program, this statistic demonstrates that some places will always be vulnerable to extreme weather events. In these locations, infrastructure may not be able to adapt, and insurance premiums should reflect this reality.
- ***Bundle weather-related risks.*** Because most flood insurance is provided by the federal government and most other property and casualty insurance is provided through the private market, arbitrary and contentious proceedings to determine the allocation of

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losses from extreme weather events are the norm. Moreover, insurance products within the private market often cover very specific risks and exclude others, making it difficult to appropriately spread risk to provide incentives to take adaptive actions. New laws or policies may help establish more efficient ways of allocating losses, or—even better—they may create incentives for insurers to offer, and for property owners or businesses to purchase, bundled insurance policies.

- ***Ensure that future underwriting takes changing conditions into account.*** Traditional insurance pricing structures are based on past incidents. Instead, insurance policies should price the risk according to scientific calculations reflecting changing conditions, risks, and uncertainties, as well as adaptive measures.
- ***Adopt a long-term horizon for pricing insurance policies.*** Existing insurance rates are priced on a yearly basis, which ignores the long-term and cumulative impacts of climate change. A policy that encourages long-term contracts would be more beneficial to adaptive insurance. Creative work to develop structures that support long-term insurance horizons would provide better incentives for long-term planning. Insurers and their policyholders would be forced to assess the viability of the property and its risk of hazard much further into the future.
- ***Inform property owners of climate-related risks.*** Individuals and businesses often misperceive risks by, for example, treating low-probability, high-magnitude events as if their probability were zero or assuming that risks that are invisible or not disclosed are unlikely to materialize. Proper information and disclosures, beyond pricing insurance to reflect risk, may help to counteract these cognitive failures.
- ***Provide equitable solutions for vulnerable individuals and businesses.*** Disasters are bad for everyone, and disasters are particularly bad for those who are already vulnerable. Reforming insurance policies should be mindful of social, economic, and cultural differences and provide assistance as needed and just. For example, this may mean that subsidization or some form of assistance should remain in place for people with limited assets outside their current, vulnerable location.

Existing law poses an obstacle to implementing these principles. For example, states have not yet integrated insurance concerns with climate change adaptation concerns. Moreover, the insurance industry, like many big sectors, has decades of inertia that push it to continue business as usual. Public and private insurance providers, regulators, climate scientists, land use planners, and other stakeholders should work together to develop strategies that

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will enable insurance to provide a useful role in incentivizing adaptation and in financing and compensating for adaptive measures. At the same time, insurance companies have been leaders in updating their sector. This group left open for future discussions how the legal framework can specifically be improved to facilitate adaptation.

Private Sector Adaptation: Laws that Affect the Built Environment

For climate change adaptation, laws that cover development and the built environment are also important. These laws include zoning, building codes, water quality and water quantity, and comprehensive planning. Because the impacts from climate change will vary from state to state and county to county, many of the government efforts to facilitate private sector adaptation will necessarily need to be tailored to a specific location. A patchwork of efforts has already appeared: cities in California such as Ventura and San Francisco and east coast cities such as Norfolk, Virginia, have been proactive in planning for the effect of sea level rise on their built environment. Yet other places remain staunchly opposed to any adaptation measures. A study by the Insurance Institute for Business and Home Safety released a report in January 2012 that ranked Gulf Coast states Mississippi, Texas, and Alabama among the bottom of 18 states based on the strength of building codes to protect against wind damage.¹²

This discussion group identified two overarching principles for good private-sector adaptation, as well as other ways the legal framework can be improved to facilitate adaptation.

- ***Adaptation efforts must use the language and other reference points that reflect local culture, politics, and issues of concern.*** Adaptation actions here are likely to be very personal and very local, and potentially therefore the most contentious. In some instances, for example, using an example or importing leadership from another state or region may not be helpful.
- ***Adaptation efforts should include regulations, policies, incentives, and other factors that affect a broad swath of the built environment rather than delivering piecemeal, sector-by-sector strategies.*** For example, the insurance sector is a private actor that has a tremendous ability to affect the private industry, developers, and lenders.

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This discussion group identified specific roles for government facilitation, including a source of information and coordination among different municipalities or regions. For example, the government could provide scientific data about the impacts of climate change, climate change models, and tools or model legislation for building code standards. The government also can play a significant role in coordinating laws, removing conflicting provisions, or removing barriers to effective adaptation. This group agreed that climate change adaptation poses a new and different problem for the role of government because of the potential for direct coerciveness at the individual level. Government actions may fall primarily toward to coercive end of the spectrum because of the urgent need to address widespread climate change impacts.

The existing legal framework can help with adaptation in the private sector by:

- **Providing information.** This includes full spatial information about climate change impacts on local infrastructure. The dearth of accurate, localized information about climate impacts creates too much uncertainty to effectively adapt.
- **Coordinating between parties.** Climate change adaptation will involve comprehensive thinking that addresses the interconnected parties that form the private-sector web. Coordination must also occur at the appropriate temporal, spatial, and geographic scales.
- **Ensuring equality.** The built environment must accommodate all levels of the socio-economic ladder and, in adapting, should ensure diversity of housing for all. Adaptation efforts should also consider social vulnerability and sensitivity if and when communities are displaced. New developments may become increasingly climate-aware, but older communities may be left behind.
- **Promoting smart, wet, and green growth.** Smart growth involves minimizing urban sprawl by infilling urban areas and building public transportation networks; wet growth uses features that mimic the natural environment to retain water and compensate for impervious surfaces; and green growth promotes planting trees, developing green spaces, and relying on renewable energies as urban areas develop. Collectively these strategies are “no regrets” strategies, meaning that even if not a single climate change impact were to occur, these strategies nevertheless would make the built environment a more livable and healthier place.

Facilitating adaptation in the built environment touches on many aspects of personal property rights, which raises tough political considerations. Ideally, decisions will be made on a proactive basis, rather than on a reactive basis.

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Private Sector Adaptation: Privately Held Natural Resources—Agriculture, Timber, and Aquaculture

The government holds roughly 30 percent of the land area in the United States, meaning the remaining 70 percent is privately held. Much of this privately held land is devoted to renewable and harvested natural resources, including agriculture, timber, and aquaculture. Agriculture in the United States generates \$200 billion annually in food commodities, more than half of which is livestock.¹³ Agriculture both contributes to climate change and will be impacted by climate change impacts. The sector contributes 8.6 percent of the total greenhouse gas emissions from the United States, including 80 percent of the total nitrous oxide and 31 percent of methane emissions.¹⁴

While some positive responses occur because of higher CO₂ concentrations for plants, significant negative responses are also likely. These responses include a loss of yield and nutritional value for crops; loss of herbicide effectiveness; an increased spread of disease, invasive species, allergens, and pests; and an increase in extreme weather events that cause major crop and timber losses. Similarly, aquaculture is likely to see serious negative consequences as a result of ocean acidification and increased water temperatures.

This discussion group identified four overarching principles to guide climate change adaptation for privately-held natural resources. Adaptation actions should:

- ***Strive to build and maintain ecological, social, and institutional resilience;***
- ***Consider the current and future climate in deciding what species to plant, harvest, or otherwise select;***
- ***Minimize negative externalities; and***
- ***Consider distributional equity.***

The central hurdle of writing and passing entirely new laws or programs—or identifying new sources of funding—in order to address climate change adaptation is lower for this sector than others. The existing legal framework has incentives, programs, and regulations to promote adaptation, such as the forestry offset programs and crop insurance and subsidy programs.

However, as this discussion group noted, the majority of federal subsidies for the agricultural and forestry sector encourage maladaptive practices. Negative incentives include water and grazing subsidies, below-cost timber sales, renewable energy standards that promote corn ethanol, and incentives for commodity crop production rather than edible fruits and vegetables. These incentives sacrifice long-term resilience and soil health for short-term

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yields. Even federal labeling and certification programs that have good intentions, such as the U.S. Department of Agriculture’s “organic” certification standards, are riddled with negative incentives and prohibitive costs.

Rather than adopting new laws, the focus is on changing the existing incentives to promote good adaptation and using the existing legal and regulatory framework and programs to facilitate the process. The Farm Bill is the natural starting point for private-sector adaptation measures in the agriculture sector. Historically, it has been difficult (if not impossible) to alter because the agricultural interests are benefit from the current programs. This discussion group saw an opportunity, however, in the current economic situation and the federal government’s preoccupation with reducing the federal deficit. Together, these factors may create an opportunity to start chipping away at the perverse agricultural subsidies. For example, Congress could eliminate, restructure, and update provisions and subsidies within the Farm Bill—as recommended by a recent report from the Government Accountability Office¹⁵—and pursue joint efforts to conserve land with the Department of Interior or other federal agencies. The Farm Bill could also provide direct tax breaks or repurpose existing subsidies to promote adaptation.

More generally, the private agricultural sector should shift to climate-appropriate crops and varieties without creating problems with invasive species. Agricultural operators should diversify crops and move away from mono-cropping, thus increasing overall resilience in the food system.

Another suggestion focused on creating and expanding offset markets. These markets would provide the agricultural and timber sectors with mechanisms to repurpose landscapes and with financial support to conserve forests and fields. These landscapes are part of the “green infrastructure” that can help buffer against climate impacts, and less carbon-intensive use of the land will also have complementary mitigation benefits.

Private Sector Adaptation: Other Resources

The fourth discussion group turned to other privately held resources, including residential real estate, businesses, yards, and other types of resources conveyed with a deed. In facilitating private-sector adaptation, the government will need to play similar roles as discussed in the other sectors: provide information and coordinate private sector actions.

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This group defined “good private sector adaptation” as “whatever allows an individual to thrive in acute and chronic climate disruption in an efficient, cost-effective, and equitable manner, as autonomously as possible but without disrupting others and while keeping a sense of place.” The notion of *thriving* means avoiding bottlenecks around critical resources. The notion of *autonomous* implies that individuals have useful information about how to respond to specific impacts. For example, how can a homeowner use information about sea level rise to adjust her actions? The *sense of place* recognizes that communities have strong ties to their physical location, even when that location is no longer habitable because of climate impacts. Relocation, when necessary, should respect community connections and these ties to place. *Cost-effective* means that these measures must be affordable for both the individual and the public at large. The cost factor may arise when assessing the political palatability of certain adaptation actions.

The existing legal framework that guides this category of “other” resources covers zoning law and insurance law and policies. It also focuses on how changes in private property can affect publicly provided services and how publicly protected access to resources and goods affects values in the private sector. In addition, the public trust doctrine is worth exploring to better understand what exactly falls under the doctrine and government’s responsibilities and duties. Adaptation for this sector may also involve reimagining private property or even embracing new forms of cooperative private property, such as the business model for Zipcars or condominium associations.

Conclusion

This workshop marked the beginning of a long and necessary discussion on the government’s role in facilitating appropriate adaptation in the private sector. The private sector indisputably has its own motivations for taking action, but haphazard actions or those that create unintended consequences for other parts of the private sector will invite and, in many cases, require government assistance and intervention. Furthermore, governments need to examine how law and policies may discourage adaptation or encourage maladaptive actions. Future discussions should explore in detail specific solutions or policy recommendations for each of the sectors.

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Endnotes

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- ² U.S. Global Change Research Program, “Key Findings,” <http://www.globalchange.gov/publications/reports/scientific-assessments/us-impacts/key-findings> (last visited July 4, 2012).
- ³ A list of participants can be found on page 15. The views expressed in this paper represent a general consensus of the participants but may not reflect specific individuals’ views. The views in this paper do not represent the views of the institutions for which the participants work.
- ⁴ IPCC, *CLIMATE CHANGE 2007: MITIGATION OF CLIMATE CHANGE* 818 (B. Metz et al., eds., Cambridge University Press 2007) [hereinafter *IPCC Mitigation Report*].
- ⁵ IPCC, *CLIMATE CHANGE 2007: IMPACTS, ADAPTATION AND VULNERABILITY* 6 (M.L. Parry et al., eds., Cambridge University Press 2007) [hereinafter *IPCC Adaptation Report*].
- ⁶ *IPCC Mitigation Report*, *supra* note 3, at 101.
- ⁷ White House Council on Environmental Quality, [Progress Report of the Interagency Climate Change Adaptation Task Force: Recommended Actions in Support of a National Climate Change Adaptation Strategy](#) 15 (Oct. 5, 2010).
- ⁸ Munich Re, *Topics Geo 2011: Earthquake, Flood, Nuclear Accident*.
- ⁹ *Id.*
- ¹⁰ *Id.*
- ¹¹ Repetitive loss properties are those that have flooded more than once in a ten-year period and that have received flood insurance payments of \$1,000 or more. [Government Accountability Office, National Flood Insurance Program: Actions to Address Repetitive Loss Properties](#), GAO-04-401T (March 25, 2004).
- ¹² Evan Lehmann, States facing the wind resist efforts to storm-proof homes, *Climate Wire* (Jan. 10, 2012).
- ¹³ U.S. Global Change Research Program, *Global Climate Change Impacts in the United States* 79 (2009).
- ¹⁴ *Id.*
- ¹⁵ U.S. Government Accountability Office, *Farm Programs: Direct Payments Should be Reconsidered*, GAO-12-640 (July 2012).

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CLIMATE CHANGE ADAPTATION

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