

CLIMATE CHANGE DEEP DIVE

FEBRUARY 22 – 23, 2018 | Cambridge, MA

2018 REPORT

A synthesis of ideas from the Harvard University
Advanced Leadership Initiative Deep Dive



HARVARD
Advanced Leadership Initiative

Climate Change Deep Dive 2018 Report

February 22 – 23, 2018 | Cambridge, MA

CLIMATE CHANGE DEEP DIVE CHAIR

Forest Reinhardt
John D. Black Professor of Business Administration
Harvard Business School
Co-Chair
Harvard Advanced Leadership Initiative

ADVANCED LEADERSHIP INITIATIVE CHAIR AND DIRECTOR

Rosabeth Moss Kanter
Ernest L. Arbuckle Professor of Business Administration
Harvard Business School

ABOUT THE ADVANCED LEADERSHIP INITIATIVE

The Advanced Leadership Initiative (ALI) is a third stage in higher education designed to prepare experienced leaders to take on new challenges in the social sector where they potentially can make an even greater societal impact than they did in their careers.

ALI Deep Dive Sessions highlight one major global or community challenge where ALI Fellows might fill a gap. Deep Dives include readings, outside experts, often faculty from relevant Harvard programs, and a focus on problem-solving and practical applications of knowledge.

ALI Fellows contribute ideas based on their experience and knowledge for immediate solution-seeking with major figures in the field under discussion and with affected constituencies.

2018 REPORT CREDITS

Bryan Panzano
Communications & Marketing Manager
Harvard Advanced Leadership Initiative
bryan_panzano@harvard.edu

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EXECUTIVE SUMMARY

The 2018 Climate Change Deep Dive presented ALI Fellows with a multi-faceted view of the causes, consequences, and potential solutions for climate change. The Deep Dive was led by ALI Co-Chair Forest Reinhardt of Harvard Business School (HBS). The Deep Dive also featured speakers from Harvard's John A. Paulson School of Engineering and Applied Sciences (SEAS), the Harvard Kennedy School (HKS), the Harvard Law School (HLS), Harvard's Faculty of Arts and Sciences (FAS), the Harvard Divinity School (HDS), and the United States Military.

The first day of the Deep Dive focused on scientific aspects of climate change and several options for mitigation. Speakers on the first day included Professor Peter Huybers (SEAS), Professor Forest Reinhardt (HBS), Professor Robert Stavins (HKS), Professor Joseph Lassiter (HBS), Joseph Goffman (HLS), and Professor Rosabeth Moss Kanter (HBS).

The second day of the Deep Dive presented options for climate change adaptation and mitigation and helped ALI Fellows synthesize the content of the two-day event. Speakers on the second day of the Deep Dive were Secretary Ray Mabus, Professor John Macomber (HBS), Professor James Engell (FAS), Professor Amy Edmondson (HBS), and Terry Tempest Williams (HDS).

Overall, the Climate Change Deep Dive allowed Fellows to take an analytical and ethical look at some of the world's most pressing environmental issues; fellows examined the global and local, the measurable and immeasurable impacts of greenhouse gases. At the close of the Deep Dive, Fellows had a chance to consolidate their thinking, and developed some key takeaways, including:

- Firms should reduce emissions, alter operations, and have transparency toward sustainability goals.
- Governments should develop clear standards, simplify and prioritize regulation, and institute carbon pricing.
- Universities should educate individuals about climate change and develop best practices for response and adaptation.
- Media and the press should raise awareness about the problems of climate change and communicate the stories of affected individuals.

As a result of the Deep Dive, Fellows gained a better understanding of the complicated problems underlying climate change, and the need for a cross-sector approach to develop pragmatic solutions.





Professor Peter Huybers

THE PHYSICAL BASIS OF CLIMATE CHANGE

Professor Peter Huybers of the Harvard Faculty of Arts and Sciences and the John A. Paulson School of Engineering and Applied Sciences led the first session of the 2018 Climate Change Deep Dive. Huybers explained the physical basis of climate change, a brief history of environmental science, and his perspective on sources of disagreement in the scientific community. Huybers' remarks helped form a foundation of understanding for the following sessions of the Deep Dive.

First, Huybers explained the role of the atmosphere in the Earth's climate. Without an atmosphere, he said, the Earth would capture much less energy from the sun, and average temperatures on the planet would be much lower. The atmosphere radiates energy reflected from the surface of our planet and helps sustain a constant temperature suitable for life. While the planet has seen cycles of warming and cooling over thousands of years, prior to the 20th century, the average temperature of the planet was relatively constant thanks to Earth's atmosphere.

As temperatures on the planet rise, however, Earth's conditions create a positive feedback loop that can speed the rate of temperature increase. Melting snow and ice, for example, cause the planet to reflect less energy from the sun, which leads to rising temperatures. Huybers explained the physics behind these temperature increases using mathematical formulas and showed that slight increases in this feedback loop could lead to dramatic increases in Earth's temperature.

When asked where the scientific community disagreed in their opinions about climate change, Huybers had a simple answer: clouds. He noted that there is significant uncertainty regarding the degree to which changes in clouds will amplify global warming. This uncertainty in cloud behavior underlies many of the questions around how much Earth will warm in response to greenhouse gas emissions.

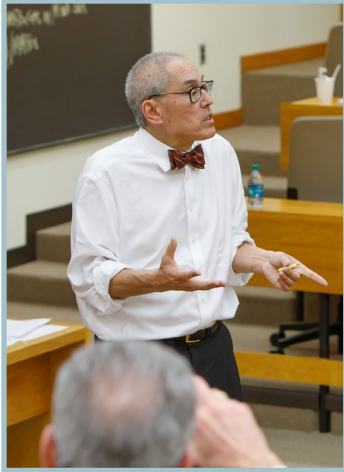
Huybers continued to explain that there was no room for debate, however, on whether humans have impacted global warming. While he allowed that there were natural fluctuations in Earth's temperature, the evidence overwhelmingly showed a warming trend, and that recent increases in human-generated CO₂ emissions accounted for this warming.

In fact, scientists knew as early as 1907 that atmospheric CO₂ would lead to global warming. By presenting data of CO₂ levels over time, Huybers showed that humans are dramatically increasing quantities of atmospheric carbon. The steady increase of CO₂ levels became significantly more rapid following the industrial revolution.

He further explained that we are only beginning to see the consequences of this human-generated increase in CO₂ levels. The ocean helps mute the effects of global warming, acting as an energy sink for the environment. Nonetheless, Huybers said, the trend of warming will continue and the consequences will be serious. As ice loss and sea level rise happen more rapidly, coastal communities around the globe will see tangible impacts of climate change. He added that it is difficult to know exactly what sort of impact rising CO₂ levels would have on global weather patterns.

Huybers recognized that communicating the consequences of climate change was essential to driving action. “We need to align our incentives with the consequences we have created for ourselves,” he said. He noted that his previous service in the military was often more important to his credibility than his credentials as a scientist. As he concluded his presentation, he said, “winning of trust and showing respect for people with different views is important to get this message across.”





Professor Forest Reinhardt

THE ECONOMICS OF ENERGY SUPPLY

In the following session, Deep Dive Chair and Harvard Business School Professor Forest Reinhardt brought an economic perspective to the discussion of climate change and energy consumption. By exploring a case about an energy provider in Chile, Reinhardt used a practical lens to examine the implications of global energy use. Over the course of the discussion, ALI Fellows started to consider how the climate change issue impacts day-to-day economic decisions for businesses and individuals.

In the session, Fellows looked at the case of Colbún, a Chilean energy company setting a path forward for how the firm will generate electricity. Colbún faced a critical decision: whether to meet Chile's growing electricity demand with traditional fuel sources like coal and natural gas, or to rely more heavily on wind, hydro, and nuclear power. While debates about climate change are often divorced from numbers, Reinhardt emphasized the importance of economic arithmetic in decisions about energy consumption.

Businesses and individuals must make comparisons in their decisions about energy and the environment. Which power plant is most costly to build? Which has the lowest variable cost? Which is most likely to meet political resistance? Importantly, he added, it is necessary to quantify the climate risk.

Throughout the discussion, Reinhardt emphasized that decisions about energy consumption are deeply connected with the needs of individuals. Without energy, people can be trapped in poverty. Energy can help to level the playing field between rich and poor. In nearly every case, he said, "energy consumption privileges the local and the short-term over the global and the long-term."

Ultimately, Reinhardt explained that to reduce energy use, we have to focus on consumers. By undervaluing energy and carbon dioxide, we are effectively creating a "tragedy of the future commons" – one in which short-term benefit is traded for future cost. Part of the difficulty, he said, came from an inability to develop a common language around energy decisions: "The things that matter in energy and climate change are global and local, short-term and long-term, measurable and immeasurable."

"The things that matter in energy and climate change are global and local, short-term and long-term, measurable and immeasurable."

Forest Reinhardt



Professor Robert Stavins

THE ECONOMICS OF CLIMATE CHANGE

In the next session of the Deep Dive, Professor Robert Stavins of the Harvard Kennedy School further explained the economic implications of climate change. Stavins explained the rationale behind viewing the climate change crisis from an economic perspective, presented several economic solutions, and described the political realities of driving change internationally and in the United States.

Stavins started by explaining that people often think of the economy and the environment as opposites when, in reality, they are deeply connected. He argued that the causes of environmental problems are economic and the consequences of environmental problems have economic dimensions. Therefore, “an economic perspective is essential to understand environmental problems and develop pragmatic solutions.” Only with an economic perspective can societies around the world create policies that meaningfully address climate change.

In part, the economic perspective to environmental problems is essential because of the very nature of greenhouse gases. As Stavins explained, greenhouse gases mix in the atmosphere, and societies feel the effects of CO₂ emissions independent of the location of the emissions. This leads to what economists call a “global commons problem” where the costs of changing emissions behavior are local, while the benefits are spread globally.

Further complicating matters, greenhouse gases accumulate in the atmosphere, so the consequences are long-term but the costs of abatement are typically incurred up front. In sum, the nature of greenhouse gases creates a “tragedy of the future commons” – a significant problem that requires international cooperation.

To combat this “tragedy of the future commons,” Stavins and other economists suggest carbon pricing. Carbon pricing – policies that put a cost on emitting CO₂ – takes two forms: a carbon tax and a cap-and-trade system. The carbon tax would tax people who produce emissions, while the cap-and-trade would set a limit on CO₂ emissions and allow firms to buy and sell their allocated contributions toward that limit. Economists like these options because they create a cost-effective solution to meaningfully reduce emissions.

Undeniably, Stavins continued, carbon pricing would have consequences for the fossil-fuel industry and consumers. Namely, carbon pricing would amount to a tax on the coal industry because of its relatively high carbon content. This would lead to overall lower energy output, increased

investment costs in new energy, and increased costs to retire existing plants. It would also likely lead to an increase in demand for natural gas but would have less impact on the oil industry. Stavins explained, “Carbon pricing is bad news for coal, mixed for natural gas, muted for oil, and good for renewables.”

Stavins said that the international community was already taking steps to address global environmental problems. In addition to a number of countries instituting carbon pricing, nearly 200 countries around the world signed the Paris Climate Agreement, a plan for greenhouse gas emissions mitigation, adaptation, and finance. This agreement covers 97% of the world’s carbon emitters, but it is unclear whether the policies are sufficiently ambitious to reduce global carbon emissions. Stavins said that individual national policies were critical in this work because “internationally, the policies are fundamentally voluntary.”

Despite the recent international agreement around climate change, US domestic climate policy saw a major shift under the Trump administration. President Trump, who describes global warming as “a total and very expensive hoax,” began to roll back environmental regulations in the US, including the Clean Power Plan and the CAFE Standards, and withdrew the nation from the Paris Climate Agreement. With the absence of the US, Stavins said that China had emerged as the global leader on climate change.

In his closing remarks, Stavins expressed some optimism around “sub-national” action around climate change in the US. He noted that EPA Administrator Scott Pruitt would likely make cuts, “with a scalpel rather than an axe,” and that many states and regions were adopting stringent regulations around carbon emissions. Stavins also explained, with some hope for existing laws protecting the environment, “it is non-trivial to change federal laws and regulations.”





Professor Joe Lassiter

PURSuing A NEW ENERGY FUTURE

Harvard Business School Professor Joe Lassiter presented a less optimistic view of climate change and energy consumption than earlier Deep Dive presenters. Lassiter outlined the fundamental conflict at the heart of the energy crisis: cheap energy can be a tool to alleviate poverty and accelerate economic growth, but it does so at a high environmental cost. Rather than accept that outcome, he challenged the ALI Fellows to consider some promising, albeit imperfect, options to provide clean energy at far lower costs in time to preempt the impacts of climate change.

Lassiter began by describing Germany's new clean energy transition and the energy infrastructure that emerged in the country. The country set a goal to have 80% of its energy come from renewable sources by 2050 while eliminating the use of nuclear power. By 2012, Germany generated 25% of its total energy from renewable sources.

Even with an increased investment in renewables, however, the country needed to burn coal and natural gas to meet hour-by-hour demand. The renewable energy sources were unable to respond to fluctuations in demand, and in some cases were simply not available. All told, the country needed to maintain a costly "shadow-system" of conventional energy to ensure reliable delivery of energy year-round.

Lassiter explained that the case of Germany highlighted "energy's Gordian knot" – clean energy is usually not the cheap, reliable energy that is needed to jump-start stagnate economies in the developed world or emerging economies in the developing world. Unsurprisingly, most of the recent growth in fossil fuel emissions had come from countries in the developing world. Eager to join the modern economy and lower poverty rates, these countries relied on coal for their energy needs.

Lassiter highlighted the examples of China and India to show this dependence on coal in the developing world. China continued to build coal plants regularly in an effort to accelerate industrial growth near urban centers and combat rural poverty. As he described, their strategy has been to "bring people to the power, not power to the people." India has indicated that they will do the same.

In China and India, low-cost, high-availability coal energy has saved more lives than coal pollution has claimed; inexpensive energy allows for investment in infrastructure and higher wages, providing better nutrition, healthcare, sewage, and clean drinking water. According to Lassiter, these countries tell the developed world that they must continue to burn coal to meet the "today" needs of their citizens.

Given the role that China and India will play in future emissions in the global economy, Lassiter said that new energy technologies must pass Vinod Khosla’s “Chindia test.” If a new technology is not cheaper than the status quo in China and India, then it is not a viable, scalable, or cost-effective long-term alternative.

Lassiter suggested several options that might “beat coal by 2030” and meaningfully reduce global carbon emissions. The most promising options were new next-generation nuclear power plants and utility-scale solar energy plants with natural gas turbines as a backup. These nuclear plants and natural gas turbines would be linked across urban centers by high-capacity transmission lines. The only other options, he said, would be to “hope for some totally as-yet-unknown invention or to learn how to adapt to the consequences of climate change.”

In all cases, private capital – private investors and venture capitalists – would likely move quickly to fund these technological developments. “Private investors find the exceptional, rather than proving the rule.” According to Lassiter, the majority of existing solutions “don’t change the equation soon enough for the bulk of the world where people live and work.”

In the end, Lassiter encouraged the ALI Fellows to watch for the people who do things differently, “individuals with great ideas that can change the path of global carbon emissions soon enough for it to actually matter.” He said any solutions must have an immediate economic impact for people around the world. “There’s not a totally clean solution, but people can change.”





Joseph Goffman

LEGAL ASPECTS OF CLIMATE CHANGE

Joseph Goffman, Executive Director of the Environmental and Energy Law Program at Harvard Law School, brought an important legal perspective to the Climate Change Deep Dive. Having previously served in the Environmental Protection Agency (EPA) during the Obama Administration, Goffman explained the 20-year legal history of climate change in the US. He said if ALI Fellows only left with one takeaway from his session, he hoped they would realize that some of the smartest people in our country are employed at the EPA.

To launch his discussion on the history of climate change law, Goffman explained that Senators Chafee and Lieberman introduced the first carbon pricing bill to the US Senate in 1998. In subsequent years, Lieberman worked with other senators to create a bipartisan bill instituting a cap-and-trade system in the country.

By 2007, 54 senators voted in favor of the bill – not enough to pass the bill into law, but a clear indication that climate change had become a concern for the American public. In 2009, US Representatives Waxman and Markey passed a cap-and-trade bill in the House of Representatives, that, ironically, would fail in the Senate because of disagreement between Senators Lieberman, Kerry and Graham.

In light of the inability of the US Congress to pass legislation related to Climate Change, President Obama leveraged the Clean Air Act of 1970 to take action through the executive branch. The Obama administration used the Clean Air Act to draft standards for greenhouse gases, labeling CO₂ as an air pollutant regulated under the terms of the law.

The Supreme Court supported President Obama's interpretation of the law, suggesting that the definition of air pollution was intentionally broad to capture previously unknown pollutants. Goffman explained, "The Clean Air Act is a highly dynamic, almost subversive, and maybe disruptive, piece of legislation that implied an expansive role of the EPA."

In his second term, President Obama made climate change a focus of his administration and gave authority to the EPA to take action. He released a memorandum to the EPA to set standards for CO₂ emissions for power plants – what would later be called the Clean Power Plan (CPP).

Under Goffman's leadership, the EPA launched an expansive outreach plan to have public opinion shape the CPP. After two years of outreach, four million public comments, and hundreds of stakeholder meetings, Goffman explained, "We were determined to build a rule from the group up."

With the CPP serving as a guide, states and communities began to take action to reduce their carbon pollution. Power plants started looking for ways to improve operational efficiency, and, in some states, codified a systems-based approach to emissions reductions. The CPP set conservative targets for the country to reduce emissions by 32% from 2005 levels. Goffman said that, at the time, the EPA was only mildly optimistic about the prospect of technological advances reducing future emissions.

In reaction to these regulations, states and other parties attempted to dismantle the CPP. On the first two attempts, the circuit court of the District of Columbia (DC) denied their claims and refused to grant a stay of the regulations. Ultimately, though, the Supreme Court approved the stay of the petitioners, who argued that the statute gave the EPA too much power. Before the DC circuit court could issue a decision, a new President and EPA administrator announced that they would be revoking the Clean Power Plan.

Goffman said that the central issue of the case was defining the authority of the EPA. Yet, while the CPP had been effectively undone, the EPA under Scott Pruitt would need to institute replacement regulations. Would these new regulations also push the boundaries of the EPA's authority?

"The Clean Air Act is a highly dynamic, almost subversive, and **maybe disruptive**, piece of legislation that implied an expansive role of the EPA."

Joseph Goffman



Professor Rosabeth Moss Kanter

THE TRANSPORTATION CONNECTION

To close out the first day of the Climate Change Deep Dive, ALI Chair and Director and Harvard Business School Professor Rosabeth Moss Kanter explained the important connections between transportation, infrastructure, and the environment. Kanter described the major problems with US infrastructure, their impacts on the environment, and potential solutions to these problems. She also urged ALI Fellows to be leaders with a clear vision for responding to climate change.

First, Kanter detailed transportation's significant impact on all elements of society, particularly the environment. In the US, the transportation sector accounts for 28-34% of emissions. Of that number, personal auto accounts for 62% and freight trucks account for 22% of transportation emissions. Significant improvements to the US transportation sector, she explained, have the potential to mitigate global environmental impacts.

Unfortunately, transportation improvements are at a standstill because of aging infrastructure. In the US, there is a \$5 trillion backlog in infrastructure repairs; the country is playing the catch-up game rather than focusing on new investment. If the US does not make these repairs, Kanter said the country could expect to see costs nearing \$9 trillion for disaster recovery and economic decline.

In part, she attributed the infrastructure backlog to political inertia. Many politicians are focused on re-election and take a short-term approach to governance, while infrastructure repairs are costly, time-consuming, and yield benefits in the distant future. "Political inertia comes from only looking at one issue at a time and a general aversion to taxes in the United States."

Nonetheless, she highlighted several potential solutions to the infrastructure problems in the US. For example, more fuel-efficient vehicles, complete streets campaigns that promote walk and biking, and improved public transit could help to alleviate strain on the infrastructure. Additionally, green trains with a reduced carbon-footprint, and intermodal connections to transfer freight from trucks to rail would help mitigate emissions. She also explained that high speed trains and the elimination of grade crossings would be an important step to improving infrastructure and protecting the environment.

All of these solutions require investment, however, and someone has to pay. Many highlight public-private partnerships as the solution to infrastructure investment, but Kanter cautioned that these investments are not always true partnerships.

Others think that technology is the answer – autonomous vehicles and ride hailing apps can reduce traffic. Yet, all of this technology depends on widely available broadband, a technology that the US helped invent but is struggling to deploy. “Everyone agrees that these are terrible problems, but they can’t agree on solutions,” she said.

In the end, Kanter said leadership is the real answer to these problems: US infrastructure solutions require grand vision. “Maintenance is not vision,” she explained, “we need to think outside the building and see the interconnected nature of all the parts of our infrastructure.” She also emphasized a need for cross-sector collaboration that included leadership from the tech sector. Kanter closed her remarks by stressing the urgency of these problems and charging ALI Fellows to take action to mitigate and respond to climate change.





Secretary Ray Mabus

ADAPTING TO CLIMATE CHANGE IN THE US ARMED FORCES

To start the second day of the Climate Change Deep Dive, ALI Fellows heard from former US Secretary of the Navy Ray Mabus. Mabus also previously served as governor of Mississippi and US Ambassador to Saudi Arabia. In his remarks, Mabus described his efforts to develop energy goals for the Navy and Marine Corps and the need for rethinking the role of fuel and energy in the military. He also encouraged a shift in messaging around environmental issues.

Mabus began his remarks with a bold pronouncement: “climate change is a national security issue.” Training soldiers, buying supplies, and updating fleets all depend on access to fuel and energy. “Energy is a weapon,” he said, “one that we could use or could be used against us.” In one form, energy is an economic weapon: rising fuel prices create serious implications for the US Navy’s strategy. Moreover, the US military’s use of fuel and energy has serious implications for the environment and coastal naval bases.

As a result, Mabus developed energy goals for the Navy and Marine Corps to obtain at least half of their fuel from renewable sources. “The Navy has been in the lead of energy changes,” he said, arguing that the switch to renewables was a huge cost savings. “We did it to be better war fighters,” he added, “but if we don’t do something to halt sea level rise, some of our bases will disappear.”

The Navy and Marine Corps also have an incentive to mitigate the effects of climate change because they are often the US military’s first responders to humanitarian crises. Mabus explained that as Secretary of the Navy, he received a request every two weeks for disaster assistance. More frequent and violent floods and storms, more frequent droughts, and more displacement from climate change leads to desperation, instability, chaos, and conflict. For the Navy and Marine Corps, mitigating this conflict is essential.

By choosing to mitigate the effects of climate change, and adopting new energy goals, the military has the potential to shift the entire energy market. According to Mabus, the Pentagon is the single largest user of fossil fuels on earth. Under his leadership, the Marine Corps decreased oil use by 62% and the Navy decreased oil use by 16%. Furthermore, the Navy is producing “hybrid ships” that use less fuel and can stay out at sea for longer periods of time. These energy goals have also made soldiers more efficient: Navy SEAL Teams have nearly net-zero energy and water

consumption which makes them harder to detect and extends the time they can stay in the field of combat.

Mabus said the military's efforts to combat climate change are just the beginning; the US needs to totally change its thinking about fuel and energy. He cited Puerto Rico as an example of the need for this change. Months after the devastation of Hurricane Maria, the country still lacked complete power and was launching efforts to rebuild obsolete power plants. "We need to be updating and repairing our infrastructure across the United States," Mabus said, "Systems don't change over time. It takes concerted effort and leadership."

Asked about the Trump administration's plans to roll back climate change policies, Mabus said, "Nothing has been rolled back in the military." He explained the use of renewable energy was saving the Navy and Marine Corps money and changing existing contracts would create additional costs. "We're past the tipping point now," he added, explaining that the adoption of alternative energy sources had already proven to be an economic and strategic advantage. He also said that the military is moving forward with their commitment to renewables regardless of the messaging from the White House.

In closing, Mabus encouraged the ALI Fellows to take the lead on furthering the conversation on climate change. He told Fellows to create a narrative around energy, to make it a personal narrative that highlighted individuals, and to explain the national security rationale behind adopting renewables. He also said that Fellows should be prepared to explain this narrative repeatedly, and never assume that their understanding means that others understand. Finally, he urged them to act first and to think differently. "If everybody else is doing it, it's too late. If it's conventional wisdom, question it."

"Climate change is a **national security** issue."

Former US Secretary of the Navy
Ray Mabus



Professor John Macomber

SEA LEVEL RISE TOOLKIT: PROBABILITIES, INVESTMENT, AND INSURANCE

The following session of the Deep Dive examined financial investment as an approach to climate change mitigation. Professor John Macomber of Harvard Business School used the case study of a Miami waste treatment plant to illustrate the short- and long-term costs of responding to climate change. Through this example, he showed how the economic calculus behind these decisions can change drastically over time, and as the probability of climate disasters increase.

Macomber began by outlining the investment potential in climate change mitigation and response. Many of the world's largest cities are on the coast, and "mega-cities" on the coast are only continuing to grow. Even without considerable sea level rise, these cities are at risk because of migration patterns. With even the slightest sea level rises, however, major cities will have to drastically rebuild and rethink infrastructure and city planning. Nonetheless, many financial investors have not yet invested in this work.

In part, the difficulty in investing comes from the uncertain probabilities surrounding climate change disasters. "How much should we invest to save the probable future cost of something we don't know is going to happen?" Macomber asked Fellows. He explained that all indications showed that the market had not yet responded to the potential for sea level rise. More assets were being invested in coastal cities despite rising insurance costs that, in many cases, were only affordable with state subsidies.

Macomber showed the difficulties, and the rationale, behind these decisions through the case study of a Miami waste treatment plant. Facing the potential of flooding from sea level rise, the plant had to decide whether to protect its existing location, to relocate to an inland location, or to do nothing. In determining the best decision, Macomber encouraged ALL Fellows to consider the short-term costs of action, the long-term costs of disaster recovery, and the indirect costs of the plant's failure.

Often, as was true with the Miami case, the option with the best expected value is to do nothing. Short-term probabilities of disasters are usually low, and politicians and investors are hesitant to spend significant money on events that are unlikely to happen. In addition, in the US, the federal government often intervenes to help with disaster recovery. As Macomber showed, the four-year cycle of American democracy and the six- to

seven-year returns of investors are ill-suited for considering probabilities of disaster in the long-term.

Ultimately, he explained, it is critical to show investors the financial merits of getting involved with climate change mitigation and response. Some rating agencies were already beginning to factor climate change vulnerability into their calculations. “Somebody here knows the likelihood that your house is going to flood, but they’re not telling you or your insurer,” said Macomber. There is an active market for insurance linked securities, weather derivatives, and catastrophe bonds; until similar markets exist for climate change mitigation, investment is unlikely.

Macomber closed his session by explaining the five options for responding to climate change: rebuild, reinforce, restrict, retreat, rebound. He explained that these options are most often ignored, however, for a sixth option: do nothing. In part, responding to climate change requires long-term thinking, which makes investment a challenge. “Rebuild it better’ is hard to finance, but a destroyed city is not a sustainable city.”





Professor James Engell

NEW CONSCIOUSNESS? NEW DECISIONS?

Next, Harvard Faculty of Arts and Sciences English Department Professor James Engell brought a perspective from the humanities to the Climate Change Deep Dive. By examining Pope Francis' Encyclical Letter and Seamus Heaney's *Höfn*, Engell made the case for developing a new set of human values in response to climate change. Beyond the economic, and legal arguments for responding to environmental crises presented in earlier sessions, he outlined an ethical argument for protecting our planet.

Engell began by showing the depth of human understanding of climate change, and previous attempts to communicate its dangers. He presented Frank Capra's *The Unchained Goddess*, a film from 1958 detailing the risks of global warming. While the film's goal was to awaken social consciousness and social justice around climate change, little had changed in the nearly sixty years since its release. More alarmingly, Engell explained that humans have known about the possible effects of CO₂ and global warming since the late 1800s.

Because of our inability to act, he said, human kind now faced an existential crisis. Climate change represents a fundamental threat to humanity around the globe, particularly those communities located on the coasts. In the short term, however, climate change will most likely affect poorer communities and individuals who have limited options in response to a changing environment. Climate change, then, has disparate effects for different populations and our response requires deep ethical examination.

Fundamentally, Engell said that humanity needs a transformation of belief – a drastic reshaping of human values. People around the world must come to see the planet as our “common home,” one that we share with other countries and other species. Engell cautioned Fellows against relying on technology to supersede this shift in beliefs. “Even with the greatest technology available, there is a certain carrying capacity of the Earth that will be difficult to exceed,” he said.

In part, the need for an ethical approach to climate change is the result of human domination of the planet. Human beings have come to dominate all eco-systems and are a “keystone species” that impact all others. Citing Pope Francis' Encyclical, Engell noted that there is a biblical imperative to protect all species on Earth. “Earth is now our home and we are the managers of it in a way that we've never been before.”

Engell also said that we cannot, as a species, rely on market forces to save us from the consequences of climate change. Referencing Pope Francis' description of a "deified market," he warned Fellows about the risks of market failures. Perfectly rational markets don't exist, he explained, and poor, marginalized communities will likely suffer the most from our collective dependence on the economy. As more and more communities experience climate change disasters, the Pope's notion of a "common home" becomes more salient.

Changing the market alone, he continued, would not be enough; we must change the habits of individuals and companies. Only by altering the daily decisions of people around the planet could we hope to reduce carbon emissions to a sustainable level. Engell cited the importance of education and clear messaging to convince leaders to adopt a new habit of mind to address climate change. "I think we can change," he said, "but we've got a stopwatch on us."

Engell closed his session by turning to Heaney's Höfn for a striking look at what is at risk. Describing a melting glacier seen from a plane above, Heaney contrasts the calving ice with the warmth and comfort of civilization. While much remains uncertain, Engell suggested that much was at stake. "These happy, warm communities will soon face serious problems."

"I think we can change, but we've got
a **stopwatch** on us."

Professor James Engell



Professor Amy Edmondson

CLIMATE AND ORGANIZATIONAL CHANGE

By this point in the Deep Dive, ALI Fellows had a clear sense of the urgent need to lead change around environmental issues. Fortunately, Harvard Business School Professor Amy Edmondson shared a case and framework with Fellows to help them orchestrate complicated organizational change. Through a case discussion of Siemens' sustainability initiatives, Edmondson helped illustrate the differences between technical and adaptive problems and define best practices for leading change.

The session focused on the case of Siemens, and the efforts of one its leaders to streamline its supply chain and establish sustainability standards. Central to the case were questions of profitability, culture, and how to bring about lasting change in a well-established organization. Complicating matters, Siemens' Chief Sustainability Officer (CSO) had to secure buy-in from other leaders and managers within the organization.

As Edmondson explained, the case highlighted two distinct problems that organizations often face: technical problems and adaptive problems. Addressing Siemens' supply chain was a technical problem for the CSO; the problem was well-specified and had a well-specified solution. On the other hand, developing sustainability mandates represented an adaptive problem. The problem was ill-defined and had no clear solutions. In short, it was a problem that required complex organizational change.

Responding to these sorts of adaptive problems requires a model for change management. Edmondson turned to Harvard Business School Professor John Kotter's 8-step model for change management to consider the different phases of the process. First, leaders need to get started – they create urgency, form coalitions, and define a vision. Next, they seek to involve everyone – to communicate their vision, empower others, and define metrics for success. Finally, leaders want to institutionalize the change – to consolidate improvements and produce more change.

Edmondson acknowledged, however, that this classic framework operates on assumptions that are not always applicable today. Namely, the model assumes we know today what we need to be successful in the future, that we can develop a plan with targets and deadlines, and that achieving change is about motivating employee effort. In novel territory, she said, a plan for future success can only be an educated guess, we have to experiment to reduce uncertainty, and this requires reducing employee fear.

In sum, Edmondson made the case that leading change amid uncertainty is about adopting a learning logic. Change requires leadership that is distributed and decentralized with solutions that are emergent and difficult to measure. This learning logic is essential for addressing climate change. “To make serious progress on climate change, we need to generate an adaptable vision, assess results, and constantly iterate.”



SYNTHESIS AND WRAP-UP

Nearing the end of the day’s sessions, Deep Dive Chair Forest Reinhardt helped ALI Fellows synthesize the content of the last two days and develop next steps for action. To spark the conversation, he led a discussion on the role of firms, governments, and other actors in responding to climate change. Some of the highlights of that discussion follow:

- Firms should reduce emissions, alter operations, and have transparency toward sustainability goals.
- Governments should develop clear standards, simplify and prioritize regulation, and institute carbon pricing.
- Universities should educate individuals about climate change and develop best practices for response and adaptation.
- Media and the press should raise awareness about the problems of climate change and communicate the stories of affected individuals.

Reinhardt also offered his own take on the best path forward for addressing environmental issues. He suggested that meaningful change in emission levels would only come through carbon pricing. “If we want to change behavior, we have to price it higher.” Even so, he cautioned Fellows not to let pricing be the only mechanism to drive change. “Pricing can also crowd out other reasons that we protect the things we love.”



Terry Tempest Williams

THE LEADERSHIP OF THE LAND

The final presenter of the Deep Dive was Terry Tempest Williams, a writer-in-residence at the Harvard Divinity School. Williams brought a spiritual perspective to the discussion and helped humanize the implications of climate change. Her remarks highlighted some of her own takeaways from the two days of presentations, while challenging ALI Fellows to consider voices that were missing from the conversation.

Williams commended the group for their willingness to reflect and hear new perspectives and offered her remarks as one additional point of view to shape their opinions on environmental issues. She recognized that some individuals might disagree with her point of view, and also acknowledged that her own personal history was deeply connected with her beliefs on environmentalism.

The previous sessions of the Deep Dive led Williams to ask herself some challenging questions about her most fundamental beliefs. Namely, was being an environmentalist actually harming the environment by hindering the construction of dams and nuclear power plants? Williams said, throughout the Deep Dive, the presentations challenged her assumptions and exposed her biases. Upon reflection, though, she felt that her actions as an environmentalist were making a difference and helped to create a common language around climate change.

Creating this common language, she said, required listening to voices often left out of discussion. She highlighted the missing perspectives of young people and indigenous communities in previous sessions. “I have been brought to my knees by the young people who lead this movement,” she said. She also noted that a sense of grief seemed to be missing from the public conversation around climate change. “Where is our grief for a world we are losing?”

Williams explained that the conversation in the US around climate change needed to center around these voices and around shared public lands. Public lands accounted for over 620 million acres of the US, and fossil fuel development on these lands emitted more greenhouse gases than most countries. Yet, US citizens often had little information about the consequences of fuel leased from public lands, and discussion of public lands was absent from the previous sessions of the Deep Dive.

Williams’ personal story helped to humanize those consequences for ALI Fellows and show the value of community and identity in environmental protection. She spent most of her life in Utah, and members of her family were heavily involved in the oil and gas industry. Seeking a different

connection with the land around her, Williams became an environmental activist and traveled the world speaking out against her father's industry. Ultimately, she realized her efforts were better focused by protecting the environment of her home in Utah: "I realized I wanted to work in my own community, in my own body, in my own place."

As a professor at the University of Utah, she traveled across the state to hear personal stories of the impacts of climate change. As a result of these stories, she decided to learn more about the oil and gas leasing process; she eventually bought leases through a public auction in an effort to protect the environment. This decision had a serious backlash, both within her family and at her university, and caused her to leave Utah. "I still grieve not being able to go home, simply because we don't know how to talk to each other."

Williams shared this story to show the importance of open dialogue in advancing the climate change debate. "What is at stake is our very lives. But we are not the only species that live and breathe on this planet."

To make this point more salient, she shared a detailed account of a trip to Yellowstone National Park. On a hike in the park, she witnessed a dead female bison being picked clean by a pack of wolves. Once the wolves had left, a group of seven other bison circled the dead body, nudged, pawed, and grieved their lost mate. "We are not the only species who live and love on this planet."

In closing, Williams told ALI Fellows that humanity had arrived at a crossroads, an opportunity to unite as citizens with a common cause. "We have arrived at the hour of the land," she said. Encouraging the Fellows to seek out wild places, she told a final story about sitting in a traffic jam caused by a herd of bison, listening to Vivaldi's Four Seasons recomposed by Max Richter. She played the arresting song that had stopped her in her tracks for the Fellows before parting with a closing thought: "Wild mercy is in our hands."

"Wild mercy is in our hands."

Terry Tempest Williams

APPENDIX – SPEAKER BIOGRAPHIES



Professor Amy Edmondson

Harvard Business School

Faculty Co-Chair, Harvard Advanced Leadership Initiative

Amy C. Edmondson is the Novartis Professor of Leadership and Management at Harvard Business School. Her work on teaming, psychological safety, and leadership continues to influence corporate and academic audiences around the world. Edmondson's latest book, *Extreme Teaming: Lessons in Complex, Cross-Sector Leadership*, provides new insight into the effective management of global enterprises and teaming across boundaries. Her other books include – *Building the Future: Big Teaming for Audacious Innovation*, *Teaming to Innovate* and *Teaming: How Organizations Learn, Innovate and Compete in the Knowledge Economy*. Edmondson has published numerous articles in the *Harvard Business Review* and in academic journals including *Administrative Science Quarterly*, *Academy of Management Review* and *Organizational Science*. She has been recognized by the biannual Thinkers50 global ranking of management thinkers since 2011 and was honored with the Talent Award in 2017. Before her academic career, Edmondson was Director of Research at Pecos River Learning Centers, where she worked on transformational change in large companies. In the early 1980s, she worked as Chief Engineer for architect/inventor Buckminster Fuller, which inspired, *A Fuller Explanation: The Synergetic Geometry of R. Buckminster Fuller*, a book elucidating Fuller's mathematical contributions for a non-technical audience. Edmondson received her PhD in organizational behavior, AM in psychology, and AB in engineering and design from Harvard University.



Professor James Engell
Harvard Faculty of Arts and Sciences

James Engell, Gurney Professor of English and Professor of Comparative Literature, began his studies first in science and was a young NSF fellow at the Jackson Laboratory in Maine. He also researched comparative effects of non- and biodegradable detergents immediately introduced to freshwater fish populations, with results later confirmed by others.

His first employment was at Janney, Battles & E. W. Clark (now Janney), where he was offered a partnership in a local brokerage office. He decided in the end primarily to pursue studies in the humanities with an emphasis on literature. In that field he has authored four books and edited and contributed to nine others.

His writing on energy policy has appeared in The Huffington Post and The Energy Collective. He conceived of and co-edited the widely used text *Environment* (Yale, 2008). His awards and fellowships include those from the Ford Foundation, the Council for Advancement and Support of Education, and The National Humanities Center. *Saving Higher Education in the Age of Money* (2005, co-authored with Anthony Dangerfield) won the Association of American Colleges and Universities award for “Best Book on Liberal Education.” His essay “The CFR Task Force Report on ‘U.S. Education Reform and National Security’: A Reply and Response,” received acclaim.

While devoting most of his career to the humanities, he has pursued a life-long formal and informal interest in science. A member of the American Academy of Arts and Sciences and recipient of several faculty-wide teaching prizes as well as a national mentoring award, Engell teaches (as well as co-teaches, in the Economics Department at Harvard) courses that engage environmental and other issues involving human values and expression, history, science, economics, and reform.



Joseph Goffman
Harvard Law School

Joseph Goffman is Executive Director of the Environmental and Energy Law Program at Harvard Law School. Prior to his recent role as Democratic Chief Counsel to the U.S. Senate Committee on Environment and Public Works (EPW), he was Associate Assistant Administrator for Climate/Senior Counsel to the Assistant Administrator for Air and Radiation at the U.S. Environmental Protection Agency during the Obama Administration. There he played a key role in developing the Clean Power Plan, the Mercury and Air Toxics Standards, the Cross State Air Pollution Rule, the Oil and Gas New Source Performance Standards, and related air quality and climate change rules. During an earlier stint at EPW, he authored Title IV of the Clean Air Act Amendments of 1990, pioneering the use of cap and trade in the program that tackled acid rain. His career also includes senior legal, policy and management positions at the Environmental Defense Fund. Goffman graduated from Yale College and Yale Law School.



Professor Peter Huybers

Harvard Faculty of Arts and Sciences
Harvard John A. Paulson School of
Engineering and Applied Sciences

Dr. Peter Huybers is a professor at Harvard University in the Department of Earth Planetary Sciences and School of Engineering and Applied Sciences.

He received his B.S. in physics from the United States Military Academy in 1996 and served as an Armor Officer. Peter received a Ph.D. in climate physics from MIT in 2004 and, after completing a post-doc at the Woods Hole Oceanographic Institute, joined the faculty at Harvard University in 2007.

Peter's research interests lie in developing a better understanding of the climate system and its implications for society. One line of his work involves changes in glaciation, temperature, and ocean circulation over the past thousands and millions of years. Another focuses on weather and climate extremes over recent decades, especially as they influence crop production.

Peter is a recipient of a MacArthur 'genius' grant, a Packard Fellowship, and the American Geophysical Union's Macelwane Medal. In 2012-2013 Peter worked as an advisor in the White House's Office of Science Technology Policy, and he is presently the co-director of the Harvard University Center for the Environment.



Professor Rosabeth Moss Kanter

Harvard Business School

Chair and Director, Harvard Advanced Leadership Initiative

Rosabeth Moss Kanter holds the Ernest L. Arbuckle Professorship at Harvard Business School, where she specializes in strategy, innovation, and leadership for change. She is also Chair and Director of the Harvard University Advanced Leadership Initiative, an innovation that helps successful leaders at the top of their professions apply their skills to national and global challenges in their next life stage. A collaboration across all of Harvard, the Advanced Leadership Initiative aims to build a new leadership force for the world. Her latest book, *MOVE: Putting America's Infrastructure Back in the Lead*, a New York Times' Book review Editor's Choice, is a sweeping look across industries and technologies shaping the future of mobility and the leadership required for transformation.

Her strategic and practical insights guide leaders of large and small organizations worldwide, through her teaching, writing, and direct consultation to major corporations and governments. The former chief Editor of Harvard Business Review, Professor Kanter has been repeatedly named to lists of the "50 most powerful women in the world" (Times of London), and the "50 most influential business thinkers in the world" (Thinkers 50). She has received 24 honorary doctoral degrees, as well as numerous leadership awards, lifetime achievement awards, and prizes. These include the Academy of Management's Distinguished Career Award for scholarly contributions to management knowledge; the World Teleport Association's "Intelligent Community Visionary of the Year" award; the International Leadership Award from the Association of Leadership Professionals; and the Warren Bennis Award for Leadership Excellence.

She is the author or coauthor of 19 books. Her book *The Change Masters* was named one of the most influential business books of the 20th century (Financial Times). *SuperCorp: How Vanguard Companies Create Innovation, Profits, Growth, and Social Good*, a manifesto for leadership of sustainable enterprises, was named one of the ten best business books of 2009 by Amazon.com. A related article, "How Great Companies Think Differently," received Harvard Business Review's 2011 McKinsey Award for the year's two best articles. *Confidence: How Winning Streaks & Losing Streaks Begin & End* (a New York Times business bestseller and #1 Business Week bestseller), describes the culture of high-performance organizations compared with those in decline and shows how to lead turnarounds, whether in businesses, schools, sports teams, or countries. *Men & Women of the Corporation*, winner of the C. Wright Mills award for the best book on social issues and called a classic, offers insight into the individual and organizational factors that promote success or per-

petuate disadvantage; a spin-off video, *A Tale of 'O': On Being Different*, is a widely-used tool for diversity training. A related book, *Work & Family in the United States*, set a policy agenda; later, a coalition of university centers created in her honor the Rosabeth Moss Kanter Award for the best research on work/family issues. Another award-winning book, *When Giants Learn to Dance*, showed how to master the new terms of competition at the dawn of the global information age. *World Class: Thriving Locally in the Global Economy* identified the rise of new business networks and dilemmas of globalization, a theme she continues to pursue in her new book *MOVE* and the Harvard Business School U.S. Competitiveness Project.

Through her consulting arm, Goodmeasure Inc., she advises numerous CEOs and has partnered with IBM on applying her leadership tools from business to other sectors as a Senior Advisor for IBM's Global Citizenship portfolio. She has served on many business and non-profit boards, such as City Year, the urban "Peace Corps" addressing the school dropout crisis through national service, and on a variety of national or regional commissions including the Governor's Council of Economic Advisors. She speaks widely, often sharing the platform with Presidents, Prime Ministers, and CEOs at national and international events, such as the World Economic Forum in Davos, Switzerland. Before joining the Harvard Business School faculty, she held tenured professorships at Yale University and Brandeis University and was a Fellow at Harvard Law School, simultaneously holding a Guggenheim Fellowship. Her Ph.D. is from the University of Michigan.



Professor Joseph Lassiter
Harvard Business School

Joe is the Senator John Heinz Professor of Management Practice in Environmental Management, Retired. He focuses on one of the world's most pressing problems: developing clean, secure and carbon-neutral supplies of reliable, low-cost energy all around the world. He studies how high-potential ventures attacking this problem are being financed and how their innovations are being brought to market in different parts of the world. In the HBS MBA and Executive Education programs, he teaches about the lessons learned as well as potential improvements in business practices, regulation and government policy. On retiring in 2015, Joe was appointed as a Senior Fellow to continue his work on energy and climate change related issues at HBS as well as in supporting University-wide efforts as a Faculty Fellow of the Harvard Environmental Economics Program (HEEP) and a Faculty Associate of the Harvard University Center for the Environment (HUCE).

After joining HBS in 1996 as a Senior Lecturer, he was appointed a Professor of Management Practice in 1997. He was awarded the MBA Class of 1954 Chair in 2000 and the Senator John Heinz Chair in Environmental Management in 2012. From 2010 until 2015, Joe was Faculty Chair of the University-wide Harvard Innovation Lab (Harvard i-lab). Joe's academic and professional work focused on the creation of high-potential ventures --both as new companies and within existing companies-- and the efforts of their managers to turn these ventures into high-performance businesses. At HBS, he taught courses in Entrepreneurial Finance, Entrepreneurial Marketing, Entrepreneurial Management, Building Green Businesses and Innovation in Business, Energy & Environment. For Harvard University, he taught courses in Innovation & Entrepreneurship to undergraduates, graduate students and post-doctoral fellows from across the University and its affiliated hospitals. Outside Harvard, Joe was active as an investor in and director of a wide range of both new ventures and public companies.

From 1994 to 1996, Joe was President of Wildfire Communications, a telecommunications software venture backed by Matrix Partners and Greylock Partners. From 1977 to 1994, Joe was a Vice President of Teradyne (NYSE/automatic test equipment) and a member of its Management Committee. Joe joined Teradyne in 1974 as a Product Manager while on sabbatical from MIT.

Joe began his career at MIT's Department of Ocean Engineering as an Instructor in 1970 and was promoted to Assistant Professor in 1972. He developed and taught a course on marine mineral resource economics.

He lectured in hydrodynamics, marine transportation, and computer simulation modeling. In a joint program with Harvard Law School, he lectured on marine legal / regulatory policy. His research focused on forecasting economic and environmental consequences of offshore oil and gas development. He was appointed to the MIT-led National Academy of Engineering study on the future of engineering education. Joe received his BS, MS, and PhD from MIT and was awarded National Science, Adams and McDermott Fellowships. He was elected to Sigma Xi.



Professor John Macomber
Harvard Business School

John Macomber is a Senior Lecturer in the Finance unit at Harvard Business School. His professional background includes leadership of real estate, construction, and information technology businesses. At HBS, Mr. Macomber's work focuses on the urban impacts of infrastructure projects in both the developed and emerging worlds, with a particular focus on enterprise-led, government supported new cities. His teaching combines infrastructure finance (including public-private partnerships), economic development, and urban planning as well as the impact of new technologies.

Mr. Macomber is engaged in the Business and Environment Initiative and Social Enterprise Initiatives at HBS and is the Faculty Chair of the HBS Africa Research Center. He teaches Finance, Real Estate, Urbanization, and Entrepreneurship courses in the elective curriculum and in Executive Education.

Mr. Macomber is the former Chairman and CEO of the George B H Macomber Company, a large regional general contractor; and remains a principal in several real estate partnerships. He serves or has served on the boards of Young Presidents Organization International (YPO), Boston Private Bank, Mount Auburn Hospital, and the WGBH Educational Foundation.



Secretary Ray Mabus

Executive Fellow in Executive Education,
Harvard Business School

Ray Mabus has been a change leader throughout his career, from attacking entrenched public corruption as Mississippi's State Auditor in the early 1980s to reviving a bankrupt publicly traded sector manufacturing company with no loss in equity and no loss to creditors to revolutionizing the Navy and Marine Corps as Secretary of the Navy under President Obama.

The longest serving Secretary of the Navy since World War I, Mabus has also served as Governor of Mississippi, Ambassador to the Kingdom of Saudi Arabia, and Chairman and CEO of Foamex.

Recognized by Glassdoor as one of the top 50 CEOs in the country, Mabus earned international attention leading Navy for his efforts to rebuild the U.S. fleet; revolutionize energy procurement and consumption, including moving the Navy away from fossil fuels; promoting innovation in personnel and business practices; and strengthening global partnerships by traveling over 1.3 million miles to meet with Sailors and Marines and leaders in over 152 separate countries and territories.

In June 2010, President Obama gave him the additional task of producing a long-term Gulf Coast restoration plan after the Deepwater Horizon spill. Many of the recommendations in his report, "America's Gulf Coast," were adopted into law when Congress passed on a bipartisan vote and the President signed the "Restore Act."

The youngest governor of Mississippi in more than 150 years at the time of his 1987 election, he stressed education and job creation, passing one of the most comprehensive education reform programs in America; while providing teachers the largest pay raise in the nation. In 2000, he was chosen in a poll of Mississippians as the Best Governor of the 20th Century.

As Ambassador, a crisis with Iraq was successfully deterred, a terrorist attack was weathered, and contracts worth more than \$16 billion were signed between Saudi Arabia and American companies.

Currently, Mabus is CEO of The Mabus Group, a strategic advisory consulting firm focusing on resiliency, helping business, organizations and institutions prepare for, mitigate against and gain competitive advantage from man-made and natural change. He also serves as an advisor to Google Ventures, a lecturer at the Harvard Law School, an executive fellow at

the Harvard Business School and as a visiting fellow with the Institute of Politics and the Belfer Center for Science and International Affairs.

A fourth generation Mississippian, he holds a bachelor's degree from the University of Mississippi, Summa Cum Laude, a master's degree from the John Hopkins University, where he was a Woodrow Wilson Fellow, and a law degree, Magna Cum Laude, from Harvard. He also served in the U.S. Navy aboard the cruiser USS Little Rock.



Professor Forest Reinhardt

Harvard Business School
Faculty Co-Chair, Harvard Advanced Leadership Initiative

Forest L. Reinhardt is the John D. Black Professor of Business Administration at Harvard Business School.

Reinhardt is co-chair of the Harvard Business School's Global Energy Seminar, a new executive education course for the leaders of firms that produce oil and gas, generate and distribute electricity, or play other important roles in the delivery of energy services. He also teaches regularly in the HBS Agribusiness Seminar.

In the HBS Owner/President Management Program, Reinhardt teaches a core course on Global Markets. Drawing on microeconomics, macroeconomics, political science, and history, the course helps business leaders understand the economic and political environment in which business is conducted, and the strategic opportunities and risks to which globalization gives rise.

Reinhardt recently served as course head for the required MBA course, Strategy, which covers topics in industry analysis, competitive advantage, and corporate strategy.

Reinhardt currently serves as the faculty chair of Harvard Business School's Asia-Pacific Research Center and the chair of the HBS Executive Education Asia-Pacific Region.

Reinhardt is interested in the relationships between market and nonmarket strategy, the relations between government regulation and corporate strategy, the behavior of private and public organizations that manage natural resources, and the economics of externalities and public goods. He is the author of *Down to Earth: Applying Business Principles to Environmental Management*, published by Harvard Business School Press. Like that book, many of his articles and papers analyze problems of environmental and natural resource management. He has written numerous classroom cases on these and related topics, used at Harvard and many other schools in MBA curricula and in executive programs.

Reinhardt received his Ph.D. in Business Economics from Harvard University in 1990. He also holds an MBA from Harvard Business School, where he was a Baker Scholar, and an A.B., cum laude, from Harvard College.

Born and raised in Montana, he lives in Belmont, Massachusetts.



Professor Robert N. Stavins
Harvard Kennedy School

Robert N. Stavins is the A. J. Meyer Professor of Energy & Economic Development at the Harvard Kennedy School, Director of the Harvard Environmental Economics Program, Chairman of the Environment and Natural Resources Faculty Group, Director of Graduate Studies for the Doctoral Program in Public Policy and the Doctoral Program in Political Economy and Government, Co-Chair of the Harvard Business School-Kennedy School Joint Degree Programs, and Director of the Harvard Project on Climate Agreements. He is a University Fellow of Resources for the Future, a Research Associate of the National Bureau of Economic Research, Co-Editor of the *Review of Environmental Economics and Policy*, and a Member of: the Board of Directors of Resources for the Future, the Board of Academic Advisors of the AEI-Brookings Joint Center for Regulatory Studies, the Editorial Boards of *Resource and Energy Economics*, *Climate Change Economics*, *Environmental Economics Abstracts*, *B.E. Journals of Economic Analysis & Policy*, *Economic Issues*, and *Environmental Economics and Policy Studies*. He is also a Vice-President of the American Association of Wine Economists, an editor of the *Journal of Wine Economics*, and is the Chair of the Expert Advisory Board of the Harvard Alumni Alliance for the Environment.

He was elected a Fellow of the Association of Environmental and Resource Economists in 2009, and was named the 2016 recipient of the Edmund G. Pat Brown Award. He was formerly a member of the Scientific Advisory Board of the Fondazione Eni Enrico Mattei, the Editorial Board of *Land Economics*, *The Journal of Environmental Economics and Management*, the Board of Directors of the Association of Environmental and Resource Economists, a member and Chairman of the Environmental Economics Advisory Committee of the U.S. Environmental Protection Agency's (EPA) Science Advisory Board, a member of the Executive Board of the U.S. Environmental Protection Agency's (EPA) Science Advisory Board, the Editor of the *Review of Environmental Economics and Policy*, Chair of the Scientific Advisory Board of the Massachusetts Executive Office of Environmental Affairs, a member of the Executive Committee of the Harvard University Center for the Environment, a Lead Author of the Second and Third Assessment Reports and a Coordinating Leading Author of the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, and a contributing editor of *Environment*. He holds a B.A. in philosophy from Northwestern University, an M.S. in agricultural economics from Cornell, and a Ph.D. in economics from Harvard.

Professor Stavins' research has focused on diverse areas of environmental economics and policy, including examinations of: market-based policy in-

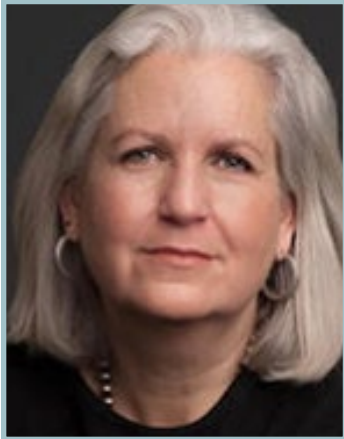
struments; regulatory impact analysis; innovation and diffusion of pollution-control technologies; environmental benefit valuation; policy instrument choice under uncertainty; competitiveness effects of regulation; depletion of forested wetlands; political economy of policy instrument choice; and costs of carbon sequestration. His research has appeared in the *American Economic Review*, *Journal of Economic Perspectives*, *Quarterly Journal of Economics*, *Journal of Economic Literature*, *Science*, *Nature*, *Journal of Environmental Economics and Management*, *Ecology Law Quarterly*, *Journal of Regulatory Economics*, *Journal of Urban Economics*, *Journal of Risk and Uncertainty*, *Resource and Energy Economics*, *The Energy Journal*, *Energy Policy*, *Annual Review of Energy and the Environment*, *Explorations in Economic History*, *Brookings Papers on Economic Activity*, other scholarly and popular periodicals, and several books. In 2017, he received the Publication of Enduring Quality Award from the Association of Environmental and Resource Economists, together with Richard Newell and Adam Jaffe for their 1999 article, “The Induced Innovation Hypothesis and Energy-Saving Technological Change,” published in the *Quarterly Journal of Economics*.

He is the co-editor of *Post-Kyoto International Climate Policy* (Cambridge University Press, 2009), *Architectures for Agreement: Addressing Global Climate Change in the Post-Kyoto World* (Cambridge University Press, 2007), editor of the fourth, fifth, and sixth editions of *Economics of the Environment* (W. W. Norton, 2000, 2005, 2012), co-editor of *Environmental Protection and the Social Responsibility of Firms* (Resources for the Future, 2005), editor of *The Political Economy of Environmental Regulation* (Edward Elgar, 2004), co-editor of the second edition of *Public Policies for Environmental Protection* (Resources for the Future, 2000), and the author of *Environmental Economics and Public Policy: Selected Papers of Robert N. Stavins, 1988-1999* (Edward Elgar, 2000) and *Economics of Climate Change and Environmental Policy: Selected Papers for Robert N. Stavins, 2000-2011* (Edward Elgar, 2013).

Professor Stavins directed Project 88, a bi-partisan effort co-chaired by former Senator Timothy Wirth and the late Senator John Heinz, to develop innovative approaches to environmental and resource problems. He continues to work closely with public officials on matters of national and international environmental policy. He has been a consultant to the National Academy of Sciences, several Administrations, Members of Congress, environmental advocacy groups, the World Bank, the United Nations, the U.S. Agency for International Development, state and national governments, and private foundations and firms.

Prior to coming to Harvard, Stavins was a staff economist at the Environmental Defense Fund; and before that, he managed irrigation devel-

opment in the Middle East, and spent four years working in agricultural extension in West Africa as a Peace Corps volunteer.



Terry Tempest Williams
Harvard Divinity School

Terry Tempest Williams will join HDS as a writer-in-residence for the 2017-18 academic year. She is the author of numerous books, including the environmental literature classic, *Refuge: An Unnatural History of Family and Place*. Her most recent book is *The Hour of Land: A Personal Topography of America's National Parks*, which was published in June 2016 to coincide with and honor the centennial of the National Park Service. Her writing has also appeared in *The New Yorker*, *The New York Times*, *Orion Magazine*, and numerous anthologies worldwide as a crucial voice for ecological consciousness and social change.

During her year at HDS, Williams will spend time contemplating and writing about the spiritual implications of climate change, and will lead a seminar with HDS students.

Williams's appointment at HDS is supported by the Compton Foundation and the Susan Shallcross Swartz Fund.



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14 Story Street, Suite 100, Cambridge, MA 02138

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