# Blindsided by Change

## Slow Threats and Environmental Policy

Robert L. Olson
David Rejeski

ENVIRONMENTAL LAW • INSTITUTE®

Institute for Alternative Futures

2017

# Blindsided by Change

## Slow Threats and Environmental Policy

**Robert L. Olson**

Senior Fellow, Institute for Alternative Futures

**David Rejeski**

Director, Technology, Innovation, and the Environment Project

Environmental Law Institute

# Authors

**Robert L. Olson** is a Senior Fellow at the Institute for Alternative Futures. He was previously the Institute's Director of Research and a member of its founding Board of Directors. Much of his recent work has focused on technological, economic, and social developments shaping the environmental future. He has been a consultant to the Wilson Center's Science and Technology Innovation Program, the World Resources Institute, the President's Council on Sustainable Development, and a wide variety of corporations and government agencies. He is the author of *Exploring the Future*, editor of *Mending the Earth* and co-editor of *Environmentalism and the Technologies of Tomorrow*. Formerly, he served as a project director and consultant to the Director at the Office of Technology Assessment of the U.S. Congress. He was a Fellow of the Center for Cooperative Global Development at American University for several years and has been a Resident Fellow at the University of Illinois' Center for Advanced Study.

**David Rejeski** directs the Technology, Innovation, and the Environment Project at the Environmental Law Institute after serving for over a decade as director of the Science, Technology, and Innovation Program at the Woodrow Wilson Center. His research at ELI focuses on better understanding the environmental impacts and opportunities created through emerging technologies and their underlying innovation systems, from synthetic biology to 3-D printing. Prior to the Wilson Center, he worked at the White House Office of Science and Technology Policy, the Council on Environmental Quality and the Environmental Protection Agency (Office of Policy, Planning, and Evaluation). He is a Fellow of the National Academy of Public Administration (NAPA), a guest Researcher at the International Institute of Applied Systems Analysis (IIASA) in Austria, a member of EPA's National Advisory Council on Environmental Policy and Technology, and board member of American University's Center on Environmental Policy.

# Introduction

Some threats to the environment, like acid rain and stratospheric ozone depletion, emerged fairly rapidly, and abrupt threats like an oil or toxic chemical spill demand an immediate response. But most environmental problems have the opposite character: they involve *Slow Threats* where small, hardly noticeable changes add up over time to produce large impacts. A retrospective analysis by the European Environmental Agency of 88 slow-moving environmental problems found that 84 of them were situations of clear policy failure where inaction allowed problems to keep worsening despite years or decades of warnings.[1] Nearly all of the most serious environmental problems we face involve slow threats. For example:

- **Climate Change** The rate of global warming averaged over the past 50 years was just 0.13 degrees C per decade, increasing over time as more fossil fuels were burned.[2] Yet, U.N. Intergovernmental Panel on Climate Change warns that if the world continues down this carbon-emitting course, the average global temperature could rise by up to a staggering 4.8 degrees C (8.6 degrees F) at the end of the century.[3]

- **Species Extinction** The rate of species extinctions has gradually grown at least since the late 19th century when global population growth began to accelerate. Now it is estimated to be in the range of 1,000 times the normal background rate.[4] The World Wildlife Fund's 2016 *Living Planet Report* estimates there was a 58 percent overall decline in vertebrate populations (fish, birds, mammals, reptiles, and amphibians) between 1970 and 2012, the last year with available data. Biologists speak of being on the brink of a Great Extinction on the scale of the largest extinction events of the Earth's past.[5]

- **Deforestation** Global deforestation has been creeping along for decades at just under 1 percent annually, but this seemingly low figure is resulting in the loss of swaths the size of Panama each year. According to the World Resources Institute, more than 80 percent of the Earth's natural forests already have been destroyed.[6] Tropical rainforests contain the greatest diversity of species of any of the world's ecosystems, and about half of them have been cleared.[7]

- **Soil Erosion** David Pimentel, professor of ecology at Cornell, estimates that half the world's topsoil has been lost over the past 150 years. Asked why this is not a matter of great concern, he says the difficulty is that "erosion is a slow and insidious process" and "who gets excited about dirt?"[8]

- **Endocrine Disruption** Awareness that some chemicals affect the endocrine system goes back to the 1930s. Media coverage of the build-up of "endocrine disruptors" in the environment peaked in the mid-1990s, spurring research and limited efforts to do endocrine screening. But the action and impacts of

> endocrine active compounds have proven so difficult to pin down that a recent overview of the field concludes that "we are only at the very beginning of a long journey toward improved understanding of the basic mechanisms of endocrine-mediated toxicity and the extent to which relevant exposures to hormonally active agents impact human and environmental health."[9]

Slow environmental threats like these all involve some form of deterioration occurring over a period of decades or generations or even centuries—time periods that historians regularly deal with but that stretch out beyond the time frame in which governments make budgets or do strategic planning. In the U.S. government, where political appointees remain on average for two years, problems of this kind are typically treated as low priority or politically irrelevant, if they are even noticed.

The media, caught in the constant 24/7 push for clicks and hits, devotes little coverage to slow environmental threats. They may be mentioned occasionally in newscasts or op-eds when a major research report is published or some disaster occurs, but they seldom reach the level of sustained visibility and concern they deserve. Without that awareness and sense of alarm, the problems are likely to continue worsening until their impacts become severe and obvious, stressing our ability to respond or, in worst cases, passing tipping points where no amount of effort can prevent catastrophic impacts.

We urgently need a better understanding of why it is so difficult to galvanize attention to slow environmental threats and sustain efforts to deal with them. No single explanation is sufficient. But insights from several different fields—evolutionary psychology and neuroscience, behavioral economics and decision theory, social psychology, journalism, and political science—can help us see what we are up against so we can devise better strategies for approaching this class of problems.

# Brain Wiring

A fundamental reason why it is hard to motivate action on many environmental problems is that our brains are simply not wired to respond to large, slow-moving threats. Psychologist Robert Gifford explains the perspective developed in the field of evolutionary psychology: "The human brain has not evolved much in thousands of years. At the time it reached its current physical development . . . our ancestors were concerned with their immediate band, immediate dangers, exploitable resources and the present time," not with problems that are "slow, usually distant, and unrelated to the present welfare of ourselves and our significant others."[10]

Psychologist Daniel Gifford argues that our brains evolved to respond best to threats that have particular properties. For example, we respond strongly to intentional actions to cause harm. We show relatively little concern over the fact that influenza sometimes kills more than 40,000 people in one year alone in the

United States, but if terrorists intentionally killed 40,000 or even 40 people with a bioweapon, it would dwarf every news story on the planet. Some kinds of actions deeply offend our moral sensibilities and impel us to action. We are especially motivated to action by threats that are imminent and abrupt, because a primary need when the human brain was evolving was to get out of the way of immediate physical dangers. A much smaller part of the brain is devoted to thinking about circumstances that are not yet here and getting out of the way of threats that are emerging slowly.[11] We also respond much more forcefully to threats that are certain than to those that are disputed or ambiguous, and to threats that are simple and clear-cut rather than complex and difficult to understand. Unfortunately, slow environmental threats seldom have any of the characteristics that trigger a strong response.

| Our brains are wired to respond to threats that involve: | Slow environmental threats have: |
|---|---|
| Intentional action to cause harm | No action directly intended to harm |
| Immoral actions that cause revulsion and impel action | No moral alarms are usually tripped |
| Visible, clear, and present dangers | Circumstances that are not yet here |
| Changes that occur quickly | Changes drawn out over years, decades, or longer |
| High certainty | Often various degrees of ambiguity and uncertainty |
| Simple, clear-cut causality | Complexity |

These findings from evolutionary psychology are supported by research in neuroscience. Most importantly, functional magnetic resonance imaging (fMRI) shows that the connecting lines between the amygdala, the emotional urgency center of thinking, and the prefrontal cortex, the brain region associated with planning complex behavior, is to a large extent a one-way street.[12] Strong emotional reactions—as to intentional threats, clear and present dangers, etc.—can spark reasoning and planning, but not the other way around. Environmental threats that our reasoning suggests may be important in the future do not normally trigger a powerful emotional urgency to act in the present.

Climate change is a perfect illustration of this "brain wiring" barrier to action. George Marshall, co-founder of Oxford-based Climate Outreach, calls climate change

a “royal flush of . . . qualities that make it notoriously hard for our brains to engage with.” It is a “perfect crime everyone contributes to but for which no one has a motive. There is no outsider to blame. We are just living our lives: driving the kids to school, heating our homes, putting food on the table.”[13] The impacts are unfolding so gradually that it may take a few more decades before the seriousness of the problem is totally undeniable. Meanwhile, people trying to block action will continue “keeping the controversy alive” by fostering uncertainty and doubt, which is possible largely because the subject is so complex.

## Cognitive Biases

It gets worse. Our brains are not only poor at attending to slow environmental threats, they also have trouble assessing the risks these threats pose even when they are noticed. Research in psychology, behavioral economics, and decision theory has shed light on how common decision errors arise from biases in the way our cognition naturally operates.[14]

Unfortunately, people’s views of the risks involved in slow environmental threats are particularly vulnerable to distortion by these biases. For example, people tend to systematically undervalue long-term risks (social discounting). They are consistently more sensitive to short-term costs than to long-term costs, so are reluctant to accept short-term losses even if they are necessary to prevent much larger long-term losses (short-term bias). People often jump to conclusions based on the limited evidence they see at first, so seeing that an environmental problem is not obviously disastrous today can cause people to jump to the conclusion that it is simply “not serious,” cutting off efforts to understand how serious it could eventually become (WYSIATI: what you see is all there is). They are inclined to believe that they are personally at less risk than others from threats (optimism bias). People often make decisions by consulting their emotions or “going with their gut,” and because they don’t want slowly unfolding environmental threats to eventually cause disasters, they are often inclined to decide the threats are not really very serious (affect heuristic).

Cognitive biases like these are not just a matter of theory. They have been confirmed by hundreds of carefully designed experiments repeated with all kinds of people. They clearly make it harder to mobilize action on slow environmental threats.

## Dynamics of Denial

Beyond the way our brains are wired and our cognitive biases, there are social and psychological dynamics that sometimes keep us from accepting the reality of problems. These dynamics can be especially powerful in affecting perceptions of slow environmental threats where the full nature and impacts of the threats are not visible in the present.

An example is how people tend to hold viewpoints that are consistent with the values and outlooks held by others within the groups with which they self-identify: their extended family, church, work colleagues, political parties, and so on. It is psychologically difficult to break from these views, so people often let cultural identity override facts (cultural cognition).[15] Another example is how societies often arrive at unwritten agreements about what can be publically acknowledged and discussed and what should not be talked about. The main motivation for this collective behavior is to avoid the disturbing thoughts and emotions of fear and helplessness that serious threats can evoke (collective avoidance).[16] Another example is the phenomenon in which the more people we assume know about a problem, the more likely we are to ignore our own judgment and watch the behavior of others to identify an appropriate response. If many others appear unconcerned, we are likely to act unconcerned (bystander effect).[17]

# Is It Newsworthy?

One of the main reasons why slow environmental threats receive much less attention than they deserve is that they so seldom meet the criteria for being "newsworthy." Over the years, reporters and journalism professors have developed lists of factors that help journalists decide if something is newsworthy or not. The factors that regularly appear in these lists are[18]:

- **Timeliness** – what's happening this day, this hour, this minute
- **Significance** – number of people affected and level of impact
- **Prominence** – involves famous people, politicians, movie stars, CEOs, etc.
- **Conflict and controversy** – a major source of interest, without which there would be little literature or drama
- **Immediate loss of life or destruction of property** – "if it bleeds, it leads"
- **Human interest** – appeals to emotions with amusement, empathy, humor, sadness
- **Novelty** – when "man bites dog," that's news
- **Something goes wrong** – an incident, scandal, act of incompetence, etc.
- **Something exceptional happens** – record-breaking, extraordinary quality, outrageousness
- **Titillation value** – something that stimulates or excites, sexual or otherwise

Slow environmental threats typically meet few or none of these criteria of newsworthiness. As a result, they are usually unable to compete in the fierce struggle for space in the highly limited universe of print, television, and online viewing time, which includes not just news, but a multitude of things that are more pleasant to contemplate such as sports, celebrity gossip, and reviews of the latest smart phones.

Slow environmental threats can sometimes become prominent—for a time—before fading from view again in what political scientist Anthony Downs called an "issue-attention cycle."[19] Looking at the rise and decline of environmental issues in the 1960s and early 1970s, Downs described a cycle with five stages. In the first *pre-problem* stage, some problems are getting worse and some experts and interest groups are getting alarmed, but the problems have not yet captured much attention. In a second *alarmed discovery and euphoric enthusiasm* stage the public becomes aware and alarmed because dramatic events capture media attention (such as Earth Day, oil spills, a burning river), and this puts pressure on political leaders to express confidence they can solve the problems. In the third stage, *realizing the cost of progress*, there is a gradually spreading recognition that the problems are hard to solve. As more people realize how difficult the problems are, the cycle enters a fourth stage, *gradual decline of intense public interest*. As public interest continues declining and other issues compete for space in the news, the issue enters a final *post-problem stage*, a twilight period of lowered attention or occasional recurrences of interest.

# Speeding Action on Slow Threats

Everything reviewed here—the evolutionary limitations on how our brains respond to slow threats, the built-in cognitive biases that cause us to misperceive environmental risks, the collective ways we avoid facing problems, and the constricting criteria of what's newsworthy—make it difficult to deal with slow environmental threats. There is no way to sweep aside all these barriers to action, but there are strategies that can help environmentalists work through them. Some are conventional "effective communications" strategies and some are novel. The more strategies that can be applied on a given issue the better.

## Message and Messenger

The basic principle of effective communications is to have an appropriate message delivered by a credible messenger. As the figure below illustrates, even the best message may be viewed skeptically if the person delivering it lacks credibility with the audience, and trusted, credible messengers may not be successful communicators if the message itself does not speak to the viewpoint of the audience or is poorly crafted.[20]

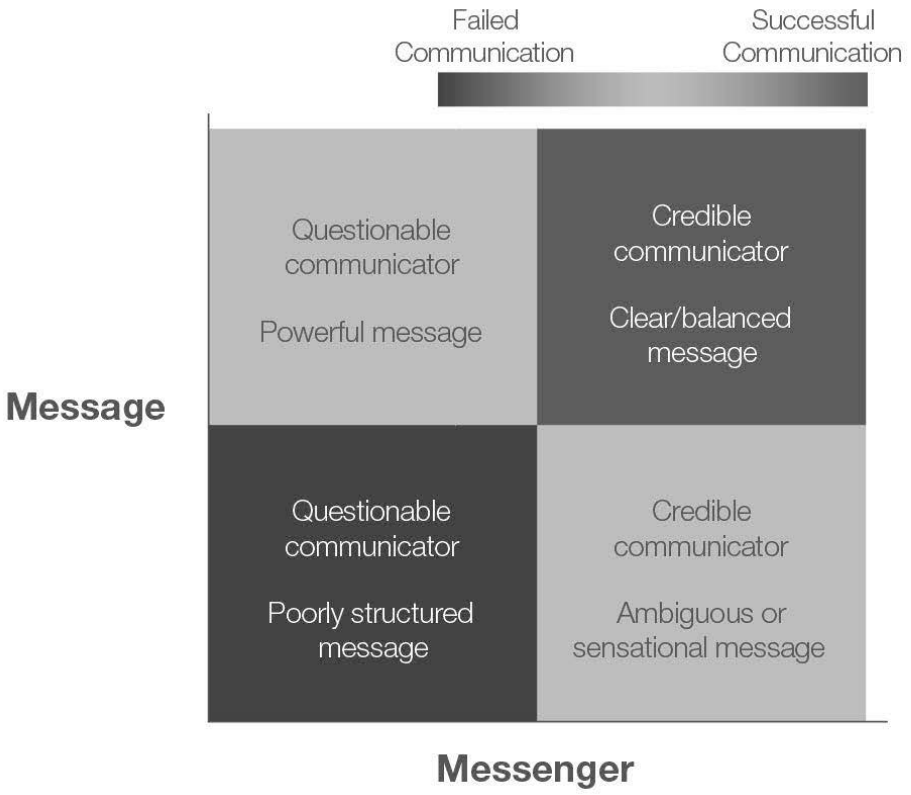



**Figure 3:** *Communicators must strike a balance between formulating the best message and having a credible messenger deliver it*

The guiding principle of social marketing is to "Start where your audience is, not where you want them to be."[21] Because our society includes people with different views and values, effective communications need to target specific population groups, taking into account what they already believe and what is important to them. Surveys, focus groups, or interviews can greatly improve understanding of different target audiences. This kind of targeting of population groups requires a considerable effort, but the reality is that to target everyone is to target no one. As Dietram Scheufele, a communications scholar at the University of Wisconsin-Madison puts it, "tailoring communications efforts to fit with publics from different social and educational backgrounds is not an option, it is a necessity."[22]

As a general rule, it is best to lead messages with shared values. Make clear, easy to understand statements, using plain English and avoiding jargon and scientific terms. Be truthful and as balanced as possible: exaggerating dangers and over-hyping possibilities may mobilize support in the short run but comes at the cost of losing credibility over time. Describe the threat clearly, but focus on solutions and benefits to inspire hope and action. Emphasize how the benefits of change are greater than the costs. Localize whenever possible. People care most about what is happening in their own community or region, so show how national or global threats manifest locally.[23] Whenever appropriate, relate to the future of people's children and grandchildren, since if there is any area where people are willing to pay attention to long-term risks and incur short-term costs for the sake of reducing those risks, it's in the lives of their own children.

Having credible, trusted messengers is as important as having a well-crafted message. Choosing a trusted messenger is not an easy task. It has to be someone who audience members associate with culturally or who they consider an authoritative expert on the content.[24] An approach that is often helpful is to involve target audience members in the message-planning process. Passionate and enthusiastic members of the target audience itself can sometimes be the most effective messengers.[25] Trust is a fragile commodity that can easily be lost if the message content is felt to be untruthful or manipulative, which reinforces the need for truthful and balanced messages. Successful communication requires both a credible communicator and a clear and balanced message.

## Focus on Bright Spots

For many people, the future seems to be growing darker. In Europe as well as the United States, many fear that we are in a time of crisis with almost every aspect of society in decline. Environmentalists risk amplifying this mood with their efforts to mobilize action through warnings about how disastrous various environmental problems could become. Extrapolating environmental trends into a bleak future runs the risk of becoming self-fulfilling, because people base their actions on what they believe the future will be like.

Warnings about the eventual seriousness of slow environmental threats are necessary, but they need to be combined with an emphasis on "bright spots," examples of positive, desirable developments in technology, policy, and citizen action.[26] An emphasis on bright spots and broader positive images of "what could be" can demonstrate that progress is possible, inspire constructive action, and reduce tendencies toward collective avoidance and other forms of denial.

Bright spots exist even in areas of greatest threat. For example, overfishing is one of the most serious areas of species extinction. Today, the world's oceans contain only 1/6th the fish population they held in 1900, and 90 percent of the stocks of large predatory fish like tuna and cod are already gone.[27] But important responses are underway. Over 13,650 Marine Protected Areas—safe havens for young fish—have been created in recent years encompassing over 2 percent of the world's oceans.[28] At the same time, new tools like Global Fishing Watch (GFW) are emerging to track compliance with regulations to prevent overfishing. GFW allows anyone with an internet connection to see fishing activity anywhere in the ocean in near real-time.[29]

## Institutionalize Foresight

A key strategy is to develop a better capacity for foresight and build it permanently into public-sector organizations, such as the Environmental Protection Agency, National Oceanographic and Atmospheric Administration, and other environment-

oriented government institutions, domestically and internationally. One aspect of foresight involves marshaling the best available science to provide an authoritative "long view" on how slow environmental threats could evolve and the scale of damage they could eventually do. Bringing the potential long-term consequences of slow changes into current awareness can help counter the tendency to undervalue long-term risks and the "What You See Is All There Is" bias where people dismiss the seriousness of a problem because its impacts are not obviously serious—yet.

Better environmental foresight can also help prevent newly emerging environmental problems from turning into long-running slow threats. Environmentalists and environmental agencies have devoted most of their effort over decades past to playing catch-up with environmental problems that emerged from earlier revolutions in technology. Now we are in the early stages of equally large or larger technological changes, with multiple revolutions in information and communications, artificial intelligence, materials science, production, logistics, and the interaction of new technologies such as nanotechnology and biotechnology. New environmental problems related to these developments are certain to emerge over the years just ahead. It would be far better to identify such problems early and respond to them quickly rather than letting them drag on as slow threats that keep worsening over time.[30]

Reports from the National Academy of Science, EPA's Science Advisory Board, and the National Advisory Council on Environmental Technology and Policy have all called on EPA to institutionalize an ongoing foresight process. The Agency is currently engaged in a Foresight Pilot Project demonstrating the value of this approach. Improving foresight is arguably the best strategy available for making environmental protection more cost-effective because it can highlight threats likely to be most costly over time and support early action to deal with emerging threats while they are still small and comparatively easy and inexpensive to head off. A recent set of recommendations by the National Academy of Public Administration called for the U.S. government to, "systematically integrate foresight into policy development," pointing out that, "unlike some other countries, the U.S. does not have an institutional mechanism or office at the top of government to methodically scan the horizon or generate alternative future scenarios."[31] The only group that comes close to filling this gap is the National Intelligence Council (NIC), which develops a global trends report every four years, but the integration of future scenarios into policy remains largely unaddressed.[32]

## Employ Advanced Visualization Tools

One reason for the rapid response to the threat of stratospheric ozone depletion was that satellite imagery was able to show the expanding "ozone hole" over Antarctica. There are other environmental issues like deforestation, desertification, and sea-level rise where existing time-lapse satellite imagery could be used much more effectively than it has been to date. Imagery of this kind can make slow processes

visible and create a psychological sense of change happening fast, presenting the kind of clear and present danger that activates strong emotional responses.

Focusing more research on innovations to make slow environmental problems visible and psychologically urgent could have big payoffs. Imagine, for example, the impact of developing a cell phone app that allows phone cameras to see $CO_2$ gushing from vehicles and buildings as ugly dark smoke.

Data visualization can be as effective as direct imagery. NASA Goddard's Scientific Visualization team recently produced a widely viewed video showing a data visualization of the millions of tons of dust blowing off the Sahara desert each year and, in this case, having a positive side effect by bringing phosphorus and other fertilizers to depleted soils in the Amazon basin. But more important than the particular subject of this effort or the technology driving the collection and analysis of data is the model this NASA work presents. Scientists, technologists, environmentalists, and journalists came together and used dramatic data visualization to make a slow process visible, make complex processes easy to understand, and present their findings to the public not just as a data display, but as a newsworthy story.[33]

## Playable Models

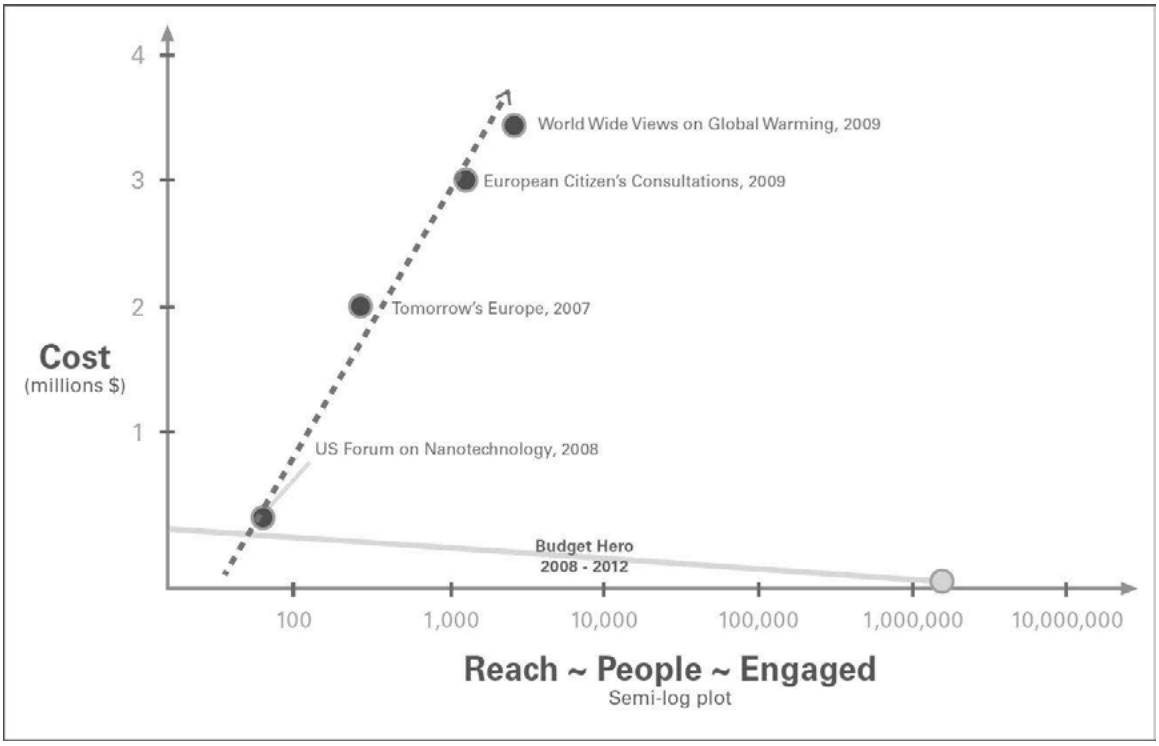
"Playable models" or "serious games" have begun to emerge as a powerful method for improving understanding of complex issues. A well-designed playable model can lead people into long-term thinking and help them look beyond narrow parts of an issue to see a bigger picture. Most importantly, it allows people to experiment and see the consequences of different choices. It engages people and deepens their understanding through active interaction and the ability to bring the future into the present.[34]

In playing with a model, time is dramatically accelerated so that slow changes are sped up to where they can appear as clear and present dangers. Complexity that normally would be off-putting can be explored playfully by making changes in one part to see what happens to other parts and the whole. Cognitive biases like undervaluing long-term risks and dynamics of denial like the bystander effect have little force in a game-like context. Resistance to "changes of mind" is lower in the kind of self-directed learning context that models create than in normal situations of discussion and argument.

*Budget Hero*, an online video game based on the Congressional Budget Office models of federal spending, and its current successor, Fiscal Ship, demonstrates what is possible.[35] Players are challenged to balance the budget by choosing from more than 80 policy options that involve cutting spending in different areas or raising various taxes. The model incorporates positive and negative arguments for each policy, drawn from scores of sources and vetted to ensure the game is nonpartisan. *Budget*

*Hero* players who were surveyed, both conservatives and liberals, came away with a more sophisticated appreciation of the budget challenge and an ability to see through the simplistic, inaccurate statements politicians often make about the budget. After playing the game, many were critical of what they saw as superficial coverage of the budget in the media.

Playable models of this kind can be built to help people explore slow environmental threats. Creating a sophisticated game requires a team of people with expertise in the subject matter, game design, and software development. While this is not an inexpensive task, playable models can be scaled to reach and influence large numbers of people at a very low cost per person, especially when compared to traditional public engagement models, as the graph below illustrates.




Because playable models are interactive, they can provide feedback and quantitative data to researchers and policymakers on player strategies, policy choices, and a host of other play-generated data, collected in near-real time (and 24/7). A wide variety of statistical analyses can be applied to the data, including time-series, cumulative frequencies, and multivariate regression models—playable models are big data machines.

## Mobilize Citizen Science

Citizen science efforts can contribute to understanding slow environmental threats and help mobilize action to deal with them. A recent European Commission Report

on identifying emerging environmental risks stressed the importance of community or people-centered early warning systems that can utilize ". . .the cooperation and local knowledge of citizens to disseminate early warning messages effectively."[36]

Several current efforts involve monitoring changes in the populations of various species, such as the long-running Audubon Christmas Bird Count, the Delaware Bay Horseshoe Crab Spawning Survey, the Hudson River Eel Project, and the "bioblitzes" organized by the National Park Service and the National Geographical Society to find as many species as possible in a specific area over a short period of time.[37] The Forest Watchers citizen cyberscience project,[38] the World Resources Institute's Global Forest Watch,[39] and the Picture Pile game at the International Institute for Applied Systems Analysis[40] all involve networks of citizens monitoring deforestation and reporting on illegal logging. EPA and state programs support citizen volunteers in monitoring water and air quality.[41] Project Budburst brings gardeners, botanists, ecologists, educators, scout troops, and others together to monitor climate change and its impacts on plants.[42] Technical progress in inexpensive, accurate sensors is giving ordinary citizens with cell phones chemical testing capabilities that previously required expensive equipment or laboratories.[43]

Citizen science can fill in gaps in conventional data-gathering, increasing the certainty of findings. Some of the sensors used by citizen science lack the accuracy of commercial versions, but because of their low cost, much larger distributed and networked systems can be created, leading to a point where quantity becomes quality. People involved in citizen science projects become better informed about environmental issues and more committed to help deal with them. They become more motivated to share their knowledge and concerns with others, countering dynamics of denial like the bystander effect. Projects involving local citizens or children in local schools often have a "human interest" cachet that makes them newsworthy.

## Provide Continuous Feedback With Environmental Indicators

A wide variety of environmental indicators have been developed that measure trends at different geographical scales related to climate change, air quality, freshwater quality, waste generation, forest resources, fish resources, biodiversity, and many other topics.[44] One of the most successful efforts of this kind is Ecohealth Report Cards, which over the past two decades has developed regular assessments of iconic ecosystems like the Chesapeake Bay, Long Island Sound, and, most recently, the Great Barrier Reef.

The annual Chesapeake Bay Report Card, for example, compares the state of dissolved oxygen, nitrogen, phosphorus, chlorophyll a, water clarity, aquatic grasses, and benthic community members like clams to scientifically derived thresholds or goals. These indicators are combined into an Overall Bay Health Index. Other indicators cover the state of blue crabs, Bay anchovies, and striped bass. The data

produced by scientists and volunteers is converted into a clearly-written, image-rich format easily accessible to a wide audience.[45]

With an indicator system like this in place, any significant declines or improvements in the state of the Bay will be noticed quickly and brought to public attention. Because the assessment is broken down geographically into a dozen areas, the report card taps into the motivation of peer pressure. Civic leaders and citizens in communities around the Bay can compare their grades with their neighbors, which leads to a desire for better environmental outcomes in their own backyard. The challenge in using indicators is always to find ways to make them as visible as possible to public and private-sector leaders and the public at large.

## Take Advantage of Teachable Moments

Organizations can prepare in advance to take advantage of "teachable moments" when a significant emotional or traumatic event occurs that can be used to educate the public about a particular slow environmental threat. Unfortunately, "retrievable disasters," smaller disasters that occur as a problem worsens, are often the best teachable moments. They draw media coverage and make it possible to highlight the reality of the threat, explain how worse impacts will occur if the threat is not adequately addressed, and set out the most important actions that need to be taken.

Hurricane Sandy is an example of a retrievable disaster where these things were done, but they could have been done better with advance preparation within and between organizations to assure effective communications—enlist credible communicators, use clear language everyone can understand, develop approaches targeted to different audiences, and reach agreement on key points to make, especially recommendations for action.

## Be Willing to Reframe the Threat to Reach Different Audiences

Many slow environmental threats have a range of impacts and can be reframed around those impact areas to better reach people with varied interests. Climate change is the best example, since its impacts are so broad-ranging. There has been significant work to reframe climate change as a security issue, stressing impacts like the potential to cause humanitarian disasters, undermine weak governments, and contribute to political violence by exacerbating conflicts over water.[46] A recent report by the National Intelligence Council noted that, "climate change is already having significant impacts—and. . . these are likely to pose significant national security challenges for the United States over the next two decades."[47] Others have reframed climate as a public health threat posed by impacts like extreme heat and the movement of tropical diseases into temperate zones.[48] Still others have framed it as a threat to water supplies, highlighting early melting of snow packs, shifting patterns of precipitation, and growing areas of drought.[49] In areas where storm

surges and tidal flooding pose special risks in people's daily lives, those impacts can be made the face of climate change.

### Call Out Bad Actors—But Do Not Humiliate Them

Identifying and calling out bad actors can evoke an urgency to take action because it triggers our brain's emotional reaction to intentional actions to cause harm as well as revulsion against immoral action. This is why it has been such a common strategy among environmental groups. The downside of this strategy is that it can make the people being accused defensive, angry, and more resistant than ever to change.

Perhaps the best statement in modern times of how to minimize this reaction is Martin Luther King Jr.'s sermon on "Loving Your Enemies" finalized while serving two weeks in jail and included in his book *Strength to Love*. He stresses the importance of developing and maintaining the capacity to forgive. "Forgiveness," he says, "does not mean ignoring what has been done or putting a false label on an evil act. It means, rather, that the evil act no longer remains as a barrier to the relationship." While opposing evil acts with all our strength, "we must not seek to humiliate the enemy. . .Every word and deed must contribute to an understanding with the enemy . . . ."[50]

## The Need for Persistent Engagement

Slow threats require a "persistent engagement" strategy that few organizations can maintain over time.[51] This capacity to constantly update and make sense of organizational context and adapt to new situations is a hallmark of what have been termed *high reliability organizations* (HROs), which ". . . preserve the capability to see the significant meaning of weak signals and to give strong responses to weak signals,. . .a counterintuitive act that holds the key to managing the unexpected."[52]

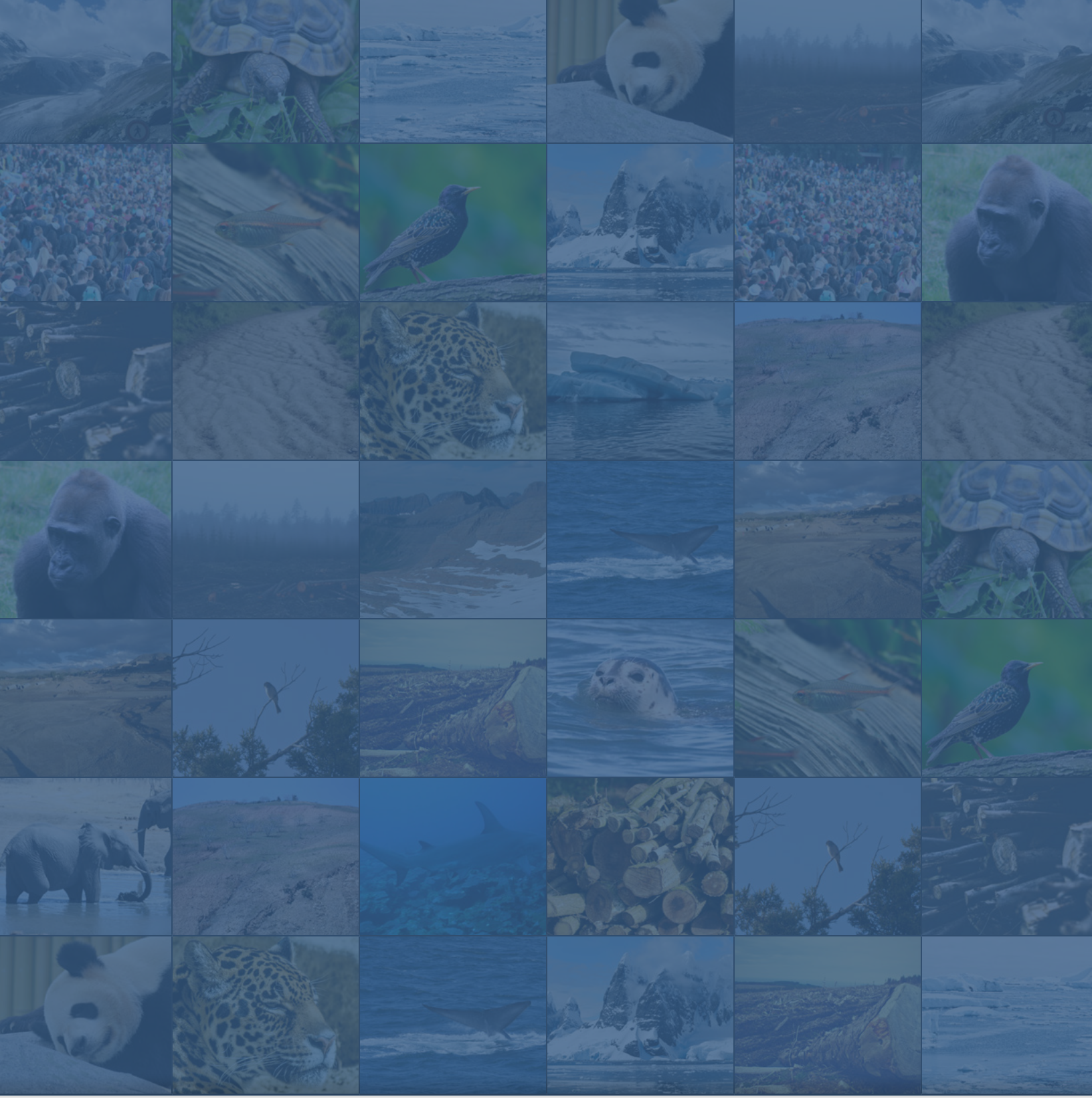
Unfortunately, HROs are in short supply, especially in the public sector. Therefore, it would be helpful to have an institution or research group whose mission, in whole or in part, is to study slow environmental threats as a distinct class of problems and to work continuously to make slow threats more visible. It could be a space for reflection protected from daily hyperbolic media headlines, knee-jerk analysis, and politics. It could share with other organizations lessons from deeper study of how to counter the dynamics that block collective action and policy solutions on these kinds of problems.

# References


[1] European Environmental Agency, *Late Lessons From Early Warnings: Science, Precaution, Innovation*, Report 1, 2013.
[2] NOAA National Centers for Environmental Information, *Global Analysis—Annual 2015*, section of State of the Climate—Global Temperatures. Available online at https://www.ncdc.noaa.gov/sotc/global/201513.
[3] IPCC, *Climate Change 2014 Synthesis Report—Summary for Policy Makers*, p. 10. Available online at https://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf.
[4] Juriaan M. DeVos et. al, "Estimating the normal background rate of species extinction," *Conservation Biology*, Vol. 29, No. 2, April 20, 2015, pp. 452-462.
[5] Sarah Kaplan, "Earth Is on the Brink of a Sixth Mass Extinction, Scientists Say, and It's Humans' Fault," *Wash. Post*, June 22, 2015.
[6] Quoted in "Forest Holocaust," National Geographic Online, *available at* http://www.nationalgeographic.com/eye/deforestation/effect.html.
[7] National Geographic Society website entry on "Deforestation" online at: http://environment.nationalgeographic.com/environment/global-warming/deforestation-overview/.
[8] Susan S. Lang, "Slow, insidious soil erosion threatens human health and welfare as well as the environment, Cornell study asserts, *Cornell Chronicle*, September 27, 2015.
[9] Mary Sue Marty, Edward W. Carney, and Justin Craig Rowlands, "Endocrine Disruption: Historical Perspectives and It's Impact on the Future of Toxicology Testing," *Toxicological Sciences*, Volume 120, Issue supp. 1, October 2010, pp. S93-S108.
[10] Robert Gifford, "The Dragons of Inaction," *American Psychologist*, Vol. 66 No. 4, May-June 2011, pp. 290-302.
[11] Daniel Gilbert, "Global Warming and Psychology," speech at Harvard Thinks Big 2010, May 21, 2010. Video available online at https://vimeo.com/10324258.
[12] H.T. Ghashghael, C.C. Hilgetag, and H. Barbas, "Sequence of information processing on emotions based on anatomic dialogue between prefrontal cortex and amygdala, *Neuroimage*, Vol. 34, No. 3, February 1, 2007, pp. 905-923.
[13] George Marshall, "Why our brains are wired to ignore climate change and what to do about it," *The Guardian*, September 23, 2014.
[14] These and many other cognitive biases are described in Daniel Kahneman, *Thinking Fast and Slow*. New York: Farrar, Straus and Giroux, 2011.
[15] Dan M. Kahan, Cultural Cognition and Public Policy," (2006). *Faculty Scholarship Series, Paper 103*. Cultural Cognition Project, Yale Law School, available online at http://digitalcommons.law.yale.edu/cgi/viewcontent.cgi?article=1102&context=fss_papers.
[16] Stanley Cohen, *States of Denial*. Cambridge, UK: Polity Press, 2001.
[17] J.M. Darley & B. Latane, "Bistander intervention in emergencies: diffusion of responsibility," *Journal of Personality and Social Psychology*," Vol. 8, 1968, pp. 377-383.
[18] See, for example, "What makes a Story Newsworthy?" at MediaCollege.com available online at http://www.mediacollege.com/journalism/news/newsworthy.html and "What Makes Something Newsworthy?" online at http://journalism.about.com/reporting/a/newsworthy.htm.
[19] Anthony Downs, "Up and down with ecology—the issue-attention cycle," *Public Interest*, 1972, No. 28, pp. 38-50.
[20] Jessica Maserik and David Rejeski, *A Guide for Communicating Synthetic Biology*. Washington DC: Woodrow Wilson Center, September 2014.
[21] Quoted from Diogo Veríssimo in the article "Start Where Your Audience Is, Not Where You Want Them To Be' posted on the *Marine Ecosystem and Management* website, February 2016, available online at https://meam.openchannels.org/news/meam/start-where-your-audience-not-where-you-want-them-be-what-ebm-and-msp-practitioners-can.

[22] Nisbet, M., & Scheufele, D. (2007). The future of public engagement. *The Scientist*, 21(10), 38-44.
[23] See comments by Nicole Lampe in "Start Where Your Audience Is, Not Where You Want Them To Be, *op.cit.*
[24] *A Guide for Communicating Synthetic Biology, op. cit.,* p. 18.
[25] See comments by Kristian Teleki in "Start Where Your Audience Is, Not Where You Want Them To Be, *op.cit.*
[26] Elena M. Bergman et. al, "Bright spots: seeds of a goof Anthropocene," *Frontiers in Ecology and the Environment*, October 2016.
[27] See "Overfishing: a one minute introduction" online at http://overfishing.org/pages/Overfishing_in_one_minute.php?w=pages.
[28] See the Wikipedia description of Marine Protected Areas online at: https://en.wikipedia.org/wiki/Marine_protected_area.
[29] See the Global Fishing Watch website at: http://globalfishingwatch.org.
[30] See Robert Olson and David Rejeski, eds., *Environmentalism and the Technologies of Tomorrow*. Washington DC: Island Press, 2005, pp. 1-7.
[31] NAPA. *Bringing Strategic Foresight to Bear on Policy Planning and Management,* Washington, DC: National Academy of Public Administration, 2015, http://napat16.org/t16-panels/bringing-strategic-foresight-to-bear-in-program-planning-and-management.html.
[32] The most recent NIC Global Trends Report is available at: https://www.dni.gov/index.php/global-trends-home.
[33] See the video and a description at NASA's website at: http://www.nasa.gov/content/goddard/nasa-satellite-reveals-how-much-saharan-dust-feeds-amazon-s-plants.
[34] David Rejeski, Heather Chaplin & Robert Olson, *Addressing Complexity With Playable Models*. Washington DC: Science and Technology Innovation Program, Woodrow Wilson International Center for Scholars, September 2015.
[35] Budget Hero is described in detail on the website of the Woodrow Wilson International Center for Scholars at http://wilsoncenter.org/budget-hero. The Fiscal Ship, developed by the Wilson Center and the Hutchins Center on Fiscal and Monetary Policy at the Brookings Institution is available on-line at www.fiscalship.org.
[36] European Commission, Future Brief: Identifying Emerging Risks for Environmental Policies, Brussels: European Commission, Issue 13, March 2016.
[37] A. Bowser A, L. Shanley, *New visions in citizen science*. Case Study Ser. 3, Woodrow Wilson International Center for Scholars, Washington, DC, 2013, available online at http://www.wilsoncenter.org/sites/default/files/NewVisionsInCitizenScience.pdf.
[38] See a description at http://forestwatchers.net.
[39] See the project's website at http://www.globalforestwatch.org.
[40] See a description on the IIASA website at http://www.iiasa.ac.at/web/home/about/news/151029-picture-pile.html.
[41] See EPA's website at https://www.epa.gov/citizen-science.
[42] See Project Budburst's website at http://budburst.org.
[43] See, for example, EPA's Air Sensor Toolbox for Citizen Scientists, Researchers, and Developers online at https://www.epa.gov/air-sensor-toolbox.
[44] For example, see OECD, *Environment at a Glance 2015: OECD Indicators*, available online at http://www.oecd.org/env/environment-at-a-glance-19964064.htm.
[45] For a full description of the Chesapeake Bay Report Card, see the online site: http://ecoreportcard.org/report-cards/chesapeake-bay/.
[46] Council on Foreign Relations, *Climate Change and National Security*, Council Special Report No. 32, November 2007, 40 pp.
[47] See https://www.dni.gov/index.php/about/organization/national-intelligence-council-nic-publications/the-impact-of-climate-change-to-2030-commissioned-research-and-conference-reports.

[48] Edward W. Maibach et al, "Reframing Climate Change as a Public Health Issue: An exploratory study of public relations," *BMC Public Health*, June 2010, available online at http://bmcpublichealth.biomedcentral.com/articles/10.1186/1471-2458-10-299.
[49] David Wigder, "The Untapped Potential of Reframing Climate Change Around Water," *GreenBiz,* December 12, 2011, available online at https://www.greenbiz.com/blog/2011/12/04/untapped-potential-reframing-climate-change-around-water.
[50] Martin Luther King Jr., *Strength to Love*, Paperback Deluxe Edition, Fortress Press, 2010. Coretta Scott King has written, "If there is one book Martin Luther King, Jr. has written that people consistently tell me has changed their lives, it is *Strength to Love*."
[51] Frank, A. et al. 2012. "Security in the Age of Systemic Risks: Strategies, Tactics and Options for Dealing with Femtorisks and Beyond," Laxenburg, Austria: International Institute for Applied Systems Analysis, Interim Report IR-12-010.
[52] Weick, K. & Sutcliffe, K. Managing the Unexpected: Assuring High Performance in an Age of Complexity, San Francisco, CA: Jossey-Bass, 2001.



ENVIRONMENTAL LAW • INSTITUTE®

Institute for Alternative Futures