

Perspectives

1998 Annual Meeting Plenary Session: Assessing and Managing Risks in a Democratic Society

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The theme of one of the plenary sessions held at the 1998 annual meeting of the Society for Risk Analysis, "Assessing and Managing Risks in a Democratic Society," was chosen to reflect the current debate about the best ways to integrate social, political, economic, and technical issues into fair risk management decisions. In the papers presented here, the three plenary speakers provide their perspectives on how environmental risk management decision making is—or should be— informed by democratic processes.

KEY WORDS: Risk perception; relative risk; public health; risk management priorities; democracy; environmental risk; natural resources; Hudson River; public trust doctrine; markets; financial risk

INTRODUCTION

There has been a movement over the last several years toward more inclusive environmental health risk management decision-making processes. The National Academy of Sciences report, *Understanding Risk*, suggested that in a democratic society, risk management decisions should be the outcome of an analytic-deliberative process. Such a process "must have an appropriately diverse participation or representation of the spectrum of interested and affected parties, of decision-makers, and of specialists in risk analysis, at each step."⁽¹⁾ The Commission on Risk Assessment and Risk Management proposed a "Framework for Environmental Health Risk Management" that put stakeholders in the center of the framework. According to the commission, a good risk management deci-

sion "emerges from a decision-making process that elicits the views of those affected by the decision, so that differing technical assessments, public values, knowledge, and perceptions are considered."⁽²⁾ Federal agencies such as the Department of Energy and the Environmental Protection Agency (EPA) have embraced increased stakeholder involvement in an effort to make their environmental regulatory and risk management activities more democratically responsive. State governments increasingly use stakeholder-based comparative risk exercises to help set risk management and budgetary priorities. As Yosie and Herbst⁽³⁾ have pointed out:

The increased use of stakeholder processes over the past decade represents a societal interest in more interactive forms of decisionmaking. Rather than a transitory phenomenon, this development reflects a culmination of a series of environmental, political, societal and technological developments that have begun to yield significant changes in the methods of making environmental decisions.

At first blush, the movement toward stakeholder involvement in risk management decision making reflects the best of our democratic society in action. Many believe that stakeholder involvement leads to better, more efficient, and more accepted decisions

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about managing risks, in addition to promoting social trust and public confidence. At the same time, however, there is a feeling that involving the public in decision making threatens the scientific basis of risk management by politicizing it. Studies showing that nonscientists rank the severity of risks approximately inversely to rankings by scientists have led to concerns about misplaced risk management priorities. Concerns are increasing about the need to enhance the importance of the role of science in decision making, resulting in calls by our legislators and by the scientific community for regulatory agencies to rely on the "best available science." Strengthening the scientific basis of decision making by reducing scientific uncertainty and then using that science in risk-based decisions are important goals. But how do we reconcile good science and public values? Do we have to reconcile good science and public values? And if so, why are they different in the first place? Is this really just another skirmish in the age-old battle between empirical science and anti-empirical ideology?

Those are the issues the three plenary speakers addressed at the meeting. In the papers that follow, John Graham takes a technocratic approach, arguing for more science in risk management decision making and priority setting. He believes that yielding to public participation at the expense of science and risk

analysis will lead to less public health and environmental protection. Robert Kennedy, Jr. describes his work with the Hudson Riverkeeper and argues that the public trust doctrine, which is a basis of the U.S. Constitution, is also the basis of the environmental movement. In his view, the environmental movement gave the United States true democracy for the first time. Finally, Jason Shogren examines how a market-based risk management strategy combines—or replaces—democratic and technocratic approaches by creating new rules to address the failings of existing markets. He argues that markets have powerful democratizing effects on risk management decisions because they are, by definition, truly stakeholder involving.

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Making Sense of Risk

John D. Graham

In preparing my remarks today, I have engaged in an extensive program of scientific research. It did not entail any field measurements of contaminants or any rodent tests in the lab but I have examined diligently the headlines of *USA Today*. I'd like to share with you what the American people will learn by consulting this most authoritative publication on the subject of risk:

- The possibility that children will develop leukemia from living near power lines.
- The possibility that women will develop breast cancer from ingesting the pesticide residues on fruits and vegetables.
- The possibility that men are at risk of heart attack from breathing the fine particles in outdoor air—that research from the Harvard School of Public Health.

- The possibility that short people and the elderly are at risk of injury from the air bags installed in automobiles.

What are the American people to make of this barrage of headlines on the subject of risk in their daily lives? Which of these risks are real? Which of these risks are plausibly true, meaning that reasonable people, upon a careful review of the evidence, would take precautionary action to protect themselves and their families? Which of these claims are really hypotheses, the kinds of things that scientists at universities are entitled—indeed, encouraged—to study, but maybe shouldn't be discussed with the general public until we have more evidence about them? And which of these scares are really phantom hazards, alleged claims without any evidence, made by a plaintiff's attorney looking for business or a journalist looking for fame?

RELATIVE RISK AND PERCEPTUAL BIAS

We know as risk assessors that what drives the mass media coverage about risk is not relative risk but the prospect of commercial fortunes. Reporters cover risk on the basis of rarity, novelty, commercial viability, and drama more than by concerns about relative risk.

The implications have been well documented. Scientists at the U.S. Centers for Disease Control counted the number of words in print media stories about various hazards and compared that count to the number of people who die from those various hazards. What they found are “undercovered” risks: tobacco use, stroke, and heart disease.⁽¹⁾ And then you have the “overcovered” risks: illicit drugs, motor vehicles, toxic agents, and homicide. In the middle are alcohol, firearms, diet, sex, and suicide.

What do ordinary citizens make of this type of information? How do we anticipate that they will respond to this information?

There are scholars who have looked at these questions. At the risk of simplifying a rich and complex literature, let me suggest that people have difficulty in dealing with this type of information.^(2,3)

On the one hand, we suffer from “optimism bias.”⁽⁴⁾ This is the attitude of “Yes, there are a lot of hazards out there, but it won’t happen to me or my family.” We find this in surveys of drivers, with 80 percent of Americans saying that “I am more competent than the typical driver.” Math suggests that it is difficult for all of us to be more competent than the typical driver. Somebody has got to be on the other side of the distribution!

The same bias has been found with regard to lifestyle hazards encountered in people’s daily lives. Psychologists argue that this attitude is not entirely harmful. It reduces depression. It protects the self-esteem of people who hold this attitude. But in the field of public health we know that it is precisely this attitude that discourages people from taking preventive steps to reduce their risk of mortality and morbidity from lifestyle causes.

The same people in our culture roaming around with this optimism bias also suffer from what we might call “outrage bias.” This is the attitude of, “Gee, this technology might be dangerous! Let’s get rid of it.” This is the “better-safe-than-sorry” attitude. Examples are public skepticism and fear of nuclear power, man-made chemicals, agricultural pesticides, and biotechnology.

Better-safe-than-sorry attitudes are exacerbated

when dangers are salient to ordinary people. “I saw the movie, *China Syndrome*. I can imagine these terrible things that could happen.” The risks are imaginable but seem beyond individual control. “I have never touched a nuclear power plant. I touch Oreo cookies all the time. They don’t seem to cause any problem for me.” This attitude of outrage bias does have certain useful features. It cultivates citizen activist groups as they tap into people’s fears and persuade them to pay membership dues and contributions to groups who will work to protect them from the evil dangers of a technological society. However, this same attitude cultivates a misallocation of resources, focusing our attention on relatively trivial dangers while the big killers remain unaddressed.

RISK MISPERCEPTION AND MISMANAGEMENT

We live in a society where the American people suffer from a lot of perception of risk, but also misperception of risk. Let me give you some broad survey evidence that suggests that this may be true.

Thinking about the *actual* amount of risk to health and safety, would you say that people are subject to more risk today, less risk today, or about the same amount of risk today as they were 30 years ago? When the survey is asked every year to thousands of Americans, we elicit the same responses: 75 percent of Americans sense more danger in their lives today than 30 years ago.⁽⁵⁾

Perhaps, on some global scale, with population explosion, the risk of global warming, and threats to biodiversity, there’s an element of truth to this perception. I’m not authoritative on those subjects. But in the ordinary world that I work in, health dangers to parents and their children, we have absolutely no basis to support this perception. If you look at the most rudimentary indicator of health risk in this country, the *crude mortality rate* (the number of people who die in a year divided by the number of people alive at the start of a year), it is roughly flat since World War II. If you adjust for the aging of our population and use the more appropriate age-adjusted death rate, you observe the steady and sustained progress we’ve been making in reducing overall mortality risk in this country.

A more frustrating example of this misperception is found in the following: Which one do you think is the most serious in this country today in terms of causing health problems for people? Is it things in the environment? Is it people’s personal habits? Or are

both about equally serious? The result we obtain from this kind of question is a random assignment of responses to the three possible answers because it's a multiple-choice question and people don't know the correct answer! That represents a tremendous failure of risk communication and of public health communication. We can count on one hand the major causes of premature sickness and death in this country. They are: smoking, abuse of alcohol, lack of physical exercise, too many calories in the diet, and teenagers! These five factors and the lifestyles they represent account for the majority of premature death and illness in this country.⁽⁶⁾

What are the implications of living in such a society? We are investing huge resources in this country on relatively speculative ways of protecting our health. For example, let's talk about cancer prevention from environmental protection. I've taken our database from the Harvard Center for Risk Analysis (HRCA) on occupational and environmental investments in cancer prevention.⁽⁷⁾ I've calculated cost-effectiveness ratios using the same basic approach that we do in clinical medicine and in health economics. The results are—if you believe EPA's estimates on number of cancers prevented and EPA's cost estimates—startling. We're not talking about thousands or hundreds of thousands of dollars. We're talking about millions of dollars for each year of life saved! We are a wealthy country, but this is a very extravagant investment.

Perhaps there are rationales for these investment disparities. Maybe there are ecological benefits to these EPA rules. Maybe these are involuntary risks that deserve a premium expenditure. But maybe the public is misperceiving the risk, cost, and benefit, and maybe that also has a role in these problems of resource allocation. When we look on the horizon, we see all kinds of emerging issues: global warming, electric and magnetic fields, fine particles in the air, endocrine-disrupting chemicals, and multiple-chemical sensitivity. We have enormous opportunities to squander oodles of money on these speculative risks if we don't straighten out our collective thinking.⁽⁸⁾

RISK ANALYSIS AND COMMUNICATION

We, as members of the Society for Risk Analysis, should not be bashful about advocating a systematic risk-analysis framework for how we deal with these problems of misperception. And what do I mean by risk analysis? I don't mean something so complicated that nobody can understand it. We have an obligation

to convey on a regular basis comprehensible information to ordinary people in the family rooms and kitchens. What are some of the elements of that?

Number one, we need to judge these hazard claims not by the weight of the headlines, but by the weight of the scientific evidence, and convey that to ordinary people in a way they can understand. At HCRA, we're working on a very simple scale, 0 to 10.⁽⁸⁾ How confident are you that this hazard exists in the first place, let alone its magnitude or probability? Let's say that listening to relaxing music is a 0 on this scale (meaning complete confidence that the hazard does *not* exist), since I have not heard any headlines about that killing people yet. And let's say a 10 goes for heavy smoking of cigarettes; we can all agree (I hope) that we have confidence that smoking is dangerous. If you're in the middle of the scale, you're just not sure, or you just have no opinion. We worked on this simple scale with a variety of alleged hazards. We've done it with scientists as well as lay people. The scientists were a random sample of members of the Institute of Medicine and fellows of the Society for Risk Analysis.

What we find is that a majority of scientists are confident that electric and magnetic fields from power lines are not a hazard, whereas laypeople are very confused and run all across the spectrum of answers. Even for the scientists there are 10 percent who are still pretty confident that electric and magnetic fields pose a danger to ordinary people. I say that may be enough scientific support to keep a significant federal research program going for another 30 years!

How about global warming from carbon dioxide pollution? This one is intriguing because we find scientific opinion and lay opinion running basically parallel in terms of overall perception. There's probably something there, but a minority of experts and scientists are skeptical about these claims.

How about radiation from medical X rays? This is a very unusual one. This is a case where scientists are more confident than laypeople that there *is* a hazard. And we find in our surveys that the public draws no distinction between nonionizing radiation and ionizing radiation. And why should they if they don't have the background that we in the Society for Risk Analysis have?

Two, we need to quantify risks and, I would like to emphasize, provide perspective. We cannot provide the kind of information that we need here without providing some contextual understanding.

We all know that there is a trend in this country to conquer all the cancer risks in our lives by adhering

to the holy number: one chance in a million. We are forcing all the man-made cancer risks below this particular level. How big is this risk?

I like the work of Bernie Goldstein and his colleagues at Rutgers, because it provides context.⁽⁹⁾ A baby born today at current mortality rates has not one chance in a million, but four chances in a million of ultimately being struck and killed on the ground by a crashing airplane. It is an instructive example because it is a technologically induced risk that is involuntary to the people who suffer it. Yet no one is suggesting that we should ground these airplanes, without regard to the benefits of airline travel, if these companies can't meet this one-chance-in-a-million standard. Indeed, no one is saying that the Society for Risk Analysis should be held negligent because this meeting has not been held underground in order to provide an extra margin of protection!

And think more about it. This four chances in a million is an average figure. People who live on flight paths or live near airports, these are the maximally exposed individuals! And they face much greater than four chances in a million, yet still nobody insists that we ought to ground all those airplanes.

Third point. We need to rank risks in order of priority: big risks before little risks, serious risks before trivial risks. At HCRA we're doing this with the American people. We're asking them, Which item kills more people in the United States each year? Is it traffic crashes or is it bullets from handguns? We find in this case a majority of Americans get the right answer. The correct answer is traffic crashes, and a majority of respondents were correct.

How about a harder one? Which item kills more people in the United States each year: air pollution outdoors or air pollution indoors? If you believe the U.S. Congress, the correct answer is air pollution outdoors. In the last 10 years they've passed a massive amendment to the Clean Air Act, running to 800 pages, but they have done virtually nothing on indoor air pollution. But most air pollutants have higher concentrations indoors than outdoors. Moreover, most people spend more of their time indoors than outdoors. It doesn't take rocket science to tell you that air pollution indoors kills more people every year than air pollution outdoors.

Fourth point. We need a way to consider countervailing risks as well as target risks. For example, we have 60 million vehicles on the road with passenger-side air bags. We've tested them very diligently to make sure that they protect 170-pound, unbelted males in 30-mile-per-hour crashes. But what's hap-

pening to children? What's happening to the elderly? What's happening to short people? We're not so sure. For each 9 or 10 lives saved by the air bag on the passenger side, a child under the age of 10 is killed. These calculations were not even attempted before the regulation was adopted, but now, after the fact, we are learning a sobering story. The good news is on the driver side, where we're saving 75 lives from the driver's-side air bag compared to every one life that we're losing.⁽¹⁰⁾

CONCLUSION: REORDERING OUR PRIORITIES

What are the implications of all this? We have a tremendous opportunity (not only in this country but around the world) to save more lives and to do more for the environment simply by reallocating priorities from little killers to big killers. For example, one of my doctoral students, Dr. Tammy Tengs, estimated (based on a sample of just 200 policies) that we could save 60,000 more lives per year in this country than we're currently saving, with no increase in costs to taxpayers or the private sector, simply by the reallocation of resources to more cost-effective investments.⁽¹¹⁾

The same findings have been replicated by Japanese scientists, and you'll see the same pattern in Sweden: huge disparities in the kinds of spending we're doing.^(12,13) This is a worldwide problem, and I submit to you risk analysis may offer some of the solution.

Of course, saving lives may not be the most important thing in life. There are a lot of other things, like the common cold, arthritis, and quality of life. All of those need to be weighed in more sophisticated cost-effectiveness analyses. We recognize that our cost-effectiveness framework is currently simplistic. We are developing more sophisticated health metrics (e.g., quality-adjusted life years saved) to account for morbidity and quality-of-life impacts, but then we will have the real hard problem of combining health and ecology into a single metric of effectiveness. I don't in any way claim that we are there at the present time.

I hope you get the not-so-subtle message. If we simply turn this whole problem of risk over to public participation and leave the risk assessors outside the door, in the long run we will refuse to save lives and refuse to protect the environment. Our ultimate goal here is something we all share: more protection of public health, more protection of the environment, at less cost.

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Risk, Democracy, and the Environment

Robert F. Kennedy, Jr.

The issues of environment and democracy are intertwined and inseparable. Environmental advocacy is really a struggle about how our government—a democracy—and the social structures that we create are going to allocate the resources of the land. Those resources include good health, a safe food supply, clean water, and fresh air. The concern is about how well we're going to implement true community control.

THE STORY OF THE RIVERKEEPER

I work for a group that's very community oriented, which was originally called the Hudson River Fishermen's Association and today is called Riverkeeper. It was started in 1966 by a coalition of commercial and recreational fishermen on the Hudson River. We have one of the oldest commercial fisheries in the United States on the Hudson. It's 350 years old. Many of the people that I represent come from families that have been fishing the river continuously since Dutch colonial times.

Crotonville is a blue-collar community on the Hudson where this movement started out. It's not the type of community that had public parks or swimming pools. The people who lived there were carpenters, factory workers, lathers. Half of them were com-

mercial fishermen. The people who lived there had no expectation they'd ever go see Yosemite, Yellowstone, the Everglades, or any of the other national parks. They didn't have the resources to take their families on that kind of vacation. For the people of Crotonville, the "environment" was their backyard. It was the fishing holes, the swimming holes, the beaches, the waters, and the wetlands of the Hudson River. It was their livelihood, their property values.

In 1966, a four-and-a-half-foot pipe belonging to Penn Central Railroad began spewing oil in the Croton-Harmon rail yards. That oil came up the Hudson to Croton on the tides. It blackened the beaches. It made the shad taste of diesel so that they couldn't be sold at the South Street Seaport. In response, the people in Crotonville came together in the only public building, the American Legion hall. Almost all the original founders of the Hudson River Fishermen's Association and board members were ex-marines, combat veterans from World War II and Korea. They weren't radicals. They weren't militants. They were people whose patriotism was rooted in the bedrock of this country. But that night they began talking about violence, because they were angry and frustrated, and because they had seen something they believed belonged to them being taken away: the fisheries of the Hudson River that their families had been depending on for centuries.

The people of Crotonville had tried going to the government agencies for help. They had been to the Corps of Engineers, the Conservation Department, and the Coast Guard, and asked for help shutting down the Penn Central pipe. Everybody agreed the pipe was illegal, but nobody would help them. They were shown the door on 50 separate occasions at the Corps of Engineers' office in New York City, which admitted finally that they just couldn't do that to "these kind" of "important" people, referring to the Penn Central Board of Directors.

So the people of Crotonville concluded that the government was in cahoots with the polluters and that if they wanted to reclaim the Hudson, they were going to have to confront the polluters directly. But in the middle of the discussion about blowing up things, the outdoor editor of *Sports Illustrated* magazine, Bob Boyle, stood up. Two years before, he had written an article about angling in the Hudson River, and in researching that article he had come across an ancient navigational statute called the 1888 Rivers and Harbors Act. That statute said that it was illegal to pollute any water body in the United States and that polluters had to pay a high penalty if they got caught. In addition, there was a bounty provision that said that anybody who turned in the polluter got to keep half the fine. The law had never been enforced, but it was still on the books and it was a good law.

The people of Crotonville concluded that they shouldn't be talking about breaking the law, they should be talking about enforcing it. And that night, the Hudson River Fishermen's Association, later the Riverkeeper, was born. Its goal was to track down and prosecute every polluter on the Hudson River.

Eighteen months later, the organization collected the first bounty in U.S. history under the Rivers and Harbors Act—\$2,000—against Penn Central Railroad. It was a huge amount of money in Crotonville at that time. The momentum it created led to going after Ciba-Geigy, Tuck Tape, Standard Brands, and the New York National Guard, for filling a wetland at Peekskill, in Westchester County, and for dumping toxic pollutants at Croton Point. In 1973, they collected the highest penalty in U.S. history against a corporate polluter, Anaconda Wire & Copper: \$200,000. They used the money to construct a boat that today patrols the Hudson. We now have four boats on the Hudson looking for polluters.

In 1983, the Riverkeeper hired a former commercial fisherman named John Cronin as the first full-time river keeper. I was hired a year later as a full-time prosecuting attorney. Since that time we have brought

over 150 successful legal actions against Hudson River polluters. We've forced polluters on the river to spend \$1 billion in remediation. And today the Hudson River, as a result of our work and the work of two other environmental groups on the river—Scenic Hudson and Clearwater—the river that was dead for 20-mile stretches during the 1960s is today the richest water body in the North Atlantic. It produces more pounds of fish per acre, more biomass per gallon, than any other water body in the Atlantic Ocean. It is the last major river system on the East Coast of North America that still has strong spawning stocks of all its historical species of migratory fish.

Because of its success on the river, the Riverkeeper movement has been mimicked on water bodies all over the country, from Cook Inlet in Alaska, Puget Sound, San Francisco Bay, San Diego Bay, Santa Monica Bay, to the Chattahoochee in Georgia and Casco Bay in Maine. Twenty-five river keepers are now operating and we have 106 applications from new keepers. Within 10 years we are going to have keepers on every major water body across America.

THE PHILOSOPHY OF OWNERSHIP

The philosophy that really made the river keeper system work was the philosophy of ownership. The people who lived in Crotonville believed that they "owned" the Hudson River. The New York State Constitution provides that the people of the state own the river. It's not owned by the governor, the legislature, the Conservation Department, or any corporation. It's owned by the people. Everybody has a right to use it, but nobody has a right to use it in a way that would diminish or injure its use and enjoyment by others.

This is ancient law that goes back to the dawn of law and of Western legal thought. The Code of Justinian in Roman law said the same thing. It was called the public trust doctrine and it said that those things that are not susceptible to private ownership—the air that we breathe, the running waters, the shorelines, the wetlands, the wandering animals, the migratory fish—they belong to all the people. If you were a citizen of Rome, whether rich or poor, noble or humble, you had right of access to the fish. You could go anywhere you wanted to and catch a fish and bring it home to your family to eat. Nobody could block your access and nobody else could control those fisheries.

The public trust doctrine disappeared during the Dark Ages. Roman law had broken down across Europe and local kings and feudal lords began reasserting

control over the public trust resources. In England, for example, King John said that the deer no longer belonged to the people, they belonged to the nobility. That is only one of the things that got him into trouble with Robin Hood. He also began erecting fences around the major rivers of England, the Thames and other fisheries, and selling fishery monopolies and navigational monopolies. Those actions sparked a public revolt. The public, led by the barons, rose up and beat him at the Battle of Runnymede, forcing him to sign the Magna Carta, which was the seminal act in the constitutional history of this country, the first acknowledgment of constitutional government.

And that is the progenitor of our Bill of Rights. It has all of our Bill of Rights in it from the U.S. Constitution, but it also has two additional chapters, one on free fisheries and the other one on free access to navigation. And those were recognized as not only constitutional, but natural law rights, God-given rights that no human being or institution could take away.

And those rights descended to the people of the United States during the American Revolution, and they're embodied in the constitutions of each of our states: that the people own the fisheries and they own the wandering animals and the water.

EROSION OF PUBLIC TRUST

In 1880, the public trust doctrine was recognized in every state, but it began to become eroded when the Industrial Revolution began. Both courts and legislatures, through corruption or simply recognizing the benefits that industry was bringing, began devising rationalizations eroding the public trust doctrine and giving more power to the barons of industry.

The same thing happened to our other traditional environmental law, which was called *nuisance law*, and which also comes from Roman law. The public trust doctrine protects public property, but nuisance law protects private property. It says that every property owner has a right to use his land as he wishes, but cannot use his land in a way that injures the use and enjoyment of his neighbor's land. In other words, you can't do anything on your property that's going to damage the community or that's going to damage the rights of your neighbor to use his own property.

So, in 1880, in every jurisdiction, the law was this: If you build a factory on your private property and if smoke from your factory gets into my house as much as one day a year, I have an absolute right to shut

down your factory. I can get an injunction from a court and the court has no choice but to shut down your factory, because it interfered with my property rights. But the same thing happened to nuisance law that had happened to the public trust doctrine. Subtle legal mechanisms were devised to give industry more power and erode nuisance doctrine.

In general, Americans were happy. We became the greatest industrial power on earth. Ultimately, we won World War II with our industrial strength and ingenuity and people trusted the industrialists and they trusted the scientists, and we were on our way finally to beating the bugs, to winning the war against the insect.

But in 1961, for the first time, people started looking around and recognizing that there was a cost to the deal that we'd made with industry. By eroding our ancient rights and allowing industry to take over, we lost something in the bargain, and the costs of what we lost were enormous.

The first person to articulate the extent of those costs was Rachel Carson. In 1961 her book *Silent Spring* taught Americans about concepts like "latency" and "bioaccumulation," and the connections between cancer risks and infertility and other long-term diseases that could result from our exposures to pesticides—something that industry denied and [therefore] mounted a billion dollar campaign to try to destroy her. But Americans saw it. We looked around and saw what was happening to this country.

A RESURGENCE OF ENVIRONMENTAL RIGHTS

In 1970, in reaction to the accumulation of insults, 20 million Americans came out on the street, the largest public demonstration in U.S. history. Ten percent of our population demanded that our political leadership return to Americans the ancient environmental rights that had been taken from them during the previous years.

The political system responded. Republicans and Democrats got together and passed an extraordinary body of 19 major federal environmental statutes over the next 10 years to protect our air, water, food supply, wetlands, endangered species, and so forth. Those laws essentially re-enacted the ancient doctrines of nuisance and public trust but they intended to do it with more precision. The laws acknowledged that we need industry, but that we also have an absolute right to a clean environment. Nobody has the right to pollute the water and nobody has the right to pollute the air. But we're going to give people permits

or licenses to pollute if they can demonstrate two things: that they're involved in a worthwhile activity that is going to benefit society as a whole and that they're not going to pollute in a way that's going to damage anybody.

In that way, those laws created the profession of most of the people in this room. Because that's what risk assessment is about. We developed concepts like "maximum contaminant levels" and "water quality standards" and we asked ourselves, How much can we breathe and how much of this can we take without causing cancer, without killing fish, without damaging wildlife? And that's where the science of risk assessment comes in: How much risk does society want if it justifies the destruction of an absolute right?

WHO'S IN CONTROL?

Democracy is measured by two things: how fairly we allocate natural wealth and how we make sure that all the people have equal access to it. A related issue is the extent to which communities are in control.

On Capitol Hill, the people who are promoting regulatory reform bills and property rights laws and the destruction of our federal environmental statutes are saying what we really ought to do now is return control to the states, because we want community control. But what they're really talking about is corporate control. In the Hudson Valley we remember the 1960's version of community control. The General Electric Company (GE) could come into town in Fort Edward, New York, and Glens Falls, New York, and say, "We're going to build you a spanking new factory. And we're going to bring you 1,500 new jobs. And we're going to raise your tax base. And all you have to do is waive your environmental law and let us dump our toxic PCBs into the Hudson River and persuade the state of New York to give us a permit to do the same thing. And if you don't do that, we're going to move to New Jersey." Because of that threat and based upon those promises, Glens Falls took the bait and two decades later General Electric left the Hudson Valley, closed the factory, fired the workers, and left behind a \$2 billion cleanup bill that nobody in the Hudson Valley can afford.

What the federal environmental laws were meant to do was to put an end to that type of corporate blackmail: to stop corporations from coming in and whipsawing one community in New York against another in New Jersey or one in California against another in Oregon, to remove or lower their environmental standards and race to the bottom by recruiting filthy industries in exchange for the promise of a

few years of pollution-based prosperity and ransoming their children's futures in the process.

The environment is about politics and about democracy. The environmental movement—those laws that we fashion on Capitol Hill and in our state legislatures—really gave us true democracy in this country for the first time. If you look at all the progressive social movements that have really democratized this nation, whether it's the women's movement, the civil rights movement, or the labor movement, there are none that have really democratized us in the way the environmental movement has. Because if somebody tries to build a landfill, an incinerator, or a highway in your backyard, you as an individual have the right to force them to do an environmental impact statement and disclose all of the costs and benefits to your community over the generations, to demand a permit hearing, to cross-examine witnesses, to directly examine witnesses, to have a written transcript of that sworn testimony, and to obtain from an administrative court a decision that is based upon a rational interpretation of the facts that have been proven in that transcript. And if you don't get that, you have the right to appeal to a higher court.

You have a right to know, through right-to-know laws and Freedom of Information Act requests, what government and industry are doing about the environment in your neighborhoods. And you have a right to sue. If you see a polluter in your neighborhood and government fails to prosecute them, you have a right to step into the shoes of the U.S. attorney and prosecute them, yourself, through the citizen-suits provisions that are now part of every major federal environmental law, even if it's the government that is polluting.

Nobody else in the world has those kind of rights, no other country. Those rights give people a stake in our democracy and allow people—even the most alienated and humble and vulnerable people in our culture—to say, "Wait a second. I have rights here and I can exercise those rights." I've seen the empowerment that those rights inculcate in neighborhoods that are totally alienated, when all of a sudden they discover that they have a right to turn back the incinerator that was going to be placed in the middle of their neighborhood. The environmental movement really democratized this country in an extraordinary way.

ECONOMIC IMPACT

A lot of people argue that the environmental movement has come at a great cost to our economy and that we have to choose now between economic

prosperity on the one hand and environmental protection on the other. But that is a false choice, because good environmental policy is identical to good economic policy if we measure our economy, as we should, based upon how it produces jobs and the dignity of those jobs over the generations. If, on the other hand, we want to do what many on Capitol Hill are now urging us to do, which is to treat the planet as if it were a business in liquidation and convert our natural resources to cash as quickly as possible to have a few years of pollution-based prosperity, we can generate an instantaneous cash flow and the illusion of a prosperous economy. But our children are going to pay for our joyride and they're going to pay for it with denuded landscapes and huge cleanup costs that they simply won't be able to afford.

Environmental injury is deficit spending. It's a way of loading on the backs of our children the costs of our own prosperity. Look at the nations that didn't invest in their environment on Earth Day in 1970 the way that we did. There are plenty of them out there.

Look at the former Soviet Union, where they didn't have environmental laws. Russia didn't have the NEPA [National Environmental Policy Act], which is the law that requires environmental impact statements, and because of that, the Aral Sea—the largest inland lake in the world, except for the Great Lakes—is now a desert. It's as if all of our Great Lakes dried up at once. They didn't have a clean water act, and because of that, the city of Isov in Russia—the richest fishery on Earth next to Chesapeake Bay—is now a biological wasteland. They didn't have nuclear regulatory review requirements, and because of that, one fifth of Byelorussia—a state as large as Arizona—is now permanently uninhabitable because of radiation contamination.

In Turkey they don't have a clean water act, and 300 species have disappeared from the Marmara Sea over the last 10 years; the Black Sea will be dead within 15.

In Thailand they don't have a clean air act, and

you can see people on any street in Bangkok wearing gas masks and particle masks. The *New York Times* recently reported that in Bangkok—a city larger than New York, with 10½ million people—the average child that reaches the age of 6 has permanently lost seven IQ points because of the density of lead contamination in the air, because they didn't have a clean air act that said you've got to get the lead out of the gasoline.

In China, another place where they don't have a clean air act, one of the growth industries in Beijing is oxygen bars, where people literally go to buy a breath of fresh air.

In Mexico City, where they don't have a clean air act, smog inversions kill tens of thousands of people every year and shut down their principal state industries, sometimes for weeks at a time. If you own a car in Mexico City, you can legally drive it only 3½ days a week.

In those nations and many, many, many others, environmental injury has matured into economic catastrophe. And that's what would have happened here if we hadn't passed those laws back in 1970, without knowing all the consequences and all of the risks of all of those environmental injuries, but just assuming that some of them did have risks and that we had to control them.

CONCLUSION

Ultimately, the reason we're protecting the environment is not for the sake of the fishes and the birds. It's for our sake, because nature enriches us. It enriches us economically. It's the basis of our economy and we ignore that at our peril. But it also enriches us culturally, spiritually, historically, recreationally, and aesthetically, and human beings have other appetites besides money. If we don't feed those, we're not going to grow up. We're not going to become the beings that we're supposed to be. We're not going to fulfill ourselves. We don't have the moral right to destroy things that we can't recreate, and to destroy the basis of the economy for future generations.

Markets to Master Health and Environmental Risk

Jason Shogren

We all use markets in our everyday life, some of us without knowing it. Others of us even champion their use. Most of us appreciate the choices and opportunities that markets provide to our fam-

ilies, and we embrace markets daily. Voluntary exchange regulated by competition is a big part of how we all live our lives. Most everyone likes choice.

MARKETS AS A RISK MANAGEMENT TOOL

Many scientists dedicated to reducing risk believe that markets are the most effective tool humans have "discovered" to organize and coordinate the diffuse kinds of information spread throughout society. Markets use prices to communicate both the laws of nature and the laws of man. Prices send signals to coordinate efficiently decentralized economic decisions. Markets succeed when prices accurately define the trade-offs we face, such that resources are allocated to their highest valued use in society.

But markets can fail, too. Society confronts unacceptable health and safety risks when a market price fails to communicate social desires and physical constraints accurately. Prices might misstate the economic value of a reduction in health risk from an environmental threat, or prices might not even exist to signal the value. Left alone, a market might produce too few or too many goods or services. A wedge is driven between what people want individually and what society wants as a collective.

But even when markets are a problem, they can be the cornerstone of the solution. Rather than turning to more government regulation or stakeholder-participation processes, society can adjust existing markets or create new markets to manage risk.

A market is a tool whose precision depends on how society defines the rules to regulate its behavior, such as property rights, liability, and information. People who are unhappy with the prices that a market produces need to see the connection between the signals sent and the underlying rules that we define. We can work together to change those rules; we should view markets as our slave, not our master.

The market as a "third way" to manage risk works to create new rules to address the failings of existing markets. Except in those cases in which government intervention is demonstrably superior to markets, market-based policy serves as a ready substitute for technocratic or stakeholder processes, which have their own set of successes and failures. For instance, stakeholder processes often involve only those who are directly affected. Those who are indirectly affected through nonmarket avenues are generally not represented. The processes do not register the external spillovers resulting from stakeholder wins or losses, which can be large.

Think about other kinds of real risks—financial risks, for instance—in which we are all much less willing to delegate decision-making authority to government or stakeholders. The fact that people

have been creating and using markets to manage risks constructively for the last 3 centuries should send a signal of their power. In fact, the market has a powerful democratizing effect on risk management decisions. Ask yourself, What system of decision making involves greater public participation than the market?

MANAGING FINANCIAL RISKS

The odds and consequences of financial risks are greater than for most health and environmental risks. The relative stakes per percentage risk are much larger for financial risks than for environmental risks, even though we do not think much about it. But we do not ask the government to regulate stock prices. Many people are asking why it is that we allow the government to manage our social security funds given the paltry rate of return on our investment. An equivalent percentage reduction in financial risk relative to environmental health risk would yield significantly more return in present-value terms even if we value a statistical life at \$5 million. In fact, more financial wealth, some of which will be invested in health, might be more cost-effective than a direct reduction in an environmental risk.

Insurance is a prime example of how we use markets to manage certain types of risk. Imagine driving a car without it; imagine allowing your teenage son to drive your car without it. Insurance works off the law of large numbers. Those markets pool together many identical and independent risks and spread the risk around the people in the market. Insurance can separate risks into distinct pools based on a person's lifestyle and can control how people behave when no one can watch them, through deductibles, coinsurance, and exclusions of coverage. Insurance markets allow a person to reallocate some of their wealth from good days when everything goes right to bad days when everything goes wrong.

Securities are another example of market risk reduction. Securities allow a person to reduce risk by slicing big risks into small pieces. This allows for diversification. Many people can hold a small part of many risks without substantial exposure to any one risk. People can also use securities to hedge their bets. Say, for example, a person fearing risk from natural disasters (e.g., hurricanes, earthquakes) can offset the risk by buying shares in companies that benefit from such disasters (e.g., construction companies).

Consider the role of markets in how we manage children's health risks, a current policy initiative at

the United States Environmental Protection Agency. Suppose society wants to reduce the risk that a child's life would suffer because his caregiver became ill from exposure to an environmental hazard. The caregiver may value the opportunities that a higher family income can provide for the child. One might be tempted to propose some regulatory action to ensure that income, time, and stress are maintained at presickness levels. But many people have already reduced this risk through the market. They buy disability, health, and life insurance so as to help maintain a child's life chances. While not perfect, these markets reveal, in part, what the caregiver is willing and able to pay to reduce the risk to his or her children.

ACTION VERSUS RHETORIC

Markets force people to make a distinction between rhetoric and action in the context of risk. We all have opinions. Markets help separate those opinions we are willing to back up with real resources from those we are not. The discipline provided by the market forces people to relate their choices to the choices of others and to the consequences the sum of these choices produce. This role is crucial in risk reduction. Ample evidence from laboratory markets suggests that the difference between stated and actual choices can be significant. People often overstate their real willingness to cooperate or to contribute to the public good when asked a hypothetical question. And in many contexts, understanding the gap between actions and intentions can make all the difference between whether a risk reduction project actually passes the benefit-cost test. Markets do not sustain cheap talk backed by either deep or shallow pockets.

Here is an example: Consider the evidence from laboratory markets designed to reveal the stated and actual benefits of using or avoiding irradiation to reduce the health risk from the parasite *Trichinella*. The U.S. Food and Drug Administration has approved irradiation of pork, which has been shown to reduce the viability of *Trichinella* organisms by over 99 percent. My colleagues and I designed several experiments to judge whether stated willingness to pay actually matches up with what people really paid. The evidence suggests they do not, and that this gap between intentions and actions might be context specific. This observation suggests that the stated benefits to use or to avoid food irradiation are exaggerated in surveys, and that it seems most worthwhile to pay attention to research using actual field trials in retail markets.

MANAGING ENVIRONMENTAL HEALTH RISKS

Whether markets will flourish as a tool to manage environmental and health risk needs to be considered over decades of time. Markets to trade pollution permits are a case in point. Conceived in the 1960s, tested in the 1970s and 1980s, and implemented in the 1990s, tradable pollution permits and rights are now discussed routinely. Emission markets work by assigning property rights to pollute. These rights create value to something that was otherwise a free good, for example, clean air or water. The most visible example is the acid rain trading program, which reduced sulfur dioxide emissions by 50 percent at one half to one third the cost of a command-and-control approach. Such success stories raise the costs to policy makers who neglect how effective markets can be at managing risk to society.

Even climate change policy has rallied around the "carbo" market, that is, the market for carbon emissions, as an integral part of the cost-effective risk reduction strategy. The United States has proposed creating an international market to trade carbon emissions. This carbo market would allow buyers the flexibility to find the lowest-cost carbon emissions from around the world. Estimates suggest that a perfectly functioning market would cut the costs of reaching the Kyoto targets by between 50 to 80 percent. The interesting twist here is the biggest advocates for carbon markets are noneconomists. In contrast, economists question whether the property rights regimes could be constructed such that the market would function as predicted.

The carbo market is supposed to help ease the costs of reducing risk through mitigation. But people also reduce risk privately through adaptation. Markets help facilitate these choices. People adapt through the market by investing in actions to reduce the probability that bad events occur, to reduce the severity of a bad event if it does occur, or both. These private self-protection and self-insurance markets affect how a person perceives the value of a collective project aimed at reducing risk that can be privately addressed. Again, markets matter for managing risk because human behavior generally, and economic parameters in particular, help determine the degree of risk.

A fundamental point emerges when we acknowledge that people already use the market to reduce risk, suggesting that economic behavior probably plays a bigger role in the technical assessment of risk

than many people think. If markets affect choice, and choice affects risk, then the traditional risk assessment–risk management bifurcation is open to challenge. This is because even if an environmental hazard applies equally to everyone, the actual risk might differ across people and situations, given their access to private markets.

Risk assessment is a function of both natural science and behavioral parameters, like relative wealth and prices. Risk assessment that does not incorporate such market information can be biased, overestimating risk to those who can adapt while underestimating the risks to those who cannot. Market actions and reactions to risk must be addressed head-on in risk assessment.

CONCLUSION

The *New York Times* reported sometime within the last year that for 5,000 years the best humans could do was to increase our life expectancy by 5 years. About 200 years ago, however, something changed, and since then Western culture has witnessed a 30-year increase in how long we might live. How can it be pure coincidence that around the same time, Adam Smith's classic work on the power of the market, *The Wealth of Nations*, was published? For 2 centuries scientists have noted that the market is one of

the best ways to organize diffuse information and to direct motivations in society. Markets avoid the risk that someone someday might decide to use a “democratic participation” stakeholder argument to wrestle control over our savings and pensions, which many people now seek to accomplish with respect to health and environmental risk.

I see the market as a process of discovery. Markets allow us to create more wealth, that in turn allows us to create more health. When one market fails, a new market can be constructed to manage a risk. Markets can make good risk policy better by allowing the flexibility to reduce risk cost-effectively. Rejecting market-based solutions to risk management requires critics to uncover a logical difference between financial risk and health and environmental risk—a difference so logical that a politician would be unsuccessful in arousing public support for treating them the same.

As my colleague Tom Crocker has said more than once, “There is no universally preferred system . . .” to reduce risk. I argue that markets have a leading role to play in how we choose to reduce risk and maintain social order. But we must remember that markets work for *us*, and not the other way around. Identifying when and where potent markets can be created or corrected to reduce risk is a major task for all of us, especially members of the Society for Risk Analysis.

Audience Questions and Answers

(Q) *Don Barnes, U.S. Environmental Protection Agency:* I would like to hear the panelists' views on the present economy. How far away is the present economy from what they think would be ideal?

(A) *Mr. Kennedy:* The answer to that question crystallizes the problem that I had listening to both the other speakers. I understand how the political process works and I'm trying to envision how the kinds of pure systems that the other speakers are advocating would work in reality. How do you get a system that actually is run by scientists?

We fought the tobacco industry for 40 years. For 40 years the tobacco industry was killing one out of every four of its customers who used its product as directed. And yet there was a whole cadre of tobacco scientists from the Tobacco Institute—the best scientists in their field and the most highly paid—who were saying that there's no scientific proof that tobacco's

bad for you. Everybody knew that it was bad for you but there were scientists out there who said that it wasn't.

Industry employs what we call “biostitutes” or professional confusionists, and oftentimes they're Nobel Prize winners. They're people who did good science at one point in their lives, and they're planted in some think tank down in Washington, D.C., and instead of doing real science they're out there publishing these glossy, very slick publications that can be slipped in a briefcase and read between the Capitol and National Airport. It's much easier for the press and the public to read these publications than to read a real scientific study that's thick and not written in lay terms. So how do you choose between opposing scientific views? The press is going to choose the easier one to read. These choices are ultimately made on the basis of politics.

If you look at all the natural resource issues that have driven the environmental movement in this country over the past 3 decades, they're all about subsidies involving water, grazing, mining, and timber, particularly in the western states. Political clout is used to escape the discipline of the free market. For example, if you're a farmer in the state of Idaho, you can get unlimited amounts of federal water. We own those streams, you and I. We bought them with the Louisiana Purchase. We built the dams, we built the irrigation systems and the canals. We get unlimited amounts of our federal water for 19¢ an acre-foot. But if we send that water to the city of Los Angeles and sell it for hydroelectric power, it's worth between \$300 and \$800 an acre-foot. So we're giving that farmer a minimum of a \$299 subsidy on every acre-foot he uses. Because he gets the resource for free, he uses it wastefully. He grows rice in the desert. He puts Louisiana rice farmers out of business. And he's sucked every river in Idaho dry. There hasn't been a salmon season in Idaho in 15 years.

If you're a rancher in the state of Idaho and you want to graze a cow and calf on my private land, you're going to pay me \$16 or \$18 a month. What if you have the political clout to get a federal lease on the federal land that you and I own? What do you pay? \$1.61 a month. So we're giving you a \$16.39 per month subsidy on every animal that you have, and because you get the resource for free, again you use it wastefully. You've turned millions of our acres into deserts from overgrazing. You put the Oklahoma cattlemen out of business because they don't have federal land.

We're not talking about the poor rural cowboy, the icon of American culture, that we're all trying to preserve. Seventy-five percent of the grazing land in Idaho is controlled by a tiny handful of families: the Simplatts, the Hewletts, the Packards, and David Russell of Santa Barbara, who alone controls a million acres. These are the richest people in America. These are the same people who financed this revolution on Capitol Hill and they have their indentured servants now in Washington, D.C., standing on the Capitol floor demanding capitalism for the poor and a free market for the poor. But at the same time they're fighting to preserve the system of socialism for the rich. You know, these welfare cowboys in the western states getting \$30 billion a year in federal subsidies and destruction of our property.

If you want to buy old-growth timber in this country, you've got to come to us, the federal taxpayer. You and I own it all. It was all cut on private

land in the 1980s. There are trees in the Tongas National Forest that have been growing there since Christ was walking the earth. There are 1,000-year-old spruce trees and cedars, 60 foot around at the base. Some of these trees have a free market value of \$50,000 apiece. What do we sell them for? \$1.89.

Half the Tongas was cut by Alaska Pulp and Paper, and those trees weren't even milled here. They're shipped over to Osaka Bay and stored on the shoreline or below the waterline for the next generation. And we spend—you and I—\$250 million every year to build logging roads so that these cut-and-run timber companies can get up there and cut the last of our trees.

The mining industry is the worst of all.

When GE dumped its PCBs into the Hudson River, it was avoiding one of the costs of bringing its product to market, which was the cost of properly disposing of a dangerous chemical. In avoiding that cost, GE was able to expand its profit margins. But the cost didn't disappear. It went into the fish, it made the people sick, it put the fishermen out of work, it dried up the barge traffic, took the land off the tax rolls. Those costs were passed on to the rest of us. In a true free market economy, those costs would have been reflected in the price of GE's product when it finally got to the marketplace. But by using chemical ingenuity and political clout, industries are able to escape the discipline of the free market. What we need are stronger environmental laws and stronger enforcement to stop them from doing that.

Dr. Shogren's claim that the race to the bottom doesn't exist is belied by the facts. If you look at what's happened in this country since 1994, there's been, on the state level, a 50 percent reduction in environmental enforcement. In the state of Virginia, 70 percent. Last year there was one polluter ticketed in the entire state of Virginia; Virginia is one of the most polluted states in the country. Federal environmental laws, although they're supposed to be applied evenly, are actually enforced through delegated state programs. States have now discovered that we can offer you a federal-free zone if we just tell industry that we're going to stop enforcing the law. And many of the states have done just that in order to attract industries.

(Q) *Lorna Zack, University of Canterbury, New Zealand:* A couple of you have reinforced the free market concept and I'd like you to explain how the free market takes into account future costs, future generations, and future uses.

(A) *Mr. Kennedy:* I don't think that the free market works everywhere. I think that it works in most cases, but I don't think it works on the commons. That's why the passenger pigeon disappeared. We need an endangered species act, because a lot of species have no value; they have no market value, no commercial value. But we have a moral obligation to preserve them anyway. Take, for example, the Pacific yew tree. It's a "trash" tree. It has no value. It was almost exterminated. And then people realized that there was an ingredient in the bark that put many breast cancer cases and other kinds of cancer into remission. But it was almost exterminated by the time people realized that.

How do you preserve species like that, that have no value? Through the Endangered Species Act, which is not a market-oriented act. It just sim-

ply says there is a "common" out there, there is something that everybody owns. Nobody has a right to destroy it. Everybody has a right to use it but nobody has a right to use it in a way that's going to diminish or injure its use and enjoyment by others. How do we protect those interests? We do it by regulation. And that's the vacuum you need regulation to fill when you're dealing with public trust assets or common assets.

The tragedy of the commons is that under a free market everybody is going to overuse the commons—because the costs fall on everybody but the benefits flow only to the users. So the free market does not work on a commons basis. It only works where there's ownership. In cases where you cannot have ownership, like endangered species, open oceans, shorelines, and wetlands, you have to have regulation.