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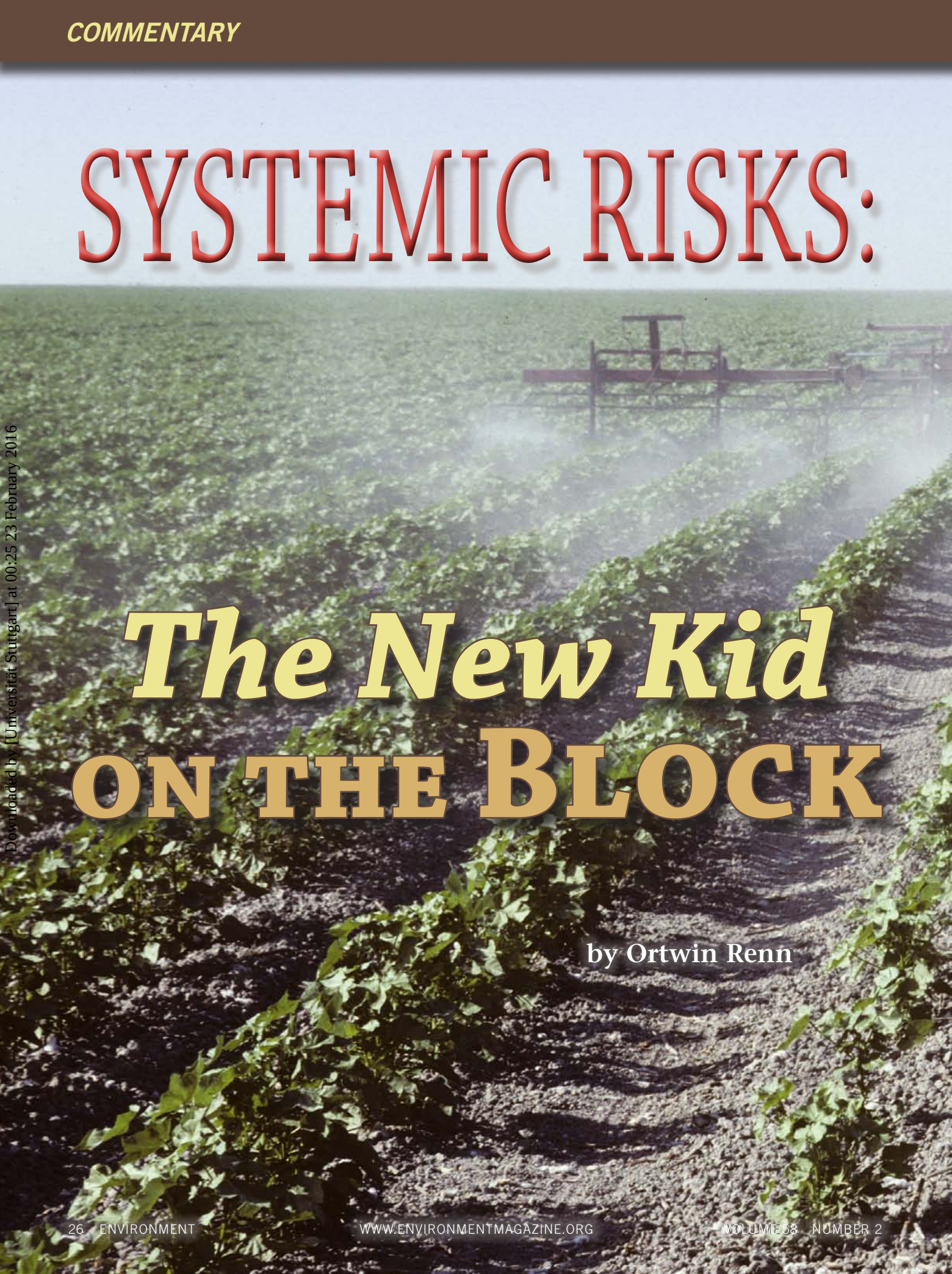
SYSTEMIC RISKS:



The New Kid ON THE BLOCK

by Ortwin Renn

Pesticide use has been very effectively regulated in OECD countries but still haunts many people in the developing world.

This is the fourth commentary in Environment Magazine*'s retrospective on "Our Hazardous Environment," following the first three commentaries published in the January/February issue of* Environment. *The original three articles discussed in the following and other commentaries are available at* www.environmentmagazine.org.

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New York—September 21, 2014: Woman carries a placard depicting 'One Planet, One People, One Future' and protests against climate change at the People's Climate March along 6th Avenue in Manhattan.

Europe 6,000 years ago: Three representatives of the *Homo sapiens* species are sitting outside their cave, talking. "We have perfectly clean water," says the first. "Yes," agrees the second, "we eat purely natural food and don't have stressful jobs." "That's true," muses the third, "and this all sounds idyllic, but we won't live more than 30 years." Today, on the other hand, average life expectancy in the United States is 78 years and in most parts of Europe and Japan even higher than 80. This extremely positive trend can largely be attributed to four factors: a healthy and balanced diet, medical and technological advances, relatively good welfare provision, and high standards of hygiene. These factors alone account for the fact that the risks to life and health have steadily declined for decades and continue to do so.[1]

Much of this success can be attributed to risk pioneers who have alerted society to the common task of assessing, evaluating, and managing risks in society. While Harriss, Hohenemser, and Kates (1978) provide a taxonomy for dealing with technological and environmental risks, Fischhoff, Hohenemser, Kasperson, and Kates (1978) demonstrate the need for more effective risk management based on a comparative review of hazards in modern life.[2,3] Bick and Kasperson (1978) draw our attention to natural hazards as well as environmental risks, which appeared to take the place of some of the major former health risks such as infections. All three papers have something in common: (i) They are based on a thorough analysis of historical trends of risk emergence and risk management practices, (ii) they give advice on how to address, regulate, and manage these risks, and (iii) they demonstrate the need for continuous risk awareness and safety culture.[4]

Their voice has been heard throughout the Organization for Economic Cooperation and Development (OECD) countries, but less in threshold and developing countries where conventional risks, including natural hazards, are still rampant and often badly managed. The plea to address technological and environmental risks in the United States, Europe, and Japan has been resonating with society and its governance. Let's take just one example from my home

country, Germany.[1] The latest statistics show that 26,000 out of every 100,000 Germans die of cancer. Cancer is therefore the most common cause of death for people in Germany under the age of 70 years. The immediate cause of this disease for 11,000 out of the 26,000 people who die of it is highly likely to be smoking or an unhealthy diet (mostly obesity). By contrast, the general medical opinion is that only 26 cases of cancer (with a confidence interval of roughly 0 to 120) can be attributed to residual pesticides or chemical preservatives in food. Some environmental organizations believe these figures are too low and reckon there are up to 240 such cases for every 100,000 people. Even this is still a vanishingly small number. And even more dramatic is the decrease of deaths attributed to environmental factors in OECD countries. Hohenemser et al. (1983) calculated a roughly 30% of premature death to all environmental causes.[5] Modern estimates range from 6 to 17% depending on assumptions and calculations modes.[6,8]

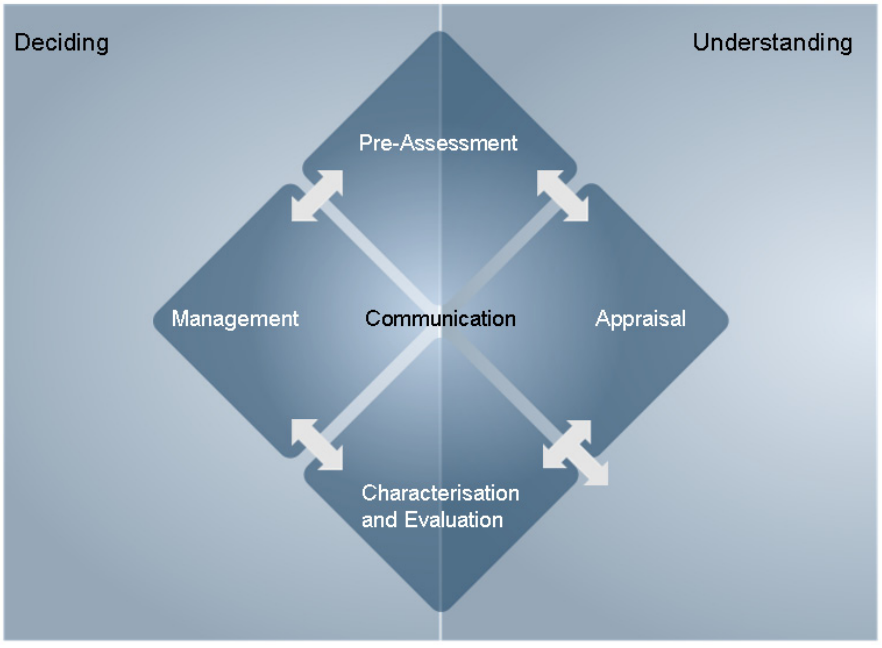
The Emergence of Systemic Risks

The history of the last four decades has been a success story in terms of conventional risk management. Traditional risks have obvious negative physical impacts. But they are bounded.[9] A fire, for example, may destroy a school, which could lead to the direct loss of the facility and to the interruption of the affected children's education. However, in an age when fires are prevented from consuming entire cities, the impact of almost any blaze is likely to be limited. When fire breaks out at a school, safety equipment, sprinklers, and routine fire drills (some of the basic tools of conventional risk management) are likely to be effective. With appropriate safeguards in place, the odds are minimal that lives will be lost, or even that anyone will suffer serious physical harm. What is more, the economic cost is almost certain to be limited by insurance claims and contingency budgets, while disaster planning probably means that the lives of teachers and students are disrupted for no more than a few days.

This success of conventional risk management is documented in many statistical data. Referring again to my home country Germany,[10] the number of fatal accidents at work decreased from almost 5,000 in 1960 to less than 500 in 2014; the number of traffic accidents decreased from 22,000 in 1972 to 3,700 in 2014; and the number of fatal heart attacks and strokes decreased from 109 cases per 100,000 to 62 in the time period between 1992 and 2002.[11,12] In addition, the number of chronic illnesses as well as fatal diseases from environmental pollution or accidents has steadily declined over the past three decades, since the time when these three classic articles reminded society of the unfinished business in risk reduction.

However, the picture becomes less favorable if we look at globally interconnected, nonlinear risks such as those posed, for example, by climate change or the global financial system and the closely related growing inequality between rich and poor. In order to take account of this situation, the OECD introduced the new category of "systemic risk."[13] A widely cited definition of a systemic risk was provided by Kaufman and Scott (2003).[14] While they defined systemic risks in the context of financial systems, their definition is robust enough to accommodate much broader systems, like the global climate: "Systemic risk refers to the risk or probability of breakdowns in an entire system, as opposed to breakdowns in individual parts or components, and is evidenced by co-movements (correlation) among most or all parts" (372). It is the totality of the threat, the probability that the entire system can collapse, that distinguishes systemic from other types of risk.

Systemic risks can be characterized by four major properties:[15] They are (1) global in nature, (2) highly interconnected and intertwined leading to complex causal structures, (3) nonlinear in the cause–effect relationships, and (4)



The risk governance framework of the International Risk Governance Council (IRGC) includes separate sections for pre-assessment (framing) and evaluation. It also places communication in the center of the activities.

stochastic in their effect structure. The main features of systemic risks include ripple effects beyond the domain in which the risks originally appear and the threat of a multiple breakdown of important or critical services to society.[16] The main problem is that it is often difficult to predict when a system will suffer a breakdown or collapse. Threats to the system, such as climate change, may be hidden in small incremental effects that provide no hint about when thresholds have been reached. Or a collapse may occur due to a domino effect where a small glitch is released that affects multiple elements within a system or even multiple systems in parallel, thereby amplifying the overall risk.[17]

Insidious systemic risks tend to be underestimated and do not attract the same amount of attention as catastrophic events that occur suddenly. There are three main sources of global hazards that we need to focus on: the growing extent of human intervention in nature (climate change, pollutant emissions, use of land and water); inadequate or ineffective control of central processes in the realms of business and politics (capital markets, corruption, capacity deficits); and adverse by-products of globalization and modernization (unequal living conditions, lack of security, loss of identity). Although most people are usually familiar with them, they do not get the same attention that the conventional hazards and risk have been given in the past. This can have disastrous consequences—and not only in financial markets.

Is there, for example, a link between the financial crisis of 2008 and the outbreak of the Ebola epidemic? What we can, at least, say is that this possibility cannot be ruled out.[18,19] This is because the lack of attractive alternative investments during the crisis caused speculation in foodstuffs to rise sharply, which boosted the prices of rice and corn in world markets. This in turn meant that the poorest countries in particular had to get into further debt in order to feed their populations. Their desperate financial plight forced many West African countries to suspend virtually all capital investment in health care and infrastructure projects—with devastating consequences, as we now know. This example clearly illustrates how today's systemic risks are totally impenetrable for any layperson who thinks in direct causal chains. Even experts have found it challenging to model systemic risk with any degree of accuracy and to use such models to make reliable recommendations on issues such as how to manage risk.

Another key characteristic that sets systemic risks apart from conventional risks is that their negative physical impacts (sometimes immediate and

The loss of biodiversity as a result of excessive land use is one of the systemic risks that need more attention.

obvious, but often subtle and latent) have the potential to trigger severe ripple effects outside of the domain where the risk is located.[13,20] When a systemic risk becomes a calamity, the resulting ripple effects can cause a dramatic sequence of secondary and tertiary spin-off impacts.[21] They may be felt in a wide range of seemingly divergent social systems, from the economy to the health system, inflicting harm and damage in domains far beyond their own. A commercial sector, for example, may suffer significant losses as a result of a systemic risk, as we witnessed in the financial crisis in the aftermath of the Lehman Brothers collapse. Even fairly healthy financial institutions were negatively affected, and in the end, taxpayers had to pay the bill for the reckless behavior of a few.

Another example is the bovine spongiform encephalopathy (BSE) debacle in the United Kingdom, which affected not only the farming industry but also the animal feed industry, the national economy, public health procedures, and politics.[22] People refused to eat British beef, regardless of the tangible evidence showing little danger to their health or safety.

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Managing Systemic Risks

Systemic risks pose specific challenges for risk assessment and risk management because they are not amenable to the reductionism of the standard risk assessment model. They require a more holistic approach to hazard identification, to risk assessment, and to risk management, because systemic risks are complex, stochastic, and nonlinear. This means that it is difficult to trace the connections between causes and effects, to understand the direct impacts of human actions against a background of random changes, and to start learning from simulation rather than from trial and error. Risk analysis for systemic risks must focus on interdependencies, ripple and spillover effects, and other nonlinear dynamics that initiate impacts that cascade between otherwise unrelated risk domains.[23] Governing systemic risks presents specific and unique challenges, challenges magnified by the reality that systemic risks vary considerably across and within systems; no two are exactly alike. While each one has similarities common to the definition of systemic, the characteristics of individual risks within a domain vary dramatically. Since the risks are inherently different, they require fundamentally different governance approaches.[13,24]

A critical component for the effective management of systemic risks is the simple realization that the risk manager requires a different set of decision-making tools because of the inherent

problems of systemic risks being complex, stochastic, and nonlinear. In practice, conventional approaches are not sufficient. One approach for addressing systemic risks is the risk governance framework proposed by the International Risk Governance Council (IRGC) in Geneva.[25,26] This framework provides guidance for the development of comprehensive assessment and management strategies to cope with systemic risk. The framework integrates scientific, economic, social, and cultural aspects and includes a disciplined scheme for the engagement of stakeholders. It introduces three decision-making strategies to fit with different types of risks. The strategies—probability-based, resilience-based, and discourse-based—correspond to the three problem characteristics of complexity, uncertainty, and political ambiguity. The framework incorporates different concepts to complement the classic decision-making steps such as selecting objectives, assessing and handling data, and finding the most appropriate procedure for balancing pros and cons.[27] A crucial element of the governance proposal is the integration into the regulatory framework of analytic-deliberative processes, a term introduced in the risk community by Stern and Fineberg of the U.S. National Research Council Committee and now widely adopted in the democratic governance of risks.[28,29]

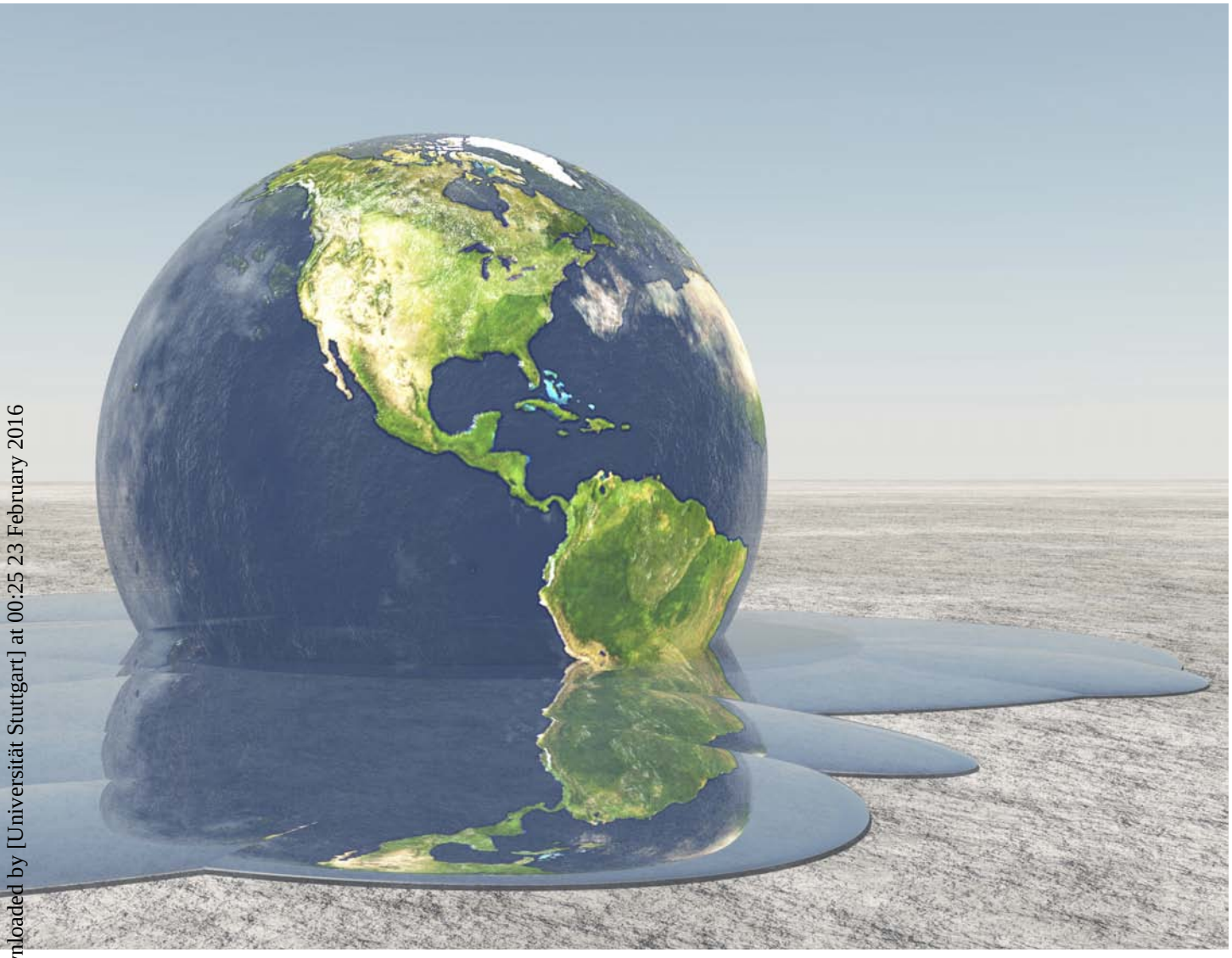
The robustness of the governance framework is consistently tested by an increasingly multicultural word. This adds yet an additional complexity to the governance of systemic risks, since significant cultural and political differences, as well as similarities, cloud the risk perception mechanisms and processes that prevail within cultures. The cloud thickens for cross-cultural, transboundary risks. These differences shape variations in risk perception. Individuals in divergent cultures may develop very different ideas about what is a risk, what is not, and what to do.[30] This culturally incubated shift in perceptions creates an important issue for the governance of such systemic risks that have no more respect for multicultural boundaries than they do for political, social, or economic ones.

Conclusions for Risk Management

What does this imply for our approach to risk? First, the three classic articles remind us that given enough political will, resources, and commitment, risks can be effectively reduced. This lesson has been learned in most OECD countries but is still far from being implemented in most other countries. The World Health Organization (WHO) still estimates that almost 7 million people die each year prematurely due to air pollution, around 60% of them in China and India.[7] Second, the challenge that the three articles raised with respect to risk management of conventional hazards need to be transferred to the new emerging systemic risks. These risks are global in nature, complex, stochastic, and nonlinear. They require cooperative management efforts of experts, the corporate sector, civil society, and regulators. Effective risk management must strike a balance between efficiency and resilience, and the solutions devised must be fair for the people affected. This means that we have to factor uncertainty more into the way we capture risk, and we must offer solutions that are effective even when unforeseen events occur. We need a form of risk management that demonstrably mitigates risk, is economical with the scarce resources available, helps to overcome unlikely but possible setbacks, and enables the resultant benefits and risks to be evenly shared.

Current societies are challenged by a number of pressing global systemic risks arising from global environmental change, in particular climate change. Responding adequately to global systemic risks is a challenge for our world society where national interests and different cultures conflict with efficient

responses. Governance of systemic risks requires strategies that address the complexity, scientific uncertainty, and sociopolitical ambiguity of its underlying relationships. However, national and international attempts to address systemic risks have decoupled risk anticipation from sustainable and resilient risk management processes and structures.[31] Furthermore, the modernization process facilitates the emergence of plural knowledge and value claims that leads to the request of multiple stakeholders to be part of the risk management process.[32] This often includes a power



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Systemic risks are global by nature. We cannot approach them by trial and error. We need to correct our policies before the major errors occur.

imbalance among stakeholders in decision making and communicative processes. Public participation has proven to be an important part and often key driver for successful and legitimate risk governance for advancing climate change policies.[29] The various actors of society and the public at large can be important in providing local knowledge and experiences, informing decision making, especially with regard to uncertainty and ambiguity, and securing legitimacy for managing risk. In the end, risk management and communication need to address the four characteristics of systemic risks and develop the appropriate instruments to deal with global, interconnected, stochastic, and nonlinear risks.

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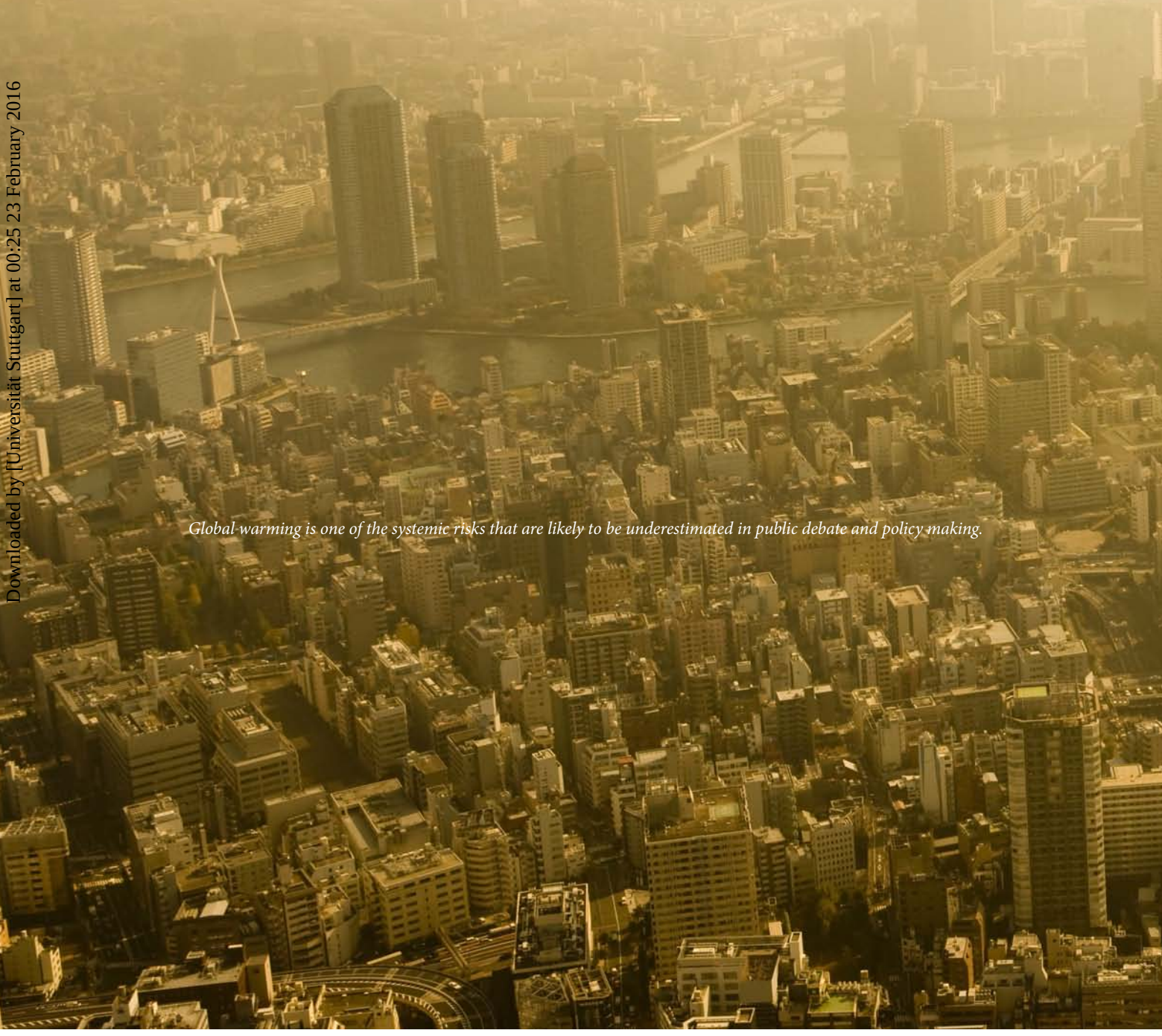

Global warming is one of the systemic risks that are likely to be underestimated in public debate and policy making.

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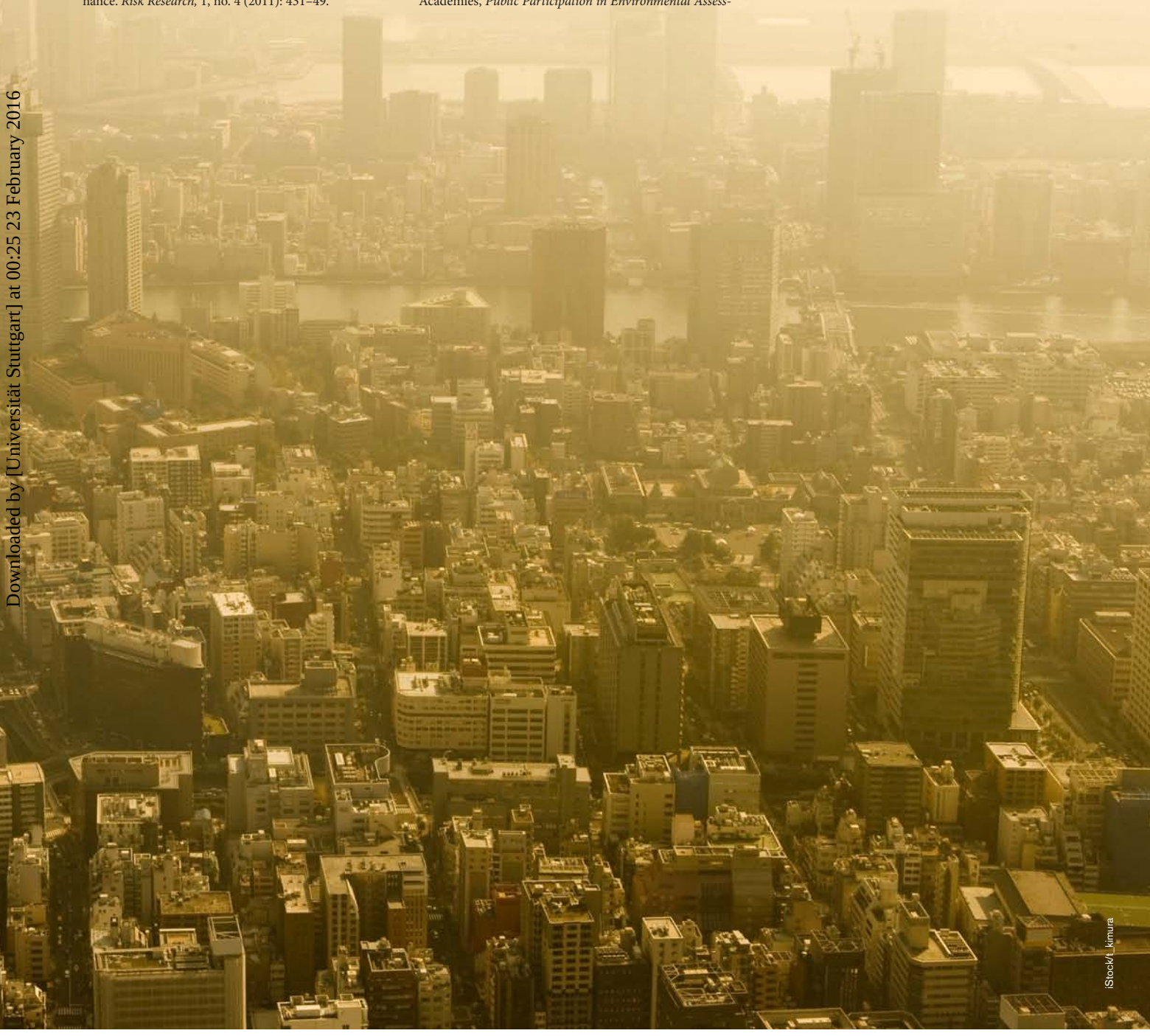

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