State of the World 2015

Confronting Hidden Threats *to* Sustainability

THE WORLDWATCH INSTITUTE

Advance Praise for
State of the World 2015: Confronting Hidden Threats to Sustainability

"The *State of the World* report has always been at the forefront of bringing new issues and new perspectives to wide public attention in the United States and abroad. Devastating findings abou our world have been matched with exciting opportunities for action. For thirty years, there has been nothing quite like it, and now comes another major contribution in the series. The 2015 volume once again explores new territory, including, I am happy to see, an examination of whether GDP growth, as we now experience it in places like the United States, brings more costs than benefits. Overall, an extremely important contribution."

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"As the world has evolved over the past three decades, so has the annual *State of the World* report. This edition offers an even more systemic analysis than past ones, integrating finance into its snapshot of ecological and societal trends on Planet Earth. Everyone who cares about th overarching issues shaping our future should pay attention, as the warning lights on our dashboard are glowing."

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State of the World 2015

Confronting Hidden Threats to Sustainability

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We add a special note of thanks to Jerre Hitz and Nancy Hitz, who are stepping down after eig years of distinguished service. Their collegial and generous approach to Board responsibilities help make Board operations smooth and productive, and each played important roles in setting th Institute's direction at critical junctures. We extend to them our deepest thanks for their dedicatio and service, along with sincere wishes for great success in the years ahead.

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For our thirty-second edition, the Institute welcomes submissions from a wide range of authors— all of whom contribute atop the many pressures of their own work. We are grateful to Katie Auth, Be Caldecott, Peter Daszak, Heather Exner-Pirot, François Gemenne, Nate Hagens, Tim Jackson, Willia B. Karesh, Elizabeth H. Loh, Catherine C. Machalaba, Robert Rapier, and Peter Victor for the generous contributions to the book. Seldom has the affirmation “we couldn’t have done it witho you” been so literally true.

State of the World is ably edited by Lisa Mastny, whose skill at converting the language of divers authors into clear and consistent prose makes the book accessible to a broad audience. Lisa is a nimb and highly organized manager who coordinates the work of dozens of authors and others to meet firm deadline. She is also consistently cheerful and exceedingly diplomatic, which makes th production process surprisingly painless. Lyle Rosbotham uses his exceptional design talents to tur printed words into engaging text and graphics in a beautiful layout. We are grateful to Lyle for h continued involvement in making the book as engaging as it is. We also thank Kate Mertes for he work in preparing the index.

Producing and printing *State of the World* is just the beginning of the project effor Communications Director Gaelle Gourmelon works to ensure that the book’s messages reach f beyond our Washington offices and offers key input to project design decisions. Director of Financ and Administration Barbara Fallin ensures that the trains run on time at Worldwatch, through he efficient management of daily operations. And Mary Redfern manages our relationships wi foundations and other institutional funders, helping to match Institute needs with funder opportunitie

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Units of measure throughout this book are metric unless common usage dictates otherwise.

The Seeds of Modern Threats

Michael Renner

On September 21, 2014, an estimated 400,000 people marched in New York City to demand th government leaders assembling in that city for a “climate summit” finally move from rhetoric action. It was the largest of more than 2,600 protest events worldwide. The marches were t culmination of decades of growing climate activism that got its start soon after Dr. James Hansen p climate change on the political map. On a fittingly sweltering day in June 1988, Hansen—then t director of NASA’s Goddard Institute for Space Studies—testified before the U.S. Senate’s Energ and Natural Resources Committee that global warming was not a natural phenomenon, but rather w caused by human activities that triggered a buildup of greenhouse gases in the atmosphere.[1]

Hansen was far from the first scientist to theorize about human-induced climate change. Suc studies go back as far as the late nineteenth century, but by the 1960s and 1970s, scientists started view the warming potential of gases like carbon dioxide as increasingly convincing. In February 197 the World Meteorological Organization (WMO) concluded in its “Declaration of the World Climat Conference” that “it appears plausible that an increased amount of carbon dioxide in the atmosphe can contribute to a gradual warming of the lower atmosphere. . . . It is possible that some effects on regional and global scale may be detectable before the end of this century and become significa before the middle of the next century.” By the 1980s, the pace of climate studies quickened, and t Intergovernmental Panel on Climate Change (IPCC) was set up in 1988 by the WMO and the Unit Nations Environment Programme (UNEP).[2]

It was Hansen, however, who conveyed an unmistakable sense of urgency, telling the assemble senators in 1988: “It’s time to stop waffling so much and say that the evidence is pretty strong that t greenhouse effect is here.” Yet his testimony marked merely the beginning of a protracted struggle t get governments, corporations, and society at large to understand that humanity’s own actions hav brought about a challenge unlike any other—and then to act on that understanding.[3]

Michael Renner is a senior researcher at the Worldwatch Institute and codirector of *State of the World 2015*.

NASA

James Hansen testifying in 1988.

Ben Powless

Hansen getting arrested at a civic protest in 2011.

During the past quarter century, much has indeed changed. From Hansen's early findings, clima modeling became ever more sophisticated, observational work multiplied, and scientific consens solidified. The world's governments came together in 1992 and set up the United Nations Framewo Convention on Climate Change, the starting shot for a process of annual "conferences of the partie (COPs) charged with negotiating a global climate treaty. Climate change, once the preserve of ve few specialists, has become a household word. The number of studies and reports on climate impac and possible solutions has mushroomed. By late 2013, the IPCC concluded that it "is extremely like that human influence has been the dominant cause of the observed warming since the mid-twentie century."[4]

However, lofty rhetoric has far outpaced action. Climate negotiations have failed to deliv anything close to the breakthrough agreement that the world desperately needs. Hansen's own sense increasing urgency moved him from scientific inquiry toward activism in recent years. He was eve arrested a few times at high-profile civic protests.

Strangely, we now find ourselves in an era of "sustaina*babble*"—marked by wildly proliferati claims of sustainability. Even as adjectives like "low-carbon," "climate-neutral," "environmental friendly," and "green" abound, there is a remarkable absence of meaningful tests for wheth particular governmental and corporate actions actually merit such descriptions.[5]

Meanwhile, powerful fossil fuel interests have mobilized with great effectiveness to thwart actio amid all this hot air, sowing doubt and confusion about climate science, and opposing or delayi effective policy making. It brings to mind a quote from author Upton Sinclair, who once exclaime that, "It is difficult to get a man to understand something, when his salary depends upon his n understanding it!"[6]

Endless economic growth driven by unbridled consumption is so central to modern economies a is so ingrained in the thinking of corporate and political leaders that environmental action is still ofte seen as in conflict with the economy, and is relegated to inferior status. We have an economic syste that is the equivalent of a great white shark: it needs to keep water moving through its gills to recei oxygen, and dies if it stops moving. The challenge, therefore, is broader than merely a set technological changes. As activist Naomi Klein has argued, saving the climate requires revisiting t central mechanisms of the world's pre-eminent economic system: capitalism.[7]

Shying away from such radical change, governments and international agencies are lining behind "green growth"—a concept that reaffirms the centrality of economic growth and avoids a critique of the underlying dynamics that have brought human civilization to the edge of the abys According to the Organisation for Economic Co-operation and Development (OECD), "green grow means fostering economic growth and development while ensuring that natural assets continue provide the resources and environmental services on which our well-being relies."[8]

Humanity's climate predicament is only the latest—if by far the most challenging—manifestati of its collision course with planetary limits. Ecological stress is evident in many ways, from speci loss, air and water pollution, and deforestation to coral reef die-offs, fisheries depletion, and wetla losses. The planet's capacity to absorb waste and pollutants is increasingly taxed.

The *Millennium Ecosystem Assessment* found that even a decade ago, more than 60 percent of t world's major ecosystem goods and services were degraded or used unsustainably. Some 52 percent commercial fish stocks are now fully exploited, about 20 percent are overexploited, and 8 percent a depleted. The number of oxygen-depleted dead zones in the world's oceans that cannot support mari life has doubled each decade since the 1960s; in 2008, there were more than 400 such zones, affecti an area equivalent in size to the United Kingdom. The decline of bees and other pollinators jeopardizing agricultural crops and ecosystems. Urban air pollution causes millions of prematu deaths each year. The World Health Organization recently revised its estimates of global deaths fro air pollution to about 7 million people in 2012—more than double previous estimates and making pollution the world's single worst environmental health risk.[9]

A Double-edged Sword

How did we get to this moment in time? The onset of agriculture was the first major marker humanity's rising claim on the planet's resources, followed by the Industrial Revolution starting in t late eighteenth century. According to environmental historian J. R. McNeill, shifting agricultu improved caloric intake and thus increased energy availability perhaps 10-fold over what w available to hunter-gatherer societies. Settled agriculture provided another 10-fold increase, a domesticated animals (oxen, horses, etc.) offered concentrated muscle power for transport a plowing of fields. These were the beginnings of an—albeit still modest—energy surplus.[10]

It was the Industrial Revolution that increased that surplus beyond anything seen before, and th allowed humans to dominate Earth's biophysical systems. The invention of the steam engi permitted industrializing societies to tap coal as the primary energy source, replacing and augmenti the muscle power of humans and their domesticated animals. By 1900, steam engines had become times as powerful as the first machines of around 1800. Then, by the late nineteenth century, intern combustion engines made their appearance, more efficient and powerful than steam engines, allowi for the generation of electricity and offering a means of mass transport.[11]

The period since the advent of the Industrial Revolution has seen astonishing scientific a technical advances. Whereas just 10 scientific journals were published in the mid-1700s, today th number in the tens of thousands, with estimates ranging from 25,000 to 40,000. Perhaps some million scientific articles have been published since the beginning of the Industrial Revolution, wi an estimated 1.4 million to 1.8 million articles published annually. Although hard to measure, or study estimated that scientific publications may be growing at an annual rate of 8–9 percent, up fro just 2–3 percent during the period from the mid-eighteenth century to 1945, and less than 1 perce prior to the middle of the eighteenth century.[12]

The second half of the twentieth century, in particular, ushered in an unprecedented degree o progress in many fields, with tremendous gains in health, food availability, material well-being, an life spans. Yet these advances came at great cost to the planet's ecosystems and resources. Technica advances were often pursued single-mindedly, with little sense of restraint or long-term wisdom th might consider the repercussions for the natural world. Science, in other words, is a double-edg sword: it underpins the breathtaking progress that modern societies now take for granted, but it als enables the process that turns every last resource of the planet into a commodity.[13]

To a large extent, this is the result of large evolutionary forces—the genetic, developmental, an cultural factors that influence and determine human behavior. Humanity's ability to marshal th earth's resources, along with the economic and political competition that drives government corporations, and individuals, has meant that there have been few—if any—constraining factors o human actions. This lack of constraint may be the biggest threat to human survival. As J. R. McNei observed, "The same characteristics that underwrote our long-term biological success—adaptabilit cleverness—have lately permitted us to erect a highly specialized fossil fuel-based civilization s ecologically disruptive that it guarantees surprises and shocks."[14]

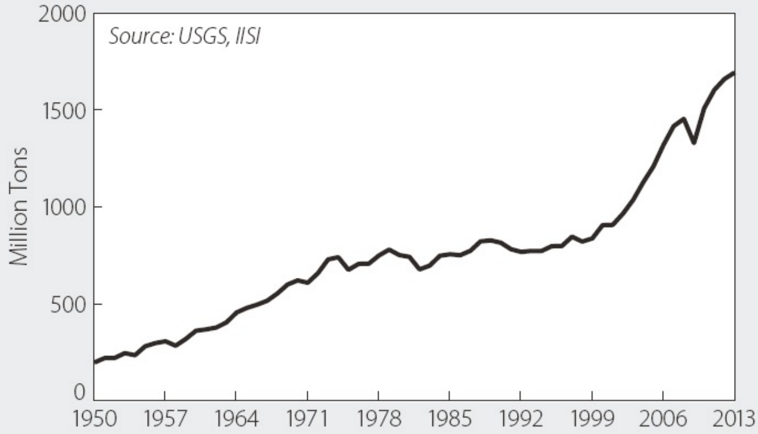
The industrial era's innumerable discoveries and inventions were underwritten by cheap an plentiful fossil energy. Humans used perhaps 10 times as much energy during the twentieth century a they did in the 1,000 years before. Coal, oil, and natural gas not only pack far more energy tha traditional sources like wood, but their versatility allows them to be used for many different purpose such as heating and cooling, industrial processes, electricity, and diverse forms of transport.[15]

World coal extraction shot up from about 10 million tons in 1800 to 762 million tons by 1900. reached 4,700 million tons in 2000, and then climbed to almost 7,900 million tons in 2013—a mo than 10-fold increase since 1900. World oil production started only in the late nineteenth century, bu grew rapidly from 20 million tons in 1900 to 3,260 million tons in 2000, and to 4,130 million tons 2013—a 207-fold expansion since 1900.[16]

Pre-industrial societies relied on a limited range and quantity of materials, with wood, ceramic cotton, wool, and leather playing major roles. By contrast, industrialized societies use tens thousands of versatile materials drawn from the entirety of naturally occurring elements. Materia like plastics or aluminum are ubiquitous nowadays (generating convenience as much as pollution), b they had their beginnings only in the late nineteenth century.[17]

Metals have long been used by humans, but their application on a mass scale is a relatively rece phenomenon. World metals production rose from 30 million tons in 1900 to 198 million tons in 195 After reaching 740 million tons in 1974, output leveled off for the next 20 years. But then can another phase of rapid growth, driven principally by economic expansion in China, and productio reached 1.7 billion tons in 2013. (See Figure 1–1.) The bulk of this figure is accounted for by ste production, which expanded 55.8-fold since 1900 and 8-fold since 1950. Aluminum production gre 32-fold since 1950, copper and zinc 6- to 7-fold, and lead and gold about 3-fold.[18]

Figure 1–1. World Metals Production, 1950–2013



Chemical compounds have become ubiquitous to the point that a 2013 UNEP report noted, “The is hardly any industry where chemical substances are not used, and there is no single economic sect where chemicals do not play an important role.” Roughly 10 million chemical compounds have bee synthesized since 1900, with some 150,000 or so put to commercial use—although nobody knows th exact number. The global chemical industry’s output climbed from $171 billion in 1970 to over $4 trillion in 2010 (expressed in nominal dollars). World chemical sales more than doubled during ju the last decade, again due mostly to China, where output nearly tripled.[19]

New chemicals keep getting introduced into commerce each year—an average of 700 in the Unite States alone. The rising number of compounds, their increasing complexity, and an ever more intrica supply chain is giving rise to concerns that poor management of chemicals could pose substanti dangers to the health of communities and ecosystems. The industry is a perfect example of the mix benefits and hidden threats that is so characteristic of the modern age.[20]

Increased use of synthetic fertilizers has been a key aspect of today’s industrialized agricultu (along with high energy and water use and inputs like pesticides). In 1940, the world used about million tons of fertilizer. By 2000, the figure reached 137 million tons, and by 2013, about 179 millio tons. As J. R. McNeill reminds us, without fertilizers, “the world’s population would need about 3 percent more good cropland.” Massive use of synthetic fertilizers led to widespread water pollution. also helped consolidate food production to a limited number of crops that responded well applications of fertilizer, leading to widespread monocultures. And fertilizer production is high energy intensive, part of the industrialization of agriculture.[21]

One of the areas in which the consequences of industrialization show up most dramatically is a quality. For most of human history, air pollution was of a local and limited nature, but during th twentieth century, it grew exponentially as heating, power generation, metal smelting, motorize transportation, waste incineration, and other human activities mushroomed.

Automobiles provide extraordinary individual mobility, but they have been a major contributor urban air pollution. From fewer than 10,000 in 1900, 8 million cars rolled off the world’s assemb lines in 1950, a number that skyrocketed to 85 million in 2013. From perhaps 25,000 cars on th world’s roads in 1900 and less than 1 million in 1910, the global automobile fleet was close to 10 million in 1960 and crossed the 1 billion threshold in 2013.[22]

Pollution Control and New Growth Impulses

Massive air pollution was one of the signature issues for a budding modern environmental moveme in the early 1970s, which eventually prodded governments in industrialized countries to ado pollution control measures and to compel industry to develop more-efficient production technologie In the United States, sulfur dioxide emissions were cut by 83 percent between 1970 and 2013, carbo monoxide emissions declined by 64 percent, nitrogen oxides by 51 percent, and volatile organ compounds by 49 percent. Better controls and more-efficient technologies also helped redu emissions of metals like copper and lead, although they remained far above the levels of a centu earlier. (See Table 1–1.)[23]

Table 1–1. World Metal Emissions to the Atmosphere, 1901–1990

Period	Cadmium	Copper	Lead	Nickel	Zinc
	annual average, in thousands of tons				
1901–1910	0.9	5.3	47	0.8	39
1951–1960	3.4	23	270	14	150
1971–1980	7.4	59	430	42	330
1981–1990	5.9	47	340	33	260

Source: See endnote 23.

During the final quarter of the twentieth century, pollution control, greater efficiency, and a degre of material saturation in the Western economies slowed further growth of production ar consumption. But since the 1990s, globalization and the rise of China and a number of oth “emerging economies” provided a whole new impulse for industrial development and resource use. rising middle class in these nations started to imitate Western lifestyles, and industrial productic relocated increasingly to these countries. China alone now accounts for just under half of the world steel production, up from only 5 percent in 1980 (when worldwide production was less than half what it is now).[24]

The 1992 Earth Summit in Rio de Janeiro was a milestone in global environmental consciousnes Yet in the two decades since then, the pressures on the planet’s natural resources and ecologic systems have only increased, and the second Rio conference—“Rio+20” in 2012—was far less of environmental milestone. (See Table 1–2.) The production of energy-intensive materials—cemer plastics, and steel—has more than doubled since 1992, far outstripping overall economic growt Global resource extraction—of fossil fuels, metals, minerals, and biomass—grew 50 percent in the 2 years between 1980 and 2005, to about 58 billion tons of raw materials (and another 40 billion tons material removed simply to gain access to coveted resources).[25]

Recognizing and Acting on Unexpected Threats

Being science-based, modern societies eventually come to learn about the unexpected and sometim unintended consequences of turning ever-greater portions of the planet’s natural base in commodities. We have gradually come to comprehend that we are depleting resources unsustainable rates, spreading dangerous pollutants, undermining ecosystems, and threatening unhinge the planet’s climate balance.