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BUILDING GLOBAL
RESILIENCE IN
THE AFTERMATH
OF SUSTAINABLE
DEVELOPMENT

Planet, People
and Politics

Richard Pagett



Palgrave Studies in Environmental Policy
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Richard Pagett

Building Global Resilience in the Aftermath of Sustainable Development

Planet, People and Politics

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FutureStates (Global) Limited
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PREFACE

This book describes why the concept of sustainable development needs to be consigned to history. This flies in the face of current, received wisdom. But it has to be said nonetheless. Using examples from around the world, the author will demonstrate that so-called sustainable development has simply been a cul-de-sac, condemning millions to continuing extreme poverty.

This book will explore the changes necessary for a more just and equitable economic and societal model with planetary limits at its core, and furthering the resilience of communities, from small tribal units to megacities and to countries. These changes will reflect the fundamental problem of basing global governance on weak and/or mediocre national governments worldwide, in the face of an ever-growing population with insatiable appetites.

Yet it is not simply a planetary calamity, it could be a time of opportunity, a time for innovation and above all a time for real collaboration between governments and people.

It is all about choice. OUR choice...

Purton, UK

Richard Pagett

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It is a pleasure to acknowledge the contribution that Susan Pagett made to this book. Her challenge, advocacy and attention to detail, though not always warmly welcomed, were invaluable. Thank you.

CONTENTS

Introduction	1
Part I Planet	
Where We Are at with Climate Change	9
Does Ocean Acidification Even Matter?	17
Isn't the Ozone Hole Sorted Now?	23
Fertiliser Dependency	29
Biodiversity Loss	33
There's Water Everywhere	39
Whose Land is it Anyway?	49
Chemical Pollution is Everywhere	55

Part II People

Air	67
Water	71
Food	75
Energy and Commodities	83
Land	87
Shelter	91
Health	95
Education	99
Work	103
Technology	107

Part III Politics

Global Weakness	113
National Competence	121
Governance	129

Part IV Blueprint

How to Manage the Planet	137
How Humanity Has to Change	139
How Governance Systems Have to Change	141
Final Word	159
Index	161

LIST OF FIGURES

Introduction

Fig. 1	Trees poisoned by quarry slurry, Argentina	2
Fig. 2	Rotting railway stock, Liberia	4
Fig. 3	Extremes in Bangladesh	5

Where We Are at with Climate Change

Fig. 1	Earnest Summit folk in Peru	12
Fig. 2	We choose to see, or not, Marshall Islands	14

Does Ocean Acidification Even Matter?

Fig. 1	Grab it while you can, Florida, USA	19
--------	-------------------------------------	----

Isn't the Ozone Hole Sorted Now?

Fig. 1	The unsuspecting rooftops of Phnom Penh, Cambodia	26
--------	---	----

Fertiliser Dependency

Fig. 1	Minimising run-off at coasts is critical, Guinea	31
--------	--	----

Biodiversity Loss

Fig. 1	We need fresh ideas, New Zealand	35
--------	----------------------------------	----

There's Water Everywhere

Fig. 1	This is my water, Namibia	41
Fig. 2	We all need a bit, Vietnam	42
Fig. 3	Let's share, Pakistan	44
Fig. 4	A donor-funded Parliament building on a foreshore is not the brightest idea, Kiribati	46

Whose Land is it Anyway?	
Fig. 1 The burned-out hulk of the land registry, Ghana	51
Fig. 2 Sometimes the commonality of water is easier, Chuuk	53
Chemical Pollution is Everywhere	
Fig. 1 Poorly managed chemicals, Japan	56
Fig. 2 If it burns, burn it, Former Yugoslav Republic of Macedonia	58
Air	
Fig. 1 Burning verges in Belize	66
Fig. 2 Free energy appliances in Guam	68
Water	
Fig. 1 New desalination in Gaza	72
Food	
Fig. 1 Scaling-up agroforestry in Rwanda	78
Energy and Commodities	
Fig. 1 Getting power where it is needed in Mauritania	84
Land	
Fig. 1 Illegal forest clearance by Chinese in Sierra Leone	89
Shelter	
Fig. 1 Open sewage behind the hotel tennis court, Togo	93
Health	
Fig. 1 HIV-AIDS in Yap	97
Education	
Fig. 1 A primary school in a rainforest clearing in Guyana	100
Work	
Fig. 1 Myopia in Uganda	104
Technology	
Fig. 1 Bingo in Republika Srpska	108
Global Weakness	
Fig. 1 Sustainable management in Tuvalu	116
National Competence	
Fig. 1 Yemen needs more of this	126

Introduction

Abstract This book has three parts: the first part is about the planet and the key challenges that it faces. Most of these challenges are currently dealt with at national level yet are global in nature. The second part is about people and population, what we consume and how we are depleting resources at a rate that is greater than the replenishment of those resources. Again, the book demonstrates how the management of these resources is at country level, yet the threats are global. The third part concerns itself with how we manage the planet through our governance systems. A final section indicates the way forward and the consequences of inaction. Finally, there is a Plan B if all else fails, as this is anticipated.

Keywords Planet · People · Population · Government · Global Challenges

The current interglacial period began about 10,000 years ago and allowed agriculture and complex human societies to develop. For the first time, we did not have to be preoccupied with mere survival. We began to invest in natural resources upon which we have now become dependent on for our way of life, our organised societies, our technologies and our economies.

Until recently, the Earth's natural and mineral resources were able to accommodate activities of humanity. That accommodation has changed since the industrial revolution. We had our warning about stratospheric



Fig. 1 Trees poisoned by quarry slurry, Argentina

ozone some years ago, and we are having our climate change one now. The growing human population is now challenging the threshold of other aspects of the Earth's resilience.¹

There is, of course, considerable uncertainty in knowing the planet-scale limits due to the intrinsic uncertainty of how these complex systems actually behave. It is no longer possible to envisage the limits for Earth-scale processes to be independent of the preferences, values, political compromises or socio-economic justifications of humanity. Work is clearly needed to determine the future shape of human activities in order to stay within limits at an Earth scale. If that is even possible.

There is ample evidence from local to regional scale that ecosystems (such as lakes, forests and coral reefs) are experiencing gradual changes (through biodiversity harvesting, soil [mis-] management, freshwater abstraction, nutrient cycles and so on) that could trigger abrupt changes when critical limits have been breached (Fig. 1).

Many planet-wide processes (such as climate change) produce impacts at a more regional scale. For example, climate change is associated with various “tipping points” (such as, the Indian monsoon and El Niño events) which all show varying degrees of sensitivity to a global change in, for example, temperature. The intergovernmental response to that is to propose a planet-wide limit such as the famous “2 degrees”.² We will return to this.

The concept of sustainable development³ has been a useful aspiration. Yet, for far too long, implementation has been unachievable: “...development that meets the needs of the present without compromising the ability of future generations to meet their own needs” has failed us and any future generations.

We have been compromising the ability of future generations to meet their own needs for decades. The term “sustainable development” is being routinely used without a shred of evidence of sustainability. The quality of life and resilient planetary systems are inextricably linked and can only be achieved through a different societal and economic system predicated on the principles of nature, nurture, replenishment and resilience. Building resilience is the key to withstanding shocks while moving towards a sustainable and meaningful human society.

This book describes why the concept of sustainable development needs to be consigned to history. Using examples from around the world, the author will demonstrate that so-called sustainable development has simply been a cul-de-sac, condemning millions to continuing extreme poverty. The Millennium Development Goals⁴ expired in 2015, and the post-2015 framework and with it the Sustainable Development Goals⁵ that are now being touted around are mostly based on a flawed premise (Fig. 2).

This book will explore the changes necessary for a more just and equitable economic and societal model with planetary limits at its core, and furthering the resilience of communities, from small tribal units to megacities to countries.

These changes will reflect the fundamental problem of basing global governance on weak and/or mediocre national governance worldwide, in the face of an ever-growing population with insatiable appetites.

Part I is about the Planet—how we rely on it and why it is in such poor shape. It summarises where we are at with some key things we need to take care of: climate change, ocean acidification, stratospheric ozone



Fig. 2 Rotting railway stock, Liberia

depletion, global phosphorus and nitrogen cycles, biodiversity loss, global freshwater use, land use and chemical pollution (Fig. 3).

Part II is about us, the People—what we need from the planet: air, water, food, energy, land, shelter, health, education, work and technology.

Part III is about Politics—why it is all rather a mess.

Finally, there is a blueprint for planetary management, how humanity has to change and how our governance systems have to change. The path we must tread is clear, as are the consequences if we choose not to, and it is a choice.



Fig. 3 Extremes in Bangladesh

NOTES

1. Ability to persist (absorb and resist shocks) adapt and transform in the face of natural and human-induced change.
2. <https://www.ipcc.ch>.
3. <http://www.un-documents.net/ocf-02.htm>.
4. <http://www.unmillenniumproject.org/goals/>.
5. <http://www.un.org/sustainabledevelopment/sustainable-development-goals/>.

PART I

Planet

Where We Are at with Climate Change

Abstract Copenhagen, Cancun, Durban, Doha, Warsaw, Lima and Paris climate change summits are now lost in obscurity such was their impact. Save for two—Copenhagen and Paris. Copenhagen set out basic requirements for global action, yet it took a further six years of glacial negotiation before the basics could be agreed in Paris. Poor countries are concerned that money promised to them still will not be nearly enough to protect them. Not all of the agreement is legally binding, so future governments could yet renege on their commitments. In fact, the only legally binding part was that countries should report on their progress at a meeting in five years. This section looks at the reality of the climate change summits and what they really mean.

Keywords Climate Change · Summit · UNFCCC · COP

While it is still difficult to link, conclusively, any single big weather event to global warming, for several years climate scientists all over the world have been warning about the risk of extreme weather (deluges of rain, flooding, heatwaves, cold and so on). So why are we surprised when each event, wherever one is in the world, seems to take the population and its government unawares. Why are we surprised each time it happens? Has no one figured out that these so-called one-in-a-hundred-year events are actually occurring rather frequently? Is no one noticing this?

We pay those who advise government to advise, and we elect those in office to make appropriate decisions and to take action based on that advice. Either those who are supposed to advise are not up to it or will not, or those who are supposed to make decisions are unable to or will not. Which is it? Or, could it be a blend of both?

Perhaps, there are some clues in the climate change summits that occur annually. The summit names, Copenhagen, Cancun, Durban, Doha, Warsaw, Lima and Paris (based on the hosting cities), are now lost in obscurity such was their impact. Save for two—Copenhagen and Paris.

Copenhagen set out the basic requirements for global action, yet it took a further six years of glacial negotiation before the basics could be agreed in Paris. Interestingly, at each of the intervening summits, so-called last-minute deals were struck to save the day. In fact, they did not save anyone's day they just saved a bit of face. The one in Durban was particularly unedifying. It came down to an eleventh hour face-to-face with two negotiators (from European Union and India) squaring off against each other surrounded by a sea of onlookers.¹ It smacked of watching two playground bullies testing each other out. It was terrible theatre and culminated in a worthless set of agreements that at the time were hailed as historic.

And that is one of the critical issues.

Why do so many nominally well-educated men and women spend a couple of weeks each year getting really nowhere and yet to a person greet the outcome as a heroic achievement? Why do these people let the world down so badly? Largely, because they are answerable to no one other than themselves.

It all smacks of the Emperor's new clothes, and no one seems to have the wit, courage or insight to break ranks and come clean. Consequently, much of the climate change summity has been a circus.

After Copenhagen, we had the *Copenhagen Accord*: American officials spun the deal as a “*meaningful agreement*”,² and the British prime minister of the day hailed it as “*a success on five out of six measures*”.³ Really?

After Cancún, we had the *Cancún Agreements*: the negotiator from Bangladesh⁴ addressed the plenary and praised the Mexican presidency of the talks for having “*restored the faith of all the parties*” and hailed the *Cancún Agreement* as a “*great compromise*”. Really?

After Durban, we had the *Durban Platform*: negotiations at the UN climate conference in Durban (December 2011) ended with 195 countries pledging to negotiate a new international climate treaty by 2015. Pledging to do something in four years' time is not much different

to fiddling while Rome burns (especially when we know now what the real outcome was in 2015). The *Durban Platform* also formally provided for a second commitment period of the Kyoto Protocol and the launch of the Green Climate Fund to distribute the US\$100 billion in assistance pledged by developed nations to assist developing nations with mitigation efforts. The EU representatives applauded the *Durban Platform* as an “*historic breakthrough*” in the fight against climate change⁵....Really? Five years on the Fund is understaffed and buffeted by politics and is still struggling to define itself, with barely 10 billion in its pocket. Yet, it was to transfer 100 billion by 2020. Consequently, it seems to just wave through any old proposal, such as solar panels in Chile where some suppliers already give away the energy produced; it is so abundant.

As an aside, South Africa produces nearly half of the continent’s greenhouse gas emissions and only just managed to produce a *First National Climate Change Response* before the conference which was strong on intent and rather thin on substance at the same time as the country was drawing up a strategic electricity plan based largely on fossil fuels. Hardly leadership from the host country.

And therein lies a global truth, many countries have used legislation and fiscal governance to effect improvement and to change industry practice, yet it is still not enough. While a common exhortation is for the private sector to take some ownership and we should not rely solely on governments, what we find is that the private sector does the minimum necessary. Their *raison d’être* is not to save the world but to turn a reasonable profit to ensure their own sustainability. If there is one thing that a business *does understand* is what *their sustainability* depends upon. And that is not necessarily what the world as a whole needs.

After Doha, we had the *Doha Amendment*: (to the Kyoto Protocol) featuring a second commitment period (to reduce emissions) running from 2012 until 2020 and limited in scope to 15% of the global carbon dioxide emissions due to the lack of commitment by Belarus, Japan, New Zealand, Russia, Ukraine and the USA. Also, developing countries such as Brazil, China (the world’s largest emitter) and India were not included since they were not subject to emissions reductions under the Kyoto Protocol anyway. The conference made little progress towards the funding of the Green Climate Fund. More fiddling...

After Warsaw, we had the *Warsaw Outcomes* when governments took further essential decisions to stay on track towards securing a universal climate change agreement in 2015. How much more fiddling is there to do? (Fig. 1).



Fig. 1 Earnest Summit folk in Peru

After Lima, we had the *Lima Call for Climate Action*: the Secretary General of the United Nations hailed the outcome and praised delegates for setting the groundwork for a more conclusive agreement⁶ to be reached in 2015 having brought together the 195 Parties to the UNFCCC in an attempt to hammer out a new universal treaty which would enter force by 2020. The EU purred that this climate change conference would pave the way for the adoption of a new, legally binding, global climate agreement in Paris 2015. Fast forward to Paris.

After Paris, the agreement was hailed as “*historic, durable and ambitious*”.⁷ Developed and developing countries alike are required to limit their emissions to relatively safe levels, of 2 °C with an aspiration of 1.5 °C, with regular reviews to ensure these commitments can be increased in line with scientific advice. Finance will be provided to poor nations to help them cut emissions and cope with the effects of extreme weather. Countries affected by climate-related disasters will gain urgent aid. Wonderful.

But take a closer look, the caps on emissions are still too loose, likely to lead to warming of 2.7–3 °C above pre-industrial levels, breaching the 2 °C threshold that scientists say is the limit of safety, beyond which the effects—droughts, floods, heatwaves and sea level rises—are likely to become catastrophic and irreversible. Poor countries are also concerned that the money provided to them will not be nearly enough to protect them. Not all of the agreement is legally binding, so future governments of the signatory countries could yet renege on their commitments. In fact, the only legally binding part was that countries should report on their progress at a meeting in five years.

To be legally bound to turn up to a meeting in 2020 to make a report, is that it? Some achievement. Yet, as the news spread around the world, the reaction from civil society groups, governments and businesses, was overwhelmingly positive. These people do not serve humanity well (Fig. 2).

Interestingly, even though negotiators were content to work with a 2 °C threshold, an expert meeting had been convened in Oxford by the UK Meteorological Office to plan for a 4 °C world. That meeting was more than five years ago. That is the difference between political expediency and a technological reality.

The next and most recent summit was in Marrakesh (2016) and called for a road map to put the promises of the *Paris Agreement* into action. For the climate vulnerable in the poorest countries, this means



Fig. 2 We choose to see, or not, Marshall Islands

support to adapt and build resilience to the impacts of climate change. Many are concerned that although there are various pots of international and national climate finance available, money is not reaching the local level. There is a recognition that national governments are unable or unwilling, or both, to deal with the consequences of climate change. The response now is to channel funds to the local level. There is a basic assumption that local people with their first-hand experience and relevant knowledge of how to manage the shocks and stresses of previous years are the appropriate ones to deal with climate change into the future.

The challenges of climate change in the most affected countries are not going to be dealt with by tweaking agriculture (so-called smart agriculture) or flood defences or setting up insurance schemes or similar small activities. Some countries such as Kenya, Mali, Senegal and Tanzania are using existing devolved government structures to access different sources of climate finance and getting it into the hands of local governments. Since some local governments have not been able to deal with the most

basic of human needs such as clean water, sanitation, health and education, why should we assume they could deal with one of the largest challenges to humanity? The most vulnerable need to be helped, not be given funds and hope they can do what is necessary.

Developed countries have committed to more than US\$ 100 billion of climate finance reaching developing countries each year by 2020. This is simply not happening. But the answer is not to give it to local governments which barely have functioning offices, may be a computer hogged by the boss, and often no vehicles. Some even argue that although governments may have expectations on how to build climate change resilience, these may not be the same as needs identified by the community and prefer communities to decide what is important for them as far as resilience is concerned and then the government supports what the community decides. This makes no sense.

Examples are cited in sub-Saharan Africa where areas in arid and semi-arid areas are affected by drought almost each year. Yet, these areas do not have the basic infrastructure development in the first place. This basic stuff should be fixed first as that is a fundamental of future resilience, for instance, barrages to retain seasonal water, and well-constructed markets with the means to access them (roads that work during the rainy seasons) and early warning systems. Basic institutional strengthening at national and local level is critical with, of course, treasury not project support. This basic institutional development needs to be based on a professional, career-structured civil service to retain skills, knowledge and experience.

The summit concluded with the countries agreeing the *Marrakech Action Proclamation*. This was a political statement of support for urgent action by governments, business and civil society, in the same vein since the 2009 *Copenhagen Accord*. This time the countries reaffirmed their commitment to the *Paris Agreement* and pledged to finalise the rules by 2018. The meeting had been managed to lower expectations for progress in the formal negotiation of the rules for the *Paris Agreement*. It was agreed to continue work to develop the rules with the aim of finalising them by their meeting in 2018 (at COP 24). This is the same date that the IPCC is anticipated to publish its analysis of pathways to 1.5 °C. In essence, countries are only just starting to get to grips with the technical detail and practical aspects of what they agreed in Paris back in 2015.

NOTES

1. <http://www.independent.co.uk/environment/climate-change/11th-hour-agreement-in-durban-sees-big-three-legally-bound-to-reduce-carbon-emissions-6275762.html>.
2. <https://www.theguardian.com/environment/2009/dec/18/copenhagen-deal>.
3. <https://www.theguardian.com/environment/2009/dec/19/copenhagen-reaction>.
4. <https://www.theguardian.com/environment/blog/2010/dec/10/cancun-climate-change-summit-final>.
5. <http://www.hfw.com/The-UNFCCC>.
6. <http://ens-newswire.com/2014/12/14/lima-climate-talks-produce-weak-draft-for-global-treaty/>.
7. <http://www.canadianenergylawblog.com/2015/12/17/historic-durable-and-ambitious-unfccc-member-nations-adopt-the-paris-agreement/>.

Does Ocean Acidification Even Matter?

Abstract The chemistry of the ocean is changing ten times faster than at any other time during the past 50 million years and at least 100 times faster than at any other time in the last 20 million years. By the year 2200, under a business-as-usual scenario for fossil-fuel consumption, the increasing acidity of seawater could have serious impacts on coral reefs and associated ecosystems presumably with ripple effects throughout the food chain. It can be anticipated that such changes will affect all the other services that seas and oceans provide. That, of course, will have profound effects on coastal economies (fisheries, tourism, biodiversity and so on). The reader is taken through the issues and briefed on the need for robust global dialogue and political processes.

Keywords Ocean · pH · Acidification · Chemistry

It is well known that the ocean regulates our climate and our weather and is essential for cycling water, carbon and nutrients. It is estimated that since the eighteenth century, when the industrial revolution began, the oceans have absorbed as much as a third of the man-made carbon dioxide,¹ a key gas responsible for much the global warming that we see today. As ocean water absorbs carbon dioxide, it becomes more acidic. It is thought that the chemistry of the ocean is changing ten times faster than at any other time during the past 50 million years and is at least 100 times faster than at any other time in the last 20 million years.²

By the year 2200, under a business-as-usual scenario for fossil fuel consumption, the increasing acidity of sea water is likely to have serious impacts on coral reefs and associated ecosystems presumably with ripple effects throughout the food chain.³

It can be anticipated that such changes will affect all the other services that seas and oceans provide. That, of course, will have profound effects on coastal economies (fisheries, tourism, biodiversity and so on).

The difficulty of going beyond these broad observations is that the specific effects of ocean acidification on most marine animals are still largely unknown. Many regions of the world lack monitoring instrumentation and trained personnel to collect the data required to understand this growing issue. In addition, the general public in most nations has little awareness of ocean acidification. But that is almost irrelevant in the big picture. So what, if one has a doctorate on the implications of ocean acidification—the challenge is the amount of carbon dioxide in the atmosphere. We know enough about that already, at least since Copenhagen in 2009. What we need is a concerted action to deal with the issue knowing that. Knowing a bit more about how ocean acidification affects coral reefs does not actually help. For the big picture, we do not need to consider further research and cooperative actions. We just need to get on with it and fix the overarching problem.

How many more calls to action do we need? It is almost pointless having media campaigns to raise public awareness of the need to protect the ocean. Giving ordinary citizens a way to help out is a false hope as it has no appreciable effect overall. Simply trying to protect particular coastal habitats, including seagrass beds, salt marshes and mangroves that effectively sequester and store carbon should be done anyway as it enhances lots of benefits. That has been known for decades and should be done as a matter of course anyway, not just because of the relatively new threat of global warming (Fig. 1).

How many times have we heard that the private sector and civil society organisations will come together in a conference to describe initiatives to safeguard the well-being of the oceans? How many times have we heard how this will empower future collaboration? Let us get real on this, a bunch of stakeholders discussing and proclaiming a set of obviously commonsense principles in the expectation they can or will be taken forward is too sad.

We do not have sufficiently robust global dialogue and political processes to make that happen.



Fig. 1 Grab it while you can, Florida, USA

It is just a cul-de-sac.

It is clear that coastal and ocean ecosystems and communities are currently confronted with numerous devastating problems—sea level rise, ocean acidification, coral bleaching, loss of top predators, dead zones, garbage, chemical pollution, habitat loss and more—that do not have short-term solutions. If human societies are willing and able to address these issues, namely by reducing root causes and/or mitigating or repairing harmful effects, that work may require decades to show signs of success. However, these relatively long timescales are paired with much shorter political, management and funding cycles, of a few years, as well as relatively short attention spans of the public for these issues.

We make excuses for not fixing these problems; ocean ecosystems have always been difficult to address because the problems are hard to see; the key events can be highly episodic (e.g. more frequent and serious flooding events due to background sea level rise); the consequences of ocean problems can be difficult to connect to their root causes (e.g. shellfish corrosion due to acidifying waters); and, possibly most importantly, the regions and populations contributing to problems are often diffuse and different from those that bear the burden of the problems.

In addition, sustaining public attention on long-term problems, not just ocean ones, is problematic in general. Humans have evolved to respond to threats that involve intentional action to cause harm, immoral actions, imminent danger, instantaneous change, a high degree of certainty and simple causes—many of which do not apply to the greatest threats to the ocean. Furthermore, even when people do notice a threat, cognitive bias, such as undervaluing future risks, weighting current loss more than future gain, and believing one is at less risk than others from threats, prevents people from appropriately assessing the risk arising from a problem.

Even when risks are understood, a number of social and psychological dynamics—including a desire to avoid disturbing thoughts and emotions and a tendency to base one's actions on the actions of others—can prevent societies from agreeing on policy actions to deal with problems. Even the persistent media bias towards novel and sensational news means that these problems often only receive attention immediately after a disaster or controversial report. This lack of continuity makes it difficult to keep public pressure on policymakers to sustain initiatives to address long-term problems.

NOTES

1. <http://www.livescience.com/37003-global-warming.html>.
2. <http://ocean.si.edu/ocean-acidification>.
3. www.ucar.edu/communications/Final_acidification.pdf.

Isn't the Ozone Hole Sorted Now?

Abstract It is true that the atmospheric levels of nearly all the ozone-depleting substances have declined substantially during the last twenty years or so. Further decline is expected to result in a more-or-less complete recovery of the ozone layer by around the middle of this century. This achievement indicates that global cooperation is able to achieve adequate management of planetary processes. It is telling that all 142 developing countries were able to meet the 100% phase-out mark for CFCs, halons and other substances by 2010. However, we need vigilance, increased anthropogenic emissions of very short-lived substances containing chlorine and bromine, particularly from tropical sources, is now an emerging issue for stratospheric ozone.

Keywords Atmosphere · Ozone · Montreal Protocol · Stratospheric CFCs

Stratospheric ozone filters ultraviolet radiation from the sun. The appearance of the Antarctic ozone hole was a textbook example of a limit being breached. To date, the Montreal Protocol¹ (and its subsequent amendments) allowed humanity to pull back from the limit—a consequence of a relatively low cost, easy techno-fix, combined with (of paramount importance) a zero effect on national development. Contrast that with climate change mitigation requirements.

It is true that the atmospheric levels of nearly all the ozone-depleting substances have declined substantially during the last twenty years or so. Further decline is expected to result in a more or less complete recovery of the ozone layer by around the middle of this century. The long time-scale for this recovery is due to the slow rate at which these substances are removed from the atmosphere by natural processes. This achievement indicates that global cooperation is able to achieve adequate management of planetary processes.

The Montreal Protocol is one of the most successful and effective environmental treaties ever negotiated and implemented. No single factor led to its success. But if an overarching reason is needed, look no further than the unprecedented level of cooperation and commitment shown by the international community. So it can be done though it does rely on leadership and innovative approaches. Much negotiation was held in small, informal groups. This enabled a genuine exchange of views and the opportunity to take some issues on trust, such as the funding support. The people negotiating the treaty also included scientists, which lent credibility.

The science was not definite at the time, so it was a credit to the negotiators that they developed a highly flexible instrument which could increase or decrease controls as the science became clearer. It enabled them to get on with it. It was only after the initial framework was negotiated that the science became firmer: early conclusions about the extent of ozone depletion turned out to be significantly underestimated. This flexibility meant the protocol could be amended to include stricter controls: more substances added to the control list and total phase-out, rather than the original partial phase-out. Starting out modestly also encouraged a greater confidence in the process.

One element that encouraged countries to ratify the Montreal Protocol was the trade provisions. These limited signatories to trade only with other signatories. Once the main producing countries signed up, it was only a matter of time before all countries had to sign up or risk not having access to increasingly limited supplies of these substances.

The idea of taking action when the science was not yet conclusive formed the basis of the “precautionary principle”, and the concept of common, but differentiated, responsibility also took root in the Montreal Protocol² so developing countries were given longer to phase out these substances.

Key sectors were targeted yet allowed industry to plan long-term research and innovation. Of course, it was convenient that there were benefits for industry of moving away from these substances. One of the main substances was chlorofluorocarbon, an old technology and well out of patent. Transitioning to newer, reasonably priced formulations with lower- or no ozone-depleting potential benefited the environment and industry.

A particular fund, the Multilateral Fund,³ has been another reason for the success of the protocol. It provided incremental funding for developing countries to help them meet their compliance targets. Significantly, it has also provided institutional support. This helped countries build capacity within their governments to implement phase-out activities and establish regional networks so they can share experiences and learn from each other.

A final reason for the success of the protocol implementation has been its compliance procedure.⁴ This was designed from the outset as a non-punitive process. It prioritised helping wayward countries back into compliance. Developing countries worked with a United Nations agency to prepare an action plan to get themselves back into compliance. If necessary, resources from the Multilateral Fund were available for some short-term projects. It is telling that all 142 developing countries were able to meet the 100% phase-out mark for chlorofluorocarbons, halons and other substances by 2010.

The ozone layer is expected to return to 1980 levels between 2045 and 2060 as long as all countries continue to meet their obligations and phase out the last substances in the next few years. The *Scientific Assessment of Ozone Depletion (2014)* is the most recent World Meteorological Organisation and the United Nations Environmental Programme assessment.⁵ It contains the most up-to-date understanding of ozone depletion and reflects the thinking of more than 300 international scientific experts who contributed to its preparation and review.

As these substances decline, the evolution of the ozone layer in the second half of the twenty-first century will largely depend on the atmospheric abundances of carbon dioxide, nitrous oxide and methane. Overall, increasing carbon dioxide and methane elevate global ozone, while increasing nitrous oxide further depletes global ozone.

The amount of the hydrofluorocarbons currently used as replacements makes a small contribution of carbon dioxide equivalent emissions per year. These emissions are currently growing at a rate of about 7% per



Fig. 1 The unsuspecting rooftops of Phnom Penh, Cambodia

year and are likely to continue to grow. If the current mix of these substances is unchanged, increasing demand could result in increasing emissions with carbon dioxide equivalent emissions per year by 2050, nearly as high as the peak emission of the late 1980s (Fig. 1).

Replacements of the hydrofluorocarbons that have a high global warming potential with those that have a lower potential could avoid these carbon dioxide equivalent emissions. Some of the substances with lower potential are hydrofluoroolefins which on breakdown in the atmosphere release the persistent trifluoroacetic acid. Although apparently benign, the long-term effects of this acid are unknown. Current predictions suggest that by 2050, hydrofluorocarbon banks are set to increase significantly.

In addition, increased anthropogenic emissions of very short-lived substances containing chlorine and bromine, particularly from tropical sources, are an emerging issue for stratospheric ozone. The relative contribution of these emissions could become important as levels of ozone-depleting substances controlled under the Montreal Protocol decline. As the atmospheric abundances of these substances continue to decrease over the coming decades, nitrous dioxide, as the primary source of nitrogen oxides in the stratosphere, will become more important in future ozone depletion.

While levels remain high, a large stratospheric sulphuric aerosol enhancement due to a major volcanic eruption could result in a substantial chemical depletion of ozone over much of the globe. While past actions taken under the Montreal Protocol have substantially reduced production and consumption of ozone-depleting substances, additional, though limited, options are available to reduce future ozone depletion.

Continual innovation will be necessary to avoid going backwards, and there are good signs of this already.⁶

NOTES

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Fertiliser Dependency

Abstract Global nitrogen and phosphorus are largely affected by our farming. At the beginning of the twentieth century, nitrogen and phosphorus budgets were either balanced or excesses were small. Yet within fifty years, excess global soil nitrogen almost doubled and phosphorus eight fold. With a burgeoning world population it is anticipated that there will need to be increasing global crop levels (perhaps by as much as 80% up to 2050) and increases in livestock production even more (+115%) due to the growing middle class in places such as China. Alternative management of livestock production systems will be needed. A shift in human diets, with poultry or pork replacing beef, could reduce nutrient flows in countries with intensive ruminant production.

Keywords Global Nitrogen · Phosphorus · Farming · Soil · Nutrient

Global nitrogen and phosphorus are largely affected by our farming (crops and livestock). Even at the beginning of the twentieth century, either nutrient (nitrogen and phosphorus) budgets were balanced or excesses were small. Yet, within fifty years, excess global soil nitrogen almost doubled and phosphorus eightfold. Between 1950 and 2000, the global surplus increased even more.¹

Environmental and economic issues have increased the need to better understand the role and fate of nitrogen in crop production systems. Nitrogen is the nutrient most often deficient for crop production, and its

use can result in substantial economic return for farmers. However, when nitrogen inputs exceed the requirements of the crop, there is a possibility that excessive amounts, as nitrate, will enter either ground or surface water.

Nitrogen exists in the soil in different forms and changes very easily from one form to another. There are various ways in which nitrogen enters the soil and becomes available to plants for their growth. It may come from the atmosphere, commercial fertilisers, the soil's own organic matter, and the remains of previous crops and livestock manure. As nitrogen enters and leaves the soil, it is influenced by biological processes that, in turn, are influenced by prevailing climatic conditions, together with the physical and chemical properties of the particular soil. The amount of nitrogen added to soil from precipitation could be 5 kg per acre per year.² The amount of nitrogen supplied by manure varies with the type of livestock, handling, rate applied and method of application.

Soil organic matter is also a major source of nitrogen used by crops. Organic matter is composed primarily of humus that has collected over a long period of time. Easily decomposed portions of organic material disappear relatively quickly, leaving behind residues more resistant to decay. Soils contain approximately 1000 kg of nitrogen in organic forms for each per cent of organic matter.³ Decomposition of this portion of organic matter proceeds at a rather slow rate and releases about 9 kg/acre/year for each per cent of organic matter.

Nitrogen may be lost from the soil system in several ways: by rain-water leaching, bacterial breakdown, crop removal and soil erosion and run-off. The latter, in particular, is increasingly a problem. High nitrogen levels (as nitrate) in water are a problem. Excessive concentrations of nitrate in lakes and streams greater than about 5 mg/l may be responsible for the excessive growth of algae and other plants, leading to occasional loss of dissolved oxygen.

Nitrate can also get into the water directly as the result of run-off of fertilisers containing nitrate. Some nitrate enters water from the atmosphere, which carries nitrogen-containing compounds derived from automobiles and other sources. Nitrate can also be formed in water bodies through the oxidation of other, more reduced forms of nitrogen, including nitrite, ammonia and organic nitrogen compounds such as amino acids. Ammonia and organic nitrogen can enter water through sewage effluent and run-off from land where manure has been applied or stored.



Fig. 1 Minimising run-off at coasts is critical, Guinea

Water quality regulatory agencies seek to avoid high concentrations of nitrate in water to minimise both of the problems noted above. Nitrate standards take two forms: drinking water standards, designed to prevent adverse human health effects, and ambient water standards, designed to prevent excessive eutrophication⁴ in lakes and streams.

This means managing agricultural operations to minimise application of fertiliser and to minimise run-off of fertiliser that is applied (Fig. 1).

Some farmers are now using computerised maps of their fields, calibrated to the specific soil and water conditions in various parts of their fields, to restrict the application of fertiliser to only what is needed for each part of the field. In some countries, for example, Switzerland, drinking water providers enter into contracts with farmers in their source areas in which farmers receive subsidies to eliminate fertilisers and use organic farming methods. Prevention also means proper handling of manure and animal waste lagoons, to minimise the discharge of animal waste or waste run-off to streams. Nitrate contributions from other sources can also be curtailed, for example, by adding tertiary treatment, or by nutrient removal, to sewage treatment plants and by controlling emissions from automobiles.

With a burgeoning world population, it is anticipated that there will need to be increasing global crop levels (perhaps by as much as 80% up to 2050)

and increases in livestock production even more (+115%) due to the growing middle class in places such as China.⁵ Global nutrient surpluses are expected to increase. Alternative management of livestock production systems will be needed with better integration of animal manure in crop production, and matching nitrogen and phosphorus supply to livestock requirements can effectively reduce nutrient flows. A shift in human diets, with poultry or pork replacing beef, could reduce nutrient flows in countries with intensive ruminant production.

NOTES

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4. Excessive richness of nutrients in a lake or other body of water, frequently due to run-off from the land, which causes a dense growth of plant life.
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Biodiversity Loss

Abstract We depend on “nature” for air, water, food, shelter, energy and materials. There are two schools of thought about how to manage nature. One says that if we want to manage nature, we have to price it so we can take account of that when making decisions on how much damage a particular human activity may cause. The other says that something so instinctive to our collective well-being cannot be managed by a price. When the two words “capital” and “nature” are linked, there is a failure to assign parity between the two. Environmental and social impact assessments should be a warning, whereby developments have been approved in the face of clear residual environmental and social impact, because the economic case was overwhelming.

Keywords Biodiversity · Nature · Offsetting · Capital

Biodiversity is a fancy name for nature, from microscopic animal and plants to the largest whales and trees. Without “nature”, humanity could not survive. We depend on it for air, water, food, shelter, energy and materials. There are two schools of thought about how to manage nature (for our benefit naturally). One school says that if we want to manage nature to our, and succeeding generations’, benefit, we have to price it so we can take account of that when making decisions on how much damage a particular human activity may cause. The other school says that

something so instinctive to our collective well-being cannot be managed by price.

The pricing school is theoretically correct, while the spiritual school knows that practice is very different from theory. A classic failure is the DEFRA offsetting project¹ which measures biodiversity by its extent, importance and condition. The problem with this is that when it is used in practice by those unfamiliar with ecosystem principles (such as at some UK planning appeals), it can be a disaster.² And this is the problem when we do science, and then, the science is undone with political decision-making. We tick the box, but that is all it does.

We are exhorted to ensure that the enormous economic value of forests and coral reefs as well as socio-economic consequences of that loss must be factored into political and economic policies in all countries. Of course, some 30 million people around the world rely on reef-based resources for food production and livelihoods. Attaching a dollar importance to the global economy of the natural world with the kinds of policy shifts and smart market mechanisms that can embed fresh thinking in a world beset by a rising raft of multiple challenges sounds like a plan. Not really. The problem with pricing anything is that its value is whatever it is worth to someone.

Let us be clear. Pricing a finite resource does not stop its consumption, but it merely makes the consumption more efficient so the finite amount lasts a little longer. In the end, it will still all be consumed. Therein lies one of the challenges of so-called sustainable development. To be sustainable, one has to be able to do that thing in perpetuity (or at least for several generations).

Yet, we are gobbling up the world's resources (nature) to such an extent that we have already consumed or degraded 60% of all that was available, just during the last twenty-five years.³ So, we have 40% left for the rest of time.

Putting a price on "nature" will not stop the relentless consumption of that last 40%, especially as middle classes develop in hitherto poor countries. Middle classes want meat and things. Even for the billion members of that consuming cohort (chiefly from China, India and Africa), there simply will not be enough stuff to go around. This is not a reason to deny the self-determination of that billion, but it is merely pointing out that there is a job to do and simply putting prices on nature is naïve and will not make the cut (Fig. 1).



Fig. 1 We need fresh ideas, New Zealand

Latest IUCN Figs.⁴ reveal that 23% of mammals are extinct or threatened along with 15% of birds, 21% of reptiles and 31% of amphibians. If one extends the trends during the past century to a pre-human background rate of two extinctions per million species per year under normal conditions, the number of vertebrate extinctions from 1900 to 2014 would be expected to occur during a period of 800–10,000 years, not as in the last 114 years.⁵

The urbanised bubble we have become so comfortable in creating gives the illusion of independence from the deteriorating planet. With more people living in urban environments than ever before we distancing ourselves further from the natural world, both spatially and psychologically. Our lack of exposure to nature has severed the cause-and-effect aspect of resource use. We are now eliminating species at a rate unseen outside of a mass extinction event.

Remember, in 2016 Earth Overshoot Day⁶ (the date when humanity's annual demand on nature exceeds what Earth can regenerate in that year) was 8 August. So for the rest of August and all of September, October, November and December of that year, we were simply borrowing from the future, as we have done for the preceding twenty-five years.

The current and projected rates of biodiversity loss constitute the sixth major extinction event in the history of life on Earth—the first to be driven specifically by the impacts of human activities. Previous extinction events, such as the tertiary extinction of the dinosaurs and the rise of mammals, caused massive permanent changes in the biological composition and functioning of Earth's ecosystems. The current, accelerated biodiversity loss is particularly serious, given growing evidence of the importance of biodiversity for sustaining ecosystem functioning and services and for preventing ecosystems from tipping into undesired states. Species play different roles in ecosystems, and species loss therefore affects both the functioning of ecosystems and their potential to respond and adapt to changes in physical and biotic conditions.

Currently, the global extinction rate far exceeds the rate of forming new species, and consequently, loss of species is the primary driver of changes in global biodiversity. Accelerated species loss is increasingly likely to compromise the biological capacity of ecosystems to sustain their current functioning under the novel environmental and biotic circumstances that are to come.

The average global extinction rate is projected to increase to 1000 extinctions per million species-years during this century. Simply put,

about a quarter of well-known species are threatened with extinction. Until recently, most extinctions since 1500 occurred on oceanic islands. During the last twenty years, however, about half of the recorded extinctions have occurred on continents, primarily due to land-use change, species introductions and, increasingly, climate change, suggesting that biodiversity is now broadly at risk throughout the planet.

Another interesting distraction is “natural capital”. Once again this is simply “nature”. We are now seeing a number of organisations developing their own protocols around so-called natural capital. It is easy to foresee efforts going into the process rather than understanding and tackling political nativity in relation to water scarcity, greenhouse gases, land tenure, waste and so on.

This echoes the disaster of sustainable development, laudable but politically a void.

The World Conservation Congress 2016⁷ considered a controversial motion to incorporate the language and mechanisms of “natural capital” into IUCN policy. Critics rightly worried about the emphasis on economic, as opposed to ecological, language and models, and a corresponding marginalisation of non-economic values.

Recent natural capital initiatives such as World Forum on Natural Capital,⁸ the Natural Capital Declaration⁹ and the Natural Capital Financing Facility¹⁰ aim to prove to the financial market and to potential investors the attractiveness of biodiversity (and climate adaptation operations) in order to promote sustainable investments from the private sector. This is a giant folly.

When the two words “capital” and “nature” are linked, there is a failure to assign parity between the two. Environmental and social impact assessments should be a warning, whereby developments are approved in the face of clear residual environmental and social impact, because the economic imperative is overwhelming.

Associating “capital” with “nature” serves merely to add a cloak of respectability to undergarments of exploitation of the world’s last 40% of its natural resources.

Self-interest can be a force for short-term good. A so-called keystone dialogue between scientists and seafood industry leaders has created a breakthrough in ocean stewardship. Eight of the world’s largest seafood companies have committed to improving transparency and traceability and reducing illegal, unreported and unregulated fishing in their supply chains. Antibiotic use in aquaculture, greenhouse gas emissions and

plastic pollution will also be prioritised. The seafood businesses commit to eliminating any products in their supply chains that may have been obtained through modern slavery including forced, bonded and child labour. Laudable as this sounds it does depend on commercial companies doing what is right not just what is beneficial to their companies. History shows us that when companies are able to do what governments cannot, we have in effect parastatal organisations with no oversight. Increasingly, large transnational corporations now play this role, for example, in the rainforests. As history has shown, this can be a dangerous development in terms of human rights.

NOTES

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There's Water Everywhere

Abstract We seem to have a lot of freshwater, yet there is no “new” water on the planet. The available water is recycled through a well-connected system between the earth and the atmosphere. This means that, despite a rapidly growing population, the available and accessible freshwater is roughly the same as it always has been. Supplying this growing population therefore depends on the capacity (and the will) to manage the resource differently (i.e. ensuring its quality, quantity and access) so that it can reach more people. Before the industrial revolution, it was possible to withdraw and consume water to everyone’s satisfaction. We are in a different place now; population numbers no longer allow for the management of water without cooperation, at which we are not good.

Keywords Water · Population · Management · Conflict · Resource

On the face of it we have a lot of freshwater. The thing to remember is there is no “new” water on the planet. The available volume of water is recycled through a well-connected system between the earth and the atmosphere. This means that, despite a rapidly growing population, the volume of available and accessible freshwater is roughly the same as it always has been. Supplying this growing population therefore depends on the capacity (and the will) to manage the resource differently (i.e. ensuring its quality, quantity and access) so that it can reach more people.

A common perception is that most of the available freshwater resources are visible (as lakes, reservoirs and rivers). However, this visible water represents only a tiny fraction of global freshwater resources, since most of it is stored in aquifers, with the largest stocks stored in solid form in the Antarctic and in Greenland's ice cap.

Managing water sensibly is not as straightforward as one might think. Think about Fiji in the Pacific. It has been bottling its ancient groundwater for years and sending it to the USA, in plastic supplied by China, yet Fiji still has about 35,000 people unable to access clean drinking water.¹ Where is the responsibility (and the sense) in that?

The world's population has got everything to do with the whole equation of water availability and its use. But the importance of population is not the only factor to consider. The brutal challenge of climate change resulting in changes in rainfall regimes, threatening surface water and the regularity of aquifer recharge, and the contamination of aquifers in expanding urban areas are other factors that contribute to making water resources scarcity a reality.

Before the industrial revolution, it was possible to withdraw and consume water to everyone's satisfaction. We are in a different place now; 1 billion in 1800, 2 billion in 1900 and 6.6 billion at the end of 2007 no longer allow for the management of water without cooperation.

Accessible water is unequally distributed, and population growth varies on every continent. Sub-Saharan Africa and Southeast Asia, where access to clean water is already a challenge for the current population, present a high risk of increasing, and irreversible, water scarcity (Fig. 1).

The way governments have mismanaged water for decades does not auger well for future management. The demise of the Aral Sea² in Central Asia was caused primarily by the diversion of the inflowing rivers to provide irrigation water for local croplands. These diversions dramatically reduced the river inflows, causing the Aral Sea to shrink by more than 50%, to lose two-thirds of its volume and to greatly increase its salinity. At the current rate of decline, the Aral Sea may virtually disappear in a decade or two. Fishing in the Aral Sea has ceased completely, while shipping and other water-related activities have substantially declined; the associated economic changes have taken a heavy toll on agricultural production. Rising unemployment has led to a major exodus from the region. Even though there is now an international effort to save the Aral Sea, it is doubtful that the Aral Sea will ever be



Fig. 1 This is my water, Namibia

restored to the conditions that existed before the large-scale diversion of its inflowing rivers.

Another fine example of mismanagement is Lake Chad³ which is shared by Cameroon, Chad, Niger and Nigeria and has been a source of freshwater for irrigation projects in each of these countries for years. Since 1963, the lake has shrunk to nearly a twentieth of its original size, due both to climatic changes and to high demands for agricultural water. The changes in the lake have contributed to a local lack of water, crop failures, livestock deaths, collapsed fisheries, soil salinity and increasing poverty throughout the region. The main factors in the shrinking of the lake have been overgrazing (resulting in deforestation) and large and unsustainable irrigation projects.

Shared water and its availability is critical. The Mekong River⁴ rises on the Tibetan Plateau and descends 5000 m flowing across six



Fig. 2 We all need a bit, Vietnam

countries before reaching its delta. More than a third of the population of Cambodia, Lao PDR, Thailand and Vietnam—some 60 million people—live in the Lower Mekong Basin, using the river for drinking water, food, irrigation, hydropower, transportation and commerce (Fig. 2).

Millions more in China, Burma and beyond the boundaries of the basin benefit from the river. In the plains, the river basin accounts for half the arable land in Thailand. Further downstream in Cambodia, the Tonlé Sap Lake, with one of the world's largest freshwater fisheries, is replenished by the Mekong. Nearly half of Cambodia's people benefit directly or indirectly from the lake's resources. As the river approaches the sea, the Mekong Delta, home to 17 million Vietnamese, yields more than half of Vietnam's rice production and a third of its GDP.

The Mekong Delta is reeling under the impact of natural and man-made disasters including climate change, less rainfall, serious salt water intrusion and more landslides, which are becoming the new norm affecting upwards of 18 million residents. While it was usual to experience

six months of salt water intrusion, this period has now expanded to seven months because of reduced rainfall therefore there is less time to grow the rice crop that is necessary.

One province in Vietnam has spent billions of local currency to build a 30-m dyke stretching for kilometres.⁵ Yet, local economic activities and human activity have contributed to the problem with illegal sand exploitation which has worsened the erosion of river banks and landslide issues, while wastewater from residential areas and industrial parks along the Mekong has severely polluted the environment. There are some short-term activities that could be done, for instance, the rice fields could be watered earlier to allow rice to retain water longer, the time of the rice harvest could be adjusted to minimise salt water intrusion, and floating rice could be planted to cope with the flooding.

Building dykes, constructing stronger houses, setting up early warning alarm systems and making proper use of land and educating people are also other activities. But it is short term, nearly half of Vietnam's rice production, 65% of its aquaculture and some fruit cultivation could be submerged if sea levels continue to rise.

The scarcity of water in South Asia will become harder to manage as demand rises. South Asia's population of 1.5 billion is growing by 1.7% a year which is essentially the same as adding North Korea's entire population to the region every year. Greater wealth in South Asia brings with it a soaring demand for food, especially water-intensive meat. A Dutch study⁶ in 2010 of the Western Himalayas reckons that diminishing glaciers will cut the flow of the Indus by some 8% by mid-century and one may expect flows to become less regular. A strategic foresight group⁷ in a Mumbai think tank suggests that water is a long-term threat to Asian stability.

Governments can respond in one of the two ways. The first is to improve the way they use the water by managing a better cooperation with neighbouring countries. The second is to try and take as much as possible before everyone else does. In Pakistan, bitter rows between provinces have created a history of problems with wealthy Punjabis routinely accused by downstream landowners of taking more than their fair share of the available water.⁸ Pakistan needs more dams to control floods, to store monsoon water and to make electricity (Fig. 3).

Only about 10% of the potential hydropower has been tapped, and only 30 days average river flow can be stored. In contrast, Colorado in America has dams that store water for 1000 days.



Fig. 3 Let's share, Pakistan

Bhutan's economy gets a big boost from selling hydropower to India, and India has the possibility to do the same with Nepal. Wider cooperation between China, India and Bangladesh provides an immense opportunity for better water sharing, yet the dire relations between South Asian countries mean that water will probably provoke more clashes than cooperation.

Rioting recently in southern India left at least one person dead and dozens injured after the Supreme Court intervened in a row between neighbouring states, ordering one to release water from a disputed river.⁹

The river is the main source of irrigation for crops in both states, which suffer regular periods of drought. The dispute over sharing its water stretches back decades, with Tamil Nadu repeatedly accusing Karnataka of hoarding its resources and causing devastation to crops next door. The Supreme Court backed Tamil Nadu's claim that Karnataka had diverted 50 billion cubic feet of water that it was required

to release downstream under the terms of a previous dispute settlement. Overriding Karnataka's claim that it could not spare the resources, the court ordered the state to release almost 350,000 litres of water a day for the next week to make up the shortfall.

The likelihood of conflict between India and Pakistan over shared river resources is also expected to increase.¹⁰

Global warming is likely to cause rice yield potential to decline by up to 50% on average by 2100 compared to 1990 in Vietnam, Thailand, Philippines and Indonesia.¹¹ The potential economic cost of inaction is huge. The Philippines Climate Commission expects mean temperatures to rise by more than 2° by 2050. The Philippines is vulnerable to climate change and ranks number 1 in the world in terms of vulnerability to typhoons and third in terms of the numbers of people exposed to such seasonal events.

Southeast Asia's 563 million people rely heavily on farming and are concentrated along coastlines where an increase in extreme weather and forest fires arising from climate change jeopardises vital export industries and upwards of 40% of employment and 11% of GDP.¹² The region is highly vulnerable to droughts, floods and tropical cyclones associated with global warming and has a high economic dependence on natural resources and forestry. This puts it at risk of poverty which already is high. The poor are the most vulnerable to climate change, yet despite all these calamities countries are barely prepared to respond adequately when disasters hit.

Half of the countries that borrow for disaster response do not mention disaster prevention in their development plans. The region is likely to suffer more from future climate change. The average projection¹³ is that the annual mean temperature will rise 4.8°C on average by 2100 and mean sea level rise is projected to rise by 70 cm during the same period. Indonesia, Thailand and Vietnam are expected to experience increasingly dry weather conditions during the next 20–30 years (Fig. 4).

Asia is home to more than half of humanity and has the highest population density of any continent. It has the world's largest percentage of people living in poverty and, as a region, is undergoing massive social and economic change. More people are migrating to urban centres along coastal areas making them more vulnerable, while wealthy countries such Australia, Japan and New Zealand build infrastructure to cope with major disasters.¹⁴ At least they have something of a strategic plan.



Fig. 4 A donor-funded Parliament building on a foreshore is not the brightest idea, Kiribati

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Whose Land is it Anyway?

Abstract Land-use change, driven primarily by agricultural expansion and intensification, contributes to global environmental change, with the risk of undermining human well-being and long-term viability. Humanity may be reaching a point where further agricultural land expansion at a global scale may seriously threaten biodiversity and undermine regulatory capacities of the planet (by affecting the climate system and the hydrological cycle). Indigenous peoples and local communities are estimated to hold 65% of the world's land area under customary systems. Yet, many governments formally recognise their rights to only a small fraction of those lands. This gap, between what is held by communities and what is recognised by governments, is a major driver of conflict, disrupted investments, environmental degradation, climate change and cultural extinction.

Keywords Land · Use · Rights · Tenure · Indigenous Peoples · Conflict

Land-use change, driven primarily by agricultural expansion and intensification, contributes to global environmental change, with the risk of undermining human well-being and long-term viability. Conversion of forests and other ecosystems to agricultural land has occurred at an average rate of 0.8% per year during the past 40–50 years¹ and is the major global driver behind the loss of ecosystem functioning and services. Humanity may be reaching a point where further agricultural land

expansion at a global scale may seriously threaten biodiversity and undermine regulatory capacities of the Earth system (by affecting the climate system and the hydrological cycle).

For humanity to stay within this limit, croplands should be allocated to the most productive areas, and processes that lead to the loss of productive land, such as land degradation, loss of irrigation water and competition with land uses such as urban development or biofuel production, should be controlled. Demand-side processes may also need to be managed; these include diet, per capita food consumption, population size and wastage in the food distribution chain. Agricultural systems that better mimic natural processes (e.g. complex agro-ecosystems) could also allow an extension of this limit.

Although the effects of land-use change act as a slow variable that influences other boundaries, such as biodiversity, water and climate, they may also trigger rapid changes at the continental scale when land-cover thresholds are crossed. For example, conversion of the Amazon rainforest into cultivated or grazing systems may reach a level where an additional small amount of conversion would tip the basin into an irreversible transformation to a semi-arid savanna. At the global scale, if enough high-productivity land is lost to degradation, biofuel production or urbanisation, food production may spread into marginal lands with lower yields and a higher risk of degradation.

In recent years, there has been growing attention and effort towards securing the formal, legal recognition of land rights for indigenous peoples and local communities who are estimated to hold as much as 65% of the world's land area under customary systems.²

Yet, many governments formally recognise their rights to only a fraction of those lands. This gap, between what is held by communities and what is recognised by governments, is a major driver of conflict, disrupted investments, environmental degradation, climate change and cultural extinction.

Ownership of the world's rural lands and natural resources is a major source of disagreement around the world, affecting prospects for rural economic development, human rights and dignity, cultural survival, environmental conservation and efforts to combat climate change. Historically, most rural lands were owned and governed by local communities and indigenous peoples under customary tenure systems. Over time, however, large areas of these lands have also been claimed by states under statutory law. States have often continued to assert direct claims



Fig. 1 The burned-out hulk of the land registry, Ghana

over community lands, resulting in a situation of overlapping claims to lands that extend across large areas of the world (Fig. 1).

Some countries are in the process of recognising communities' rights, and estimates from those countries provide some indication of the size of the gaps between community-owned and state-owned lands. Recent work in India and Indonesia has identified approximately 40 million hectares of customarily held forest land in each country that has not yet secured formal, legal recognition. In Peru, estimates indicate that an additional 20 million hectares is still due for formal recognition,³ and in the Caribbean region of Colombia, only around 2% of land held under customary tenure by Afro-descendant communities has been formally titled.

Many other countries have not yet established the legal authority for the recognition of communities' land rights, and there is limited information on how much land is held by communities and still due recognition.

When local communities and indigenous peoples lack formal, legal recognition of their land rights, they are vulnerable to dispossession and loss of their identities, livelihoods and cultures. Pressures are increasing as governments issue concessions for forestry, industrial agriculture, large-scale mining, and oil and gas production on community lands. Disputes over land and natural resources are also a contributing cause of armed conflict.

Secure community tenure contributes to economic development and community livelihoods, conservation of ecosystems and biodiversity, and reductions in carbon emissions from deforestation. Lands governed under community-based tenure systems often have well-established local institutions and practices for the stewardship of land and resources. These institutions and practices have historically helped to sustain large, intact ecosystems such as tropical forests, rangelands and large-scale rotational agricultural systems. These ecosystems, in turn, provide a vital foundation for the livelihoods and food security of the estimated 1.5 billion local communities and indigenous peoples around the world who govern their lands through community-based tenure.

Formal, legal recognition of indigenous and community lands is necessary but not sufficient to guarantee tenure security, which also requires that states and others respect, support and enforce such protections. Legal recognition does provide an essential foundation for securing community-based tenure rights. Community-based tenure can also be contrasted with the direct titling of individual lands, which has often resulted in negative impacts in areas with customary, community-based tenure systems.

These impacts include the loss of land, particularly where titling establishes the rights of individuals to sell the land; increased conflict; disruption of ecosystems; and reduced access to vital common property resources by the politically and economically marginalised. Of course, within community-based tenure systems, indigenous peoples and local communities may adopt a range of approaches to land management, including managing lands as common resources, allocating areas to individuals or households to manage or both.

These pressures, trends, opportunities and challenges make the formal, statutory recognition of indigenous peoples and local communities' land rights critically important for communities as well as national and international stakeholders. Increasing communities' tenure security contributes to realising national government goals to improve economic



Fig. 2 Sometimes the commonality of water is easier, Chuuk

growth, as well as greater employment opportunities, political stability and resilience. Where community land rights are respected and recognised in national law, communities can consider entering into partnerships with the private sector to establish responsible, secure and sustainable investments. By promoting community land rights, bilateral and international development partners can establish enabling environments to reduce poverty, combat climate change and promote peacebuilding.

Widespread, continued disagreement over who owns the world's land is a major constraint to progress on a wide range of development goals espoused by local peoples, national governments and the international community. A bizarre situation can be found in Chuuk, an island in the Federated States of Micronesia. All land is in private or community hands, and the only state land are the roads. Consequently, when a new water pipe needs to be laid, the middle of the road is taken up and then relaid, with massive disruption (Fig. 2).

It is up to national governments, communities, policy advocates, bilateral and multilateral development partners, international organisations, private sector investors and other stakeholders to advance community-based tenure. Measures that can achieve this advancement include lobbying, legislation, regulation, administrative and institutional capacity building, and on-the-ground implementation. The stakes are high, because ultimately, community-based tenure security will determine whether indigenous peoples and local communities have the legal right to manage their lands as they choose—a question that strikes at the heart of rural peoples' daily lives and has major implications for controlling climate change, ensuring food security, reducing political conflict and protecting the world's remaining natural resources.

NOTES

1. www.fs.fed.us/pnw/pubs/gtr802/Vol1/pnw_gtr802vol1_alig.pdf.
2. www.rightsandresources.org/wp-content/uploads/GlobalBaseline_web.pdf.
3. www.rightsandresources.org/wp-content/uploads/RRI-2016-Annual-Review.pdf.

Chemical Pollution is Everywhere

Abstract Chemical pollution adversely affects human and ecosystem health, which has most clearly been observed at local and regional scales but is now evident at the global scale. Chemicals are an integral part of modern daily life. There is hardly any industry where chemical substances are not used, and there is no single economic sector where chemicals do not play an important role. Millions of people throughout the world lead richer, more productive and more comfortable lives because of the thousands of chemicals on the market today. To protect human health and the environment and to fully benefit from the value that chemicals can yield, all countries must include in their economic and social development priorities the means to manage chemicals soundly. Currently, they do not.

Keywords Chemicals · Pollution · Management · Health

Primary types of chemical pollution include radioactive compounds, heavy metals and a wide range of organic compounds of human origin. Chemical pollution adversely affects human and ecosystem health, which has most clearly been observed at local and regional scales but is now evident at the global scale. Key effects are a global impact on the physiological development and demography of humans and other organisms with ultimate impacts on ecosystem functioning and structure and by acting as a slow variable that affects other planetary boundaries.



Fig. 1 Poorly managed chemicals, Japan

For example, chemical pollution may influence the biodiversity limit by reducing the abundance of species and potentially increasing organisms' vulnerability to other stresses such as climate change. Chemical pollution interacts with the climate change limit through the release and global spread of mercury from coal burning and also reflects industrial chemicals that are currently produced from petroleum, releasing CO₂ when they are degraded or incinerated as waste (Fig. 1).

Chemicals are an integral part of modern daily life. There is hardly any industry where chemical substances are not used, and there is no single economic sector where chemicals do not play an important role. Millions of people throughout the world lead richer, more productive and more comfortable lives because of the thousands of chemicals on the market today. These chemicals are used in a wide variety of products and processes, and while they are major contributors to national and world economies, their sound management throughout their lifecycle is essential in order to avoid significant and increasingly complex risks to human health and ecosystems, and substantial costs to national economies.

Industries producing and using these substances have a significant impact on employment, trade and economic growth worldwide, though the substances themselves may have adverse effects on human health and the environment. A variety of global economic and regulatory forces influence changes in chemical production, transport, import, export, use and disposal over time.

Human activity creates dust, while burning coal, dung, forests and crop waste fills the atmosphere with soot, sulphates and other particles. The global concentration of these aerosols has more than doubled since pre-industrial times. The resulting haze influences the climate and is a threat to human health, so “aerosol loading” should be considered a potential planetary issue. The impacts are highly variable, though. Some aerosols, such as sulphates, reflect solar radiation, causing cooling. Others, such as soot, absorb and re-radiate it, causing warming. The global balance of these heating and cooling effects is unclear.

Aerosols also affect the climate in other ways. For example, the near-permanent brown haze across southern and eastern Asia appears to influence both the timing and the positioning of the monsoon. Meanwhile, aerosols reduce crop yields by falling on fields and also clog up human lungs, contributing to millions of deaths from lung and heart disease.

Many national governments have enacted laws and established institutional structures for managing the hazards of the growing volume of chemicals. Leading companies have adopted chemical management programmes, and there are now many international conventions and institutions for addressing these chemicals globally. However, the increasing complexity of the background mix of chemicals and the ever longer and more intricate chemical supply chain including wastes reveal varied gaps, lapses and inconsistencies in government and international policies and corporate practices. They feed growing international concerns over the



Fig. 2 If it burns, burn it, Former Yugoslav Republic of Macedonia

threat that poor management of chemicals poses to the health of communities and ecosystems (Fig. 2).

These concerns are important to all countries but are particularly relevant in industrialising economies that face pressing needs to achieve development, national security and poverty eradication.

Developing countries and countries with economies in transition can learn lessons from the fragmented sector-by-sector chemical management approaches that have characterised conventional chemicals policies in more developed countries. To protect human health and the environment and to benefit fully from the value that chemicals can yield, all countries must include in their economic and social development priorities the means to manage chemicals soundly.

Debates about resource allocation have frequently postured a trade-off between the economic gains associated with industrial development, on the one hand, and the costs imposed by regulation on the other. What is lost in this formulation is recognition that the failure to adopt sound chemicals management can impose large economic costs, and

conversely, sound chemicals management can yield significant economic benefits in terms of economic development, poverty reduction and, crucially, reduced human health and environmental risks.

The economic benefits from sound management of chemicals will vary—potentially quite significantly—from country to country depending upon production volumes, the level of economic development, the character of chemical use and exposure, and to a significant extent, how well chemicals policies are implemented and enforced. The pros and cons of individual policy instruments will also vary depending on national situations. At the global level, the data and models are not yet available to make a comprehensive estimate of the total benefits from sound chemicals management. Further work to generate and amass this evidence is needed.

Undeniably, however, there is not a country in the world that is not becoming more chemically intensive, and there are many that would profit from improved chemicals management. The question is: do we need total certainty to know we have to act? Chemicals intensification brings economic costs at the expense of development gains where there is poor capacity for preventing related accidents and exposures. It follows that investment in sound chemicals management policy frameworks, technology and knowledge generates benefits from avoiding these costs, as well as laying the foundation for enhanced productivity, new opportunities for trade, investment and business creation through innovation.

The benefits of improving chemicals policies in global terms will be important in enabling countries, donors to country development and the private sector to deliver both development and chemicals management. It is not a case of new resources suddenly being uncovered. Limited resources will have to be reallocated either by countries or by funding agencies to accomplish this. It will be important for governments to anticipate the strategies required to manage chemicals more effectively in the face of increasing chemicals intensity and the costs associated with these. Any estimates of costs of implementation must be weighed against the overall benefits of enhanced management of chemicals in the face of increasing chemicals intensity.

An important starting point is to realise that very few countries are starting from a point of absolutely zero legal infrastructure or institutional capacity for chemicals management. Most have some level of chemical regulatory apparatus in place and industrial development authorities that will have an interest in assuring safe management of industrial chemicals.

Moreover, a new paradigm of sound chemicals management is emerging in which industry is being recognised as an essential partner for success. Industry shares many of the same goals of governments and society when it comes to minimising risks from chemicals mismanagement. Industry must carry the main responsibility for ensuring the safe use of chemicals. Tapping into these shared interests will be crucial for progress.

So, that is the planet.

There are some major challenges that a burgeoning population has created: increased greenhouse gases that are changing climatic patterns bringing extremes of temperature, rainfall, winds and so on; this is also leading to acidification of the world's oceans damaging coral reefs and coastal fisheries. The ozone hole may begin to widen again after years of slowly closing. To feed millions more people, our dependency on artificial fertilisers is likely to increase bringing risks of water pollution. Biodiversity will continue to be lost on an unprecedented level. The uneven distribution of water in relation to population will bring water scarcity and conflict. Unresolved issues of land ownership will compromise the opportunities for climate change adaptation, livelihood development and general reduction in poverty. Chemicals will continue to be more sophisticated and be increasingly injurious to people, land and water.

Yet, life goes on and every person living now and in the future expects, quite reasonably, to have access to clean air, to clean and safe water, to food of a certain quality, to affordable energy, to land, to shelter, health care, education, work and technology.

Yet, already, there are millions of people living in marginal conditions affected by climate change (droughts or torrential rain) with no proper access to clean water or adequate sanitation, with poor access to health care and education, and without much prospect for decent work.

The planet is creaking at the seams just to provide basic living conditions for the existing millions of people. Yet the climate goes unmanaged in any significant way, the oceans continue to acidify threatening coral reefs and fisheries on which millions depend, and the ozone hole is at risk of becoming an issue again. We use the word "security" now in the same breath that we say food, water and energy. The natural world on which we depend for so many benefits is at severe risk through habitat destruction, and chemical and waste management is a mess worldwide.

The threat is real, a clear and present danger, and it has to be those living now who have to start fixing it. Before we look at what needs to be done, let us look a bit more at those causing the problem.....us.

PART II

People

Some years ago, it was recognised that we should not be so comfortable with so much poverty around the world. We should be uneasy about the lack of basic education for so many, the lack of gender equality, the amount of child mortality, poor maternal health, disease generally and, of course, the threats to the natural world on which we depend.

At the turn of the century, the Millennium Development Goals were established, each with 21 specific targets and more than 60 indicators.

On the face of it, we should be pleased that the number of people living on less than 1.25 dollars a day has been reduced from 1.9 billion in 1990 to 836 million in 2015. Others might feel, quite rightly, that close on a billion people who are still surviving (it is not “living”) on less than 1.25 dollars a day is nothing short of a scandal. Governments with rural poor need to reflect on the choices they make, for instance, Uganda with seven million plus rural poor has a 2016 military budget of 467 million US dollars¹. It is simply a choice. It might be understandable if that budget was securing economic security, supply routes or market access—but that is not its objective.

During the period of the Millennium Development Goals, the target was to halve the proportion of people suffering from hunger. This was only narrowly missed. Even so, it was missed. It is unreasonable that so many millions of people should still suffer from hunger. We know how to grow food, and we know where it is needed. Asia is the continent with the highest numbers of hungry people—two-thirds of the total. Yet, it is sub-Saharan Africa with the highest percentage of population who

are hungry—one person in four there is undernourished. Nearly 30% of people in the Upper East Region of Ghana do not have adequate access to food, yet the annual defence budget of Ghana is more than 120 million US dollars². It is simply a choice. Again, it might be understandable if that budget was securing economic security, supply routes or market access ~ but that is not its objective.

Although primary school enrolment figures have shown an impressive rise, the goal of achieving universal primary education has just been missed³, though about two-thirds of developing countries have achieved gender parity in primary education.

While the child mortality rate has reduced by more than half during the past 25 years, it has failed to meet the target of a two-thirds decrease. The global maternal mortality ratio has fallen by nearly half, short again of the two-thirds reduction that was the target. Although the number of new HIV infections fell by around 40% between 2000 and 2013, the target of halting and beginning to reverse the spread of HIV/AIDS by 2015 has not been met.

Some 2.6 billion people have gained access to improved drinking water since 1990, so the target of halving the proportion of people without access to improved sources of water was achieved in 2010—five years ahead of schedule. That still leaves nearly 700 million people across the world who still do not have access to a most basic human requirement of improved drinking water. It seems obvious that we should not leave the job half done? We should continue until most of the remaining 700 million people have access to improved drinking water.

Of course, that would be too easy. What we do instead is create some more goals. So, after the Millennium Development Goals, we now have the Sustainable Development Goals which were agreed in late September 2015. These goals emerged from the UN Conference on Sustainable Development in June 2012. They replace the Millennium Development Goals and are expected to last from January 2016 until 2030. The draft text included the 17 Sustainable Development Goals with their 169 targets.

Unlike the Millennium Development Goals, which only applied to so-called developing countries, the SDGs are universal and therefore apply to all countries. However, there is an ongoing debate as to what this means in practice. Specifically, who is going to pay for what? Developing countries were very clear that while the Sustainable Development Goals are universal to all countries in terms of their nature and relevance, the degree of national responsibility in the implementation of the goals

should be differentiated in accordance with the varying capacities, realities and developmental levels of the various countries.

Yet, in reality, most countries (developing or otherwise) are quite capable technically, with adequate human resources and in most cases with sufficient finance. It is more a question of how countries want to go about spending their own treasure.

Of course, many countries would far prefer to spend another country's treasure.

What is happening now is the inevitable round of conferences about where to find or leverage funds. Hence, the *Financing for Development* conference held in Ethiopia in July 2015 from which came the *Addis Ababa Action Agenda* which was described as a critical step forward in building a sustainable future for all, providing a global framework for financing sustainable development.

Countries have agreed to establish a *Technology Facilitation Mechanism* and a *Global Infrastructure Forum* while adopting a new social compact in favour of poor and vulnerable groups. There was talk of taxing harmful substances such as tobacco; promoting affordable and stable access to credit for smaller enterprises; recommitting to achieve the target of 0.7% of gross national income for official development assistance. For their part, so-called developed countries committed to reverse the decline in aid to the poorest countries and called for strengthening support for the *UN Committee of Experts on International Cooperation in Tax Matters*. There was the usual call on developed countries to implement their commitment to a goal of jointly mobilising US\$ 100 billion per year by 2020 from a wide variety of sources to address the needs of developing countries; countries also committed to phase out inefficient fossil fuel subsidies that lead to wasteful consumption.

Many voiced concern about the above outcomes expressing deep reservations, considering that it was a lost opportunity to tackle the structural injustices in the current global economic system and ensure that development finance is people-centred and protects the natural environment.

Others considered that it exposed either an unbridged gap between the rhetoric of the aspirations and reality of the actions, or a lack of ambition and weak commitments.

An *Intergovernmental Committee of Experts on Sustainable Development Financing* found that financing needs for sustainable development are large, but that global savings would be sufficient to meet these needs. However, current financing and investment patterns would

not deliver sustainable development. While there is no single, simple policy solution, a concerted effort that draws on all those involved and mobilises all resources in an integrated manner would allow the finance necessary to achieve sustainable development for all.

Not surprisingly, developed countries are strongly pushing for “*domestic resource mobilisation as a primary vehicle for development*” which is fancy donor-speak for developing countries to find their own money. The developing countries argue that developed countries want to avoid their historical responsibility to contribute to global development.

Meanwhile, the G77 and China call for financing to be provided via aid from developed countries. And all the while, their 700 million citizens go without access to improved drinking water. India is one of the G77, and one could be forgiven for reflecting on why India should be calling for finance when they announced a space exploration budget of 1.2 billion US dollars for the period 2015–2016. China even more so. It has more than 70 million rural poor (2014), yet it spends about 2 billion US dollars each year on space activities.

A joint statement by World Bank, the Asian Development Bank, the African Development Bank, the European Investment Bank, Inter-American Development Bank and the International Monetary Fund argues that a “paradigm shift” is needed on how development will be financed to unlock the resources needed to achieve the SDGs. The world needs intelligent development finance that goes well beyond filling financing gaps and that can be used strategically to unlock and catalyse private flows and domestic resources.

Of course, all these banks remind us that the global economy is still struggling to overcome the near collapse in 2007–2008 of the international financial system. Given that there are dozens and dozens of economists in these banks and none of them seem to have seen the biggest financial crisis in modern times coming are these the right sort of folks to start talking about all this required funding?

The biggest problem in all this is a lack of understanding of sustainable development itself, let alone how climate change will pretty much unravel the SDGs anyway. But even applying first principles, the SDGs unravel. Take the first SDG goal, to “*End poverty in all its forms everywhere*”. Totally laudable, yet some experts believe it could take 100 years for the poorest people to earn even 1.25 dollars a day and to eradicate poverty is simply unachievable given the existing economic model.

It is not that it probably will not happen, it cannot happen because it is impossible.

By applying the fastest rate of income growth that the poorest 10% of the world's population have ever enjoyed over the past few decades (1993–2008) when incomes increased at a rate of 1.29% each year and extrapolating that to eradicate poverty would take 100 years. The SDG target timeline is to 2030—currently just 13 years away. Even then, the poorest 1% of the world's population will still remain in poverty even at the end of this period. That's 90 million people, more than the entire population of Germany today, who will remain in poverty forever.

Some argue, of course, especially if they have actually seen and, importantly, smelled poverty, that 1.25 dollars a day—which is the official poverty line of the SDGs—is nowhere near enough for people to survive on anyway. In reality, if people are to meet their most basic needs and achieve normal human life expectancy, they need closer to 5 dollars a day. To eradicate poverty on that more realistic basis would take a couple of hundred years.

Do-gooders in the west need to take note.

The essential problem is that it appears that the only strategy for reducing poverty is to increase global gross domestic product. The world's leaders and their advisors have only a hammer in their toolbox and therefore see every problem as a nail. They have no other ideas. They fail us. Even thinking about this for as long as it takes to drink a glass of clean, safe water, it is clear that to eradicate poverty global gross domestic product would have to increase by more than hundred times its present size if we go with 5 dollars a day.

In other words, if we want to eradicate poverty with our current model of economic development, we need to extract, produce and consume more than a hundred times more commodities than we presently do. The planet simply cannot withstand that kind of consuming onslaught. For a start, climate change would respond dramatically and wipe out any gains in poverty reduction anyway.

So, the first SDG is a complete joke and a shambles.

The rest of the SDGs provide no better answers because they are not allowed to challenge dominant economic and political interests which are on course to overwhelm the planet's available resources. Meanwhile, much of the world's poor go hungry and thirsty. Anyone who subscribes to the SDGs clearly has no understanding of sustainable development or what this is supposed to look like.

Yet, the United Nations Development Programme argues in its sad, blinkered fashion, “*...ending poverty can be achieved if sustainable economic growth, social protection, and environmental health and stewardship are considered together*”. That is an astonishingly naïve statement, verging on the irresponsible. It gives hope where there is none.

Paying equal regard to natural capital and ecosystem services, protecting, restoring and enhancing natural assets, ensuring equitable access to natural resources and sustainably-derived basic services, promoting green and innovative fiscal policies and investments, and tracking progress through new indicators should be part of the drive towards eradicating poverty irreversibly through smart, sustainable and inclusive growth. However, it needs to be done by smart people in smart institutions because currently, the current way forward has no resonance with what is really happening in the world today.

Forty years after the first UN meeting on the environment (1972 in Stockholm), not one country can show that it has achieved absolute decoupling of economic growth from environmental stress. For a start, an acknowledgement of this failure needs to be strongly reflected in the design of the SDGs framework. Issues relating to poverty, inequity, health, excesses of wealth, aspirations and so on are as fundamental to patterns of consumption, and production as technology is to production processes. Beyond just technical tweaks and hopes for absolute decoupling, getting to “sustainable consumption and production” through the SDGs framework would require nothing short of a critical review of the culture of consumerism. This is highly unlikely.

NOTES

1. <http://allafrica.com/stories/201606090545.html>
2. <http://militarybudget.org/ghana/>
3. <http://www.un.org/millenniumgoals/education.shtml>

Air

Abstract For something that we take for granted, air quality can be a major risk to human health. By reducing air pollution levels, countries can reduce the burden of disease from stroke, heart disease, lung cancer and both chronic and acute respiratory diseases, including asthma. Most sources of outdoor air pollution are well beyond the control of individuals and demand action by cities and governments. In addition to outdoor air pollution, indoor smoke is a serious health risk for some 3 billion people who cook and heat their homes with biomass fuels and coal. A shift towards cleaner and more efficient modern fuels, such as biogas, liquefied petroleum gas and kerosene, could largely eliminate this health risk and prevent 1.5 million deaths a year globally.

Keywords Air Quality · Smoke · Indoor · Outdoor · Fuels · Health

For something that we take for granted, air quality can be a major risk to human health. By reducing air pollution levels, countries can reduce the burden of disease from stroke, heart disease, lung cancer and both chronic and acute respiratory diseases, including asthma. As recently as 2012, outdoor air pollution in both cities and rural areas was estimated to cause 3.7 million premature deaths worldwide. Nearly 90% of these premature deaths occurred in low- and middle-income countries, and the greatest number in the Western Pacific and Southeast Asia regions.



Fig. 1 Burning verges in Belize

Policies and investments supporting cleaner transport, energy-efficient housing, cleaner power generation, industry and better municipal waste management would reduce key sources of urban outdoor air pollution (Fig. 1).

Reducing outdoor emissions from household coal and biomass energy systems, agricultural waste incineration, forest fires and certain agroforestry activities (e.g. charcoal production) would reduce key rural and peri-urban air pollution sources in developing regions. Reducing outdoor air pollution also reduces emissions of CO₂ and short-lived climate pollutants such as black carbon particles and methane, thus contributing to the near- and long-term mitigation of climate change.

Most sources of outdoor air pollution are well beyond the control of individuals and demand action by cities and governments across key sectors such as transport, energy, waste management, buildings and agriculture.

This isn't rocket science, there are many examples of successful policies in transport, urban planning, power generation and industry that reduce air pollution. For example, for industry, there are clean technologies that reduce industrial smokestack emissions and improved management of

urban and agricultural waste, including the capture of methane gas emitted from waste sites as an alternative to incineration (for use as biogas). For transport, shifting to clean modes of power generation; prioritising rapid urban transit, walking and cycling networks in cities as well as rail interurban freight and passenger travel; and shifting to cleaner and low-emission vehicles and fuels, including fuels with reduced sulphur content.

For urban planning, improving the energy efficiency of buildings and making cities more compact, and thus energy efficient. For power generation: increased use of low-emission fuels and renewable combustion-free power sources (such as solar, wind or hydropower); co-generation of heat and power; and distributed energy generation (e.g. mini-grids and rooftop solar power generation) (Fig. 2).

For municipal and agricultural waste management: strategies for waste reduction, waste separation, recycling and reuse or waste reprocessing, as well as improved methods of biological waste management such as anaerobic waste digestion to produce biogas, are feasible, low-cost alternatives to the open incineration of solid waste. Where incineration is unavoidable, then combustion technologies with strict emission controls are critical.

In addition to outdoor air pollution, indoor smoke is a serious health risk for some 3 billion people who cook and heat their homes with biomass fuels and coal. Some 4.3 million premature deaths were attributable to household air pollution in 2012. Almost all of that burden was in low-to middle-income countries. In developing countries, indoor exposure to pollutants from the household combustion of solid fuels on open fires or traditional stoves increases the risk of acute respiratory infections and associated mortality among young children; indoor air pollution from solid fuel use is also a major risk factor for cardiovascular disease, chronic pulmonary disease and lung cancer among adults.

Estimates of the burden of disease due to indoor air pollution highlight the heavy toll solid fuel use takes on the health and well-being of people in, among others, Afghanistan, Benin, Burkina Faso, Burundi, Ethiopia, Madagascar, Malawi, Mali, Mauritania, Pakistan, Rwanda, Senegal, Sierra Leone, Togo and Uganda. In Afghanistan, Bangladesh, Burkina Faso, China, Ethiopia, India, Nigeria, Pakistan and Tanzania, indoor air pollution is to blame for a total of 1.2 million deaths a year. Globally, reliance on solid fuels is one of the ten most important threats to public health, particularly women and children who are affected disproportionately.

Worldwide, more than 3 billion people depend on solid fuels, including biomass (wood, dung and crop residues) and coal, for cooking and



Fig. 2 Free energy appliances in Guam

heating. A shift towards cleaner and more efficient modern fuels, such as biogas, liquefied petroleum gas and kerosene, could largely eliminate this health risk and prevent 1.5 million deaths a year globally. In the short term, the promotion of more fuel-efficient and cleaner technologies, such as improved cooking stoves, smoke hoods and insulated retained heat cookers, could substantially reduce indoor air pollution and would bring about many other socio-economic benefits.

Water

Abstract The World Bank reports that 80 countries now have water shortages that threaten health and economies, while 40% of the world—more than 2 billion people—have no access to clean water or sanitation. In this context, we cannot expect water conflicts to always be amenable resolved. More than a dozen nations receive most of their water from rivers that cross borders of neighbouring countries which are viewed as hostile. A prime cause of global water concern is the ever-increasing world population. As populations grow, industrial, agricultural and individual water demands escalate. According to the World Bank, worldwide demand for water is doubling every twenty one years, more in some regions. Water supply cannot possibly keep pace with demand, as populations soar and cities explode.

Keywords Water · Agriculture · Meat · Population · Sanitation · Conflict

The World Bank reports that 80 countries now have water shortages¹ that threaten health and economies, while 40% of the world—more than 2 billion people—have no access to clean water or sanitation. In this context, we cannot expect water conflicts to always be amenable resolved. More than a dozen nations receive most of their water from rivers that cross borders of neighbouring countries which are viewed as hostile. These include Namibia, Cambodia, the Congo, the Sudan and Syria, all



Fig. 1 New desalination in Gaza

of whom receive 75% or more of their freshwater from the river flow of often hostile upstream neighbours (Fig. 1).

In the Middle East, a region marked by hostility between nations, obtaining adequate water supplies is a high political priority. For example, water has been a contentious issue in negotiations between Israel

and Syria and with Jordan. In recent years, Iraq, Syria and Turkey have exchanged verbal threats over their use of shared rivers.²

A prime cause of the global water concern is the ever-increasing world population. As populations grow, industrial, agricultural and individual water demands escalate. According to the World Bank, worldwide demand for water is doubling every twenty one years, more in some regions. Water supply cannot possibly keep pace with demand, as populations soar and cities explode. Population growth alone does not account for increased water demand. Since 1900, there has been a sixfold increase in water use for only a twofold increase in population size. This reflects greater water usage associated with rising standards of living (e.g. diets containing less grain and more meat, which uses more water to produce).

In rural sub-Saharan Africa, millions of people share their domestic water sources with animals or rely on unprotected wells that are breeding grounds for pathogens. The average distance that women in Africa and Asia walk to collect water is six kilometres. Average water use ranges from 200 to 300 litres a person a day in most countries in Europe to less than 10 litres in countries such as Mozambique. People lacking access to improved water in developing countries consume far less, partly because they have to carry it over long distances and water is heavy. For the 884 million people or so people in the world who live more than one kilometre from a water source, water use is often less than five litres each day of unsafe water.

The basic requirement for a lactating woman engaged in even moderate physical activity is 7.5 litres each day. At any one time, close to half of all people in developing countries are suffering from health problems caused by poor water and sanitation. Together, unclean water and poor sanitation are the world's second biggest killer of children. It has been calculated that 443 million school days are lost each year to water-related illness.

In Tajikistan, nearly a third of the population takes water from canals and irrigation ditches, with risks of exposure to polluted agricultural run-off. A survey of 5000 schools in Senegal showed that over half had no water supply and almost half had no sanitation facilities. Of those schools with sanitation, only half had separate facilities for boys and girls. The result was that girls chose not to use these facilities, either because they did not want to risk being seen to use the toilet, or because they were warned that these facilities were not private or clean enough. Girls also

avoided drinking water at school to avoid urination, thereby becoming dehydrated and unable to concentrate.

People living in the slums of Manila and Nairobi pay five to ten times more for water than those living in high-income areas in those same cities and more than consumers in London or New York. In Manila, the cost of connecting to the utility represents about three months' income for the poorest 20% of households, rising to six months' in urban Kenya.

NOTES

1. <http://www.worldbank.org/en/topic/water/overview>.
2. The words “river” and “rival” share the same Latin root; a rival is “*someone who shares the same stream*”.

Food

Abstract One in seven people in the world is malnourished. But the solution is not about producing more food. We already produce too much. A large part of the problem is simply that our food is misallocated. The world may not be able to feed itself by 2050 if it does not increase food productivity. With a world population expected to be at least 9 billion people in 2050, the demand for food, feed, fibre and fuel will likely outpace food production if the current rate of output remains the same. Countries need to prioritise agriculture and the growing of food with more sustainable methods. It is not just about growing more, but it is also about managing what we do now.

Keywords Food · Waste · Population · Agriculture · Sustainable

One in seven people in the world is malnourished. But the solution is not about producing more food. We already produce too much. It is just not going to the right places. A large part of the problem is simply that our food is misallocated. Most of it is in the USA and Western Europe where too much is eaten and waste even more. Almost half of all the food in the USA and Europe is wasted, and globally, we waste almost a third of all the food we produce.

Yet, if women farmers had the same access to resources as men, the number of hungry in the world could be reduced by up to 150 million. As many as 66 million primary school-age children attend classes hungry

across the developing world, with 23 million in Africa alone. US\$ 3.2 billion would be needed each year to reach all 66 million hungry school-age children.

The world may not be able to feed itself by 2050 if it does not increase food productivity. With a world population expected to be at least 9 billion people in 2050, the demand for food, feed, fibre and fuel will likely outpace food production if the current rate of output remains the same. Countries need to prioritise agriculture and the growing of food in more sustainable methods. Doing nothing would force further hardship on the world's smaller and poorer farmers, who would likely suffer rising food costs as food supplies fail to meet demand. It could also damage the natural environment by reducing water levels as that resource becomes scarcer from overpopulation and its increased use in agriculture. We will probably see higher levels of methane emission from cattle if we do not learn how to produce more using less from the same resources.

It is not just about growing more, but it is also about managing what we do now. While the European Union estimates that 8% of its fish stocks are overfished, 60% of all fish caught within the European Union are thrown back. Bycatch comes in many forms: more than 300,000 small whales, dolphins and porpoises die each year entangled in fishing nets, 250,000 leatherback turtles are caught on lines, 35 million juvenile red snappers are discarded in the Gulf of Mexico, 85% of hammerheads and threshers from the north-east Atlantic are caught as bycatch, and more than 300,000 seabirds are killed every year by long lines. This litany of mismanagement pushes many species towards extinction. It is an indictment of our clumsy fishing methods and casual disregard for one of the planet's greatest assets.

If we want a fishing industry in the future, we do not need to have conversations that have to start with convincing people that resource management is worth doing. We need to accept that it is, and just do the right thing, and act responsibly in managing a key planetary resource. Population growth makes a case for preserving the natural environment even more compelling.

It is highly unlikely that the consuming public will change its habits. Only wars or regulations change habits. So which is it to be?

In 2010, just a third of British adults believed that climate change was a definite reality compared with 44% in 2009, and nearly a third were in the category that agreed that the threat was exaggerated (a category

which rose by 50% compared to the previous year). This presents problems in relation to decision-making and mitigating adaptive actions. We appear not to have arrived at a cultural tipping point, and people are either unaware (less likely) or unconcerned (more likely) by the possible effects of climate change on the natural environment on which we all depend.

Ecosystem services stewardship (looking after nature) are not words that relate to many people, so it is necessary to develop a wider understanding of environmental values and our new cultural landscape of the future using different terminology (Fig. 1).

Even using existing technologies and best management practices, agriculture could store 350–550 million tonnes of carbon dioxide equivalent each year and current nitrous oxide and methane missions could be decreased by 20–40%.

The UN Food and Agriculture Organisation estimates that there are more than 1 billion hungry people despite the various “Green” revolutions during the 1960s. Subsequent decades of technological improvement in farming methods food supply cannot keep pace with population growth. Demand for food is continuing to grow through both population growth and changing consumption patterns as developing countries adopt Western-style diets containing more processed food and meat.

By contrast, supply of food depends on mainly agricultural land that is steadily being lost to development. Intensive agriculture is also increasing vulnerable to dependence on high levels of oil and water inputs which cannot be relied upon in the long term.

The price spikes in key food commodities in recent years leaving some countries to ban food exports have demonstrated how easily food supplies can be disrupted, leading to widespread suffering in developing countries. Even in overpopulated countries such as the UK, food disruption is a real though largely unrecognised threat.

The eruption of the Icelandic volcano Eyjafjallajokull in 2010¹ demonstrated very clearly just how fragile UK supply chains are. UK government reports on climate change indicate that changes to UK climate and weather patterns are anticipated to affect the agricultural landscape quite profoundly.² With only a few days of food in the supermarkets at any one time (and much less in local shops), UK citizens are quite exposed.

The phrase “*nine meals from anarchy*” sounds more like the title of a bad Hollywood movie than any genuine threat. But that was the

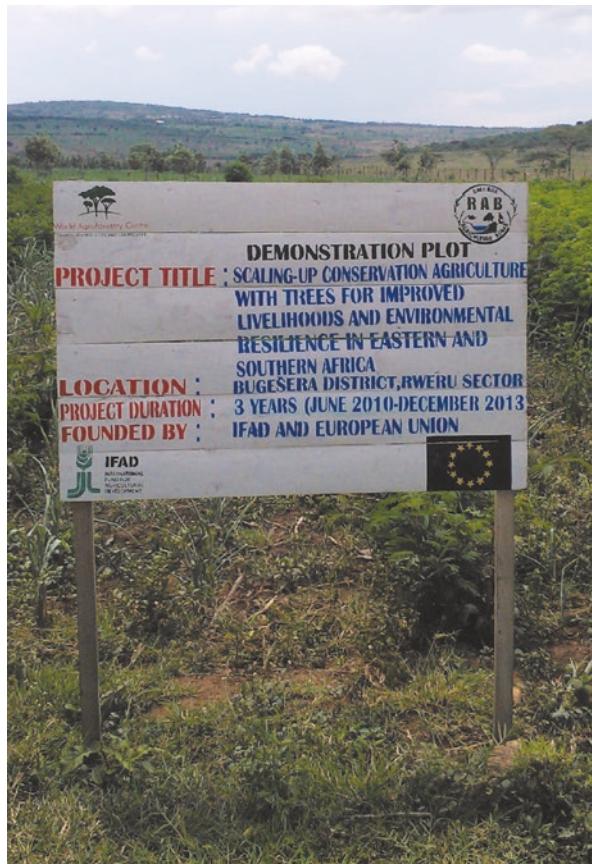


Fig. 1 Scaling-up agroforestry in Rwanda

expression coined by Lord Cameron of Dillington, a farmer who was the first head of the Countryside Agency.³

The scenario goes like this:

- Imagine a sudden shutdown of oil supplies; a sudden collapse in the petrol supply at the pumps and into the engines of the lorries that deliver food around the country, stocking up the supermarket shelves as soon as any item runs out;

- If the trucks stopped moving, people would start to worry and would dash to the shops, stocking up. By the end of day one, if there was still no petrol, the shelves would be looking pretty empty. Imagine, then, day two: the fourth, fifth and sixth meal. People would be in a panic. Day three: still no petrol; so,
- What then? With hunger kicking in, and no notion of how long it might take for supermarkets to restock, how long before those who had not stocked up began stealing from their neighbours? Or looting shops for remaining supplies? There might be 11 million gardeners in Britain, but the summer peas will not go far when people are hungry and the baked beans have run out.

It was Lord Cameron's estimation that it would take just nine meals—three full days without food on supermarket shelves—before law and order started to break down, and British streets would descend into chaos.

Hardly far-fetched because that is exactly what happened in the USA in the aftermath of Hurricane Katrina. People looted in order to feed themselves and their families.⁴ And people know what it is like when petrol delivery tankers block the refineries in the UK and the panic-buying begins.⁵

People know how they behave. It is not pretty.

Britain is not self-sufficient in food production; it imports 40% of the total food consumed and the proportion is rising. Britain relies on imports to feed itself. Food chains are sensitive to markets. Behind the always-full-looking supermarket shelves lies a supply chain that is at risk of economic, political, environmental and climatic shocks. Too much or too little rain can reduce harvests. Emerging exotic diseases such as bluetongue and African swine fever threaten to devastate livestock industries. The UK is also exposed to volatile global markets for products such as animal feed that have strong impacts on supermarket prices.

Yet, despite this, a recent report by the Institute of Mechanical Engineers, *Global Food; Waste Not, Want Not*,⁶ has noted that as much as 30% of crops in the UK are never harvested simply because supermarkets dismiss whole fields of crops based on appearance and lack of conformity.

Increasing land purchases in developing countries by wealthier nations is an indicator of that concern which also creates potential future conflict. More and more countries, unable to secure food for their populations, are leasing land from other countries (particularly from those that

have control over their people and importantly, their land). Already we see Qatar dealing with Kenya to lease 40,000 hectares of land to grow crops.⁷ In Kenya, fertile land is unequally distributed. Several prominent political families own huge tracts of farmland, while millions of people live in densely packed slums. The country regularly experiences a food crisis, with the government forced to introduce subsidies and price controls on maize after poor production and planning caused the price of the staple “ugali” flour to double.

Qatar, which has large oil and gas revenues, imports most of its food, as most of its land is barren desert with just 1% suitable for arable farming. Saudi Arabia and the United Arab Emirates have also been negotiating leases of large tracts of farmland in countries such as Sudan and Senegal. Deals are already in place to grow rice in Cambodia, maize and wheat in Sudan and vegetables in Vietnam; much of the produce will be exported to the Gulf. South Korea almost secured a lease in Madagascar to grow crops on 1.3 million hectares of land.⁸

The UK Population Matters⁹ (formerly the Optimum Population Trust) believes reducing and ultimately reversing population must be considered alongside other strategies for addressing global hunger and not least of which is improving reproductive health in developing world and helping those 215 million women who currently lack access to modern contraceptive methods.

Many of the millions of poor farming households in poor countries who make up the bulk of the world’s agricultural labour force, if not its agricultural output, already face more variable weather. That, and a lack of social safety nets, requires those who are most at risk to undertake some adaptive strategies such as changing crop varieties or planting patterns. Worse, in bad weather whole regions suffer all together.

Even if prices are higher, crops are more resilient, and insurance more readily available, abandoning the farm is a way many farmers choose to adapt. It may be prudent to provide anticipatory help, for instance, to poor African farmers. It may be better in the long term to encourage them into cities and to reform labour markets, restrictions on the opening and closing of companies and so on to help them earn money.

One half of the world’s people live in cities already and three-quarters or more may do so by mid-century. Encouraging this trend further may be a useful way of reducing the economic exposure to climate change. Climate change is already affecting African urbanisation. Yet, one of the more disappointing aspects to African urbanisation is that it does not

really work; it seems not to lift people out of poverty which it ought to since crowding people together generally supports businesses which otherwise would not exist or thrive. It just seems that African centres are simply centres of consumption, places for informal jobs, not places of good infrastructure. For instance, Lagos is littered with unfinished construction and compromised land, where the poor are seen as a blight to bulldoze away without offering alternative, better housing.

Mostly, urbanisation in Africa seems to benefit those with some or lots of money, not those with little or none.

NOTES

1. https://www.chathamhouse.org/sites/files/chathamhouse/.../r0112_highimpact.pdf.
2. <https://www.gov.uk/government/.../pb13274-uk-climate-projections-090617.pdf>.
3. A statutory body in England set up in 1999 with the task of improving the quality of the rural environment and the lives of those living in it. It has since been disassembled into other statutory bodies.
4. http://www.msnbc.msn.com/id/9131493/ns/us_news-katrina_the_long_road_back/t/looters-take-advantage-new-orleans-mess/#.UIJ-OWcw-So.
5. <http://www.guardian.co.uk/uk/2012/mar/29/panic-buying-fuel-prospect-peace-talks>.
6. <http://www.imeche.org/policy-and-press/reports/detail/global-food-waste-not-want-not>.
7. <https://www.theguardian.com/environment/2008/dec/02/land-for-food-qatar-kenya>.
8. <http://www.un.org/africarenewal/magazine/special-edition-agriculture-2014/africa%E2%80%99s-land-grabs>.
9. <https://www.populationmatters.org/>.

Energy and Commodities

Abstract Providing access to electricity in rural areas of the world is a major challenge. The fuel is generally of poor quality, and energy is used inefficiently; the power supply is unreliable and access to it limited, with about a billion people in rural areas still unable to benefit from modern energy services. This not only has an adverse effect on economic productivity; more importantly, it also affects people's quality of life and is having a strong impact on the environment. Locally based measures that use renewable energies to secure the rural power supply could open up new opportunities for economic productivity while also reducing greenhouse gas emissions and local pollutants resulting from the extensive usage of fossil fuels.

Keywords Energy · Rural · Minerals · Rare Earths

Nuclear energy is not carbon free, though offers potentially large reductions in greenhouse gas emissions compared to fossil fuels. There are two problems with nuclear: one is that the waste has to be managed for generations (by definition that is not sustainable) and two, does anyone trust any government to manage nuclear power? The Japanese still just seem to be incapable of dealing, transparently, with the really serious consequences of Fukushima.

By 2020, the UK may be generating only about 80% of the electricity it needs.¹ Although fossil fuels will remain the mainstay of supply, with



Fig. 1 Getting power where it is needed in Mauritania

renewables expanding, nuclear power will still be advocated, arguing that if the UK is to remain on the path of reducing atmospheric emissions of greenhouse gases, it will need to retain some nuclear capacity. Renewables could supply 100% of generation by 2050,² but a short-sighted lack of research and development between 1990 and 2010 ensured twenty years of delay. A classic example of weakness in governance.

Investment in renewables has been long overdue, and so, the gap in electricity supplies left by nuclear closures will almost certainly have to be bridged by building new reactors, if the UK is to fulfil its long-term ambitions on climate change. That is one view. Another is that more than 50% of Britain's greenhouse gas emissions come directly or indirectly from buildings, and the key to dealing with that source of emissions lies in renewables and energy efficiency.

Providing access to electricity in rural areas of the world is a major challenge (Fig. 1).

The fuel is generally of poor quality, and energy is used inefficiently; the power supply is unreliable and access to it is limited, with about a billion people in rural areas still unable to benefit from modern energy services. This not only has an adverse effect on economic productivity; more importantly, it also affects people's quality of life and is having a strong impact on the environment. The unsustainable use of locally sourced biomass and an increasing dependence on fossil fuels are causing environmental degradation at local (land degradation), regional (air, water and soil pollution) and global levels (greenhouse gas emissions contributing to climate change).

Locally based measures that use renewable energies to secure the rural power supply could open up new opportunities for economic productivity while also reducing greenhouse gas emissions and local pollutants resulting from the extensive usage of fossil fuels.

There is correlation between theft and global commodity markets around the world. Copper crimes are significant with missing cables causing train delays and delays in repairs to telecoms networks. Heating boilers, pipes and air-conditioners have been ransacked. An average car contains 125 kg of copper.³ Electronic gadgets from PCs to mobile phone use copper contacts. Before China's economy began to increase, copper traded at less than US \$2000/tonne. In 2011, the price hit US \$10,000/tonne before falling back to US \$8400/tonne. This reflects the scale of China's urbanisation and industrialisation both of which require plentiful supplies of metal. China consumes at least 40% of global output (about 16 million tonnes in 2010),⁴ and global demand for copper is expected to increase by more than 40% to 27 million tonnes by 2020. There are few sizeable new deposits in North and South America and Australia, and production in Chile peaked in 2007. The only new mine with significant deposits is one in Mongolia which started commercial production in 2013, and may produce eventually half of the required amount.

Additional copper supplies could increasingly rely on smaller mines, deeper underground and with lower grade ores. There will also be those in the riskier parts of the world such as Africa's copper belt stretching across Zambia and Congo. A potential mine in Afghanistan lacks access to vital infrastructure such as roads and railways, power and water. Lead-in times that were once four or five years for authorising an operation to extract now take seven to eight years.

NOTES

1. <https://www.theguardian.com/environment/2016/jan/26/engineers-warn-of-looming-uk-energy-gap>.
2. <https://www.theguardian.com/sustainable-business/britain-renewable-energy-2050-target>.
3. <http://resources.schoolscience.co.uk/CDA/16plus/sustainability/copper5.html>.
4. <http://www.visualcapitalist.com/china-consumes-mind-boggling-amounts-of-raw-materials-chart/>.

Land

Abstract Across Nigeria's middle belt, indigenous tribes spar with settlers moving south as the Sahel encroaches on their pastures. Grazing pathways for nomadic herdsman are needed. Oil-rich Niger Delta was once paralysed by an armed insurgency which began when local communities protested that little wealth generated from oil extracted on their lands made its way into their communities. The overarching problem is that Nigeria is split between the mostly Muslim north and the predominantly Christian south with its 180 million people belonging to 250 ethnic groups and speaking more than 500 languages so differences often manifest along religious or tribal lines. In most countries, such disputes will be resolved by the state, but in Nigeria the state institutions have been hollowed out by years of corruption.

Keywords Nomads · Militancy · Patronage · State Institutions

Just a couple of examples of the issues:

The farmers of north-central Nigeria have spent fifteen years fighting the nomadic Fulani herdsmen. Across Nigeria's middle belt, indigenous tribes spar with settlers who are moving south as the Sahel encroaches on their pastures. Fulani chiefs living deep inside the plateau claim they are provoked by farmers who steal their herds which is a serious crime in a culture where wealth is measured in livestock. This conflict in the middle

belt, a loosely defined region, that cuts across central Nigeria has passed unnoticed in the shadow of Boko Haram. Grazing pathways for nomadic herdsmen are needed.

Another uprising also threatened Nigeria. This one is in the oil-rich Niger Delta, part of the country that was once paralysed by an armed insurgency which began when locals protested that little of the wealth generated from the oil extracted on their lands made its way into their communities.

In the early 2000s, oil production in the Delta fell by half as militants blew up pipelines and kidnapped oil workers. Many also grew rich by stealing oil. The conflict only ended in 2009 when the government offered amnesty and militants were paid to protect the pipes they used to blow up. Those contracts have now been cancelled, and critics gloomily predict that deeper trouble lies ahead, especially if militants decide to combine forces with independence protesters in the neighbouring region formerly known as Biafra where the “Avengers” are ready to declare the Niger Delta states (Akwa Ibom, Bayelsa, Delta, Edo and Rivers) a republic.

The overarching problem is that Nigeria is split between the mostly Muslim north and the predominantly Christian south with its 180 million people belonging to 250 ethnic groups and speaking more than 500 languages, so differences often manifest along religious or tribal lines.

Politicians often fund the flames by financing family networks or favouring one group over another. Poverty and population growth exacerbate these tensions as many as 10 million children are out of school and half of all young adults are unemployed or underemployed. In most countries, such disputes would be resolved by the state, but in Nigeria the state institutions have been hollowed out by years of corruption.

A sea cucumber can sell for half its weight in silver in the markets of Guangzhou in southern China¹; this fleshy sea slug is prized as a delicacy and is a traditional medicine reputedly capable of curing joint pain and fatigue and the ubiquitous requirement for a natural aphrodisiac. Overexploitation has depleted stocks throughout Asia. Since Chinese traders discovered the animal in the waters around Sierra Leone’s Banana Island some years ago, islanders have been diving for the cucumber. The Chinese promised to use some of the profits from the trade to boost the islands prosperity with a motorboat, community centre, solar panels and water pumps in exchange for being allowed to operate for six years. The common refrain is: “...the traders made a lot of money and we didn’t get any of it...” (Fig. 1).



Fig. 1 Illegal forest clearance by Chinese in Sierra Leone

Similar words echo throughout Sierra Leone history after centuries of exploitation by foreigners of its resources, gold, diamonds and bauxite.

The country remains one of the world's poorest.

NOTE

1. <http://www.economist.com/news/middle-east-and-africa/21695880-locals-lose-out-silver-deep>.

Shelter

Abstract Some people are just living in the wrong place, and no amount of do-gooding by international NGOs can change that. What these NGOs can do is start recognising the bankruptcy of their work in the long term and begin to change mindsets of the governments with whom they work. Otherwise, they are simply shoring up incompetent governments and locking those, who they claim they want to help, into long-term grinding poverty. The problem is that there is little master planning, no planned infrastructure such as road, utilities, green or at least open spaces. Growth is outpacing any plans. By the time a plan has gone through its stakeholders (who extract benefits), the real world has moved on and a revised plan is needed.

Keywords Master Planning · Infrastructure · Growth · Population

Some people are just living in the wrong place and no amount of do-gooding by international NGOs can change that. What these NGOs can do is start recognising the bankruptcy of their work in the long term and begin to change mindsets of the governments with whom they work. Otherwise, they are simply shoring up incompetent governments and locking those, who they claim they want to help, into long-term grinding poverty.

A classic case is the chars of Bangladesh.¹ These are river islands formed from sedimentation, and the families who live on them are, not surprisingly, extremely vulnerable to natural disasters. Heavy rains

throughout the monsoon months, beginning in August, typically leave thousands of people in northern Bangladesh homeless or in dire straits as the Brahmaputra, Dharla and Teesta rivers burst their banks, spilling out over the countryside. Some of the worst hit are the 50,000–70,000 “char dwellers”.

Bangladesh loses around 32 sq km each year as coastlines shift, river beds dry up and floods and siltation leave little mounds of earth behind, which means that each year approximately 26,000 people lose their land in Bangladesh. Many of those left landless opt to start life afresh on the chars, which lack almost all basic services: a water supply, sanitation facilities, hospitals, schools, electricity, transport, police stations and markets.

All over Bangladesh, the impacts of a wetter and warmer climate are making themselves felt among the poorest and most marginalised segments of society. In a country of 156 million people, 70% of whom live in rural areas, natural disasters are magnified. Some 50–80 million people live in flood-prone or drought-prone areas around the country. While statistics about their average income vary, rural families seldom earn more than 50–80 dollars each month.

Natural disasters in Bangladesh have resulted in millions of dollars of damage every year, and for the char dwellers, the prospect of more frequent weather-related hazards must be a grim prospect. They can always take comfort, though, that their government still finds funds for launching its first satellite into Earth orbit.

The World Bank is supporting the government on its *Community Climate Change Project* at a total cost of 12.5 million dollars to assist the most vulnerable communities to cope with climate-related adversities. Tens of thousands of char dwellers will be the primary beneficiaries of these ambitious projects. Think of how much more could be done if they had access to the 100–150 million dollars Bangladesh has put aside for launching its first satellite.² In contrast, raising their flimsy homes up a few feet on plinths does not really seem to be much of a solution, more a very short-term fix.

Shuttling among new high-rises and bars before retreating to a boutique hotel, one could be deluded into thinking that after decades of neglect, several African countries are emerging from darkness. Look more closely and the cracks are there: intermittent power cuts, ancient sewerage systems and insufficient housing for an influx of migrants from the countryside. The situation is worse in rural locations where much of



Fig. 1 Open sewage behind the hotel tennis court, Togo

the population lives not only in extreme poverty but also mired in debt. Bad roads make it costly to get goods to market and impede investment. Perhaps as much as three-quarters of Africa's children live in homes that lack electricity.

Infrastructure, both physical and financial, is somewhere between crumbling and non-existent, with archaic laws and decades of under-investment in education (Fig. 1).

Governments need to tackle land rights which are confusing and poorly enforced and impede foreign investment in agriculture.

The only future for the rural poor is in the cities though not the sprawling shanties that we see on the edges of major cities in Africa or Asia. The problem is that there is no master planning and no planned infrastructure such as road, utilities, green or at least open spaces. Just piles of poorly constructed dwellings. Retrofitting is impossibly expensive and therefore will never be done.

Growth is outpacing any plans. By the time a plan has gone through its stakeholders (who extract benefits), the real world has moved on and a revised plan is needed. Lagos has had several such master plans going back years and is still an urban mess.

NOTES

1. <http://www.ipsnews.net/2014/10/bangladeshi-char-dwellers-in-search-of-higher-ground/>.
2. <http://en.prothom-alo.com/science-technology/news/120245/Deal-signed-to-launch-Bangladesh%E2%80%99s-first-satellite>.

Health

Abstract Time was, when people in poor countries were too hungry and hard-working to be obese, could not afford cigarettes and mostly died before the ailments of middle age kicked in. Non-communicable diseases were a rich world problem. But now affluence and urbanisation mean new kinds of unhealthy lifestyles are emerging in developing countries. Most of the resulting health burden stems from sugar, fat, smoke and sedentary lifestyles. Often countries have their health systems designed for acute problems (largely as a result of what foreign donors wish to fund). Sometimes, a sense of crisis (such as Ebola) brings a dramatic progress unlike day-to-day diseases that do not arouse the same passion or interest.

Keywords Affluence · Health burden · Crisis · Acute Problems

Time was when people in poor countries were too hungry and hard-working to be obese, could not afford cigarettes and mostly died before the ailments of middle age kicked in. Non-communicable diseases were a rich world problem. But now affluence and urbanisation mean new kinds of unhealthy lifestyles emerging in developing countries which already bear a heavy burden of chronic illnesses.

In India, more than 40% of children under five are malnourished.¹ Non-communicable diseases are anticipated to rise by 15% between 2010 and 2020 with jumps of more than 20% in Africa and Southeast Asia.

The number of Chinese diabetics is expected to double by 2025,² and even in sub-Saharan Africa, chronic illnesses are likely to surpass maternal, child and infectious diseases as the biggest killer by 2030.

Most of this health burden stems from sugar, fat, smoke and sedentary lifestyles, though sickle-cell disease is the biggest non-communicable killer of Africa's children even though it is easily treatable. This is because it almost always goes undiagnosed in countries which have their health systems designed for acute problems (largely as a result of what foreign donors wish to fund) (Fig. 1).

Often a sense of crisis (such as HIV or Ebola) brings a dramatic progress that day-to-day diseases do not arouse with the same passion or interest. Countries just muddle along when even simple steps can make a difference such as raising tobacco taxes, which is perhaps the simplest way of curbing cancer and diseases of the heart and lungs as well as raising money.

Many African countries have great natural resource potential which is typically marred by political cronyism and mismanaged economies. Even those with classified middle-income status with rich natural resources, good infrastructure, tantalising landscapes, nominal stable and democratic government, a free press and an economy that has grown well since their independence are not what they seem.

With a population of just 2.2 million rattling around the country one-half times the size of France, Namibia seems to be doing well, yet it is one of the most unequal nations on Earth. In Windhoek, you would think you were in a rich European town, with well-paved streets lined by elegant high-rise hotels and banks, smart boutiques, outdoor cafes and pretty little homes painted in the colours of the desert: ochre, pale yellow and salmon pink. Drive north towards Angola and there are overcrowded black townships and beyond the *cordon sanitaire*, a fence nominally to keep out goats, lie the sprawling shanty towns with its dirt-poor inhabitants living in leaky, corrugated iron shacks with no electricity, running water or sanitation. Although not dissimilar to elsewhere in Africa, the differences between those who have and those who have not are more extreme. Two in five Namibians live on less than US \$1.25 a day, and 60% continue to eke out a living as subsistence farmers.

The official unemployment rate stood at 28% in 2014,³ for two-thirds of those under 25 and never had a job; matters are worsened by HIV/AIDS. At the peak of the epidemic (2002), 20% of Namibians between 15 and 49 were infected.



Fig. 1 HIV-AIDS in Yap

Yet, in 2012, Namibia military spending was more than US \$ 430 million.⁴ It is a choice.

NOTES

1. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4367032/>.
2. <http://www.latimes.com/science/sciencenow/la-sci-sn-diabetes-exploding-world-20160406-story.html>.
3. <http://www.tradingeconomics.com/namibia/unemployment-rate>.
4. <http://militarybudget.org/namibia/>.

Education

Abstract Since 2000, there has been enormous progress in achieving the target of universal primary education. Total enrolment rate in developing regions reached 91% in 2015, and the worldwide number of children out of school has dropped by almost half. There has also been a dramatic increase in literacy rates, and many more girls are in school than ever before. These are all remarkable successes. Yet, many sense that the central principle of education as a basic human right is more equivocal today than previously. This is apparent in the shaping of the global development agenda post-2015, where such concerns have resurfaced. Achieving inclusive and quality education for all reaffirms that education is one of the most powerful and proven vehicles for building societal resilience.

Keywords Primary · Secondary · Rights · Children · Women

Since 2000, there has been enormous progress in achieving the target of universal primary education. The total enrolment rate in developing regions reached 91% in 2015,¹ and the worldwide number of children out of school has dropped by almost half. There has also been a dramatic increase in literacy rates, and many more girls are in school than ever before. These are all remarkable successes (Fig. 1).

Progress has also faced tough challenges in developing regions due to high levels of poverty, armed conflicts and other emergencies. In Western



Fig. 1 A primary school in a rainforest clearing in Guyana

Asia and North Africa, ongoing armed conflict has seen an increase in the proportion of children out of school. While sub-Saharan Africa made the greatest progress in primary school enrolment among all developing regions—from 52% in 1990, up to 78% in 2012—large disparities still remain. Children from the poorest households are four times more likely to be out of school than those of the richest households. Disparities between rural and urban areas also remain high.

Achieving inclusive and quality education for all reaffirms the belief that education is one of the most powerful and proven vehicles for sustainable development. This goal ensures that all girls and boys complete free primary and secondary schooling by 2030. It also aims to provide equal access to affordable vocational training and to eliminate gender and wealth disparities with the aim of achieving universal access to a quality higher education.

Many sense, sadly, that the central principle of education as a basic human right is more equivocal today than in the past. This is apparent

in the shaping of the global development agenda post-2015, where such concerns have resurfaced. The issue of whether the right to education can be reconciled with the Sustainable Development Goals post-2015 was also posed in the *Second World Human Rights Forum* (2014)² where participants from all regions voiced their deep concerns. They included the UN Special Rapporteur on the Right to Education whose recent report sharply focused on the risks posed by increasing privatisation of education in poorer countries.

The current formulation does not do justice to recent advances in how we conceive the right to literacy. The scope needs to expand so that literacy skills are not seen just as the ability to read and count but as enabling individuals to fully participate in society. A reluctance to explicitly refer to government obligations to allocate the necessary resources to meet education targets means that responsibility will remain with families, which greatly impacts educational opportunity for children from the poorest households.

By contrast, a decision to focus on scholarships for higher education sends the wrong signal as to what financing mechanism should be prioritised to realise the right to education. There need to be references to gender and marginalised groups which better convey the need to monitor inequalities across all levels of education. A reference to compulsory basic education is necessary such as the inclusion of at least a year of free and compulsory pre-primary education which would have also been more compatible with a rights-based approach.

Despite these challenges, some progress has been made when compared to the Millennium Development Goals. For example, the reference to free primary and secondary education is important. The growing trend in the privatisation of education may be consistent with the right of parents to choose the education they want for their children as specified in the *Universal Declaration of Human Rights*. However, it also poses the risk that governments may abdicate their responsibility. The commitment to free education is therefore very important.

In addition, the proposed target on global citizenship reminds us that education is not only a human right in itself but also a means to secure other human rights and to promote tolerance and peace. It sets the education community on the path to look deeper into how it can achieve these ultimate objectives. Beyond target formulations, the real test of whether the post-2015 agenda can be reconciled with the right to education is the establishment of robust accountability mechanisms. Such

mechanisms were practically absent from the development agenda after 2000.

The post-2015 sustainable development agenda needs to carefully consider the instruments established by the United Nations Human Rights Council as an example of a possible way forward.

NOTES

1. <http://www.gh.undp.org/content/ghana/en/home/post-2015/sdg-overview/goal-4.html>.
2. <http://www.uhrsn.org/2014/12/marrakesh-heart-2nd-world-human-rights-forum/>.

Work

Abstract People living in towns of sub-Saharan Africa spend a bigger share of their income on food than residents almost anywhere else in the world. Labourers often use over half their wage just to eat, and since Africans tend to depend on a few staple crops, rises in cereal prices can be devastating. More money on food means less on school fees, sanitation and health; it may also mean more girls forced into prostitution. In recent years, in some African markets, maize and wheat prices have risen by 30% leading to political tension in places such as Burkina Faso, Mozambique, Senegal and Uganda. Some people worry that price rises may push Sierra Leone back into conflict.

Keywords Rural Development · Labour Rights · Chinese Investment

Although the European legacy has a long history in Africa, more Chinese have come to Africa during the past twenty years than Europeans during the past 400 years. As with previous occupiers, some may care little about rules, regulations and local sensitivities.

Although local people may be employed and employers act responsibly, there are too many examples of poor practice. Those who work in Chinese-run mines in Zambia's copper belt must work for two years before they get safety helmets. China has been seeking to become a player around the table of development aid and has given more loans to poor countries in Africa than many other donors. Though this does

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Letter of the day

This letter, the Editor feels, demands special attention

It is myopic to destroy Kalangala forests

NIR – I wish to comment on the statements made in the article "Oil palm plantation: BIDCO development project" published on October 4. Contrary to what Mr Rao claims, oil palm plantations do constitute an environmental hazard. First of all, islands of Kalangala are due to the relatively high rainfall compared with rest of Uganda, and several jatropha species are primarily found there. Second, it is not entirely accurate that an oil palm plantation will contain more dry matter than the current forest. While the palms may have a higher net carbon fixation to lowland forests, they require to be replanted every 23-27 years or so, and in such the carbon is standing in the trees is replaced by that of the existing forest. Third, the canopy cover will not be one hundred percent, while it is true that a mature plantation can approach this, regrettably it

NO EVIDENCE: BIDCO workers take to seedlings

will at any time exert one hundred percent canopy cover due to the diversity of species, including shade-tolerant trees and plants that grow under the top canopy). But most important, the natural forest replaced is the habitat for an extremely diverse range of species, and so the extensive use of oilseed in

derived from medicinal plants and 25 percent of oilseed is imported directly from plant materials. It should also be mentioned that studies show the natural tropical forest does not contribute to soil erosion and the effect is long lasting. Oil palms monocultures are in general associated with soil erosion since forest clearance removes some 50 percent exposure to heavy tropical rainstorms. The picture which was published with Rao's article shows no clear evidence of the oil palms being protected against erosion as claimed by BIDCO. Malaysia is not only the world's biggest oil palm producer, but it is also the biggest user of oil palms around the world. Replacing the natural forest with vast monoculture plantations with low biodiversity is a short-sighted way of making profit for the few, with long-term negative consequences for the majority.

Fig. 1 Myopia in Uganda

not really sit well when, for instance, hundreds of textile factories across Nigeria collapsed because they could not compete with Chinese-made imports. Another example is, the Chinese-built road from Lusaka, Zambia's capital, to Chirundu, 130 km (81 miles) to the south-east was partially and quickly swept away by rains.¹

On the other hand, the Chinese are more at home with bad habits such as corruption and bribery which other donors are eschewing more and more. Most Chinese loans are tied to spending the money with Chinese companies despite this leading to shoddy work. With no competition, such favoured firms get away with delivering bad roads and over-priced hospitals. Chinese aid figures are treated as state secrets (Fig. 1).

African governments cannot cope with the sheer volume of new Chinese enterprises, and their institutions are too weak to enforce labour inspectors. The Chinese component may reside in the background. Some voices try to explain their concerns.

People living in towns of sub-Saharan Africa spend a bigger share of their income on food than residents almost anywhere else in the world. Labourers often use over half of their wage just to eat, and since Africans tend to depend on a few staple crops, rises in cereal prices can be devastating. More money on food means less on school fees, sanitation and health; it may also mean more girls forced into prostitution. In recent years, in some African markets, maize and wheat prices have risen by 30% leading to political tension in places such as Burkina Faso, Mozambique, Senegal and Uganda. Some people worry that price rises may push Sierra Leone back into conflict.

NOTE

1. <http://www.economist.com/node/18586448>.

Technology

Abstract Very poor people around the world today are choosing a smartphone, even over running water and electricity. The device connects you to the world and gives you access to information, education, price data for goods and services, ability to report corruption and so on. Technology is also the direct cause of our biggest problems—global warming, health issues and potential nuclear annihilation. In developing countries, technology advances are getting food to places that need it, empowering farmers with real-time prices so they can decide the optimal time to go to the market with their crops and delivering quality education to remote villages. Good in theory unless it is the rainy season and then there is no hope of traversing quagmired rural roads.

Keywords Software · Internet · Agriculture · Food · Markets

Software could solve the world's biggest problems, many tech entrepreneurs believe, if only it is put to the right use. Very poor people around the world today are choosing a smartphone even over running water and electricity. The device connects you to the world and gives you access to information, education, price data for goods and services, ability to report corruption and so on. Technology is also the direct cause of our biggest problems—global warming, health issues and potential nuclear annihilation (Fig. 1).



Fig. 1 Bingo in Republika Srpska

One school would argue that people are starving in the world not because we do not have enough food, but because we are not organised to solve that problem and our computers are not helping us do that. Others maintain that expanding Internet access could create another 140 million new jobs, lift 160 million people out of poverty and reduce child mortality by hundreds of thousands of lives. And still others, that vaccines are more important to the developing world than Internet connectivity.

Technology defined broadly—from medicine to electricity—has of course transformed the world and saved countless lives and livelihoods. But in the tech world, the focus is, currently, on software and Internet access. In developing countries, technology advances are getting food to places that need them and averting avoidable famine, empowering farmers with real-time prices so they can decide the optimal time to go to the market with their crops and delivering quality education to remote villages. Good in theory unless it is the rainy season, and then, there is

no hope of traversing quagmired rural roads. Technology is necessary but not sufficient to save the world other than use it more wisely and efficiently.

Why cannot technology save us from ourselves?

Man started developing technology as a tool during the Stone Age. Tools such as spears and axes would help humanity to catch and eat food. Later in the Iron Age, humanity would develop industrial technology for weapons of war by forging swords and shields out of iron and other metals. Further still in time, we saw the development of industry—the machine age would allow us to do more and be more productive in our quest to make and sell more things. Fast forward to today, and we see electronics technology being combined with machines to create smart mobile phones, smart cars and even smart appliances. Then, of course, there is artificial intelligence.

So with all of this great technology at our fingertips, what is the problem? It is humanity itself.

Humans are inherently flawed. We are not computers, and we are not perfect. Many would, and do, argue that machines and computers are the more perfect versions of us, but it is us who currently control technology, and therein lies the problem.

A radar-guided missile system can be accurate to within mere metres of a target miles away, yet when a human pushes the button, the loss of an innocent commercial jetliner may ensue. We have smart cars that can almost drive themselves, yet so many people die each year to drunk drivers and red-light runners. We have technology that can sense the existence of bacteria in food, yet we constantly hear about people relabelling expired meat or shipping tainted food because they were not paying attention or else they were trying to cheat the system to make more money.

The limit of technology today is that it is still under human control, which means that any dummy with access to a control button can cause a major disaster, regardless of how advanced the technology in their hands might be. We are a society of mammals who know enough to be dangerous, but not enough to save ourselves from ourselves. All technology can do is sit and wait for its button to be pushed, while humanity continues to allow tragedies to occur—in effect relegating technology to simply watch helplessly.

New technologies are slowly evolving to take some of humanity's imperfections away from humans. But until technology is given the

ability to stop humans from doing stupid things, we will continue to be at the mercy of ourselves. Time will reveal how much effort humanity places in developing life-saving technologies versus technology that merely looks cool and makes more sales or worse, allows killing of each other as if a computer game.

PART III

Politics

Global Weakness

Abstract Under basic sovereignty principles, a country's government is responsible for its own state. Convenient as it might be, it is not credible to blame anyone else. However, at least a joint responsibility should be laid at the doors of global institutions and donors from industrialised countries. They have overseen the general mess that the world now experiences. The planet has two sets of resources: minerals which are largely finite and natural resources which are mostly renewable. From at least the second half of the last century, increasing damage to the natural resources has been documented and trends predicted. In general, it has been underestimated. Despite that, no one in any global institution or in any national government, anywhere, can say they did not know.

Keywords Global Institutions · Resources · Finite · Renewable

Sustainable development means that development should meet the social, economic and environmental needs of the present without compromising the ability of future generations to meet their own needs. Fair enough. But how do we know what this looks like?

It means living within environmental limits to ensuring a strong, healthy and just society with a sustainable economy, underpinned by good governance. Sounds good.

During the last twenty five years, we have used unsustainably, or degraded, 60% of the world's resources so that leaves just 40% for the

rest of time. That cannot sound sustainable in anyone's definition of sustainable development, no matter how bizarre. We certainly have compromised the ability of future generations to meet their own needs comprehensively. Though until global governance gets that, sustainable development is pretty much a lost cause.

Of course, under basic sovereignty principles, a country's government is responsible for its own state. Convenient as it might be, it is not credible to blame anyone else. However, at least a joint responsibility should be laid at the doors of global institutions and donors from industrialised countries. They have overseen the general mess that the world now experiences.

The Earth has two sets of resources: minerals which are largely finite and natural resources which are renewable, at least in principle. From at least the second half of the last century, increasing damage to the natural resources has been documented and trends predicted. In general, it has been underestimated. Despite that, no one in any global institution or in any national government, anywhere, can say they did not know. Not unless they have been living in a cave, and there are few documented instances of this. One of the more well-known ones, of course, is that of the current Chinese president who spent his teenage years living in a cave in a village called Liangjiahe in northern China.¹ That aside, not many can use cave-living as an excuse for ignorance.

Individual solutions to natural resource usage and management have been promoted for decades. Again, no one in any global institution or in any national government, anywhere, can say they did not know. It is hard to avoid the conclusion that so many officials in global institutions and national governments can get this so wrong, for so long, unless it is by design.

It is quite topical to believe in conspiracies from the Moon landing to Area 51.² It is equally difficult to believe that so many officials in global institutions and national governments could be coordinated and manipulated in such a fashion. It seems inconceivable. So, the only other reasonable and rational explanation is that these officials are simply not up to the task.

Herein lies the dilemma; on the one hand, we need global institutions to hold poor national governance to account, yet on the other hand we need the national governments to fund the global institutions. Currently, the global institutions are clearly in hock to the largest contributors.

The United Nations is funded by its member states through compulsory and voluntary contributions. The size of each state's compulsory contribution depends mainly on its economic strength, though its state of development and debt situation are also taken into account. The USA pays the lions share, yet still only has the same number of votes as Burkina Faso—one. If past decades provide a guide, new problems will be thrown at old institutions that were created for other purposes (Fig. 1).

Global action is important. Some core principles are required to guide as to when, where and how global action is required. While many problems could be resolved at the national or regional level, in reality the compromises would be so severe as to render any outcomes meaningless.

Take climate change that has to be resolved at global level. Global collective action is clearly required to protect the common good. While certain countries have to be present, the ones who can fund the options, countries most affected by the problem need to be there. Although one could just involve the top twenty countries accounting for over 80% of the emissions, countries most affected (such as Tuvalu, in the case of climate change) need to be included in the planning and shaping of global action.

The process of global management must be an efficient one so the process of global management needs to accommodate the minimum number of countries required at each stage of managing a problem. For climate change, every country needs to be involved.

Actions have to be agreed by all parties. This is where much better education of world leaders is needed so they also do what they promise. This is not easy in a world which has a single power centre. Intergovernmental reviews and pressure among governments is one route towards enforcement. Equally vital is public pressure which emerges when inactions or failure are brought to light by the media, by the campaigning of NGOs or by other public institutions. This requires widespread information about what governments agree among themselves and about their compliance with the rules. The enforceability of global action therefore requires a high degree of transparency.

We need radical reform of those that exist, including their streamlining. This may well involve the closure of some and the redefinition and transformation of others. If this does not happen, there will be growing frustration among citizens with the slow progress and erosion of legitimacy and effectiveness of global governance.



Fig. 1 Sustainable management in Tuvalu
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The question is whether this will be in time to proactively address systemic global crises—or whether reform must emerge from the ashes of a devastating crisis, as has been the historical norm.

The urgency of global governance lies in the hope that the collective management of our global commons can prevent immense human tragedy and suffering, on a much larger scale than the two world wars combined.

The outlook is not good, and politicians only make such critical decisions when it is blindingly obvious what they need to do. History shows us that that is always too late.

So, there is a new kid on the block: simulation with games.

In March 2015, teams of international diplomats, military professionals and scientists engaged in a game simulating real-world decision-making regarding climate change over the next 100 years. The most surprising result was a tipping point that emerged mid-century, when climate change began to make country players selfish, more insular and more willing to take risks to preserve the *status quo* for their nations. Perhaps as indicated by the UK Brexit, the rise of European far-right parties, and the election of Donald Trump in the USA. Of course, these real-world results occurred decades ahead of what the simulation predicted. Certainly, a majority of migrants heading to Europe today are not coming from Syria or Iraq. Three-quarters are from arid zones in central Africa, where the combination of climate change and population growth is making small-scale farming unsustainable.

Game simulation may be one means of anticipating such possibilities though they are able to cover only a few aspects of complex, real-world events. If well designed, they could still reveal the major decisions that leaders should make in stressful and evolving situations. The usual flaw in all this is that these games do not use the actual leaders. Rational people take the roles of China, the European Union, India, Russia, the USA and so on. Even if the games simulate global and regional temperatures... food and energy supplies...military assets...migrants, civil unrest, terrorist forces and insurgents...as well as shortages, the players are relatively rational. The players play the countries in which they are experts. The logic is that the players bring their knowledge and expertise and their rationality. This rationality is developed within a framework of, variously, science, knowledge, societal norms and so on. This is not the rationality that prevails when in the midst of a web of patronage, of favours owed, of expectations to be met and so on.

The game itself was played four times by different groups: one of the scientists, one of the diplomats and two of the military experts. The scientists achieved the “best” results, initiating a cooperative plan to achieve a low-carbon emissions path early. One hasty conclusion could be that we need more scientists in positions of power, as they tend to have a more cooperative, progress-oriented approach.

Scientists understand the rational elements of the global situation and were able to find “a common basis to come together”.

The games undertaken by diplomats and military personnel did not achieve such fortunate outcomes, as players attempted to improve their own countries’ performance rather than working towards the greater good. As a result, conditions deteriorated for everyone. Countries cooperated only when they were absolutely forced to do so. In the second run-through, “*cooperation only occurred when climate-change events reached a tipping point that had simultaneous impacts on multiple regions*”, a statement that could easily apply to the third and fourth trials. The situation was even worse in the fourth run-through, when the USA became engaged in an arms race with China, renegeing on cooperative efforts. Facing widespread disturbance, “*the European Union player became an isolationist who gave up on eliminating unrest and mitigating climate change and acted aggressively toward migrants*”. Aggressive actions eventually resulted in harm to all. A variety of possible events, that is, were simulated, depending partially on constraints imposed by the rules, partially on the goals and situations of the various countries, but also on human personality.

In any case, in the games, as the global situation worsened, all countries grew increasingly self-interested and xenophobic, regardless of who was playing the respective parts, an ominous portent for the future, and a reasonable reflection of how countries actually behave. Sometimes we appear to cooperate (the Paris Agreement), sometimes we are in conflict (war in Syria, the unresolved conflict in Ukraine with Russia trying to recreate the great power struggles of the nineteenth and twentieth century), and sometimes conflict is just over the horizon but eminently foreseeable such as actions by the Chinese in the South China Sea, who continue to treat international relations as a zero-sum game in which it aspires to be the winner.

It is perfectly possible to act cooperatively from the beginning, investing in and sharing technology and rushing aid to beleaguered players when they needed it. This, of course, is immensely far from the real

world, though does indicate that with a cooperative, forward-looking international spirit, we might be able to solve our problems. This is not what is happening right now since there is an overwhelming attitude of winner-take-all. There is a real need to avoid being trapped in ideology or national interest.

NOTES

1. <http://s.telegraph.co.uk/graphics/projects/xi-jinping-cave/>.
2. <http://www.telegraph.co.uk/science/2016/03/12/area-51-and-extra-terrestrial-life-both-exist-says-head-of-nasa/>.

National Competence

Abstract Addressing the issue of sustainable resources in nations that largely obtain their energy from oil, coal and gas is a formidable goal, but one that we must pursue rigorously. Moreover, many uses of fossil fuels, as well as their extraction, contribute to air pollution and can cause severe damage to our health and the environment. Responsible stewardship of our planet demands that we find new ways to minimise or eliminate those effects. That goal appears attainable, and considerable progress is already evident. Worldwide energy demand is forecast to nearly double by 2030. Much of that growth will be in developing nations, notably China and India, which between them contain more than one-third of the planet's people—creating unprecedented competition for limited conventional resources.

Keywords Agriculture · Energy · Infrastructure · Military Spending

In general, low-income countries are far more dependent on agriculture than are middle- or high-income countries. In 2008, agriculture accounted for 29% of GDP in low-income countries on average, compared with just 10% for middle-income countries and 1% for high-income countries. Thus, agriculture in low-income countries has much greater significance to the national economy and food security, making agricultural growth critical to sustainable and inclusive economic growth. This is only compounded by the reality that populations in many of these

countries will continue to grow at high rates into the future. As a major contributor to growth, sustainable investments in agricultural research and development in these countries and regions—both to adapt and to disseminate technologies developed elsewhere and to address unique local needs—remain essential.

In developing regions, especially those least developed and those experiencing rapidly rising populations, employment growth is driven mostly by demographic changes. The majority of workers in these regions do not enter into formal wage employment, but instead are engaged in self-employment or unpaid family work, such as in agriculture, and especially subsistence farming.

Consequently, economic downturns tend to have only a limited impact on overall employment growth in these economies, in contrast to industrialised economies where employment growth is closely linked to the business cycle. Considering that the large share of the working poor is engaged in agriculture, developments in that sector have a major impact on welfare throughout much of the world. Until 2000, agriculture was the mainstay of employment around the world. Since then, the services sector has assumed this mantle and the gap between the two has widened. Although employment growth in agriculture has slowed, the number of workers in this sector reached over one billion in 2009. In sub-Saharan Africa, growth in agricultural employment accounted for half of all employment growth between 1999 and 2009.¹ In South Asia, nearly 33% of all employment growth since 1999 was in agriculture.²

By contrast, agricultural employment is falling in the more developed economies, East Asia and Latin America and the Caribbean regions. At the global level, women are more active in the agricultural sector than men—some 38% versus 33%.³ Labour force participation rates are usually highest in the poorest countries. More people are employed out of necessity than by choice, as only a fraction of the working-age population can afford not to work. In these countries, low unemployment figures in conjunction with high labour participation rates result in large swathes engaged in vulnerable employment and many in working poverty. This holds for many economies in sub-Saharan Africa, where female participation rates feature among the highest in the world.

Poverty is the principal driver of the high rate of child labour in agriculture. Around 60% of all child labourers—129 million girls and boys—work in agriculture.⁴ More than two-thirds of them are unpaid family members. The agricultural sector has the highest incidence of

both unpaid child labour and early entry into the workforce, which often occurs between the ages of five and seven.

The standard of living unprecedented in human history can attribute a large measure of its success to increasingly sophisticated uses of energy. The strength of industry, the speed of transportation, the myriad comforts and conveniences of home and workplace, and the security of the nation all derive from ever more ingenious provision and application of various sources and forms of energy.

But that condition has come at a cost—to irreplaceable resources, to the environment and to our national independence. Society has begun to question the methods we use to power modern life and to search for better alternatives. As the debate continues, it is already evident that managing energy use wisely in the twenty-first century will call for balancing three essential, but quite different, concerns: resources, responsibility and security.

Our appetite for energy appears boundless, but traditional supplies are not. We are depleting the planet's finite stores of fossil fuels millions of times faster than they were formed, a situation that cannot continue indefinitely. Eventually, we must devise ways to keep resources and consumption in sustainable equilibrium. Addressing the issue of sustainable resources in nations that largely obtain their energy from oil, coal and gas is a formidable goal, but one that we must pursue rigorously. Moreover, many uses of fossil fuels, as well as their extraction from the Earth, contribute to air pollution and can cause severe damage to our health and the environment. Responsible stewardship of our planet demands that we find new ways to minimise or eliminate those effects. That goal appears attainable, and considerable progress is already evident.

Humanity relies on energy that is available when and where it is needed, is generally affordable at stable prices and can be counted on in the near future. Yet, nations are dependent on a few countries for petroleum supplies as well as many other resources, and the world is an uncertain place. As a result, access to some critical energy sources is beyond our control. Many planners argue that this situation threatens the economic and military security of nations and urge policies that maximise the use of domestic resources. This is a difficult objective and will likely require many years to address thoroughly, as worldwide consumption trends put increasing pressure on traditional energy sources.

Worldwide energy demand is forecast to nearly double by 2030.⁵ Much of that growth will be in developing nations—most notably China and India, which between them contain more than one-third of the planet's people—creating unprecedented competition for limited conventional resources.

Whatever happens, three developments are certain. First, fossil fuels will be a major part of the world's energy portfolio for decades to come because no single technology will provide all of tomorrow's energy and because it takes time and money to change the distribution and consumption patterns of large populations. Second, invention and development of more cost-effective, low-carbon energy sources will become progressively more urgent. And third, bringing those new technologies to market in convenient and affordable forms will pose a challenge even more daunting than the research itself.

Tackling the inefficiency and financial burden imposed by under-performing infrastructure is an important issue for developing and transitional countries. A lack of adequate infrastructure is an impediment to the development of the wider economy. Quality infrastructure is valuable in itself (e.g. clean water) and as a multiplier, enabling further development and allowing governments to achieve social, economic and political aims. While the goal of infrastructure programming may be to produce tangible physical infrastructure, poor decisions or analysis early in infrastructure development can have significant cost ramifications.

The world needs to dramatically ramp up spending on infrastructure though many major economies are going in the other direction. Perhaps an additional \$350 billion of annual spending is needed on transportation, power, water and telecommunications infrastructure across the world.⁶

Even if they have never seen a gun, millions of children suffer from wars, as resources that could have been invested in development have been and continue to be diverted into armaments. Indeed, one of the most distressing realities of our time is that most wars have been fought in precisely those countries that could least afford them. Even, in 1993, there were 42 countries with major conflicts and another 37 that were suffering from some kind of political violence.⁷ Of these 79 countries, 65 were in the developing world and military spending globally in 1993 was estimated to be US\$ 790 billion, of which US\$ 121 billion was spent in developing countries.

It seems clear that poverty and lack of development fuel hatred and escalate hostilities, and that improvements in such areas as nutrition, health, education, water, sanitation and family planning would go far to reduce the underlying causes of so many wars. The year 2000 goals for children, which call for an assault on poverty and underdevelopment through advancement in these areas, could be achieved for US\$ 30 billion to US\$ 40 billion a year more than is currently spent.

By any reasonable international perspective, this seems a relatively small sum of money. Consider the decline in military expenditures from 1987 to 1994⁸: cumulative savings of nearly a trillion dollars. This could have meant a transfer of sizeable sums of money to social, economic and environmental programmes. Instead, it appears that virtually all of these savings have gone to budget deficit reductions and non-development expenditures. This seems an extremely short-sighted policy.

At the same time, despite the overall global decline, large amounts of scarce resources continue to be devoted to armaments. Between 1960 and 1991, total annual military expenditures by developing countries rose from US\$ 27 billion to US\$ 121 billion. Sadly enough, some of the steepest increases occurred in the poorest countries. Ethiopia, Mozambique, Somalia and Yemen have for many years spent more on their military than they have on their people's education and health. Money spent on arms could have been put to much better use (Fig. 1).

The United Nations Development Programme has estimated that redirecting just one-quarter of developing countries' military expenditure could have provided the additional resources to implement most of the year 2000 programme: primary health care for all, immunisation of all children, elimination of severe malnutrition, provision of safe drinking water for all, universal primary education, reduction of illiteracy and family planning.

In recent years, however, there has been some limited improvement in both developing and industrialised countries. As a result, a trend has emerged showing a global drop in military expenditures and an upturn in social spending. Uganda is an example of developing countries that has managed to reallocate its budget.

Yet, distorted priorities remain and the industrialised countries must share responsibility since they are the dominant arms suppliers. The top five exporters to developing countries are the five permanent members of the United Nations Security Council. With the end of the first Cold War, the weapons industries in the rich countries were scrambling for



Fig. 1 Yemen needs more of this

new markets wherever they can find them—often with the enthusiastic support of their political leaders.

While arms sales have dropped significantly in the last few years, sales to developing countries in 1994 still amounted to US\$ 25.4 billion, all of which was money potentially lost to development efforts. The largest single supplier has normally been the USA, though in 1994 France acquired that dubious distinction: its sales rose from US\$ 3.8 billion in 1993 to US\$ 11.4 billion.

While these sales are largely of expensive hardware such as submarines or sophisticated fighter aircraft, much of the damage is now done by light weapons and smaller arms. Relatively little is known about the international trade in small arms, which often operates through the informal sector, powerful criminal networks and the dark web. It is clear that in war zones weapons have been accumulating over decades. The arms on sale in the bazaars of Afghanistan, northern India and Pakistan, for example, are a legacy of the Soviet invasion of Afghanistan in 1979

and of the US pipeline of arms to the Afghan guerrilla groups. Similarly, the arms used in Somalia's civil war had been supplied to the previous regime by the USA and the Soviet Union. And more recently, the arms used by the government of Bosnia and Herzegovina included light weapons left over from the Lebanese civil war.

It is therefore appropriate to repeat a tragically consistent theme on the state of the world's children: if even a fraction of the resources devoted to building military capacity could be diverted to achieving basic development goals, we would soon be living in a world with fewer social and environmental problems and far fewer and less destructive wars.

It is a choice...

NOTES

1. www.fao.org/docrep/015/i2490e/i2490e01b.pdf.
2. www.fao.org/docrep/015/i2490e/i2490e01b.pdf.
3. www.fao.org/docrep/013/am307e/am307e00.pdf.
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5. <https://www.eia.gov/forecasts/ieo/world.cfm>.
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8. www.state.gov/documents/organization/185648.pdf.

Governance

Abstract Steps should be taken to reduce people's vulnerability now and in the future. Governments are the main bodies with resources and oversight to do this. There are countless reports that clearly show where the most vulnerable people live exposed to floods, droughts and heat waves. The risks associated with these extremes align with increasing areas of the world that are densely populated. We need a portfolio of defensive options to address a range of hazards. We need to invest in infrastructure to reduce impact extreme weather though look beyond traditional engineering and use options based on natural ecosystems or processes. Governments need to develop resilient strategies and incorporate resilience building into all policies, which are evaluated and updated in real time, in the light of new evidence.

Keywords Infrastructure · Vulnerability · Hazards · Resilience

Extreme weather has a huge human cost which cannot be accurately quantified. Between 1980 and 2000, the economic cost has been estimated to be US\$ 1.4 trillion.¹ This shows that societies are not resilient to extreme weather today, and analysis shows that the risk it poses is increasing. Steps should be taken to reduce people's vulnerability now and in the future. Governments are the main bodies with resources and oversight powers to do this. Climate change will continue to affect the frequency and severity of extreme weather into the future. If emissions of

greenhouse gases continue at the current rate, extreme weather is like to pose an increasing threat to people.

There are countless reports that clearly show where the most vulnerable people live exposed to floods, droughts and heatwaves. The risks associated with these extremes align with increasing areas of the world that are densely populated. At the local level, the impact of extreme weather communities could be averted by physical interventions to defend people, for example, prevention of flooding is straightforward. We need a portfolio of defensive options to address a range of hazards, involving both physical and social techniques. We need to invest in infrastructure to reduce impact extreme weather though look beyond traditional engineering and use options based on natural ecosystems or processes.

Steps are necessary to allow individuals and societies to adapt, progress and develop regardless of extreme weather. The steps need to be taken at local, national and international levels by the public and private sectors, local communities and non-governmental organisations. Government needs to develop resilient strategies and incorporate resilience building into all other policies. These should be evaluated and updated in real time, in the light of the new evidence.

If international organisations and national governments can figure this out for themselves and factor in resilience building into their policies and plans, then the need for costly disaster responses will be reduced. Government responsibility to develop resource resilient strategies will be most effective when they:

- Focus on minimising the consequences of infrastructure failure by prioritising resilience of critical infrastructure and having plans to minimise impacts when non-critical infrastructure fails;
- Incorporate resilience building into other relevant policies such as poverty alleviation and land-use planning;
- Consider all the factors that are likely to be impacted by extreme weather;
- Use a range of expertise from disciplines such as environment management, climate change adaptation, disaster management and sustainable development of sources including private sector, non-governmental organisations and local communities; and
- Support and enable local actions consistent with national strategies.

At the international level, governments would be more effective by sharing expertise, coordinating policy and pulling together resources to confront common risks. To limit the need for costly disaster responses, more national and international agencies would be needed to direct funds to build resilience to extreme weather. It is important that design and implementation of policy frameworks cover climate change, disaster reduction and development and are aligned and consistent regarding extreme weather.

In particular, more effort should be made to:

- Emphasise importance of the natural environment in managing risk;
- Develop and use identical metrics in these policy frameworks to incentivise coordinated action and allowing the effectiveness of different resilience-building methods to be compared;
- Measure progress in implementing resilience-building strategies as well as impacts of extreme weather;
- Align the time frames and reporting protocols for all the various goals and targets; and
- Ensure international oversight to strengthen national capacity and to coordinate data collection and analysis.

Government should also pursue policies that help the poor disproportionately such as investment in power and road infrastructure, education and health care. Getting sustainable management which includes development into the heart of what we do is actually crucial for the future environment and to our society. This is clear to most experts but understanding proves elusive. We need to embed the language of sustainability and natural resource management into our everyday lives. Futures depend as much on understanding sustainability as the ability to articulate it. We have to ensure that sustainability is at the core of secondary education. It is all about *Common Sense for the Common Good for the Common Future*.

The world spends about US\$ 2 trillion annually on defence²; investing in health security is a similar form of insurance and would provide better returns.

Protecting a single port city from floods is easier than protecting similar population spread out along coastlines. Cities have higher rates of innovation in developing new businesses, business models and social strategies, formal or informal. Ideally, there would be opportunities to

move to cities in other countries to absorb migrants from struggling areas.

The cost of all this adaptation is hard to judge. Money and know-how are essential but so is example. Rich countries can show through their own programmes of flood defence, zoning laws and general leadership that adaptation must be part of the mainstream political-economic life not an eccentric and marginal idea for the poor alone.

Because global action is not going to stop climate change, the world needs to look hard at how to live with it. Many people and communities are just too poor to adapt. The problem lies with the governments of so-called poor countries. If these governments fail to act, we will see mass migration on a far larger scale than hitherto. Some migration has to occur. There are people simply living in places that are no longer suitable. For instance, the rural poor in the riverine areas of the Niger Delta have little or no access to clean, safe water or sanitation. The terrain is simply not conducive to clean water or sanitation.

In the tropics and subtropics, land may become barely habitable. These places may be large sources of migration. Such effects already visible in, for example, a large part of the population of Côte d'Ivoire who come from Burkina Faso.

To avoid taking action, governments try to rely on the need to wait for better climate models to provide greater certainty about what might happen. This is a forlorn hope. Faster computers and new modelling techniques will provide more detail, though not necessarily be more accurate or precise. Adaptation decisions can be made in the face of uncertainty by finding ways of adapting to many possible future climates. Tailoring expectations to one future, in particular, may not be so sound.

The best adaptation is to be rich, though that is not foolproof. Resources help people adapt before the fact, by reducing risks and after that by aiding recovery from harm. Wealth can create hedges against the effects of climate change. Poor countries are often cited as lacking the financial means, technical expertise or political institutions for such endeavours.

At the best of times, all governments are consumed by short-term problems. Science continues to support the case for curbing greenhouse gas emissions, yet the world (that is, its governments) fail so badly on their part. Changing the basics of how industrial economies work has not yet been worked out. While India has heaps of coal and China is still obsessed

with being taken seriously on the basis of its economic power, there is little reason for smaller industrial economies to do things differently.

The fear of politics is that it cannot deliver on what science requires so countries default to find the compromise that will protect the integrity of the process rather than solve actual problems.

NOTES

1. <https://www.ncdc.noaa.gov/billions/>.
2. www.globalissues.org.

PART IV

Blueprint

How to Manage the Planet

Abstract At least fifty developing countries face recurrent earthquakes, mudslides, floods, hurricanes and droughts, yet many do not seem to recognise this. Unless such countries stay engaged with increasing urbanisation, migration patterns and population growth, their citizens will be occupying high-risk areas in greater numbers than ever before, increasing their vulnerability to climate change, unplanned and rapid urbanisation, poor land regulation, complex supply chains, and non-sustainable use of natural resources and declining ecosystems. Resilience is the capacity to maintain essential services during a range of circumstances from normal to extreme. It is achieved through assets, networks and systems management to anticipate, absorb and recover from disturbance, while ensuring that the environment and ecosystem services are also able to recover to their original state.

Keywords Disaster Management · Urbanisation · Migration · Population

Disasters can be used as a proxy for all other Earth-threatening factors. By using a human-centric problem that is immediately visible, it cuts through the time-wasting arguments about “value”.

At least fifty developing countries face recurrent earthquakes, mudslides, floods, hurricanes and droughts, yet many do not seem to recognise this. Unless such countries stay engaged with increasing

urbanisation, migration patterns and population growth, their citizens will be occupying high-risk areas in greater numbers than ever before, increasing their vulnerability to climate change, unplanned and rapid urbanisation, poor land regulation, complex supply chains, and non-sustainable use of natural resources and declining ecosystems. Since 2005, disasters have resulted in more than 700,000 people losing their lives, with approximately 23 million being made homeless and more than 1.5 billion people being affected by disasters in various ways, with total economic losses estimated more than 1.3 trillion US\$.

Resilience is the capacity to maintain essential services during a range of circumstances from normal to extreme. It is achieved through the ability of assets, networks and systems management to anticipate, absorb and recover from disturbance. This has to be accomplished while ensuring that the environment and ecosystem support services are also able to recover to their original state.

The technical task is to:

- Establish an all hazards risk register recording all the influences on resilience to be considered, the potential disturbances to any service;
- Evaluate current and future resilience strategies to each hazard and potential mitigation improvement measures;
- Quantify the solution options including a life cost benefits and compare and contrast the contributions to resilience; and
- Choose a preferred solution and fund it properly supported by robust institutions, free from political control.

How Humanity Has to Change

Abstract We confuse achievement with the acquisition of gaudy bling and celebrity fame, and while history rarely repeats itself, it does tend to rhyme. We do not hold our politicians to reasonable standards, especially when they show a distinct lack of interest and perhaps a failure of courage when it comes to considering their country's decline. They do not define themselves by the murder rate, the rape rate, the percentage of long-term youth unemployment, number of teenage pregnancies and low rates of educational attainment yet accept that the most marginalised live in the worst urban and rural environments. They seem beholden to donors and to large-scale vanity projects. They create the financial crises and carve out a growing chasm between the rich and the poor.

Keywords Government · Politicians · Standards

Sometimes, a nation catches glimpses of itself in the mirror and does not recognise the familiar defects and thinks of them as virtues.

We confuse achievement with the acquisition of gaudy bling and celebrity fame, and while history rarely repeats itself, it does tend to rhyme.

We do not hold our politicians to reasonable standards, especially when they often show a distinct lack of interest and perhaps a failure of courage when it comes to considering their country's decline. They do not define themselves by the murder rate, the rape rate, the percentage

of long-term youth unemployment, number of teenage pregnancies and low rates of educational attainment yet accept that the most marginalised live in the worst urban and rural environments. They seem beholden to donors, to large-scale vanity projects and the like.

They have often been party to economic and social policies which give rise to unacceptable behaviour in the first place. They create the financial crises and carve out a growing chasm between the rich and the poor.

Environmentalists in Western Europe are fiddling while Rome burns too. They are getting away with silly stuff like asking people to walk more, drive less and consume less meat and so on. These changes are irrelevant when one considers how the hundreds of millions of people in China and India aspire to, and will try to attain, lifestyles comparable to the energy-rich and meat-dominated lifestyles of Europe.

We, and India, need to recognise that India has 650 million cell phone subscribers, yet only 300 million people with access to decent sanitation.¹

Access to clean water is a basic human right. There is an urgent need to think about water differently to manage more efficiently.

The UN passed a resolution which acknowledges that access to clean safe water is a basic human right, most countries put their full voting weight behind it, while the UK and the USA abstained.²

Read into that what you will.

Humanity is not thinking clearly.

NOTES

1. <https://unu.edu/media.../greater-access-to-cell-phones-than-toilets-in-india.html>.
2. www.un.org/press/en/2010/ga10967.doc.htm.

How Governance Systems Have to Change

Abstract Increasingly, world economic power is likely to be concentrated around the Pacific. The growing middle class in China and India means the emergence of a large, well-educated workforce with a thirst for the world's base resources. The European Union will continue to import poorer migrants and export its professionals and will endure this evolutionary shock, with its middle class suffering the most. There are some uncertainties: future pandemics, future (perhaps accidental) nuclear strike triggering further destabilisation, a people revolution in China which could trigger unprecedented levels of consumer demand, a great depression in the USA (far more than experienced in 2008/2009) and/or a complete domination of basic resources by an increasingly autocratic and belligerent China (in the absence of the people revolution).

Keywords Economic power · China · Resources · Pandemics · Nuclear Strike · Depression

There is a critical backdrop that must be taken into account. Within the next twenty years, a world could be foreseen that consists of three essential dynamics:

- A globalising area (E Europe, North America, Oceania, NE Asia, India, SE Asia, C America) about half the world with a growing middle class*;

- A stagnating area (Middle East, Africa, S Asia) about a third of world population with low incomes, economic regression and controlled by unpopular and harsh governance systems**; and
- A declining area (European Union*** and South America) with less than 10% of the world population yet a quarter of the wealth.

*We are already seeing this in SE Asia in places such as Vietnam which is now classified as a middle-income country.

**From Africa we are already seeing mass migration for economic reasons (rather than conflict).

***With BREXIT¹ reflecting the general malaise of the European Union.

World economic power is likely to be concentrated around the Pacific Ocean. The growing middle class in China and India means the emergence of a large, well-educated workforce at a relative low cost with a huge thirst for the world's base resources. The European Union will continue to import poorer migrants and export its professionals (particularly its scientists and engineers) and will endure the main shock of this evolution, with its middle class suffering the most.

Three relevant consequences may be inferred:

- Net population increase will exclusively occur in newly industrialising countries such as India and Malaysia and in the agrarian economies of sub-Saharan Africa, potentially retaining their resources or retaining their “export”, for home markets;
- Sub-Saharan Africa will have a higher growth than any other region, with potential mass exodes from land made marginal due to climate change. This will have two main effects: action based on an unsubstantiated belief that an escape to Western Europe (via the southernmost countries (Spain, France and Italy)) is a solution to a desperate situation; triggering unprecedeted levels of mass entries potentially overwhelming the southerly border controls of Western Europe; and an increasingly autocratic response in many African countries to rural exodes into the swelling urban areas which will precipitate further additions to the “escape” to Europe; and
- Thirdly, we will see more and more countries, unable to secure food for their populations, leasing land from other countries (particularly from those that have control over their people and importantly, their land).

This rush by foreign governments and companies to secure food supplies in Africa is, in effect, a “neocolonial” agricultural system. Some of the first overseas projects to secure food by Gulf companies in Sudan, where more than five million people receive international food aid, showed limited local benefits, with much of the specialist labour and farming inputs being imported. Some food imports are already being paid for in arms shipments, which cannot be good.

Potentially, all nations will shift towards a fertility rate of about 2.1 children per woman² (replacement level) a rate at which, historically, people tend to focus on well-being, use of contraceptives and gender equality (a facsimile for a developing middle class). However, the fall in fertility rates may be faster in some countries (notably in the EU) and much slower in many other countries.

The expected decline of the European population would only be an adjustment, compared to the rapid growth occurring in the past, and may be welcome: less population could allow better living and less pollution. In practice, migration may be used (as historically) to solve the problem of a declining workforce in Europe, in order to support an increasingly longer-lived population that is straining health and welfare services.

The increase in population in poorer countries is not necessarily helpful, especially when more than 1 billion children are already suffering from the lack of basic needs: clean water, sanitation, good nutrition and education. One billion children means about 500 million girls, living mostly in sub-Saharan Africa and the Middle East (with high fertility rate) and with each girl having an average of three children before 2030. This means that the expected increase in the population (1.7 billion) will mainly come from these mothers who have been deprived of good nutrition, education, health and so on. This increase in population in poorer countries will result in other consequences: more deforestation, with rainforests in SE Asia and Central Africa being seriously damaged by 2030 with irreversible consequences for the climate. The availability of water will be also a serious threat in the entire North Africa and Middle East, as well as in Central Asia.

The general picture above may be further complicated by future, unpredictable regional shortages in food, water and energy, and the effect of pandemics, natural catastrophes, wars and continual low-level armed conflict.

With world economic power being concentrated around the Pacific Ocean: that could represent two-thirds of the world global national income with the following characteristics:

- USA and Canada the same as in 2004;
- China and the newly united Korea growing by a third;
- The area dominated by authoritarian governance systems may only have a few per cent of the world's global national income, yet host a third of the world population; and
- The European Union share falling from a third, despite enlargement.

The most important fact is that the growing middle class will represent two-thirds of the world population in 2030 (25% in 2004).³ For example, China and India's middle class will sharply increase (650 million expected in China by 2030). In turn, this larger middle class will mean a consumption explosion and with corresponding pressure on all known resources, potentially constraining the supply to Europe.

As a result, the percentage of poor people will decrease from 75% to under a half and will concentrate in South Asia (except India) and in Africa (except South Africa). Large segments of the world population will endure a greater poverty than in 2004. For example, the situation in sub-Saharan Africa will be catastrophic with the world global national income per capita (already a tiny £ 222 in 2004) dropping a further 20% promoting mass exodus to urban areas in search of work and causing massive social unrest (which will be ruthlessly suppressed) and environmental pollution, as the already poorly maintained and barely functioning water and sewerage systems struggle to cope and collapse.

There are some uncertainties: the effect of future pandemics, a future (perhaps accidental) nuclear strike triggering further destabilisation, a people revolution in China which could trigger unprecedented levels of consumer demand in that country, a great depression in the USA (far more than recently experienced in 2008/2009) and/or a complete domination of basic resources by an increasingly autocratic and belligerent China (in the absence of the people revolution).

There have been more discoveries from 1945 until today than since the beginning of humanity until 1945. The effect of mobile computing and the Internet especially in leveraging market development of agricultural products in poor countries may shift export to domestic consumption.

Nano- and biotechnology may enhance human resilience, extending lifespans with a consequent drain on country medical resources. Nuclear fusion that could provide humanity with an unlimited supply of energy will still be thirty years away. A manned landing on Mars, expected by 2030, may be a little later but will still change humanity's perception of itself and with renewed optimism for future access to mineral resources.

Development of non-lethal weapons (e.g. microwaves) could represent an unwelcome step change in the history of humanity, by avoiding the killing inherently associated with conflicts. This will lower the barrier to solving conflict through military means, especially to secure scarce resources.

Climate change, already the cause of extreme and unpredictable weather around the world, will almost certainly have worsened by 2030. Even if the world magically stopped emitting greenhouse gases today, those gases emitted during the last thirty years will continue to influence the Earth's atmosphere deleteriously until at least the middle of the twenty-first century. For this reason, adapting to the effects of climate change is one of two of humanity's greatest and most important challenges during the period to 2030. The other is to adapt to the increasing restriction (actual, economic or political) of the flows of resources of all kinds from those that have them (predominantly China, India and the poorer nations) to those whose lifestyles and basic assumptions rely on that steady, uninterrupted flow to Europe.

Even as it stockpiles its own mineral resources, China is systematically securing its access to other resources around the world, including investments in iron mines in Australia, cobalt in Congo and bauxite in Fiji. At the same time, China is filling up its warehouses. Its zinc inventories have more than doubled since March 2009, while its lead supplies have grown by close to 600%.⁴ A battle over coveted natural resources has now begun, as industrialised nations worldwide vie for access to the biggest remaining reserves.

In Europe, there has been the belief that natural resources would always be available, cheap and abundant, preferring to worry about access to crude oil and natural gas than from where tungsten or indium will come. Of course these sought-after resources are also found buried underground elsewhere in the world. In fact, geologically speaking, there should be no shortages at all. The availability of rare metals is more a question of price. Smelting companies in the industrialised world (except China) are reluctant to make the substantial investments needed

to obtain a few tons of exotic metals. China, with its cheap labour force and lax environmental laws, can afford to extract the materials, however. Rare earth mines are being developed in South Africa, Greenland and Canada. But these mines are at least five years away from being able to generate a significant level of production.

Global demand for these materials is booming, tripling over the past decade from 40,000 to 120,000 tonnes. China provides 97% of the global supplies of rare earth elements, most coming from a single mine in Inner Mongolia.⁵ Global demand for rare earth materials is forecast to hit 300,000 tonnes a year. But for several years China has been steadily reducing the amount of material it makes available for export. Supplies of Chinese-produced terbium and dysprosium—irreplaceable elements of magnets used in the batteries of hybrid cars and wind turbines—are likely to be cut sharply in coming years.

We need to tackle the fatalism that is creeping to people's attitudes to planetary issues. Public attention rarely remains sharply focused on any issue for very long even if it involves a continuing problem of crucial importance to society. Central to this is the theory that when people appreciate the true cost of making significant progress with resolving an issue and the personal sacrifices involved, the initial enthusiasm for bold action wanes rapidly.

Many fully appreciate that our lifestyles are completely unsustainable, but the alternatives are just too challenging to contemplate.

Governments now have to recognise:

- Any materials mined from the earth should not exceed the environment's capacity to disperse, absorb, recycle or otherwise neutralise their harmful effects to humans and the environment;
- Synthetic substances in their manufacture and use should not exceed the environment's capacity to disperse, absorb, recycle or otherwise neutralise their harmful effects to humans or the environment;
- The biological diversity and productivity of ecosystems should not be endangered;
- A healthy economy should be maintained, which accurately represents the value of natural, human, social and manufactured capital;
- Individual human skills, knowledge and health should be developed and deployed to optimum effect;

- Social progress and justice should recognise the needs of everyone;
- There must be equity for future generations; and
- Structures and institutions should promote stewardship of natural resources and the development of people.

In 2015, Ethiopian officials say the harvest is failing as completely as in the series of droughts that together killed more than 1 million of the country's people between 1965 and 1985 and made Ethiopia a byword for hopeless famine. More than 8 million Ethiopians in 2015 were going hungry,⁶ though a decade-old food security programme was keeping the poorest from starvation. Six million Ethiopians spent five days each month for half of the year on public works such as digging water-holes for animals and building terraces for crops in return for which they receive 13 kg of cereal and 4 kg of pulses a month or the cash equivalent. Famines just do not need to occur. It is a choice.

Preliminary analysis suggests that humanity has already transgressed three Earth limits⁷ (climate change, the rate of biodiversity loss and the rate of interference with the nitrogen cycle). There is significant uncertainty surrounding the duration over which limits can be transgressed before causing unacceptable environmental change and before triggering feedbacks that may result in crossing of thresholds that drastically reduce the ability to return within safe levels. Fast feedbacks (e.g. loss of Arctic sea ice) appear to already have kicked in after having transgressed the climate limit for a couple of decades. Slow feedbacks (e.g. loss of land-based polar ice sheets) operate over longer time frames. Despite the phasing-out of chlorofluorocarbon emissions and the fact that the ozone holes did not spread beyond the polar vortex regions, which remained largely intact, the ozone holes over the polar region will only slowly decline over the next half-century and then may re-emerge.

There is little doubt, however, that the complexities of interconnected slow and fast processes and feedbacks in the Earth system provide humanity with a challenging paradox. On the one hand, these dynamics underpin the resilience that enables planet Earth to stay within a state conducive to human development. On the other hand, they lull us into a false sense of security because incremental change can lead to the unexpected crossing of thresholds that drive the Earth system, or significant subsystems, abruptly into adverse states, catastrophic to human well-being. The concept of planet-wide limits provides a framework for humanity to operate within this paradox.

It is entirely foreseeable that a combination of climate change, a growing global population and changing dietary habits will result in a surge in demand for food, water and energy by 2030 that will drive up prices and could lead to widespread shortages. Demand for food and energy will increase 50% by 2030, while demand for freshwater will rise 30% as the population grows to top 8.3 billion. Falling levels of agricultural productivity and water shortages across many hot regions will be leading to mass migration and increased risks of cross-border conflict.

Many individuals have warned of similar things, as have many international organisations. Yet, the only body of institutions who can make any sort of difference or take up that challenge are national governments. And they choose not to.

Still looking into the future just a little, within twenty years, currently unthinkable scientific breakthroughs will have occurred—in computing, in healthcare, in communications, in wealth generation, in the performance of materials, in additive manufacturing, in travel and in robotics. Shortly after 2030, a milestone in technological development will have been reached.

Around this time, the first computer will have been developed that will be the intellectual equal of a human. Because of the accelerating, exponential nature of technological development (fuelled entirely by faster and richer information flows), it follows that a short time after that we will be assisted by our super-intelligent computers to build a machine twice as clever as the most capable human. Shortly after will appear a machine four times as clever as a human, then eight times as clever, then sixteen times as clever and so on. Once super-intelligent machines begin to take over the task of technological development, as they surely will, change will be so rapid that most people will be controlled by it, rather than the converse, and the future could then take unforeseeable directions.

By then, one hopes we will have figured out how to live with that.

Tomorrow's risk is being built today. We must therefore move away from risk assessments that show risk at a single point in the present and move instead towards risk assessments that can guide decision makers towards a resilient future. Only then will they be able to visualise the potential risk that results from their decisions taken today and see the benefit of enacting policies to reduce climate change, halt the construction of unsafe buildings, enforce land-use plans, reduce subsidence and much more.

Although we have more than 75,000 years of experience living with disasters, until the last hundred years we had the luxury of space, we had room to be heroic. Today's challenges demand that we do things differently. We must continually learn, innovate and push boundaries, so that we can build a safer world for ourselves and the generations to come. Environmental change is sweeping the world at a faster pace than previously thought, making it imperative that governments act now to reverse the damage being done to the planet.

In almost every region, population growth, rapid urbanisation, rising levels of consumption, desertification, land degradation and climate change have combined to leave countries suffering from severe water scarcity. These worrying trends are also making it increasingly hard for the world to feed itself. If current trends continue and the world fails to enact solutions that improve current patterns of production and consumption, and if we fail to use natural resources sustainably, then the state of the world's environment will continue to decline.

In Latin America and the Caribbean, the future of the region's economies, as well as the ability of countries to fight poverty and reverse inequality, depends heavily on harnessing the region's natural resources sustainably while mitigating and adapting to climate change, and decoupling economic growth from resource consumption. Greenhouse gas emissions are growing in the region as a result of urbanisation, economic growth, energy consumption, land-use changes and other factors.

Agriculture has had a strong impact on the emission of nitrous oxide and carbon dioxide. Nitrous oxide emissions—from soils, leaching and run-off, direct emissions and animal manure—increased by about 29% between 2000 and 2010. The abundance of beef and dairy cattle in the region has also increased methane emissions, which grew by 19% between 2000 and 2010.

Most of the cities in regions for which data are available have concentrations of particulate matter above World Health Organisation guidelines.⁸ These regions' urban population increased by more than 35 million people between 2010 and 2015 and is expected to climb to a total of 567 million by 2025. More than 100 million people already live in areas where they are at risk of air pollution.

Andean glaciers, which provide vital water resources for millions of people, are shrinking, and an increase in the intensity and frequency of extreme weather events are affecting dependent economies.

Unprecedented economic growth in the Asia and Pacific region has lifted millions out of poverty, at the expense of heavy pressure on natural ecosystems. Increasing unsustainable consumption patterns have led to worsening air pollution, water scarcity and waste generation, threatening human and environmental health. Increased demand for fossil fuels and natural resources—extensive agriculture, palm oil and rubber plantations, aquaculture and the illegal trade in wildlife—are causing environmental degradation and biodiversity loss. Last year, the Asia-Pacific region continued to be the world's most disaster-prone region. About 41% of all natural disasters reported over the last two decades occurred in the Asia-Pacific region, which also accounted for 91% of the world's deaths attributable to natural disasters in the last century. The number of record-breaking rainfall events increased by 56% over the 1981–2010 period. By the 2070s, the top Asian cities in terms of population exposure to coastal flooding will be Bangkok, Dhaka, Guangzhou, Kolkata, Mumbai and Shanghai, threatening hundreds of millions of people with displacement.

In Southeast Asia, the average area deforested annually is more than 1 million hectares, resulting in the release of hundreds of millions of tonnes of carbon dioxide every year between 2005 and 2015. The contamination of water sources by human and industrial waste, including pharmaceutical and personal care products, is a major problem in the region. It is estimated that about 30% of the population uses drinking water contaminated by human faeces. Water-related diseases and unsafe water contribute to 1.8 million deaths. Unsafe sanitation, disposal of untreated wastewater and run-off of agrochemicals are responsible for a rise in waterborne diseases, especially in Asia's population-dense urban areas. Uncontrolled dumping, which is still the main waste disposal method in the region, is also a major source of disease. Population growth, a growing middle class and urbanisation have led to higher emissions and growing amounts of ill-managed waste. Rapid economic growth and intensified industrialisation have also led to increasingly unhealthy, polluting and carbon-intensive lifestyles. The main driver for accelerating domestic material consumption is the expanding middle class (from 21% in 1990 to 56% in 2008).

The size of the global middle class is projected to increase from 1.8 billion (2009) to 4.9 billion in 2030 with most of this growth coming from Asia.

A rise in the amount of degraded land and the spread of desertification is the most critical challenge in West Asia and will have a profound economic and environmental effect on the region; West Asia is suffering from an increase in water demand, overexploitation of groundwater resources and deteriorating water quality, as well as unsustainable patterns of consumption that threaten the region's ability to secure its sources of food, water and energy. The scarcity of the region's renewable water resources also poses a major challenge in the region, impacting West Asia's ability to produce enough food to meet the growing population's needs. High population growth and ongoing conflicts mean that the carrying capacity of the land has become too low to support people with freshwater and food. Water demand in the region is increasing while water quality is deteriorating. Groundwater resources are being overexploited. As a result, only four out of 12 countries in West Asia are above the water scarcity limit of 1000 m³ per person per year.⁹

Continuous conflict and the mass displacement of people throughout the region are also triggering severe environmental impacts that are endangering the health of people. Heavy metals from explosive munitions and radiation from missiles have leached into the environment as a result of the region's conflicts. The main environmental risk factors for human health in the region are air pollution; lack of access to safe water and adequate sanitation; climate change; exposure to hazardous chemicals and wastes; emergencies and disasters; and exposure to radiation. More than 229,500 people die prematurely each year because of specific environmental risks, and 8.24 million healthy life years are being lost because of these risks. This means every individual in the West Asia region is losing 17 days of life annually because of modifiable environmental risk factors.¹⁰

Almost 90% of municipal solid waste in West Asia is disposed of in unlined landfill sites, and leachate from these is contaminating scarce groundwater resources. Rising populations, urbanisation, economic growth, burning of fossil fuels and conflict all place enormous stress on the environment and harm human health. It is estimated that air pollution alone, which has increased steadily over the past two decades, was responsible for more than 70,000 premature deaths in West Asia in 2010.

Other top issues in the region are climate change, which will exacerbate water stress in the region, and biodiversity, which is under threat from urban expansion, pollution, the overconsumption of biological resources and changes in habitat.

Land degradation, air pollution and the provision of sanitation and safe drinking water are among the main problems in Africa. Many of the region's fisheries, both inland and marine, face overexploitation from illegal, under-reported and unregulated fishing. The continent has an opportunity to use its large young population to drive its growth. Low-carbon, climate-resilient choices could develop the continent's infrastructure, accelerate industrialisation, increase energy and food production and promote sustainable natural resource governance.

Indoor air pollution is responsible for 600,000 premature deaths every year in Africa. The continent's reliance on the use of biomass for cooking, lighting and heating means that 90% of the region's population is exposed to this health threat. The proportion of the population served with clean water is increasing and grew only 4% from 2005 to 2012, and absolute numbers of people without safe drinking water remain high. More than half of the population in sub-Saharan Africa still does not have any access to improved sanitation, compared to 90% coverage in North Africa, with a vast difference between urban and rural areas.

African megacities, such as Cairo, Kinshasa and Lagos, and emerging megacities, such as Dar es Salaam, Johannesburg and Luanda, face challenges from poor management of sanitation services due to inadequate and deteriorating infrastructure resulting from under-investment. Land-based activities causing pollution of freshwater bodies ultimately impact coastal and marine resources.

Land is the most prized asset for food production, nutritional health and economic development. Yet, half a million square metres of land in Africa is being degraded due to soil erosion, salinisation, pollution and deforestation. This land degradation can damage agricultural productivity, nutrition and human health.

A growing population and a rise in the demand for firewood will mean that forest cover in Africa is likely to continue shrinking, declining to less than 600 million hectares by 2050. Overcultivation, inefficient irrigation practices, overgrazing, the overexploitation of resources, uncontrolled mining activities and climate change will further degrade land in Africa. This will lead to reduced agricultural productivity, reduced food security, which can increase migration and spread disease, the destruction of infrastructure, such as roads and bridges, and high rates of poverty.

Warming in the Arctic has increased at twice the global average since 1980. There are other worrying trends. Over the past twenty years, for

example, there has been a progressive and dramatic decrease in summer sea ice extent, which has led to an increased surface area of blue water during the summer months. The largest contributions to global glacier ice loss during the early twenty-first century were from glaciers in Alaska, the Canadian Arctic and the periphery of the Greenland ice sheet, as well as in the Southern Andes and Asian mountains. Together, these areas account for more than 80% of the total ice loss. The melting of sea ice has also created new expanses of ocean allowing large populations of phytoplankton to bloom and change the marine food chain.

And, finally, let us not forget the Middle East where the 2.97 million refugees in Lebanon, Jordan, Yemen and Iraq are placing an immense environmental burden on the region, producing about 1440 tonnes of waste per day in 2015,¹¹ overwhelming governments and increasing the risk of disease outbreaks.

This is what needs to be done:

- Strengthen intergovernmental coordination at the regional and sub-regional level and confront mediocre national governance issues;
- Improve gathering, processing and sharing of data and information to inform decision-making;
- Enhance sustainable consumption and production to reduce environmental pressures by critically addressing drivers associated with manufacturing processes and consumer demand;
- Harness natural resources so that there is no further depletion of ecosystems;
- Implement measures to minimise and halt pollution and other environmental pressures;
- Invest in urban planning: infrastructure and clean transport;
- Insist governments decouple economic growth and resource consumption;
- Aggressively reduce dependency on fossil fuels and diversify energy sources;
- Establish greater foresight processes to identify possible future risks, opportunities and conflicts;
- Enhance meaningful international cooperation on population, climate, air quality and other planetary issues;
- Respond to planetary risk;
- Build resilience to natural hazards and extreme climate events; and

- Recognise that worldwide low-carbon, climate-resilient choices in infrastructure, energy and food production coupled with effective and sustainable natural resource governance are key to protecting the ecological assets that underpin a healthy society that maintain a planetary balance.

What we should not do is be distracted by short-term fixes, do not:

- Re-frame the problem to connect with peoples' daily lives and personal concerns: this merely raises false expectation;
- Take advantage of teachable moments or other unplanned opportunities: this simply looks like an unthinking expedient;
- Connect with relevant businesses when possible: this is the widely promulgated alternative to government, though government is the only way to embed long-term change;
- Engage high-profile champions to help deliver the messages: too glib and superficial;
- Laud every small step: wait until big steps have been taken;
- Focus on what can be done and show that progress is possible: this is usually simplistic and cannot be scaled-up;
- Use visualisations of the problem whenever possible: world leaders do not need to be patronised;
- Engage with un-tested global initiatives: they simply do not resonate with the realities of governance; and
- Be prepared to give good advice on the long-term consequences of not dealing with the problem: no one who needs to listen is hearing.

During the last fifteen years, the number of scientific publications on resilience in relation to the environment has increased about twenty five times, to well over 6000 publications with more than a total of 120,000 citations across the natural sciences, social sciences and humanities, and in interdisciplinary journals. Today, resilience thinking is found in studies on everything from ecology, technology and international relations to politics, urbanisation and disaster management. Resilience thinking embraces human and natural systems as complex intertwined entities constantly undergoing cycles of change, and seeks to understand the qualities of such systems that must be maintained or improved in order to achieve sustainable development. When it comes to applying resilience

in national policy and practice, things are not moving so fast. Resilience deals with complexity and true uncertainty and how to learn to live with change and make use of it.

Perspectives do not lend to the usual political cycles of change. What needs to happen is to avoid the trap of simply rebuilding and repairing flawed structures of the past, such as an economic system overly reliant on risky speculation and overexploitation of natural resources. On the contrary, resilience thinking is about anticipating, adapting, learning and transforming human actions in the light of the unprecedented challenges of our increasingly turbulent world.

For instance, Future Earth¹² and the Stockholm Resilience Centre¹³ are launching a call for Sustainable Development Goal Labs (SDG Labs) in advance of the *Resilience 2017 Conference* and *International Conference on Sustainability Science*, which will be held back-to-back in Stockholm 21–26 August 2017. They exclaim that they are looking for brilliant ideas with the potential to make major breakthroughs on the SDGs. The outcomes of the SDG Labs will be presented on 24 August 2017 during the joint “Ideas and Innovation” policy day for policymakers, business, researchers and media. Supposedly, these SDG Labs are multi-stakeholder and transdisciplinary processes to catalyse transformation and to encourage innovative ways to overcome lock-ins and plant seeds of change.

The general intention is to prioritise labs that can feed into the UN High-Level Political Forum in 2018, focusing on the goals below:

- SDG 6 Clean water and sanitation
- SDG 7 Affordable and Clean Energy
- SDG 11 Sustainable Cities and Communities
- SDG 12 Responsible Consumption and Production
- SDG 15 Life on Land.

These are good goals, excellent even, and certainly critical path goals, yet the laboratory funding that is available is for only five to seven laboratories with up to US \$5000 each. Pretty derisory really. We do need to recognise that we have serious issues to fix and that will take serious thinking, serious action and serious cash.

A new, “in-depth” online publication on resilience thinking and global development called *Rethink*¹⁴ has recently been launched. The new online magazine will publish in-depth features that communicate

resilience thinking to people who might use it in global development, policy making, research and more, so we are told. *Rethink* is short for resilience thinking, and the publication aims to tell the long and sometimes complex stories that resilience research uncovers, in a compelling way and to a broader audience. This is symptomatic of the malaise when we deal with existential threats. Hearing about innovative urban lake restoration in Bangalore, or how centuries-old ways of farming rice in Balinese water temples which takes the whole system into account to produce the best yields and thereby indicate how systems change and adapt, and in the end, how we can create a more resilient world is a simple distraction. While resilience of a community, city, rainforest or any socio-ecological system has the capacity to be flexible and deal with changes without changing its basic identity, so to speak, this does not allow for dealing with existential threats such global resource depletion, climate change and overwhelming population growth. The real story is not being told.

A new kid on the block, in terms of fixing key global issues, is systems thinking which, notionally, can deal with social, environmental and political perspectives. The challenge that is rarely voiced is that systems thinking works only when we think and act in a logical and rational way. Climate change discussion during the last ten years or more suggests that we do not do this.

NOTES

1. *Brexit* is a commonly used term for the UK's planned withdrawal from the European Union. Following the 2016 referendum vote to leave, the UK government triggered the withdrawal process on 29 March 2017, setting the date for the UK to leave by April 2019.
2. https://www.google.com.gh/?gfe_rd=cr&ei=sDgLWMzNIIXEaJDivPgF#q=all+nations+will+shift+towards+a+fertility+rate+of+about+2.1+children+per+woman+.
3. http://oecdobserver.org/news/fullstory.php/aid/3681/An_emerging_middle_class.html.
4. <http://www.spiegel.de/international/business/rare-earths-high-tech-companies-face-shortages-as-china-hoards-metals-a-658977-2.html>.
5. www.iags.org/rareearth0310hurst.pdf.
6. www.voanews.com/a/save-the-children-over...million-ethiopians.../3093206.html

7. <https://scripps.ucsd.edu/news/earth-has-crossed-several-planetary-boundaries-thresholds-human-induced-environmental-changes>.
8. <http://www.who.int/mediacentre/factsheets/fs313/en/>.
9. <http://ldcnews.com/eight-countries-west-asia-water-scarcity-limit/>.
10. www.unep.org/newscentre/default.aspx?DocumentID=27074&ArticleID=36180.
11. www.unep.org/newscentre/default.aspx?DocumentID=27074&ArticleID=36180.
12. <http://www.futureearth.org>.
13. <http://www.stockholmresilience.org/>.
14. <https://rethink.earth>.

Final Word

Abstract On the face of it, it seems likely that, simply through lethargy and a simplistic approach, which humanity typically adopts when faced with overwhelming challenges, we will do nothing. We will rely on Plan B. It is not really a plan, merely a default consequence. Until we do leave this planet in mass interplanetary migration, it is going to be fairly unpleasant for billions of people. The question for you, dear reader, is that your legacy.....? Yet it is not simply a planetary calamity, it is a time of opportunity, for innovation and collaboration between governments. It is all about choice. Your choice.

Keywords Plan B · Space · Choice

In the event that all the above fails, what then? Is there a Plan B?

Well, there is always a Plan B.

As Professor Stephen Hawking said, all we have to do is get through the next 100 years and then we will be moving off-planet anyway.¹ On the face of it, that seems more likely a scenario and more likely to happen, simply through the lethargy and the simplistic approach that humanity typically adopts when faced with overwhelming challenges. Though, of course, it is not a plan, merely a default consequence.

In some ways, it becomes a self-fulfilling prophecy. As Arthur C Clarke anticipated many years ago.... *Humanity will live most of its history off the planet Earth.*

However, until we do leave this planet in mass interplanetary migration, it is going to be fairly unpleasant for billions of people.

The question for you, dear reader, is that our legacy.....?

It is YOUR responsibility, the time for ignorance is long gone. Your lives (or what is left of them) and your children's and at least your great grandchildren are in OUR HANDS, no one else's. When they are mature enough to make decisions or influence, it will be too late and they will look back at THIS generation...

Yet it is not simply a planetary calamity, it is a time of opportunity, a time for innovation and above all a time for real collaboration between governments. Despite that, it is down to us, the people. Admittedly, it would be easier if there was an actual purpose to life and then we might be more inclined to act. It is the lack of purpose that probably explains why, when we face existential threats we are simply, and collectively, passive. We seem to be none too bothered about approaching our extinction because we have no higher purpose other than to survive, and to procreate as and when the opportunity arises. In essence once we have done that, our job is done and we simply serve out our time....or do we?

It is all about choice. OUR choice...

NOTE

1. <http://www.iflscience.com/space/stephen-hawking-warns-humanity-could-destroy-itself-next-100-years/>.

INDEX

A

- Acidity, 18
- Adaptation, 132
- Aerosols, 57
- Africa
 - Sub-Saharan, 15, 40, 73, 96, 100, 105, 122, 152
- Agriculture (al)
 - expansion, 49, 151
 - industrial, 1, 13, 17, 40, 43, 52, 56–59, 68, 73, 109, 132, 133, 150
 - intensification, 49, 59
 - reduced productivity, 85, 152
 - run-off, 30, 31, 73, 149, 150
 - small-scale, 117

Air Quality

- burning coal, dung, 57
- indoor, 69, 70, 152
- livelihood, 34, 52, 60, 108
- low-emissions fuels, 69
- outdoor, 67–69, 96
- particles, 57, 68
- soot, 57
- sulphates, 57

Aral Sea, 40

Asia

- central, 40, 143, 146
- south, 43, 44, 122, 144
- south east, 40, 45, 57, 67, 95, 104, 150
- west, 100, 151

B

- Bangladesh, 10, 44, 69, 91, 92
- Biodiversity
 - harvesting, 2
 - loss, 4, 20, 34, 36, 49, 52, 109, 147, 150
- Biofuel production, 50

C

- Carbon dioxide, 11, 17, 18, 25, 26, 77, 149, 150
- Chars, 91, 92
- Chemical
 - management, 4, 20, 32, 57–60
 - pollution, 4, 20, 55
 - production, 27, 32, 57, 59

- China, 11, 32, 34, 40, 42, 44, 69, 85, 88, 103, 114, 117, 118, 124, 132, 140, 142, 144–146
- Cities
 critical infrastructure, 130
 green, 77, 93
 smart, 96, 109
 unplanned, 138, 154
- Clean (er)
 power generation, 68
 production, 40, 42, 85, 149, 153–155
 transport, 68
- Climate change
 1.5°C, 13
 2°C, 13
 adaptation, 37, 60, 130
 climate change, 2, 3, 10, 11, 13–15, 23, 37, 40, 42, 45, 50, 53, 54, 56, 60, 76, 77, 80, 84, 92, 115, 117, 118, 129, 131, 132, 138, 142, 145, 147–149, 151, 152, 156
 climate finance, 14, 15
 desertification, 149, 151
 drought, 13, 60, 130, 137
 extreme weather, 9, 13, 45, 129–131, 149
 flood, 13, 14, 43, 45, 92, 130–132, 137
 green climate fund, 11
 greenhouse gas emissions, 11, 37, 83–85, 132, 149
 heatwave, 9, 13
 kyoto protocol, 11
 sea level rise, 13, 20, 45
 summits
 ; Cancun, 10; Copenhagen, 10, 15, 18; Doha, 10, 11; Durban, 10, 11; Lima, 10, 13; Marrakesh, 13; Paris, 10, 13, 15; Warsaw, 10, 11
- Vulnerability, 45, 56, 129, 138
- Coastal economies, 18
- Commodities, 77
- Conflict
 armed, 52, 88, 99
 continual low-level, 143
 hostile upstream neighbours, 72
 war zones, 126
- Consumerism, 66
- Consumption, 18, 27, 34, 50, 77, 81, 123, 124, 144, 149–151, 153, 155
- Coral bleaching, 20
- D**
- Disasters, 13, 45, 137, 138, 149, 151
 earthquakes, 137
 management, 130, 154
 man-made, 17, 42
 natural, 42, 45, 50, 91, 92, 150, 152
- Dissolved oxygen, 30
- Drought, 15, 44, 92, 147
- Dust, 57
- Dyke (s), 43
- E**
- Early warning, 15, 43
- Earth overshoot day, 36
- Economy
 growth, 30, 40, 53, 57, 121, 149–151, 153
 mis-managed, 40, 96
- Ecosystem
 health, 55, 57, 58
 services, 77, 130, 138
- Education
 gender parity, 62
 girls, 73, 99, 100, 122
 lack of basic, 143

- literacy rates, 99
- primary
 - ; enrolment, 99, 100
- secondary, 100, 101, 131
- Energy**
 - affordable, 60, 100, 123, 124
 - biomass, 68, 69, 85, 152
 - cleaner power generation, 68
 - co-generation, 69
 - efficient, 34, 69, 70, 115
 - energy-efficient housing, 68
 - fossil fuel, 11, 83, 85, 123, 124, 150, 151
 - hydropower, 42, 43, 69
 - low-emissions fuels, 69
 - mini-grids, 69
 - nuclear fusion, 145
 - renewable, 69, 84, 85, 114, 151
 - solar, 11, 57, 69, 88
 - wind, 69, 146
- Extinction (Existential)**
 - fatalism, 146
 - future, 2, 3, 13–15, 18, 20, 26, 36, 45, 60, 76, 77, 79, 93, 113, 114, 118, 122, 123, 129, 131, 132, 138, 143, 144, 148, 149, 155
- Extreme weather (Events)**
 - floods, 13, 43, 45, 92, 130, 131, 137
 - heatwaves, 9, 13
 - hurricanes, 137
 - landslides, 42
 - mudslides, 137
 - natural catastrophes, 143
 - rainfall, 40, 42, 60, 150
 - tropical cyclones, 45
- F**
- Farming**
- crops, 29, 30, 44, 79, 80, 105, 108, 147
- cultivation, 152
- grazing, 50, 88
- livestock, 29, 30, 32, 41, 79, 87
- methods, 31, 69, 77
- small-scale, 117
- Fatalism, 146**
- Fisheries**
 - freshwater, 42
 - inland, 152
 - marine, 152, 153
- Flood, 13, 14, 43, 45, 132**
- Food**
 - chain, 18, 79, 153
 - consumption, 50
 - livelihood, 34, 52, 108
 - security, 52, 54, 147, 152
- Forest (ry)**
 - conversion, 49, 50
 - fires, 45, 68, 69
- Freshwater**
 - abstraction, 2
 - use, 4
- Future**
 - games, 117, 118
 - leadership, 11, 24, 132
 - nuclear fusion, 145
 - pandemic, 143, 144
 - plan B, 159
 - unsustainable, 41, 85, 117, 146, 150, 151
- G**
- Garbage, 20**
- Gender**
 - equality, 143
 - equity, 147
 - girls, 73, 99, 100, 105, 122, 143
 - literacy rates, 99
 - marginalised groups, 101

- parity, 37
 women and children, 69
- Global warming, 9, 17, 18, 26, 45, 107
- Governance (Government)
 corruption, 88, 104, 107
 global, 3, 10, 11, 13, 31, 34, 36, 57, 59, 115, 117
 good, 113
 local, 14
 leadership, 38, 115
 national, 3, 14, 53, 54, 114, 130, 131, 148, 153
 political cronyism, 96
 transparency, 115
 weakness, 84
- H**
- Habitats
 change, 151
 loss, 20
 mangroves, 18
 salt marshes, 18
 seagrass beds, 18
- Health
 bio-technology, 145
 child mortality, 69, 108
 communities, 58
 ecosystems, 57
 HIV/AIDS, 96
 human, 15, 31, 55, 57, 58, 67, 150–152
 nano-technology, 145
 pandemic, 144
- Heatwave, 9, 13
- Himalayas, 43
- Housing
 energy-efficient, 68
 livelihood, 108
- Human rights, 38, 50, 101, 102
- I**
- India, 10, 11, 44, 45, 69, 95, 124, 132, 140, 142, 145
- Indigenous peoples, 50, 52, 54
- Infrastructure, 15, 45, 59, 81, 85, 93, 96, 124, 130, 152, 153
- Institutions
 global, 114
 smart, 52, 57, 147
 weak, 104
- Internet access, 108
- IPCC, 15
- IUCN, 36, 37
- L**
- Lake Chad, 41
- Land
 community-based tenure, 52
 customary systems, 50
 degradation, 50, 149, 152
 desertification, 149, 151
 indigenous peoples, 50
 lease, 80
 local communities, 50, 54
 loss, 52, 147
 planning, 130
 regulation, 138
 rights, 50, 52, 93
 runoff, 30
 slides, 42
 use, 4, 37
- Lifestyles
 unhealthy, 95
- Livelihood
 affluence, 95
 affordable energy, 60
 clean air, 60
 clean water, 60
 food, 34, 52
 housing, 108

- Land, to Shelter, Health care, Education, Work and Technology, 60
- rising standards, 73
- underemployed, 88
- unemployed, 88
- M**
- Marine
- animals, 18
 - mammals, 36
- Mekong River, 41
- Middle classes, 34
- Migration
- mass, 132, 142, 148
 - mass displacement, 151
 - migrants, 142
 - patterns, 138
 - rural, 132
 - urban, 45
- Military, 98, 117, 123, 124, 127, 145
- Millennium development goals, 3, 101
- Mining (minerals)
- bauxite, 145
 - cobalt, 145
 - copper, 85
 - diamonds, 89
 - gold, 89
 - Iron, 145
 - rare earth, 146
 - zinc, 145
- Mitigation, 11, 23, 138
- Montreal Protocol
- hydrofluorocarbon, 26
 - methane, 25
- N**
- Nature (al)
- allocation, 58
 - capital, 37
- catastrophes, 143
- disasters, 42, 45, 50, 91, 92, 150, 152
- resources, 1, 37, 45, 50, 52, 54, 96, 138, 145, 149, 150, 153, 155
- Nitrate, 30, 31
- Nitrogen cycle, 147
- Nutrient cycle, 2
- O**
- Ocean acidification, 18, 20
- Oil and gas, 52, 80
- Ozone
- depletion, 4, 24–26
 - stratospheric, 1, 3, 23, 26
- P**
- Pakistan, 43, 69, 126
- Phosphorus cycle, 4
- Planet
- management, 4
 - scale, 2
 - systems, 3
- Political stability, 53
- Pollution
- burning coal, dung, 57
 - chemical, 4, 20, 55
 - dust, 57
 - water, 40, 60, 85
- Population
- density, 45
 - global, 31, 148, 156
 - growth, 40, 73, 76, 77, 88, 117, 138, 149–151, 156
 - overpopulation, 76
 - reducing, 37, 76, 80
 - reversing, 80
 - rising, 73, 122, 151
 - size, 50, 73

- world, 31, 73, 76, 142, 144
- Poverty
 - alleviation, 130
 - rural poor, 85, 92, 93, 100, 132
- Precautionary principle, 24

- R**
- Renewable
 - biomass, 68, 69
 - fossil fuel, 83
 - hydropower, 69
 - solar, 69
 - wind, 69
- Resilience
 - planetary systems, 3
- Rural
 - area, 67, 84, 92, 132, 152
 - development, 50
 - exodus, 142
 - migration, 132
 - poor, 93

- S**
- Saltwater (saline) intrusion, 43
- Sanitation, 15, 60, 71, 73, 92, 105, 132, 140, 150, 152
- Sea level rise, 20, 45
- Seasonal event, 45
- Security
 - energy, 123
 - food, 52, 54, 121, 147, 152
 - water, 53
- Sewage effluent, 30
- Shelter, 4, 33, 60
- Slavery, 38
- Smart
 - agriculture, 14
 - institutions, 52, 57, 147
 - people, 109

- T**
- Technology
 - additive manufacturing, 148
 - bio-technology, 145
 - electronics, 109
 - nano-technology, 145
 - robotics, 148
 - software, 107
 - work, 4, 60
- Terminology, 77
- Tipping points, 3
- Tourism, 18
- Transport
 - cleaner, 68
- Tropical cyclone, 45

- U**
- UNFCCC
 - summits
 - ; Cancun, 10; Copenhagen, 10;
 - Doha, 10; Durban, 10; Lima, 10; Marrakesh, 13; Paris, 10;
 - Warsaw, 10
- Urban (Urbanisation)
 - affluence, 95
 - cities, 138
 - critical infrastructure, 130
 - development, 50
 - increasing, 137
 - migration, 45
 - peri-urban, 68

- rapid, 69, 138, 149
- unplanned, 138

- V**
- Vulnerability
 - climate change, 45, 56, 129, 138
 - marginalised groups, 52

- W**
- War, 109, 118, 125, 127
- Waste
 - food, 79
 - management, 68, 69
- Waste management
 - agricultural waste incineration, 68
 - uncontrolled dumping, 150
- Water (bodies)
 - Aral Sea, 40
 - competition, 50
 - conflict, 54, 60, 71
 - drinking water, 40, 42, 74, 125, 150, 152
 - ground, 30, 40
- hydropower, 42
- irrigation, 40, 50
- Lake Chad, 41
- livelihood, 60
- Mekong River, 41
- pollution, 40, 60, 85, 152
- resources, 40, 149, 151
- sanitation, 15, 71, 73, 125, 132, 143
- scarcity, 37, 40, 60, 149–151
- security, 53
- shared, 41
- surface, 30, 40
- upstream neighbours, 72
- usage, 73
- war, 109, 125
- Women and children, 69
- Work
 - additive manufacturing, 148
 - bio-technology, 145
 - nano-technology, 145
 - robotics, 148
 - technology, 4, 60, 145
 - underemployed, 88
 - unemployed, 88