

The Great Decoupling: Our Human Economic Footprint and the Global Environmental Commons

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An Issues Note:

This paper represents work in progress. It lays out some ideas for discussion at the October 12-13 Conference on the Global Commons. Insights from the conference will help guide the next phase of work. A fuller paper be prepared as part of the Global Commons Program initiated by the GEF.

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The views expressed here are those of the authors, and do not necessarily reflect those of the GEF or IUCN.

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Abstract

Massively expanding human economic activities are placing irresistible pressures on the global commons and, in many contexts, are overwhelming traditional protection and conservation approaches. Fortunately, new technologies—both physical and behavioral—are making possible a radical transformation in almost all spheres of economic and social life: our energy systems, urban design, transportation, food production, and industrial processes. There is a better future to be had in terms of prosperity and quality of life that can also radically reduce pressures on the global commons.

But such transformations will not happen automatically, and are not happening today at anything close to the pace that is required.

Such a future requires non-incremental shifts in policy and behavior, unusual political, social and corporate partnerships, and needs to be understood in the context of “movements” rather than policy shifts. Such movements need to be motivated by opportunity for a better economic and social future than by narrower environmental objectives.

A successful strategy towards the global commons will require a much greater focus on how to catalyze these mega transformations as an essential complement to current efforts. Lessons exist from previous examples of positive tipping points. In addition, exciting new developments in technology and governance offer unprecedented opportunities for breakthrough. How can they be seized?

I. Introduction: The Crushing Pressure on our Common Resources

The human economic footprint—in terms of real GDP—grew five-fold in the four centuries to 1900, then more than 20-fold in the 20th century.¹ A 3 percent annual increase of the world economy throughout the current century would create another 20-fold increase in the human footprint, while a 4 percent growth rate would yield a 50-fold increase. This latter growth rate would imply the real economy at the end of this century would be 1000 times the size of that in 1900. No wonder we are entering a new geological age, the Anthropocene!

The past century is a history of markets working, as real commodity prices fell despite a 25-fold increase in demand. But where there are no markets, as in the case of the global commons, human economic activity begun to wreak havoc. The “tragedy of the commons” moved from local to global. With today’s pace of growth, even marketed commodity prices are subjected to unprecedented instability, as the positive forces of substitution are unable to keep up.²

Human economic activity has now reached the scale that global common assets are under critical risk. Natural habitats are being destroyed at unprecedented rates, resulting in species extinction rates up to 100 times natural levels,³ and a massive churn of natural materials is placing elements and molecules in places where they do great harm: carbon and other chemicals in the upper atmosphere creating climate change; plastics and debris into the oceans, causing the breakdown of marine ecosystems; nitrogen and phosphorus into local and international waters, diverting oxygen from other organisms and thus killing entire ecosystems; and metals and minerals being undervalued and ending up in landfills.

These forces threaten to undermine physical systems that for the past 10,000 years (the Holocene Era) have been highly benign for human progress. During this period, in which annual temperatures varied by less than a degree, regular seasons emerged, and rainfall stabilized, agriculture developed, in turn providing the prerequisite for modern civilizations to evolve. From the agricultural revolution, new human cultures, economies and cities grew.

From around 1800 a second industrial revolution occurred as the power of fossil fuel energy, steam engines, electricity and internal combustion engines was harnessed. It triggered an era of mass production, mass movement and a new generation of urban living. This second revolution drove economic growth through the 19th and much of the 20th century. The late 20th century saw a third industrial revolution, this time in digital technology and computing, which has enabled a further acceleration in economic productivity and mass communication. Many commentators have termed the extraordinary growth in human activity especially since the 1950s the “great acceleration.”⁴

Human population responded to these developments, growing slowly but steadily over millennia during the Holocene equilibrium reaching about 500 million people in 1500 and one billion people by 1800.⁵ The benefits of the second industrial revolution in particular enabled

human population growth to accelerate over the last 150 years or so (through the arrival of urban sanitation systems, antibiotics, vaccinations and new medical techniques, for example). The Haber Bosch process, creating artificial fertilizers from nitrogen, coupled with new agricultural machinery, transformed farm yields from the turn of the 20th century and led to massive agricultural intensification.⁶ Consequently, the global population has increased more than seven-fold since 1800, accelerating to some 7.4 billion today and 9-10 billion in 2050.⁷

The improvements in human welfare that this recent acceleration in economic growth has delivered are staggering by historic standards. Since 1990, for example, the world has reduced the number of people living on less than US\$1.25 a day by half, and welcomed roughly 700 million more people into the mushrooming global middle classes.^{vi,8}

The global middle class, currently at about 1.7 billion people, continues to grow by about 70 million people a year, including 20 million people a year in countries outside of China and India.⁹ In 2010 the OECD famously forecast that the global middle class could double by 2020 and triple by 2030.¹⁰ Trends are on line or above this forecast; the Boston Consulting Group for example suggests that by 2020 Indonesia alone will add the equivalent of the population of the United Kingdom—67 million people—to the middle class.¹¹

Human success in reducing aggregate poverty levels and expanding the middle class over the past twenty-five years or so has also spurred a wider power shift in the global economy. Today the combined GDP of emerging economies accounts for over 40 percent of global GDP, double its share since 1990; and in the past few years emerging markets have accounted for around two-thirds of total global growth. Goldman Sachs estimates that the emerging middle income economies—and their rising middle classes—could account for close to 60 percent of global GDP by 2050.¹²

From an anthropocentric point of view, therefore, the last 10,000 years—and especially the last few decades—of human existence have been a very successful period for population and economic growth.

Yet, from an Earth systems perspective, the human success story is far less rosy.

Underpinning these extraordinary human advances has been the consistently steady-state of our global environmental systems provided by the Holocene equilibrium. Global patterns of temperature, precipitation, seasonality—and the overall health of our atmosphere, cryosphere, hydrosphere and biosphere—have remained predictable for much of the last 10,000 years, functioning within a “Goldilocks” zone—not too hot and not too cold—and providing as a result a bio-physical environment conducive for humans to flourish in. Indeed, in the success story of our economic history to-date, we have taken the stability of our global environmental systems

^{vi} The middle class is defined by the OECD as households having between \$10 and \$100 purchasing power parity per capita per day.

(and the global environmental commons that sustain them) for granted, as if they will never change and can never be changed.

Yet the footprint of our human impact on the Earth's global systems, particularly since the great acceleration of the last sixty years or so has generated much scientific concern. Advances in scientific monitoring and data collection, processing and modelling over the last few decades enable us to assess and forecast the impact of our human development on our environmental systems better than ever before.

The findings are profoundly worrying. As a result of our historical, cumulative human footprint, we could be entering a period of unprecedented environmental systems change.

In an accompanying scientific paper to this piece, Professor Johan Rockström and Nebojsa Nakicenovic set out the wide-ranging impact that this “great acceleration” has had. Among their conclusions, and those of other scientists:

- today's greenhouse gas levels have not been seen for at least three million years, i.e. since pre-Holocene times.^{vii} Even if we succeed in achieving the Paris Climate Agreement goals of a 1.5/2 degrees Celsius warmer world, this will be outside of the Holocene equilibrium;
- the Earth is losing its biodiversity at mass extinction rates, such that 70 percent of our genetic biodiversity is now extinct;
- current deforestation rates in the Amazon Basin could lead to an 8 percent drop in regional rainfall by 2050, triggering a shift to a savannah state, with much wider consequences for the Earth's atmospheric circulatory systems;
- the chemistry of the oceans is changing faster than at any point in perhaps 300 million years, due to the absorption each year of around 25 percent of anthropocentric greenhouse gas pollution. This is creating unprecedented impacts on corals and fish stocks through ocean acidification and rising temperatures; warmer oceans are also putting more energy and water into the atmosphere encouraging more storms;
- our polar and glacial ice fields are retreating at an alarming rate with potentially calamitous knock-on effects for our wider water and climate systems; the Arctic is now the fastest warming region on the planet and the warmer air and warmer water at the north pole this creates is disturbing the predictability of the Gulf and the Jet streams, which help to regulate the Earth's climatic circulatory system;
- the huge success of artificial fertilizers to boost agricultural productivity has driven arguably the largest and most rapid impact on the nitrogen cycle for some 2.5 billion years. Nitrogen and phosphate pollution from fertilizer has washed into our seas affecting fish stocks and creating among other impacts so called “dead zones” in 10 percent of the world's oceans; and

^{vii} Illustrated by CO2 concentrations which have now reached 400ppm compared to a 280 ppm Holocene baseline.

- severe impacts on our global water cycle have occurred due to abstraction and uncontrolled pollution, such that by 2030 we may face a 40 percent shortfall in the freshwater we will need to drive our global economy.

It seems that where there are no clear market signals and no clear rules and regulations, as has been the case for managing our global environmental commons, the scale of our human economic activity wreaks havoc. Without any requirement to take account of the global impact of locally-made pollution, the footprint of our cumulative human economic and industrial activities has placed great strain on our global environmental systems, like our atmosphere, biosphere, cryosphere and our oceans.

II. Inadequacies of Our Current Approaches

Traditional approaches at preventing the destruction of the global commons have involved efforts at protection and regulation—protected areas on land and sea, laws against dumping and pollution, etc. These have been accompanied by soft global governance structures in the forms of Conventions, targets and specialized funds. These have had some success in slowing the damage, and in a few cases, when accompanied with a more muscular governance system—e.g., the Montreal Protocol for ozone depleting substances—have been highly successful. These measures remain important and must be supported.

Over the past two decades, experts and policymakers have become aware that the underlying causes need to be addressed, with numerous calls to integrate global concerns into national and local policies. Take, for example, the Aichi Biodiversity targets, which were established in 2010 for the 2010-2020 period under the Convention on Biological Diversity.¹³ They include:

“Target 2. By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems.

Target 3. By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio economic conditions.

Target 4. By 2020, at the latest, Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.”¹⁴

This recognition marks important progress, and must be supported much more strongly than at present. In most contexts today. However, such goals remain aspirational rather than realistic. And, frankly, given their lack of ownership at the highest political and corporate levels,^{viii} they are very likely to be overrun by the tsunami of another 20- or 50-fold increase in the global economic footprint this century. These treaties and conventions, and their associated goals and targets are generally designed and promulgated through an exclusively (inter) governmental model, resulting in slow and bureaucratic processes that often remain ghettoized within Ministries of Environment and the environmental channels of the international community; they are often (wrongly) seen as protectionist, or anti-competitive by other parts of government or the international community (and often by emerging economies), designed deliberately or inadvertently to put a dampener on growth. As a result, these models often prove partly effective at best in terms of actually meeting their desired goals and tend to get over-run by wider forces driving the global economic footprint.

Commonly, after a period of time when it becomes clear more action is needed, a new attempt is made to refresh the goals and targets: effectively iteration, rather than innovation. The original Environmental and Development Conference in Stockholm in 1972, the Rio Earth Summit in 1992, and the two follow ups in Rio+10 in 2002 and Rio+20 in 2012 are good examples of this kind of model in action. Despite all of these immensely important and laudable efforts over the course of the last forty years or so, multiple indicators on the health of our global environmental system are today flashing red, and we are closer to irreversible tipping points than ever before. Yet, this intergovernmental model continues as our primary response to the environmental challenge.^{ix} And on aggregate, the global environmental commons continue to decline.

Overall, it can be argued that these models have a fundamental design weakness: they are generally designed by the environmental community to reactively try and protect different parts of the global environmental commons against the interrelated pressures being placed

^{viii} The Sustainable Development 2030 Agenda, adopted by the UN General Assembly in 2015, includes reference to halting biodiversity loss (SDG Goal 15 reads: “Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss”). However, issues of biodiversity continue to remain aspirational as progress under this agenda remains to be seen.

^{ix} There have been important efforts over the last few decades to augment (inter)governmental decision making and policy making through the advancement of environmental (and ecological) economics and natural capital, to try and help decision makers reframe how we “value” environmental goods and services and stocks and flows of environmental capital; and how we “price” environmental externalities. However, whilst these efforts have created a much stronger intellectual depth of understanding about the environmental issues and potential trade-offs facing decision makers, it is fair to say that environmental economics and natural capital approaches have arguably found it to date hard to trigger a systemic rethink of mainstream political and economic decision making, outside of specific analyses or programs.

upon them, rather than being designed by a broader base of stakeholders to proactively try and disrupt the systems that are creating those pressures in the first place.^x

Some difficult questions have to be faced.

Given the scale and profundity of the challenge we face to try and maintain the Earth's environmental operating conditions for human activity as we enter the uncertainties of the Anthropocene epoch, is investment in more of the same sort of international geometry and design response going to be sufficient to secure our global environmental commons?

If we do not feel confident that doing more of the same is going to be enough, what new forces can be harnessed to trigger the movements and scale-change in action we need to secure the future of our global environmental commons? What extra innovations can help us to also “hack” the food, energy, urban, industrial production and consumption systems that are creating such pressure on our environmental commons such that we can positively disrupt and transform them, as the associated Sustainable Development Goals (SDGs)¹⁵ seem to call for? And how can these new forces be put to work in ways that complement and buttress our existing international global environmental processes, goals and targets such that we actively build upon and reinvigorate, rather than simply tolerate, our current global environmental governance architectures?

III. Shrinking the Footprint: Four Revolutions in Economic and Social Life

Preserving the global commons will require radical decoupling of economic progress from its environmental footprint. But is this possible? The answer is yes, but it is going to be exceedingly difficult if we continue business-as-usual, and therefore requires a non-incremental approach to accomplish.

The past few years have brought good news in terms of possibility. In almost all spheres of economic and social life, it is possible to identify future trajectories that lead to greater prosperity and a better quality of life while sharply shrinking our ecological footprint. In most cases these can have positive returns, and in the aggregate they certainly do. The bad news is that—due to political, financial and psychological inertia, and physical “lock-in”—these transformations are not happening at a scale that is remotely close to what is needed.

^x The two exceptions that help to prove this rule are the Montreal Protocol, designed with private sector technology acceleration in mind, and recent efforts to complement the official intergovernmental climate change agenda with a wider public-private action agenda, that many commentators argue have been successful.

This section briefly summarizes this emerging understanding and explores four innovations that might be brought to bear to disrupt current path-dependent patterns.^{xi}

The Cities of Tomorrow

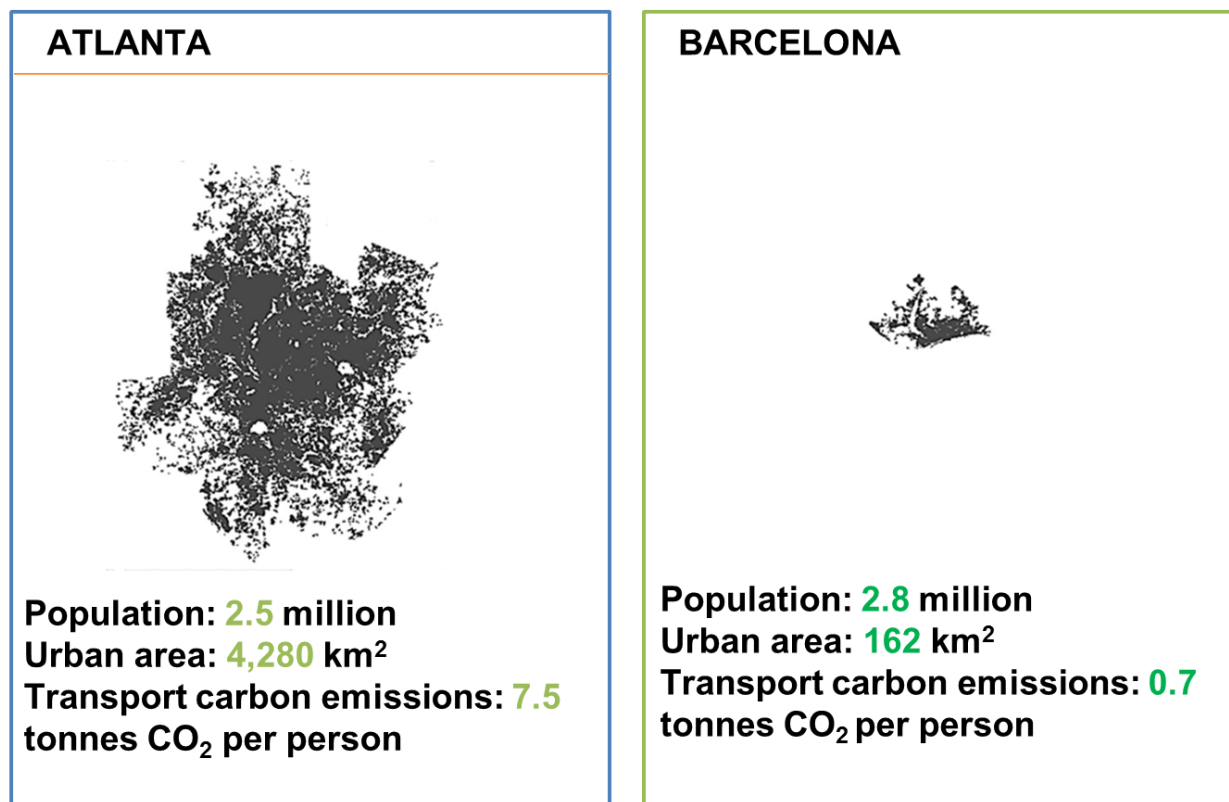
The speed and scale of our shift in human existence from rural to urban living within a few generations has been extraordinary. In 1900 about 13 percent of the world's population (about 220 million people) lived an urban existence, and only 12 cities worldwide had more than 1 million inhabitants.¹⁶ Today, there are 910 cities worldwide with between one and five million inhabitants and 35 “mega-cities” with more than ten million inhabitants. Around 3.7 billion people live in urban areas, around 55 percent of the population.¹⁷

And the sharpest burst of growth is yet to come, with more than 700 million people being added to cities each decade until 2060.¹⁸ Under current expansion patterns this will take millions more hectares of agricultural land, in turn pushing agriculture further into natural habitats. At the same time the three billion that are expected to enter the global middle class over the same period will almost all be in cities. If their consumption patterns follow those of the past generation, the number of automobiles worldwide will rise from today's 1 billion to 2 billion on the road by 2050.¹⁹ Already today many cities in the emerging world are losing almost 10 percent of their income through the costs of congestion, and another 6-10 percent due to pollution. Urban “sprawl” in the United States is estimated to cost over \$1 trillion per year.²⁰ Many cities in the emerging world are reaching breaking points whereby as the physical spread leads to ever longer commute times, evermore scarce resources allocated to road building, worsening pollution, and a downward spiral in the quality of life and environment.

It doesn't need to be this way. The Global Commission on the Economy and Climate has shown how a shift towards compact, connected and coordinated cities can dramatically shrink environmental pressures, while improving productivity.²¹ Cities that were designed before the automobile are often not only more livable, but also more productive. Carbon emissions can be lower by 90 percent (see Figure 1) through more compact design, better public transport, and better building codes.²² It is not too late to get it right: three quarters of India's urban infrastructure in 2050 has not yet been built. And Africa's urbanization is only now accelerating.

^{xi} Further analysis for the Global Commons Program will illustrate the potential impact on emissions and land uses of five main sectors—urban development, transport, circular economy, forests and renewable energy—that influence the innovations explored in this section, using the Global Calculator scenario model.

Figure 1: A Tale of Two Cities: Comparing Urban Form of Atlanta and Barcelona



Source: Bertaud and Richardson, 2004, Kenworthy (2003) cited in Lefevre, B. (2009), adapted from materials from the Commission on the Economy and Climate.

Comparing Atlanta and Barcelona demonstrates what is possible through compact, coordinated and connected urban development. Uncoordinated sprawl leads to higher costs of infrastructure, public service delivery, and transport. Cities that are compact, connected and coordinated—with higher densities, mixed-use neighborhoods, and walkable and transit-oriented environments—can be better both for the climate as well as economic productivity.

The shift from today's cities to those required tomorrow does not need to cost more. On the contrary, over the next 15 years it would save \$3 trillion in urban infrastructure investment worldwide.²³ But it requires something more scarce than money: political and social leadership; the will to fundamentally think about where people will live, work and play; how they will travel; and in what kinds of buildings will constitute a city.

Around the world there are emerging examples of best practice. And important coalitions of city leaders committed to a new model of urban growth—such as the C40 group of 80 mega cities—are providing encouraging indications that change is possible. But the impact of these remain tiny in comparison to the scale of change required.

What would it take to catalyze the revolution required?

Rethinking Food and Agriculture

The challenge for food and agriculture in the coming three decades is particularly wicked. Agriculture's impact on the environment is already huge. Thirty-seven percent of Earth's landmass (excluding Antarctica) is used to produce food (with 12 percent dedicated to cropland and 25 percent dedicated to grazing lands).²⁴ This demand for agricultural land contributes significantly to the loss of biodiversity.²⁵ Agriculture accounts for 70 percent of global freshwater withdrawals²⁶ (and 80-90 percent of freshwater consumption²⁷) and 24 percent of global GHG emissions.²⁸ Further, agriculture contributes significantly to land degradation—the soil erosion and pollution associated with fertilizer and pesticide use. The International Food Policy Research Institute (IFPRI) estimates that 10 million hectares of cropland worldwide are abandoned each year due to soil degradation, and that another 10 million hectares are damaged by salinization due to over-irrigation or other forms of poor land management.

Fast-forwarding to 2050, feeding the world will be a much more difficult challenge, as 60-70 percent more food calories will be needed to feed an estimated 9.7 billion people in the world.^{xii} This growth will be the result of population growth and changes in dietary preferences, as wealthier and more urban populations will consume greater quantities of resource-intensive foods such as beef and dairy. By 2050, demand for red meat (beef, mutton, goat) and dairy products are expected to increase by 80 percent.²⁹

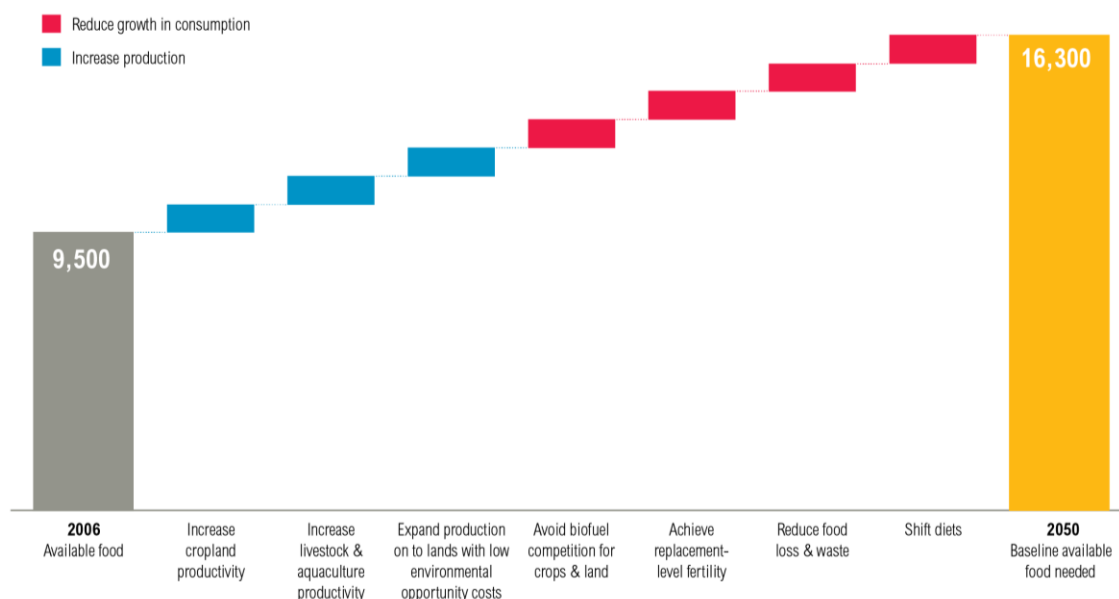
Meeting this increase in demand will require roughly the same annual rate of increase in food production as over the past four decades. But this comes as a time when greenhouse gas emissions from the sector will need to fall by more than half, even as production rises. Expansion onto forest land will not be an option if commitments under the SDGs, Climate Change and biodiversity Conventions are to be honored. Providing the required food volumes from existing land would require annual yield increases almost 50 percent higher than over the past four decades—and all this at a time when water will be come much less predictable. In the next decade alone it is estimated that up to 30 percent of food production may be at risk because of rising water stress from over-abstraction and from droughts linked to changing climate patterns.

Threading this needle will be difficult indeed. No silver bullet exists. A combination of measures are required—some that increase production, and some that reduce demand on land (See Figure 2). Each of the seven menu items listed, will require much more than business-as-usual to play their part. Consider just two of these as examples.

^{xii} Seventy percent is the required food gap between crop calories produced in 2006 and the most likely required in 2050 assuming a global population of 9.7 billion.

Figure 2: A Menu of Solutions to Sustainably Close the Food Gap

Global Annual Crop Production (kcal trillion)



Source: WRI analysis based on Bruinsma (2009) and Alexandratos and Bruinsma (2012), World Resources Report 2013-14: Interim Findings. *Note: Includes all crops intended for direct human consumption, animal feed, industrial uses, seeds, and biofuels.*

Consider food loss and waste. Thirty-two percent of all food (as measured by weight) is wasted from “farm to fork.”^{xiii} If food loss and waste were a country, it would be the third-largest emitter of greenhouse gasses behind the United States and China. Cropland the size of China and 24 percent of all water used in agriculture are used to grow food that is ultimately never consumed. This loss and waste costs USD \$940 billion per year globally. Twenty-eight million tons of fertilizer are used annually to grow lost and wasted food.³⁰ Under SDG 12.3, countries are committed to halve food waste by 2030. This would close the 2050 food gap by 20 percent as well as substantially reduce inputs of resources such as energy and water, and would reduce the need for agricultural land by 500 million hectares—massively taking pressure off the global commons.³¹

Can it be done? In principle the problem is not technically difficult to solve. At each stage in the value chain it is clear what it would take to address the problem. Yet, despite the problem having been recognized for many years, progress has been woeful. Recently, there have been some remarkable signs that progress is possible—for example, in the United Kingdom, household food waste declined by 13 percent from 2007-2010³²—but overall we are making virtually no progress, and in many contexts the problem is worsening. There are early signs that

^{xiii} If measured by calorie content, 24 percent of all food produced is lost or wasted.

this could happen, including through the creation of Champions 12.3, but a tipping point is not yet in sight. What would it take to catalyze the policy and behavioral shifts required?

Another example: an essential part of any solution will be to shift diets to more sustainable food sources. An important recent paper, “Shifting Diets for a Sustainable Food Future,” finds that diet shifts can close the food gap by up to 30 percent while simultaneously reducing the environmental impacts and resource use of agriculture.³³

Animal-based foods, particularly beef, are significantly more resource intensive than plant-based foods. Animal-based food production accounts for 75 percent of global agricultural land use, and two-thirds of the GHG emissions associated with agriculture—while delivering only 27 percent of total protein consumption.³⁴ At the same time, over 90 percent of countries consume more protein than the estimated need. According to scientists, 15 GtCO₂e (equivalent to one-third of global CO₂ emissions in 2011) could be saved in 2050 if everyone switched to the healthy diet as recommended by the WHO.^{xiv,35}

The arguments in favor of shifting diets are overwhelmingly persuasive. Yet, despite many points of light, it is not happening to any systematic extent that would make a difference. What would it take? Given the massively positive impact this could have on the health of the planet as well as of people, the environmental movement should be giving this much more attention.

The points made here for food loss and waste, and shifting diets, are equally true of the other five menu items listed above.

Decarbonizing Energy Systems

Global energy use has increased roughly 13-fold since 1900,^{xv} and will likely need to increase by another 50 percent by 2040 if the SDG goals of the industrialization and energy for all are to be achieved. Under current patterns this will cause a 34 percent *increase* in global energy-related carbon dioxide emissions,^{xvi,36} at a time when emissions will need to *fall* by roughly the same amount.

Electricity production has become a surprisingly “thirsty” business, creating a direct strain on the world’s water resources. A megawatt hour (MWh) of electricity from coal uses 1,200-2,300 liters. Consider that by 2040 India will need to quadruple its current installed capacity of about 270 GW to meet its energy needs (creating another United States in terms of energy use) with 400GW of this new capacity planned to come online by 2035 from coal fired power stations. This adds to the competitive environment for water use, especially at a time when water will

^{xiv} The healthy diet is 2,100 calories on average with 160 of those from meat. Calculated using the Global Calculator “consumer reluctance” pathway and comparing this with WHO healthy levels (levels 4 for calories consumed and 3 for meat consumed).

^{xv} From 40 exajoules to over 500 exajoules by 2010.

^{xvi} Under the EIA 2016 Reference case scenario, global energy sector emissions rise from 32.2 billion metric tons in 2012 to 35.6 billion metric tons in 2020 and to 43.2 billion metric tons in 2040.

become less reliable. Across Asia as a whole, a 76 percent increase in water demand for energy and industry is expected by 2030 compared to today. Recall that this will occur at the same time as the need to almost double levels of food production. How can these competing economic challenges be squared off?

There is another way. Indeed, of all the economic revolutions that need to take place to take pressure off the global commons, energy is the easiest to envisage. 70 percent of the energy infrastructure needed to meet this extraordinary growth in energy use by 2030 is yet to be built,³⁷ and the challenge is conceptually simple: ensure a minimal use of fossil fuels in new plants, and invest heavily in energy efficiency (which has among the highest economic and financial returns of any investment). Wind energy is already competitive with fossil fuels over almost half the earth's surface, and a new generation of solar deals is emerging with high sunshine environments (Mexico, UAE, Saudi Arabia, etc.) at around 3 cents per KW/h—at which price fossil fuels can no longer compete. Technical gains in system integration and storage also suggest that earlier concerns that baseload power required fossil fuel energy have been greatly overstated.

There is positive news also at the global level. Since 2013, global energy-related emissions have stalled at 32 billion tons, while the global economy continued to grow by more than 3 percent.³⁸ This is significant news considering that in the past 40 years emissions have only declined or stagnated relative to the previous year during times of economic downturns. This global trend is supported by the fact that from 2000-2014, at least twenty countries decoupled their GDP growth and energy-related carbon dioxide emissions (See Figure 3).³⁹

But despite this encouragement, we are very far from success. For a number of important countries with urgent needs to grow their power production—China, India, Indonesia, Pakistan, Vietnam—cost calculations are not yet clearly in favor of renewables (although they have ambitious renewable programs), and they all have large programs of new coal based generation. So too, investment in energy efficiency, while hugely attractive economically, is nowhere close to the tipping point required.

Achieving this pace of change requires a new strategy to complement the ongoing decline in the price of renewables. It would require high level political and financial engagement to shift incentives and bring down the costs of less damaging forms of power generation in those countries where the shift to low carbon is most difficult. What might this entail? How might the “global commons” community help make it happen?

Figure 3. Countries Decoupled Annual GHG Emissions from Economic Growth

Since 2000, More Than 20 Countries Have Reduced Annual GHG Emissions While Growing Their Economies



Sources: BP Statistical Review of World Energy 2015; World Bank World Development Indicators



Source: BP Statistical Review of World Energy 2015; World Bank World Development Indicators

From Take-Make-Waste to a Circular Economy

Over the past century, economic production increased 20-fold, drastically growing demand for natural resources. Growth in construction material alone have grown by a factor of 34, with ores and minerals by a factor of 27.⁴⁰ Looking forward, materials harvested, extracted and consumed worldwide are expected to increase to 100 billion metric tons per year by 2030—a 35-40 percent increase from today.⁴¹ If we continue business-as-usual, our global solid waste generation rates will exceed 11 million tons per day—more than three times today’s rates—by 2100.⁴²

This rapid rise in materials use, and waste deposited back into the environment, has contributed to serious environmental degradation, including habitat destruction, biodiversity loss, overfished and polluted waters, and desertification—placing unsustainable pressure on our global environmental commons. A decade ago, 60 percent of 24 of the world’s ecosystem services were already considered degraded.⁴³

Today’s global economy is dominated by linear approaches to the way we produce, design, use and dispose of most of our products and packaging, which means we extract natural resources, process them into products and packaging, sell the products to consumers that purchase them in their packaging, and dispose of them in the trash. What results from our linear “take-make-waste” industrial production and consumption systems is immensely unsustainable material resource use and productivity waste across the global economy. For example, every square mile of ocean contains approximately 46,000 pieces of floating plastic, with one gyre of waste material in the ocean (there are now 5) occupying an expected surface area roughly twice the size of France;⁴⁴ and one-half to three-fourths of annual resource inputs in industrialized economies are turned to waste after just one year.⁴⁵

But we can reduce the pressure on our natural capital assets and decouple resource use and waste generation from economic growth across all economies—becoming more resource productive and efficient across the economy—by adopting more circular^{xvii} economic approaches. This means looping our production, consumption and waste management processes; designing waste out of the economy and making use of waste outputs from one system as inputs for others; and keeping a given resource or product and its value circulating in the economy as long as possible. It is estimated that accelerating circularity across global supply chains can yield over US\$1 trillion per year by 2025 to the global economy,⁴⁶ while US\$4.5 trillion in revenue can be realized by 2030 through performing circular business models. For example, Sprint has saved US\$1 billion in costs through focusing on product sustainability and maximizing efforts in mobile phone design, useful life and recycling.⁴⁷

^{xvii} A circular economic model designs products, processes and services to use less resources and create products with the purpose of being shared, repaired, reused or refurbished. After the first-use cycle, products or materials retain their reuse or material value. Once they reach the end of their useful life, they can be reused, repaired, remanufactured or recycled and ultimately re-injected into the economy as an input elsewhere.

A radical shift towards more circular production systems is clearly an idea whose time has come. Good practice is emerging in many countries and industries, but the overall pace of change remains grossly inadequate if we are to take pressure off common resources to the extent requires. In Europe there are encouraging trends, with national and EU policy⁴⁸ being shaped, as well as business coalitions.^{xviii} What would it take to accelerate this transition?

Even with staggering savings and revenue estimates, we are far from achieving a rapid transformative shift of the global economy from linear, take-make-waste production and consumption patterns, and extractive industries to circular reuse industries with sustainable, productive use and management of the world's waste and natural resources. Vast amounts of food and materials are being wasted and underutilized, along with the energy and other resources, like water, used to produce them, while our planet's resources remain finite. What will it take to build circularity into the most important economic sectors, including energy, transport, manufacturing, land use and urban development?

IV. The Making of Positive Tipping Points

In each of the areas discussed above there is a beneficial path forward that will enable us to exit the current century in a better state for people and planet than when we entered it. But—with the possible exception of the energy landscape transition—there is no convincing political, economic or social process that gives any confidence that we will choose that path. What would it take, then, to move forward these issues in a manner that *would* give us confidence?

What we need are “hockey stick”-type take-offs that are non-incremental, with cascading impacts that ultimately “tip” our economic and social systems to reduce the great strain on our global environmental commons. What are the key elements in catalyzing a positive tipping point—and creating an epidemic? Research is underway as part of the Global Commons program to identify common features of such transformations.

Many historical hockey stick-type examples of non-incremental transformations exist, and have exceeded anything that had previously been anticipated. This begs the question: are there any common features?

Some examples:

- Why did social acceptability of same-sex marriages shift so suddenly?
- How did smoking become unacceptable so quickly in some countries and not in others?

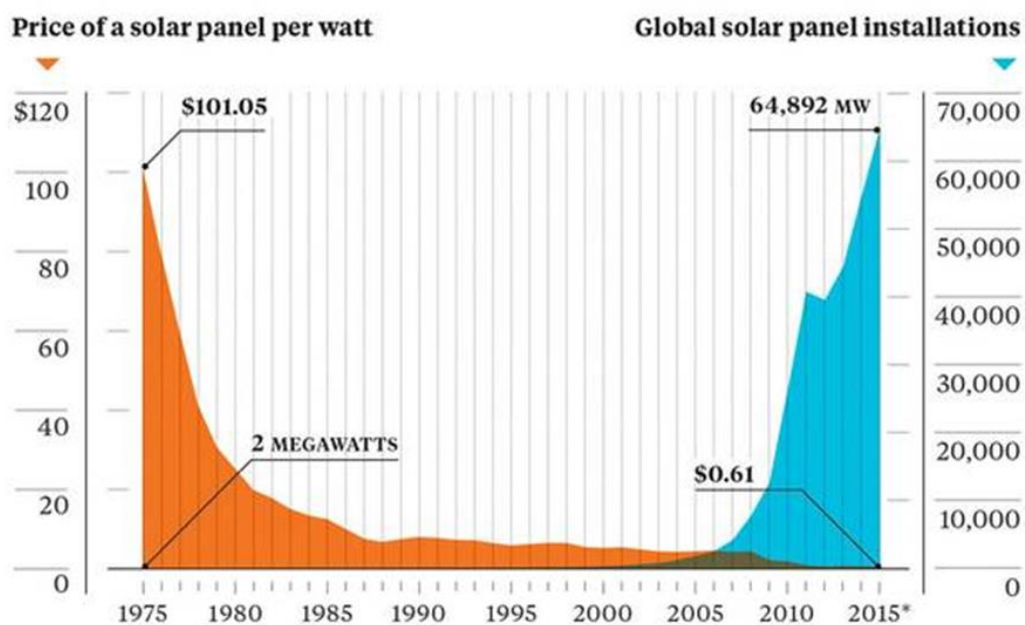
^{xviii} The Dutch Sustainable growth Coalition—a grouping of the CEOs of the eight largest companies in the Netherlands, has issued ambitious policy statements on the Circular Economy, and is actively engaged with the Government on what kinds of policy frameworks would complement private action.

- Why did 100 countries radically improve their economic policies between 1985 and 2000?
- Why did farmer-managed landscape restoration the Sahel take off so dramatically?
- How did Brazil's Bolsa Familia halve extreme poverty in a decade and its model spread rapidly to 20 other countries?
- Why did bike sharing spread from zero to 850 cities in less than 10 years?
- How did Uruguay become a wind powerhouse in less than a decade?
- Why did infant and material mortality suddenly fall by half in the first ten years of this century?
- How did the phase out of lead in gasoline accelerate in the 1990s to become globally unstoppable?

This section briefly explores some common elements to such tipping points, while the following section reviews some of the astonishing developments in today's world that can help decouple our human economic footprint and protect the global commons—if only we can seize them.

Technology change is often an important element, and sometimes a dominant one, as demonstrated by the astonishing rise in solar energy (see Figure 4) or in the spread of cellular communications. But to seize such opportunities decisions must be made by governments, corporations, communities and households. The 99.4 percent decline in the cost of solar energy in the past four decades was highly dependent on public policies, as was the 30,000-fold increase in installed capacity. In turn, public policies were influenced and enabled by a range of other factors.

Figure 4. Solar Energy Acceleration



Source: Earth Policy Institute/Bloomberg

The question is: what triggers the policy, corporate and behavioral shifts that lead to change? Our early review of positive tipping points suggests a number of ingredients. These include:

- the message: evidence of the problem, and of the solution, very well communicated;
- the messengers: the leaders, framers, agenda-setters and coalition-builders;
- citizen mobilization: bottom-up citizen power; and
- punctuated equilibrium: exogenous factors that provide “moments of opportunity” that help drive the policy system to critical points.

By no means do we expect each example of discontinuous change to have all of these elements, but often two or three working in tandem.

The Message

The starting point is the message. A problem clearly measured and communicated, and a solution that is actionable, proven and (preferably) exciting, is an essential ingredient.

- Images of brain damaged children and proof that lead was not necessary to protect the working of the engine made the transition to unleaded fuel unstoppable. Leading the way, the U.S. took 22 years for the transition. Later Vietnam did it overnight.
- The unexpected runaway success of Brazil’s and Mexico’s cash transfer programs, coupled with simple intuitive messages—e.g. give poor women modest amounts of cash if they demonstrate investment their babies health—made this an irresistible offer to social development ministries around the world.
- After two previous generations of failed bike share schemes (as bikes were lost and stolen), the city of Lyons introduced a new approach in 2005, enabled by new technology. Ten years later such schemes are running in 850 cities in every region of the world. The demonstrated popularity and, and message of health and pleasure made the choice for city councils an easy one.

In some cases new data on the scale of the problem can catalyze astonishing action. The 1986 launch of the Toxic Release Inventory, which provided emissions data on 650 toxic substances at the facility level, led to huge citizen action and numerous law suits. Between its inception in 1988 and 1995 alone, releases of chemicals listed on the TRI declined by 45 percent. That is a reduction of 1.3 billion pounds of toxic chemicals being emitted into the nation’s air, water, and land. Although initially resisted by companies, industrial leaders, environmentalists, and elected politicians have all acknowledged its remarkable effectiveness. Its success spurred the creation of Performance Rating Disclosure Programs elsewhere, including in including China, Ghana, India, Vietnam, Indonesia and the Philippines.

The point here is in the messaging. Malcolm Gladwell in “The Tipping Point” (2002) noted the message must be “sticky”—it must stick in our minds, motivated by a powerful narrative that engages us. This perhaps explains why climate change has been much more successful at motivating action than biodiversity loss. A meter rise in sea level rise, increased extreme

weather events, and forest fires, coupled with a clear 2 degree C target, and images of solar power plants, appear to have provided a much more powerful narrative than its biodiversity equivalent. The recent *Nature Needs Half*⁴⁹ is an example of a new narrative that may prove sticky. More broadly the concept of natural capital accounting—and the need to put a price on nature—may, if well communicated, be a way of capturing the complexity of the global commons, but so far has not found the required traction.

Crafting a compelling narrative for the neglected global commons is surely an urgent priority.

The Messengers

Messages need messengers, and it matters who they are. Malcolm Gladwell points out that Paul Revere was not the only rider who on April 18, 1775 was getting out the message that the British were coming. But he appears to have been by far the most effective. This was because of who he was, the trust in which he was held, and how he conveyed the message. Messages catch on because people with special characteristics use their influence to convey them. Social media today provides an extraordinary amplification device, and makes the need for messengers seem less important. Last year's ice bucket challenge resulted in 2.4 million tagged videos circulating on Facebook within just a few weeks, with most participants having no idea who started it. But even here, the regular participation of celebrities added momentum and kept the process going.

The first phase of our review of tipping points suggests that messengers matter greatly. Among many examples:

- Making a breakthrough on maternal mortality over the space of a decade involved numerous complex interventions across many government departments in many countries. But it was the leadership of a relatively small number of leaders – Kofi Annan, Gordon Brown, and a small number of African heads of state, and their spouses – that catalyzed the action.
- The astonishing expansion of cash transfer systems owed hugely to President Lula's simple, powerful commitment to bring about systemic change in Brazil. This impact was then felt across many countries.
- The re-greening of over 1 million hectares in Ethiopia's Tigray region is due to the action of tens of thousands of farmers, but it was the leadership of a small number of early adopters and credible communicators that made it possible. One such example is Aba Hawi, a community leader, who pioneered these efforts in his community and whose story is captured in the documentary "Ethiopia Rising."
- The revolution in economic policymaking in 100 countries in the 1985-2000 was inspired in significant degree by charismatic ministers of Planning and Economics in South East Asia and the Southern Cone of Latin America.

Who might be the key leaders or messengers of each of the key elements required to reduce our human footprint and preserve the global commons? The most effective leaders are those who build coalitions with others, and especially with different kinds of stakeholders. The emergence of new forms of multi-stakeholder coalitions is address in Section V of this paper.

Citizen Mobilization and Action

The history of improvements in environmental policymaking is less about leadership from government and much more about pressure from citizens.

- The most fertile period of environmental law making in the history of the US took place in the Nixon Administration, not because he led, but because citizens demanded change.
- The remarkable tipping point on same-sex marriage in the US and Europe was due in large measure to highly effective citizen action, staying on message with a positive narrative.
- The explosion of urban transport innovations, such as bike sharing and bus rapid transit owe greatly to citizen groups offering attractive solutions and demanding action.
- The impact of the open data revolution, illustrated by the Toxic Release Inventory, was due to NGOs with spending thousands of hours to understand the data, communicate the dangers, and take legal action. In the first ten years of the TRI emissions of the 650 chemicals included fell by 45 percent.

How would we assess the state of citizen action today with regard to the global commons? Included here is both the attention given to the commons themselves—biodiversity, oceans, climate water—and with regards to the aspects of economic life that most need to change—food and agriculture, urban development, circular economy, etc.

Punctuated Equilibrium

Many of the most impressive gains have been triggered by exogenous events--usually, bad ones. The important point here, is that those who advocate change are ready to take advantage of such change.

- Uruguay's transition to a leader in renewable energy was triggered by an unrelenting ten year drought that threatened its hydro-dependent power system.
- The Toxic Release Inventory, created in 1986, came into existence only because of the tragedies at the Union Carbide Plants in Bhopal (1984) and West Virginia (1985).
- Economic reform in the 1985-2000 period was triggered by serious debt crises, especially in Latin America in the mid-1980s.

It is sadly the case that in the months and years ahead there will be several very serious exogenous events—droughts, fires, hurricanes, food price spikes, urban gridlock, and the resource threat multipliers causing conflict and migration. There will also be inspiring

technological shocks opening up new ways of doing business. Will we have the institutions, leaders, and solutions ready when such opportunities arise?

V. Triggering the Revolution: Today's Unparalleled Opportunities

A number of disruptive system changes are underway, potentially offering unprecedented hope for environmental action. The questions for discussion:

- What hope do these offer to tip our economic and social systems to enable the radical decoupling of human economic progress from our environmental footprint?
- Is the environmental movement sufficiently engaged with these changes to seize the opportunities offered?

This section briefly reviews two such system changes.

The Fourth Industrial Revolution

In 2000, just 12 percent of the world's population had a cell phone subscription. Today, the figure is about 70 percent, with 2 billion of these subscriptions in China and India. 87 percent of U.S. millennials alone say that the smartphone now never leaves their side, Facebook now has over 1.4 billion regular mobile users, WhatsApp—created in 2009—sends 30 billion messages a day, and the app industry is worth at least \$100 billion, which is more than the global film industry, although the first app only appeared in 2008. Technology companies estimate there will be 5 billion smart phone subscribers before the end of the decade.

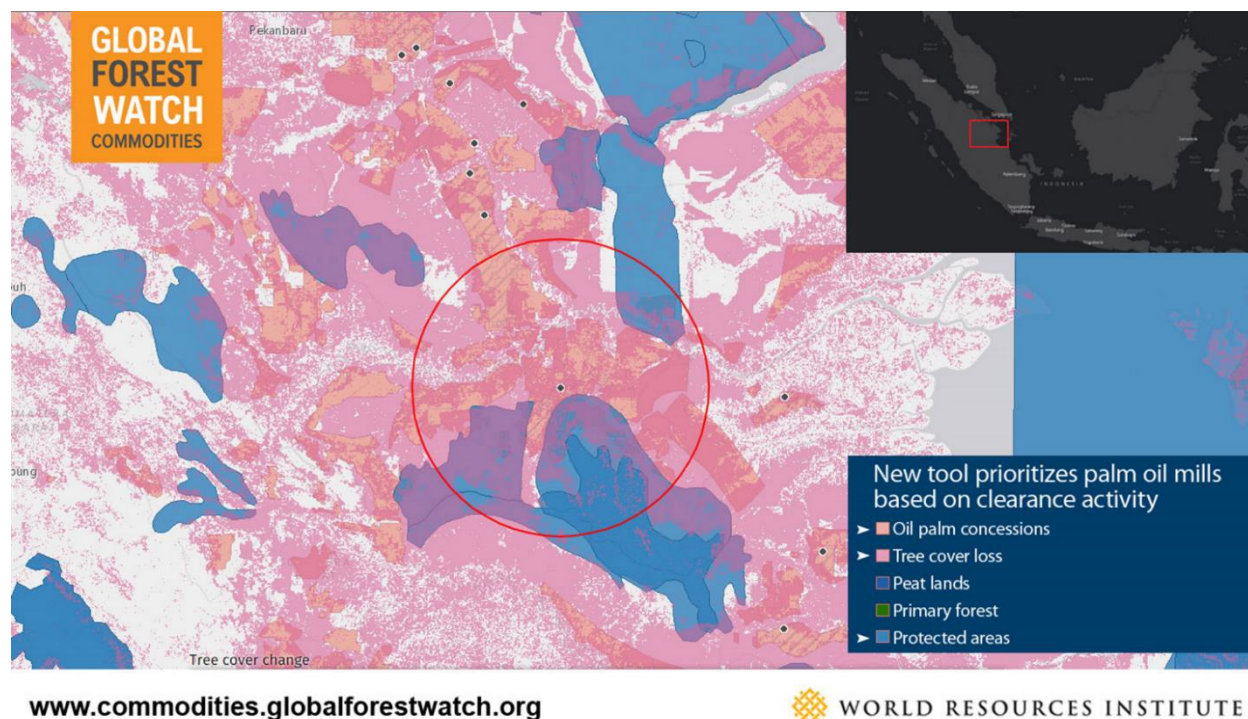
The ever accelerating growth in processing power and technology capabilities is having a profound impact on our ability to collect and process complex data. A standard tablet device today possesses the equivalent processing power of 5,000 desktop computers from 30 years ago, while the cost of storing information is approaching zero (storing 1GB costs an average of less than \$0.03 a year today, compared to more than \$10,000 20 years ago). This has completely flattened the costs of processing information. The first human genome took more than a decade to sequence, at a cost of \$2.7 billion. That was fifteen years ago. Today, a genome can be sequenced in a few hours and for less than a thousand dollars.

The World Economic Forum term this explosion in access to a ubiquitous and mobile internet, by smaller and more powerful sensors that are becoming ever cheaper, and characterized by artificial intelligence and machine learning, as the Fourth Industrial Revolution. It's potential to transform how we manage our environmental footprint—as well as our economic and social networking models—appear boundless.

A digital revolution in the global environment agenda is just around the corner. Consider, for example, what is now possible with satellite imaging because of advancements in digital systems capabilities through tools like the Global Forest Watch⁵⁰—a dynamic online forest

monitoring and alert system (see Figure 5). Whether you are a researcher, firefighter, investigative journalist or concerned citizen, GFW allows you to better manage and protect the world's forests through the transparency and accessibility of a wealth of timely forest-related data—from forest fires and haze to deforestation in commodity supply chains like palm oil.

Figure 5. Monitoring Land Use Change in near Real Time: Global Forest Watch



The above figure shows one application of Global Forest Watch: GFW Commodities. In this case the catchment area for each palm oil mill in SE Asia is monitored to determine whether oil palm is being produced on land that has been deforested in recent years, and whether it comes from peatland or protected areas.

Anyone can create custom maps, analyze forest trends, subscribe to tree cover change alerts, and download actionable data from their local area or the entire world. The most recent satellite development is a remarkable step-change in the evolution of forest monitoring that is enabling users to see small-scale forest loss, such as emerging logging roads, by measuring at 30x30 meter resolutions (roughly the size of two basketball courts) on a weekly basis. In two years it will be 10x10 meters. Remarkably, GFW was only launched in 2014. In a short few years, its ambitious expansions and developments have radically altered our ability to manage and protect the world's forests.

Another example of potentially great impact is the creation of the distributed ledger, known as Block-chain. This is a secure protocol where a network of computers can collectively verify a transaction before it can be recorded and approved. It enables people who do not know each other to collaborate without having to go through a neutral central authority and it offers its

users a shared, programmable, secure and trusted ledger, which no single user controls but which can be inspected by everyone.

Block-chain was the enabling technology for bitcoin. However, its potential applicability for widespread use in other areas is just starting to become clear. The government of Honduras for example is exploring the potential of block-chain to help with land rights allocation. For the purposes of this paper, however, scroll forward in your imagination to 2030 when the Paris Climate Agreement comes to an end and we have steadied our global emissions trajectory. By then most of the world's households will have a smart phone or at least one 3G cell phone. So why would the international community, with support of the UN parties, not be ready to launch a worldwide block-chain for mobile carbon trading? A transparent public system that uses algorithms to allocate to every one of the 8 billion people on the planet a daily /weekly /monthly science-based GHG allocation that keeps the planet within its Paris Agreement emission trajectory, but allows the world to trade with each other. The cash that this could provide for the very poorest may be immense, a wide-scale opportunity that democratizes the climate challenge and turns into wealth redistribution. Remote households could trade their GHG rights with richer families, enterprises or cities around the world, 24 hours a day. Limitless innovations are possible. Could block-chain spur the next generation of a global climate framework, stripping out the politics and the institutional weaknesses of government and international regimes, frameworks and systems, while also promoting wealth distribution and mass entrepreneurialism. Under this scenario, could even UNFCCC be "Ubered"? If this is at all theoretically possible, we will need global initiatives underway right now to ensure that the public-good integrity and equity-related checks and balances of such a technology play are baked into any such system, when—not if—it starts to take off.

This digital transformation can, and already is, making waves, creating disruptive systems change and altering what is possible with the global environmental agenda today. About 5 billion connected industrial devices already exist, covering products from cars, homes, appliances, and industrial equipment, and analysts suggest this will reach 25 billion by 2020.⁵¹ Environmental networks and movements can not only leverage ever more powerful digital platforms for social connectivity and information sharing, but this immense level of connectivity—combined with rapid advances in data processing and technology innovation—can help drive countless localized initiatives like smart street lighting and energy efficient buildings, as well as new global and regional monitoring programs and innovations for our environmental commons.

The Rise of Multidimensional Cooperation

Catalyzing the systemic change needed cannot be done by individual agencies or governments. Silos will need to be dismantled across our various international institutions and, importantly, across the public and private sectors throughout the world economy. It is becoming clear that the historic agents of large scale systems change - global institutions such as the United Nations

or the World Bank, significant intergovernmental clubs such as the G7 or G20, and national governments - cannot drive such an integrated change process alone. Recent intergovernmental experiences in trying to advance global systems reform in other complex domains such as in trade; migration and financial stability provide evidence of the challenge.

Fortunately, there is substantive evidence emerging across the last few years that governments can successfully engage with a variety of non-state actors to jointly meet complex, wicked problems like climate change and large sustainable development challenges like food and water security. This is the rise of *multidimensional* cooperation.

Businesses, NGOs, research and scientific communities, local governments, and many others across many other parts of civil society have relatively recent, but increasing experience, in mobilizing and collaborating on global environment related initiatives. The wider public private “Lima Paris Action Agenda” movement to help secure the Paris Agreement on Climate Change is a recent systemic example, but there are also substantive emerging “delivery” examples in thematic areas like forestry, water, agriculture and finance for the SDGs, among others. This emerging experience suggests that clearly defined coalitions that cut horizontally across the traditional boundaries of interest, expertise and nationality can work. Such multi-stakeholder efforts can often achieve, through collaboration, what governments working alone cannot, especially for those in emerging economies. Such cooperative efforts can be transparent, participative and accountable. They can share costs and risks. They can be at once both globally and locally owned, both “grass-tops” and “grassroots” driven. They can be based on sound scientific knowledge and produce practical outcomes at scale, in a specific timeframe. And they are usually deployed as positive disrupters, perturbing the status quo arrangements to show a “proof of concept” as to how multidimensional cooperation can trigger scaled system change in the agenda in which they are at work.

Some early indicative examples of this new agenda of multidimensional cooperation include:

- **The Tropical Forest Alliance (TFA)** is a global public private partnership whose goal is to enable zero net deforestation in four global commodity supply chains (soy, paper & pulp, palm oil and beef) by 2020. The TFA supports a partnership of over 80 Consumer Goods Forum companies, traders and producers, forested nation governments, donors, NGOs and indigenous peoples groups, working together as a community of purpose on this collective goal. Industrialized country government donors co-fund the Alliance and the World Economic Forum hosts a small secretariat which manages a distributed leadership team. The TFA is viewed as the key global platform for public-private cooperation in the sustainable forest commodities space and as such is in the forefront of assembling the required multi-actor communities of purpose and spearheading a new global systems change approach in forests and land use of local jurisdictional production and protection compacts linked to the amplifier of international public-private geometries such as global supply chains and REDD+.

- **The 2030 Water Resources Group (WRG)** is a global public private partnership hosted by the International Finance Corporation. WRG works in partnership with water-stressed developing countries around the world (including Bangladesh, India, Jordan, Kenya, Mexico, Mongolia, Peru, Tanzania and South Africa among others). At the national level WRG helps these countries' governments to engage with leading private sector, development agency and civil society stakeholders to co-design "water-proof" economic growth strategies – national policy and investment plans that can meet the country's economic growth aspirations by 2030 in conditions of future water stress (water for food, water for energy, water for cities, water for the environment etc.). It has engaged over 400 public and private actors into communities of purpose via national multi-stakeholder platforms to address problems, and links these national platforms to global partners to create a wider network of knowledge and influence. Its global partners include bilateral agencies (Sida and SDC), private companies (Nestlé, PepsiCo, Coca-Cola, Grundfos, Dow, SABMiller), development banks (IFC, the World Bank, African Development Bank, Inter-American Development Bank), INGOs and IGP's (UNDP, GGGI, GWP, the World Economic Forum, BRAC and IUCN). This simultaneously global and local public-private approach is helping the international community to rethink how it augments and innovates its efforts to scale impact on water resource management in addition to using known models of traditional governmental and intergovernmental architectures.

- **The Sustainable Development Investment Partnership (SDIP)** was launched at the Addis Ababa Financing for Development Conference in July 2015. It aims to mobilize USD 100 billion in blended financing over 5 years for infrastructure projects in developing countries. The partnership targets potential private investments by improving and enhancing instruments to reduce potential risks. It thereby contributes to closing the funding gap required to achieve the United Nations Sustainable Development Goals (SDGs). The founding members of SDIP include the Bill & Melinda Gates Foundation, Citibank, Danish Investment Fund for Developing Countries (IFU), Deutsche Bank, Development Bank of South Africa, East Capital, the International Finance Corporation, MIGA (Multilateral Investment Guarantee Agency), PensionDanmark, PKA, Senegal Sovereign Wealth Fund (FONSIS), Standard Chartered, Storebrand, Sumitomo Mitsui Banking Corporation; and the governments of Canada, Denmark, Hungary, Netherlands, Norway, Sweden, the United Kingdom and the United States. Institutional support to SDIP is provided by the Organization for Economic Co-operation and Development and the World Economic Forum. SDIP is already in the late stages of catalyzing its first project, a \$12.5bn solar partnership in South Africa.

These are just a few of a new generation of partnerships. Several others are emerging. The point here is that no one piece of the jigsaw—a global environmental agreement, a national

plan or targets, a development finance institution, a breakthrough digital technology, an innovative company, an NGO project, a leading bank in green bond underwriting—alone will be able to drive the wider *systems change* we need to inculcate in how we interact and impact on our global commons at the speed and scale required.

Rather, the emergence of a multidimensional architecture of global, regional and national platforms, that can help trigger a compelling movement of public-private alliances, action initiatives and disruptive innovation and new investment flows, which simultaneously work at global through to local levels is required. Whilst each of these multi-actor activities may be issue, sector or site specific, in aggregate the sum impact of these various alliances, initiatives and systems disruptions will be to infect our existing production and consumption systems and other key systems of human activity such as urban, transportation, energy, land use and water use, thereby disrupting, redefining and—at critical junctures—finding the “flip” to transform the way our systems interact with the global environmental commons.

In this way, a multitude of actors from cities, states and provinces, large corporations, institutional investors, family-owned businesses, domestic business associations, technology disruptors, private capital, trade unions and other civil society groups who each offer innovations and resources can be drawn into a multidimensional architecture of networks, platforms, movements and action initiatives that collectively can help mobilize the movements, provide the disruptions, scale the innovations and deliver the initiatives required to secure our global commons.

VI. Next Steps

This paper has laid out some early thoughts as to how the required revolutions might be encouraged across the range of economic and social spheres. Important elements in the argument include:

- The urgency and scale of the needed change are very great, and will require non-incremental systemic disruption.
- Such change cannot come from business-as-usual, from trying harder using existing approaches. We need to identify and diagnose potential tipping points, and be much more strategic in designing strategies for catalyzing them.
- This requires a technical and political strategy. We can learn from previous examples of tipping points as to the roles of different actors in initiating and accelerating change to the point where it becomes irresistible and self-perpetuating.

- Silver bullets rarely exist. Rather, pieces of the jigsaw puzzle—policy shifts, business decisions, technological breakthroughs, citizen engagement etc.—need to come together. This requires multi-stakeholder coalitions that operate quite differently from traditional models.
- While the task ahead is huge, new technologies and emerging practices offer unprecedented hope.
- The question is whether we can seize them.

The next stage of this project is to explore apply some of the ideas to the key economic and social spheres in which change is so urgently needed. These include the four areas identified earlier—urban systems, food and agriculture, energy, and production systems. In each of these areas there are early signs that system wide change is possible, albeit, under present trends, far off. How might these positive changes be “pulled forward” so it is not too late?

These ideas may apply to strategies for each element of the global commons—to oceans, biodiversity, water systems, as well as to the way we consume, travel and run our financial system. They may also be useful as we seek to accelerate more explicit policies directed or protect the global commons, whether integrated land use planning, regulations on emissions and waste or protected areas.

We look forward to insights gained at the *Securing Our Global Commons* Conference on October 12-13, to help guide the next phase of work.

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