Natural Resource Scarcity:

An Overview of the Issues and the Contributions of the Investor Community to Sustainable Business and Finance

Report commissioned by the Rothschild Foundation

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EXECUTIVE SUMMARY

The first decade of the twenty-first century witnessed spectacular rates of economic growth in developing countries, led by China. As a result, demand for natural resources has accelerated dramatically and at a geographically unprecedented scale over the past decade. At the most basic level, increased demand for agricultural goods, water, energy, and minerals from the world's 7 billion people have placed greater strains on the physical supply of all of these resources. However, higher production and consumption also have enormous environmental impacts in other ways: resources are, of course, required to produce resources, and the production, distribution, and consumption of commodities have negative externalities such as land degradation, water and atmospheric pollution – and, not least, climate change. Taken together, these factors have resurrected the age-old fear that, at some point in the not-too-distant future, human impacts on the natural world will exceed some inherent natural limit and prove a bottleneck to economic growth – and by extension, civilisation as we know it.

Against this backdrop, our objective in this report is twofold. The first part of the report is intended to inform the Rothschild Foundation's grant-making strategy in areas related to environmental protection and remediation and so offers a background to contemporary global sustainability issues. In so doing, we employ the lens of natural resource scarcity rather than climate change: doing so offers a more holistic and nuanced understanding of the current status quo as well as of scenarios for the decades to come. We also stress the multi-dimensional nature of scarcity, with its roots in a host of physical, social, political, economic, and institutional factors. Scale, too, is an important consideration here, as scarcity is nearly always felt at the local or regional rather than global levels.

With this framework in mind, the report proceeds to outline the key challenges pertinent to a range of individual resource categories: several types of extractive commodities, including energy; various types of agricultural goods; water; biodiversity; and waste disposal sites. It then explains some of the complex interactions evident across resource categories, namely the food-energy-water nexus; the minerals-energy-water-land nexus; and the climate-resources nexus. Finally, the report considers some of the ways in which society and environment interact to exacerbate

scarcity: through the population-resources-consumption nexus; socioeconomic inequality; violence; and commodity prices.

The second part of the report paints a picture for the investor community of the principal ways in which business and finance have, or are perceived to have, impacts on natural resource availability. Here we have highlighted the respective roles played by four key stakeholder groups: the business community, policy-makers, civil society, and investors. Of the myriad challenges and opportunities facing investors wishing not only to adopt a more sustainable strategy for themselves, but also to contribute in a meaningful way to systemic change, we have highlighted six key areas where the need for reform is at the very least being widely discussed, if not acted upon, and where the investor community can contribute either directly or indirectly to building a more sustainable economy. At the regulatory and market-wide levels, investors can take part in two ongoing debates: one about the purpose of the modern corporation as conceived in principle and enshrined more formally in law, the other about appropriate regulations in commodity futures markets. Consortia of investors could channel their capital through two types of institution: one which actively engages corporations on sustainability issues, the other which practices impact investing. Finally, a single foundation could take the initiative of convening expert groups on two wider issues: standardising and mainstreaming integrated reporting, and reforming business education to include sustainability concerns.

INTRODUCTION

The first decade of the twenty-first century witnessed spectacular rates of economic growth in developing countries. While the geographic scope of this growth has been historically unprecedented, it has overwhelmingly been led by China, with its share of one-fifth of the world's population. Despite a setback in the form of the ongoing global financial crisis, these forces have irrevocably been set in motion, with far-reaching political, socio-economic, and environmental implications. Of course, one of the most fundamental prerequisites for, and consequences of, such growth is the intensive per capita consumption of natural resources. In starker terms, the spectacular economic growth of middle-income countries has not come without environmental costs. The spectre of anthropogenic climate change looms large, but so too does an age-old fear: that of running out of essential resources such as food, water, and minerals.

As the first section of this report will describe in greater detail, demand for natural resources has accelerated dramatically and at a geographically unprecedented scale over the past decade. At the most basic level, increased demand for agricultural goods, water, energy, and minerals from the world's 7 billion people have placed greater strains on the physical supply of all of these resources. However, higher production and consumption also have enormous environmental impacts in other ways: resources are, of course, required to produce resources, and the production, distribution, and consumption of commodities have negative externalities such as land degradation, water and atmospheric pollution – and, not least, climate change. Such is the extent of the changes to the earth system wrought by human activities that many scientists believe we have entered a new epoch in geologic time, which they have appropriately dubbed the Anthropocene. Taken together, these factors have resurrected the age-old fear that, at some point in the not-too-distant future, human impacts on the natural world will exceed some inherent natural limit and prove a bottleneck to economic growth – and by extension, civilisation as we know it.

For a great many observers, this apparent 'scramble for resources' can only be a source of profound economic and political as well as environmental concern. Many conventional accounts of the 'scramble' focus on the potential for interstate or inter-regional conflict,

whether diplomatic or armed. A complementary take envisages not so much conflict in the more conventional sense but economic warfare in the form of trade barriers and intensified corporate competition for 'what's left': 'The multilateral trading system, among others, is set to become the proxy theatre of global resource war'.[1] It is true that both dynamics are already playing out in a number of arenas, including the race to claim Arctic minerals, oil and gas reserves, and shipping lanes; tensions in the north-west Pacific between China, Japan, and Korea; and farmland investment in fertile regions by finance-rich, resource-poor nations.

At one level, even modest historical perspective shows that these are simply iterations of a very old story, one defined even in the contemporary era by the thinking of Thomas Malthus. However, without denying the geophysical reality of scarcity or the possibility of (violent or non-violent) conflict over dwindling supplies, this report starts from the basic premise that, as a prominent environmental historian has put it, 'There is rarely a simple linear path from abundance to scarcity'.[2] Resource scarcity has been called a tug-of-war between human ingenuity and diminishing returns to investment, a perspective that history has largely borne out. However, the past is not necessarily a good guide to future, particularly in light of the unprecedented nature of the current global resource situation.

Our objective in this report is twofold. At one level, the report is intended to inform the Rothschild Foundation's grant-making strategy in areas related to environmental protection and remediation. The first part of the document therefore offers a background to contemporary global sustainability issues. In so doing, we employ the lens of natural resource scarcity rather than climate change, as has been more common in the past: as will be explained in further detail, we believe that such a perspective offers a more holistic and nuanced understanding of the current status quo as well as of scenarios for the decades to come. At another level, the second part of the report paints a picture for the investor community of the principal ways in which business and finance have, or are perceived to have, impacts on natural resource availability. We also propose a select few areas where the investor community can contribute to building

[1] Lee et al. 2012, p. 136.
[2] Sabin 2013.

a more sustainable economy. Collectively, the insights gleaned from the report should underpin a pragmatic approach to the environment for the investor community.

PART I

GLOBAL RESOURCE SCARCITY: SUMMARY OF THE KEY ISSUES

1. BACKGROUND

Malthusian fears of scarcity leading to the collapse of human society have been with us for centuries, but a well-known 1972 study published by the Club of Rome and entitled *The Limits to Growth* introduced the idea of ecological collapse driven by consumption of resources other than just food. Updated in 1982 and 2002, the study's projections have fit observed data with surprising accuracy. However, computer models such as those employed by the MIT researchers who carried out the study have only a limited ability to predict ecological tipping points, and to anticipate the complexity of feedback effects between environmental and socio-technological change, and critics have seized on both of these points to dismiss the study's relevance.

Regardless of the scientific accuracy of the Club of Rome report, it is difficult to understate the extent to which, in the decades since its publication, it has set the tone in debates about resource scarcity by resurrecting the Malthusian spectre of absolute limits to economic growth. By now, however, old problems have also been re-framed in fresh ways. The concept of ecological footprinting, which measures per capita consumption of various resources in numerous regions and countries, highlights distributive issues. A recent study published in *Nature*[3] attempted to calculate absolute ecological limits to growth, this time disaggregated by nine biologically critical substances, and has once again re-popularised the notion of 'planetary boundaries' to human civilisation.

Recent decades have seen numerous advances in ideas about how to reconcile resource constraints with continued economic growth. Throughout the 1990s and 2000s, 'sustainable development', or development that 'meets the needs of the present without compromising

[3] Rockström et al. 2009.

the ability of future generations to meet their own needs',[4] was something of a mantra for environmentalists and development experts alike. More recently, however, the global financial crisis, coupled with the threats posed by burgeoning demand for resources and by climate change, has led many to believe that many of the fundamental assumptions underpinning capitalism must be rethought. While calls for a 'steady-state economy' and 'prosperity without growth' have intensified, it is an inescapable fact that environmental damage cannot be completely 'decoupled' from economic growth.[5] Moreover, growth is broadly necessary not only for alleviating poverty but also for encouraging societal openness, inclusiveness, and innovation.[6]

A third important aspect of this bigger picture is geopolitical. It is easy to assume that increasing resource scarcity will lead to increased zero-sum interstate conflict.[7] At the other extreme, however, it may not be realistic to expect much in the way of efforts at multilateral cooperation in resource governance, if the failure of UN climate negotiations is any indication. This report will argue that a far more likely scenario than violent or armed conflict will be 'economic warfare'.

Our description of the current landscape of resource scarcity is informed by three often-overlooked points. First, we believe that the manner in which an issue is framed is crucial to determining how stakeholders respond to it. For example, history is showing that rather than worrying exclusively about absolute population size, which led to tragically misguided population-control policies in many countries from the 1970s on, it is most productive to focus simultaneously on per capita *and* absolute resource consumption levels. Similarly, the term 'ecological security' may be more salient than 'resource scarcity', which can be highly misleading. The idea of ecological or environmental security is moving on from its old Cold War-era connotations of a nationalistic, zero-sum game to control resources and now implies universal adequate access (e.g. UN's food security, IEA's energy security). In these and many other cases, perception may be more important than reality – a point that is illustrated in the discussion of climate change as a framing device below.

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[4] World Commission on Environment and Development 1987.
[5] Jackson 2009.
[6] Friedman 2005.
[7] Evans 2010; Klare 2012.

Second, we stress the importance of scale, both in the geographic and the temporal sense. As the sections below should illustrate, resource scarcity is rarely felt on an absolute, global level; instead, its effects are apparent at local or regional levels. By the same token, there is plenty of scientific evidence for local-level 'tipping points' – abrupt ecosystem collapse due to longer-term, more gradual stressors such as land-use change or biodiversity loss. Yet recently the idea that ecological tipping points exist at the global level has been disputed, and it appears less likely that climate change will suddenly reach a point at which its ecological effects become irreversible.[8]

Finally and not least, we believe that the social and environmental are inseparable. We take a social scientist's perspective on resource scarcity: in our view, scarcity is primarily a function of economics, politics, and even culture. In other words, scarcity is no longer assumed to be 'natural', but rather, in the vast majority of cases, caused or exacerbated by a host of social, economic, and political factors. It is important to stress that while lags in technological innovation may be a root cause of certain types of scarcity, simple failures of institutional governance are often more directly responsible.

Climate change or resource scarcity?

The problem of climate change has, with good reason, dominated the environmental agenda for several years – with, in the author's view, the unfortunate side effect that 'climate change' has become a metonymonic for *all* environmental problems in the public imagination. This not only means that other issues have been all but eclipsed in some cases, or are framed primarily in terms of their connection to climate change; it has also proven unproductive. Because climate change is both a spatially and temporally disparate phenomenon – one with its roots in decades and even centuries past, with its most severe consequences unfolding in distant regions or in future generations – the fundamental human proclivity to myopia serves as an obstacle to concerted action. This inertia is exacerbated by the fact that those in the most advantageous position to combat climate change are often those (thus far) least affected by it. Additionally, while there is overwhelming consensus that 'climate change is real', the jury is still out on the precise nature and extent of the effects of climate change,

[8] Brook et al. 2013.

offering a further pretext for inaction. Along with the (negative) moral dimension that fossil fuel consumption has by default taken on, a switch to a more sustainable way of life now seems to many to be a sort of 'atonement' for an 'original sin' for which it is impossible to pinpoint culpability.

In more concrete terms, 'climate inertia' represents a collective action failure: fossil fuel consumption is deeply implicated within the very fabric of our industrialised, materials-intensive, consumption-driven economy. This can be seen in the stalled efforts to adopt comprehensive, binding climate-related policies at the national and global levels: witness what has been pronounced as the failure of the UN climate negotiations, as well as the collapse of the EU Emissions Trading System (ETS). Therefore, this report argues that instead of thinking about the environment in terms of 'climate change' – an ultimately nebulous concept, at least to the layman – a new lens is needed: one that takes natural resource availability as its focal point, albeit while still taking into account the effects of climate change on scarcity.

Five dimensions of scarcity

A framework[9] devised to understand the various types of bottlenecks to phosphate availability can be modified and extended to other resources:

1. *Physical scarcity* refers to the absolute, global-level material quantity of a given resource in existence.
2. *Economic scarcity* refers to the distribution of a resource across socio-economic groups.
3. *Institutional scarcity* refers to a dearth of readily identifiable entities that can be held accountable for the governance of a resource – be they governments, corporations, or transnational organisations. 'Governance' in this instance refers
4. *Managerial scarcity* refers more specifically to a failure to avoid inefficiency and waste along the entire production and consumption chain of a resource.

[9] Cordell 2010.

5. *Geopolitical scarcity* refers to the concentration of a resource in a relatively small number of geographic regions, and by extension the concentration of political and/or economic control over it.

2. RESOURCE BY RESOURCE

In this subsection we consider, insofar as possible, each broad category of resource individually, outlining the key challenges pertinent to each.

Extractive commodities

Extractive or mineral commodities are typically classed into one of three types: fuels, metals, and non-metals. Here, however, we disaggregate fuel commodities into three categories while grouping non-fuel minerals together, and mineral fertilizers will be given separate treatment as agricultural goods. While each type of commodity faces its own particular set of challenges, several issues are common to the sector as a whole:

The extractive sector has long had a large ecological footprint, but growing demand coupled with a general decline in reserve grades have deepened its impact. 'Resource nationalism' is also a key challenge in the extractive sector: as previously dominant producers in the US, Australia, and elsewhere have gone into decline, many resource-rich nations are increasingly asserting their powers of ownership by demanding more favourable investment terms from foreign companies. Here a word of caution in order: contrary to the popular perception that state-owned and state-backed corporations practice 'resource diplomacy' in Africa and Latin America to the exclusion of multinationals, state-capitalist involvement here has thus far been relatively limited. For example, it is estimated that Chinese foreign direct investment (FDI) in Africa's mining sector stands at only about 5% of total mining projects on the continent.

High commodity prices have not necessarily translated into inclusive growth in producer nations, and many resource-rich countries face ongoing fiscal and political challenges in managing their natural wealth. This is evident at a range of scales: from the local, where

communities must contend with the environmental consequences of extraction without necessarily sharing in economic gains, to the national, where mismanagement of revenues contributes to problems such as macroeconomic instability and political corruption.[10]

Oil: For several decades, fears about impending oil scarcity were widespread as debates about peak oil continually resurfaced. There now is an emerging consensus that the world will not 'run out' of oil for many decades, if not centuries. In fact, the latest round of controversy over peak oil centres on the question of whether we are approaching peak *demand*.[11] However, we have passed one important 'peak' in that high-grade reserves have largely been depleted, and despite a quadrupling in exploration spending over the past decade, discoveries of new reserves have remained flat. What remains is becoming increasingly costly and difficult to produce – in financial, technological, and environmental terms, especially as extraction moves to unconventional sources such as deep-water drilling and tar sands. Geopolitical tensions over remaining reserves are also evident in many regions such as the Arctic. In addition, an estimated 65% of global oil reserves are under state ownership, raising concerns that the availability of oil will become even more heavily politicised than it is already in the years to come.

Unconventional hydrocarbons: Shale gas is projected to help meet global energy demands in the coming decades.[12] The gas revolution hold great economic promise, particularly in the US; and should analysts' projections prove accurate, the geographic shift in supply will have geopolitical implications for the relative power of OPEC member states and for the US. However, serious concerns have been raised over the environmental impacts of shale gas drilling. There is strong evidence that the chemicals used in hydraulic fracturing severely contaminate drinking water; several countries, including France, have put a moratorium on gas drilling. And a 2011 study by Cornell University calculated that in terms of greenhouse gas emissions, natural gas is a net loser.[13] Many observers and potential investors are also concerned that the gas drilling rush in the US is a financial bubble.

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[10] Collier 2010.
[11] Kleinman and Morse 2013.
[12] IEA 2010.
[13] Howarth et al. 2011.

Coal: Coal is also projected to continue to meet a growing share of global energy demand, and reserves will be more than adequate to meet it. Coal now accounts for 66% of China's total energy consumption and 44% of India's. However, coal is also the most polluting fossil fuel. A 2011 Harvard study[14] estimates that the US alone could save $330-500bn in health care costs associated with burning coal if it switched to relatively cleaner fuel sources. Coal-fired electricity also releases 47% more greenhouse gas emissions than natural gas.[15] While some believe that retrofitting coal-fired power plants with carbon capture and storage technologies is a satisfactory alternative to switching to cleaner fuel sources, these technologies are far from being fully advanced, as they remain both costly and unproven.

Metals and minerals: Metals are also generally not geologically scarce, but rising demand from rapidly industrial emerging economies is now such that Chinese demand alone drives prices. China became the world's largest consumer of base metals in 2003, driving the commodity super-cycle of the 2000s, and now accounts for 46% of global demand.[16] Meanwhile, demand for gold in India has more than doubled since 2001 and now accounts for one-quarter of global consumption, despite the government's imposition of import restrictions.[17] A number of supply-side factors are also at work here. As is the case for conventional oil reserves, high-grade deposits of certain minerals such as copper, nickel, and zinc are increasingly scarce, and exploration, development, and extraction have accordingly become more costly – again in financial as well as technological and environmental terms.

Geopolitical factors also constrict mineral resource availability and place upward pressure on prices. On the supply side, geopolitical concentration of reserves is evident for many types of minerals. For example lithium, used in lithium-ion batteries (which power electric cars and other 'green' technologies): reserves are heavily concentrated in Bolivia and Chile. By the same token, while rare earth elements are not geologically 'rare', current production is overwhelmingly concentrated in China. Because most are non-substitutable, China has an

[14] Epstein et al. 2011.
[15] Fulton and Mellquist 2011.
[16] Wood Mackenzie 2013.
[17] Chilkoti and Crabtree 2013.

ongoing policy of restricting exports to meet domestic demand.

Agricultural goods

With population growth coupled with the emergence of a global middle class, demand growth for agricultural goods – crops, livestock, aquaculture, and agroforestry – is accelerating. The UN Food and Agriculture Organisation (FAO) projects that demand for food will grow by 70% by 2050, and even more intensive energy, water, and fertilizer inputs will be required to sustain yields on a relatively inelastic supply of fertile land.[18] Yet already the ecological footprint of the global food system is enormous. Humanity now cultivates 40% of the earth's land area, and agricultural production accounts for one-third of global greenhouse gas emissions – much of it through deforestation and the manufacture of fertilizers – and 70% of freshwater withdrawals.

At the same time, of course, food production and consumption are inextricably linked with socio-economic concerns. It is true that the proportion of global hungry had dropped by 17% since the beginning of the 1990s, and the first of the UN Millennium Development Goals – to halve global hunger by 2015 – now appears to be achievable *in principle*. On the other hand, roughly one-eighth of the world's population – 842 million people – is estimated to be suffering from chronic hunger.[19] The FAO further estimates that about three billion people do not eat well. This figure includes the overweight and obese, as well as those with micronutrient deficiencies. In other words, at the same time as the problem of malnutrition persists, overconsumption is increasingly contributing to high levels of obesity and associated diseases such as diabetes in middle-income countries.

In fact, the UN calculates that current levels of food production are more than sufficient to meet the world's basic nutritional needs. Much food 'scarcity' is therefore an issue of distribution: as much as one-third of current production is wasted at some point along the supply chain. Improvements to the institutions and infrastructure that ensure access to food

[18] FAO 2009a.
[19] FAO 2013.

are therefore at least as urgent as the need to expand existing production. It is therefore crucial to think not only in terms of food *production* but more broadly in terms of the entire food *system* – the 'processing, distribution, preparation, and consumption of food' – and the environmental impact of each step.[20]

The concept of food security is most often deployed to denote an ideal situation in which 'all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food, which meets their dietary needs and food preferences for an active and healthy life'.[21] The great challenge, therefore, will be to transform the global food system into one that meets the nutritional needs of all in an ecologically sustainable manner.

Food crops: The Green Revolution has brought with it a number of extraordinary achievements: it has ensured that agricultural productivity gains far outpaced population growth, tripling cereal yields over 70 years while using only 30% more land area. However, industrial agriculture has been blamed for a host of socio-environmental ills, including biodiversity loss, soil nutrient depletion, water and atmospheric pollution, high greenhouse gas emissions, and the destruction of smallholder livelihoods. Along with demand growth, further pressures on supply include competition for land area with biofuel crops; and the effects of climate change, including droughts, floods, and other extreme weather events (both discussed below).

It is worth noting that despite the charges against industrial agriculture, it is questionable whether organic agriculture represents a panacaea: there are already severe limitations on the land and water resources that would be required for scaling up, and the use of organic fertilizers alone could not yield production levels sufficient to sustain even the current global population.[22] In this vein, too, biotechnology should not be dismissed out of hand, as it can bring with it environmental benefits such as cutting down on land, water, and fertilizer use. Another example of a more promising approach is conservation agriculture, which is similar in many respects to organic agriculture but does for instance allow the use of inorganic

[20] Carleton 2013.
[21] FAO 2009b.
[22] Smil 1997.

fertilizers.[23]

All of these pressures on supply have placed upward pressure on prices as well as contributing to volatility. The presence of financial investors in commodity futures markets is a further area of policy concern (see below). In general, increases in the world market price are transmitted to consumer prices only with a lag of a few months and to a limited degree. By the same token, price volatility has relatively little effect on consumer welfare, although it does have negative implications for producer incomes.

That said, although the food crisis of 2008, in which the World Bank food price index rose by 60%, has been proclaimed as a 'perfect storm' of supply shocks and so is unlikely to recur in the short term, it is considered indicative of what may become a more common occurrence in a 'business-as-usual' scenario. Supply-side disruptions may encourage producers to restrict exports, as occurred in over 30 countries in 2008. The food price increase of 2006-08 is estimated to have pushed at least 100 million of the world's marginal poor back below the poverty threshold.[24] Higher prices in developing regions may also lead to civil unrest, as occurred in 61 countries in 2008.[25]

Livestock: Population growth coupled with increasing affluence is increasing demand for meat and dairy products, which are orders of magnitude more input-intensive than crops. Production of meat is projected to more than double by 2050 from its 1990 levels, while that of milk will grow at nearly the same rate. It is estimated that the impact of both sectors upon land, water, and atmospheric resources will need to be reduced by half merely to avoid environmental damage beyond present levels.[26] Yet short of growing meat in test tubes, there have been very few credible public policy proposals for curbing meat consumption, given its social and cultural significance.

Aquaculture/fisheries: 85% of the world's fisheries are already overfished or harvested at their

[23] FAO 2012.
[24] World Bank 2008.
[25] Evans 2010.
[26] LEAD 2012.

maximum sustainable rate, with over half facing shrinking stocks.[27] The picture is worse for some species than others: stocks of bluefin tuna have declined by up to 96% in some areas,[28] for example, while those of cod came close to collapse in the 1990s and 2000s.[29] Here again, the root of the problem is mismanagement, as quota systems such as the EU Common Fisheries Policy are either inadequate or poorly enforced. The recent creation of several marine protected zones may help to alleviate the problem, but aquaculture is projected to meet the majority of global demand for seafood in the coming years. While aquaculture as a sector is already growing at an annual rate of 6.1%, it is feared that this will not be sufficient to meet the projected 25% global demand growth for fish to 2030. Further, fish farming is not without its own environmental concerns, including high energy consumption, waste management, and the spread of parasites and diseases.

Fertile land: Experts believe that there remains little scope for expanding the earth's existing supply of agricultural land. At the same time, soil erosion remains a longstanding problem in many parts of the world and has a number of drivers, including deforestation, intensive cultivation, and over-expansion of existing agricultural land. Degraded soils require increasingly costly (and, if not managed properly, polluting) fertilizer inputs and endanger future productivity levels. The past several years have seen a dramatic rise in the number of land deals in which finance-rich, resource-poor nations – such as various Gulf states, South Korea, and Japan – lease or buy large tracts of land from resource-rich, finance-poor nations – typically in Africa, Latin America, South and Southeast Asia, and the former Soviet Union – and grow food for re-export to the investing country. Various European companies have concluded similar deals to grow biofuel crops in order to meet stringent EU clean-energy targets.

Biofuels: Widely promoted as a form of (literally) green energy only a few years ago, biofuels are now regarded as an additional strain on scarce agricultural production resources that fail to offer net clean-energy benefits. By competing with food crops for land area, water, and fertilizers, biofuels have also placed further upward pressure on food prices. Second-

[27] Costello et al. 2012.
[28] ISC 2012.
[29] Marine Stewardship Council 2013; NOAA Fish Watch 2013.

generation biofuels, which are derived from a variety of organic waste products, remain far from being technologically and economically viable alternative energy sources. Yet largely for domestic political reasons, generous subsidies in the US and EU remain in place.

Mineral fertilizers: Current agricultural production levels cannot be sustained without inorganic fertilizers, which are manufactured from phosphate rock, potash, and nitrogen from natural gas. In the wake of the 2008 commodity price spike, when the price of phosphate rock shot up by 800%, fears of 'peak phosphorus' were widely discussed.[30] Supplies are in fact adequate to meet demand for several centuries, but we have exhausted most high-grade reserves. 90% of remaining reserves are concentrated in just five countries. Moroccan deposits account for at least half of remaining reserves, and Morocco currently accounts for about one-third of global phosphate and derivative products, a figure that is set to increase over the next decade.[31] Reserves of potash, the price of which rose by 1000% in 2008, are projected to last for up to 1000 years but are even more geographically concentrated than phosphate, with Canada and Russia the top producers.

The environmental management of fertilizer pollution remains a concern, as the runoff of phosphate- and nitrogen-based fertilizers causes eutrophication (algal blooms) in both freshwater and seawater. If sufficiently large, these algal blooms deprive other organisms of oxygen, leading to 'dead zones' such as that in the Gulf of Mexico and hypoxic areas in the Chesapeake Bay and Baltic Sea.

Water

Freshwater demand is projected to exceed currently available supply by 40% in 20 years.[32] While some have argued that we have hit 'peak water', the apparently global water crisis is largely the result of a coincidence of failures of governance and investment at various sub-global scales. Climate change is altering the global hydraulic cycle, exacerbating the problem through increased incidence of both droughts and floods. Broadly, there are two dimensions

[30] Cordell et al. 2009; Cordell 2010.
[31] OCP Group 2011.
[32] 2030 Water Resources Group 2009.

to the problem: quantity and quality.

With respect to quantity, agriculture is by far the greatest source of demand, at 71% in 2010, followed by industry (16%) and domestic use (13%). Even supposedly clean industries place strain on water resources. For example, hydropower makes up a significant proportion of these figures, accounting as it does for one-fifth of global electricity production. Similarly, high-tech industries are water-intensive: the production of a single silicon wafer chip requires 8,622 litres of water.[33] Due to increased demand and poor management, many freshwater sources are already overdrawn: for instance, major rivers such as the Ganges, Huang He, Colorado, and Murray-Darling no longer reach the sea. Closely related is the problem of water quality. In the developing world, 75% of industrial waste and 90% of sewage is discharged directly into surface waters. In China, water pollution is so severe that 38% of surface water was rated too toxic for human contact in 2006. One of the gravest results of all these trends is that 1.1 billion people lack access to a reliable supply of drinking water.[34]

In the majority of cases, both dimensions of the water issue are the result of poor management. Of the world's 268 transboundary river basins, only a fraction have interbasin management plans. Also very much at the root of the problem is an investment gap: in a worst-case scenario, spending on water infrastructure will need to quadruple from current levels to meet the world's water needs by 2030.[35]

Biodiversity

Biodiversity is one resource becoming scarcer in an absolute sense, with the diversity of genetic, individual species, and ecosystem resources being lost at 1,000-10,000 times the natural rate due to habitat change, overexploitation, pollution, invasive alien species, and climate change.[36] Forests, which account for 80% of terrestrial biodiversity, provide such ecosystem services as regulating climate and precipitation cycles and medicinal plants, but

[33] UNEP FI 2005.
[34] 2030 Water Resources Group 2009.
[35] Ibid.
[36] UNEP 2007.

deforestation is occurring at a rate of 13m ha/year to make way for cropland and development.[37] Overfishing (see above) and destruction of coral reefs through climate change are also leading to marine ecosystem collapse.

Here a word of caution is in order: it is not universally true that human 'interference' in natural habitats is damaging to biodiversity. Peter Kareiva of The Nature Conservancy, a prominent conservation NGO in the US, has pointed to hundreds of studies showing that in many cases, organisms can thrive in unexpected ways in man-made environments.[38] That said, each case must be assessed individually.

Waste disposal sites

Whether terrestrial, atmospheric, or aquatic, waste disposal sites are projected to come under increasing strain as global consumption rises. While landfill space is not necessarily scare, poor planning and infrastructure results in misallocation of potential resources for commodity recycling and energy generation. Increasingly stringent regulations in the EU and elsewhere mean that landfill gate fees will continue to rise. Deforestation, greenhouse gas emissions, and ocean acidification represent loss or saturation of major global carbon sinks. And as already mentioned, waste is more often than not discharged indiscriminately into waterways and oceans, with negative implications for water quality and biodiversity.

3. COMPLEX INTERACTIONS

Among resource categories

We have already touched on several examples of the ways in which the availability of certain resources is contingent on others, and in which climate change drives scarcity. We consider these in greater detail here.

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[37] FAO 2010.
[38] Kareiva et al. 2012.

Food-energy-water nexus: Increasing agricultural yields will require greater inputs of fossil fuel-based energy, placing additional strain on these resources and further contributing to climate change. Existing stresses on water resources will also be further exacerbated by efforts to increase yields. Through the expansion of cultivated land, monocultural cropping, and the use of pesticides and herbicides, industrial agriculture also contributes to biodiversity loss. Finally, as mentioned, biofuels are already competing with scarce arable land and other resources for food crops.

Minerals-energy-water-land nexus: Increased demand for mineral and energy commodities will have many knock-on effects, as mentioned above. The extraction of lower-quality ores will require increasing amounts of energy and water resources. Extracting lower ore grades will also produce greater amounts of (usually) non-recyclable, toxic, or carcinogenic wastes, which are often discharged into surface water. The processing and shipping of minerals will also demand higher energy inputs. In some cases, extraction may conflict with equally valuable land uses such as food production. It may also disturb ecologically sensitive areas, as is feared in the case of the enormous and rich deposits of a variety of minerals in the Arctic.

Existing trends hint at the potential unintended consequences of a shift to renewable energy. As already discussed, it is now widely recognised that biofuels have thus far failed to deliver on their promise to supplant fossil fuels. On the other hand, often overlooked are the implications of a switch to other renewable energy sources such as solar and wind power, not to mention other forms of 'clean' technology: a dramatic increase in the extraction of minerals. This is true not only of major industrial metal such as iron ore, but also of precious metals such as platinum and palladium, and of more obscure minerals such as rare earths, silicon, and lithium. As we have seen, many of these minerals may be present in ecologically or geopolitically sensitive regions.

The climate-resources nexus: The impacts of climate change on resource availability are too numerous to list exhaustively here – indeed, in many cases they are still uncertain or unknown – but even a handful of examples should help to illustrate the dramatic and wide-ranging nature of the problem. Water availability is already being affected by changes to the hydraulic cycle: floods have become more frequent and/or severe in some areas, as have

droughts in other regions. Certain bodies of water on which people depend for their livelihoods, such as Lake Chad and the Aral Sea, have shrunk dramatically due to climate effects coupled with poor management. Through changes to the hydraulic cycle, climate change can also contribute to land degradation, with knock-on effects for agriculture and forestry.

Changes in mean temperature, precipitation levels, and ecosystem composition threaten biodiversity. It may also drive some species outside their native habitats, in which case they might disturb existing ecological equilibria (e.g. by becoming 'invasive species'). Forests and coral reefs are two examples of ecosystem-wide degradation caused directly or indirectly by climate change. In the latter case, higher concentrations of carbon dioxide in oceans creates an environment that is too acidic to sustain coral, with knock-on effects for the ecosystems in which coral serves as a foundation. The most dramatic example of the potential damage is Australia's Great Barrier Reef, which currently contributes A$5.4 billion to the country's economy and sustains 50,000 jobs but faces destruction by 2030.[39]

A related but often overlooked effect of climate change on resource availability comes via the effects on crop pollinators, including certain bird species, bees, and other insects. The total annual global economic value of natural pollination is estimated at €153 billion (cited FAO 2011). While land-use pressures from an expanding and urbanising population are already placing stresses on the habitats of these pollinators, once again, changes in mean temperatures and precipitation further threaten their populations.

Society-environment

Population-resources-consumption nexus: In the past, absolute population levels were uncritically assumed to be the primary driver of natural resource depletion. Environmentalists therefore advocated population control measures as the most effective means of curbing demand. Sadly, the experience of history has shown that population control as a policy can not only have unintended consequences such as the heavily skewed gender ratio evident in China; its

[39] Great Barrier Reef Marine Park Authority 2009.

implementation can lead to human rights violations, as the experience of India in the 1970s and China from the 1980s to the present day has shown.

More recently, the view that per capita consumption rates are a more important factor has taken hold. This is particularly salient given the size of the emerging global middle class – as many as 3 billion people according to some estimates[40] – and the 'Western' consumption-driven lifestyles to which so many of its members aspire. To provide a simple illustration, it has been calculated that if China's per capita oil consumption rates matched those of the US, total world oil consumption would double; if the entire developing world matched these levels, consumption would rise elevenfold.[41] By these notional measures, several planet Earths would be required to support the world's entire population at a developed-country middle-class standard of living.

However, curbing resource consumption will prove exceptionally challenging for a number of reasons. On the supply side, for instance, it is often the case that greater efficiency measures can simply lead to even higher consumption levels – an effect first observed in the 19th century and known as Jevons' paradox. On the demand side, both the credit-fuelled consumption binge in the developed world and the rapid demand growth from middle classes in emerging markets has also called into question the ecological sustainability of universal mass consumption. The conventional prescription for global economic 'rebalancing' entails encouraging mass consumption in China, on the one hand, and promoting US exports, on the other; however, given the sheer volume of raw materials that would be needed to support much of the Chinese population alone in a middle-class lifestyle, the ecological sustainability of rebalancing is very much in doubt. The global trend towards urbanisation places additional types of stress on resources: while it is certainly true that there are efficiency gains to be had from urban as opposed to rural living, in reality the rate of migration to many cities is such that new infrastructure development cannot keep pace.

Across many cultures the consumption of a range of resource-intensive goods, from meat to

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[40] *Economist* 2009; Nair 2011.
[41] Diamond 2008.

consumer electronics to cars, is a clear marker of affluence and social status. For those who have already attained a middle-class lifestyle or better – and indeed, even for those for whom such a lifestyle is at least notionally within reach – the psychological bias known as loss aversion means that these people will be loth to give up the physical comforts to which they have become accustomed.

Perhaps for these reasons, by contrast to the challenge of expanding the supply of scarce resources, the difficult and sensitive question of how to curb resource demand, and to what extent, is rarely tackled head-on. McKinsey has made one important attempt by promoting the idea of 'resource productivity' in industrial production. According to this analysis, aggressive resource efficiency measures on the part of business may go a long way in closing the supply gap.[42] However, to our knowledge only one study – appropriately entitled *Consumptionomics*[43] – has tackled the issue of per-capita consumption head-on from a society-wide perspective. In the view of this work, it is imperative that consumerism be abandoned as a lifestyle and an aspiration. In particular, since so much natural resource demand will come from Asia, it is Asian nations that must take the lead in technological and resource governance innovation.

Scarcity-inequality nexus: Scarcity and socioeconomic inequality are often inextricably linked. Resource scarcity (and climate change) impacts poor people and poor countries hardest, both for geographic reasons and because they are least resilient to shocks. For example, a lack of access to clean water has been identified as one of the key variables preventing as many as 2 billion people from escaping poverty. Consumption of contaminated water is a leading cause of preventable deaths worldwide, and waterborne illnesses severely impede human development and economic productivity. By the same token, scarcity can exacerbate existing gender inequalities. The time-consuming task of gathering basic water supplies almost universally falls to women and girls, with the result that many girls miss the opportunity to attend school. It is crucial to reiterate that both types of problem are usually ultimately a failure of institutions and investment rather than absolute environmental

[42] McKinsey Global Institute 2011.
[43] Nair 2011.

scarcity.

When it comes to addressing the problem of poverty, one area of controversy is whether economic development should precede environmental protection, or whether development will itself improve environmental stewardship. Academic and policy research can be found to support both positions. One popular (and controversial) heuristic is that of an 'environmental Kuznets curve': the idea that the relationship between per capita income and environmental quality follows an inverted 'U' shape. In reality, economic development has mixed consequences for environmental stewardship. On the one hand, higher income levels can encourage greater consumption; on the other, greater prosperity can afford societies the wherewithal to demand higher environmental quality. Many developing countries take a 'development first, environment later' view, arguing that the Industrial Revolution was a prerequisite for prosperity in the West and that it is only fair that the rest of the world be allowed to catch up. China, of course, exemplifies this tendency, although the scope of environment-related public discontent of late may lead the country past the inflection point on its environmental Kuznets curve.

In a similar vein, long-standing debates about whether democracy or authoritarianism is more conducive to economic development continue, particularly in the context of Asia. However, the empirical evidence on this issue is highly mixed. In particular, many observers doubt democracy leads to better environmental management, with some arguing that democratic systems encounter gridlock in decision-making too often for acceptable environmental outcomes. On the other hand, again as the experience of China shows, authoritarian systems may fare little better in crafting – let alone enforcing – robust environmental protection policies.

Scarcity-violence nexus: The nature of the relationship between resource scarcity and armed conflict is not straightforward. Scarce resources have been argued to cause or exacerbate violence primarily in two ways. First is the familiar, if controversial, 'resource curse': groups within populations struggle for control of high-value commodities such as oil (as in the Niger Delta) or 'conflict minerals' (such as diamonds in various Central African countries, cobalt in Congo). Second is the more likely theory that shortages of commodities necessary

for basic livelihoods can lead to or worsen violent conflicts, as in Darfur, a water-scarce region. In this case as well as many others, climate change was a further cause of the problem, with an unusually severe drought exacerbating water shortages. Rather than thinking in terms of armed conflict, for the foreseeable future it may be more productive to think of 'economic warfare' in the form of increased diplomatic and corporate competition for access to resources, resource nationalism (see above), trade barriers, and other restrictive policy measures.

Commodity prices and scarcity: Until recently, resource optimists have always pointed to declining prices in real terms as 'proof' that resources are becoming more, not less, abundant. In 1980, the economist Julian Simon bet biologist and eco-pessimist Paul Ehrlich that the prices of five metals would drop over the following 10 years, reflecting this tendency. While Simon won the wager 4-1, it has been calculated that if it were extended to today, Ehrlich would win 4-1 – and if it were extended to other important commodities, he would win by 11-1. The Nobel Prize-winning economist Robert Solow, who in 1974 famously quipped, 'The world can, in effect, get by without resources', has done an about-face and subscribes to the idea that economic growth is not an unqualified good if it results in large-scale environmental destruction.

One still widely cited study[44] suggested that commodity prices follow a U-shaped trend. If the commodities super-cycle that began around 2002-03 continues, it may prove to be an empirical validation of this hypothesis. As for price volatility, one significant cause is often a demand shock coupled with low commodity inventories. It has also been argued that, given the need for higher resource inputs – particularly energy – for the production of many commodities, price correlation across commodity types has increased due to spillover effects. One further area of controversy here is the relationship, if any, between so-called 'speculation' in derivatives and physical markets, as will be discussed in part II.

[44] Slade 1982.

PART II

THE EFFECTS OF BUSINESS AND FINANCE ON NATURAL RESOURCES

1. BACKGROUND

Five years after the onset of the global financial crisis, it has become something of a cliché to say that capitalism faces a crisis of legitimacy. It was hoped that if anything good came of the credit crunch, it would be a fundamental rethink of the sustainability of the financial system in all senses: not just economic but also environmental and social. And yet, five years on, progress towards a resolution of this legitimacy crisis remains slow on all fronts.

As Part I of this report has suggested, the causes of resource scarcity are numerous and interrelated, and failures to remedy shortages are overwhelmingly failures of collective action. Across resource categories, one of the key stakeholder groups here is the private sector. It has long been recognised that in the pursuit of profit, business often generates significant negative ecological externalities, the management of which was ultimately believed to be the purview of the state. Yet given the magnitude of the challenges that have arisen in recent years, this conventional wisdom is being fundamentally rethought.

For an increasing number of corporations, investors, and financial service providers, it is self-evident that profit maximisation and environmental sustainability are not tradeoffs but complements: that attention to corporate environmental performance is a creator of long-term value. Yet much as in the area of financial regulation, while there is widespread recognition of the need for systemic reform, there exists little consensus on the nature of the changes required. In some ways the challenges may be even greater: while the concept of financial risk is easily understood by practitioners, sustainability risk 'remains an amorphous idea, with companies, governments and the public still sorting out the ways it should be monitored and mitigated'.[45] At the same time, there remain numerous institutional obstacles to realising the long-term opportunities presented by a transition to a more sustainable economy. Not least among these is the all-too-frequent absence of collective will necessary

[45] Jacobs 2013.

to implement change.

Our aim in this second half of the report is to paint a picture for the investor community of the principal ways in which business and finance have, or are perceived to have, played a part in exacerbating natural resource scarcity. After offering a cautionary note against boiling this narrative down to a simple dichotomy between short-termist (and therefore irresponsible) and long-termist (and therefore sustainable) thinking and behaviour on the part of the private sector, we proceed to outline the respective roles played by four key stakeholder groups: the business community, public policy-makers, civil society, and finally the investor community itself. We then highlight six key areas where the need for change has been recognised and, in some cases, begun to be implemented. Rather than strictly speaking the most 'urgent' or 'important' issues, these six selected areas are perhaps best thought of as the most actionable by the investor community as a whole relative to other areas of proposed action – put differently, the low-hanging fruit which, once picked, can open doors to implementing solutions in related areas.

A note about 'the long term'

It has become *de rigeur* in discussions about the problems with contemporary capitalism to argue that short-termism lies at the heart of (real or perceived) problems, and that a long-term perspective must underpin a more sustainable regime. However, few have been able to match lofty rhetoric with concrete, actionable proposals for what long-termism in business and finance might look like and how it might be achieved. Perhaps the closest to success has been the Kay Review, which contrasts long-termism with several dimensions of short-termism such as the natural human tendency to myopia and 'hyperactive behaviour'.[46] Others have written about the imperative to make explicit links between the short and long terms, and to tailor investment governance practices accordingly.[47]

As Peter Bernstein sagely pointed out shortly after the onset of the global financial crisis, the fundamental problem with framing investment policy in terms of the long run is that 'The long-run results we can discern in the data of stock market history are not a random set of

[46] Kay 2012.
[47] Clark and Urwin 2008; 2010.

numbers: each event was the result of a preceding event rather than an independent observation. … Any starting conditions we select in the historical data cannot replicate the starting conditions at any other moment because the preceding events in the two cases are never identical.' More generally, as John Maynard Keynes famously observed, 'The long run is a misleading guide to current affairs. Economists set themselves too easy, too useless a task if in the tempestuous seasons they only tell us that when the storm is past the ocean will be flat.'

Since actionable definitions of long-termism remain evasive, we will avoid explicit discussions of short- and long-termism for the sake of focusing on more concrete, specific areas that demand attention and reform. However, it is no less true that long-termism is an undercurrent in the discussions to follow.

2. ISSUES FACING KEY STAKEHOLDERS

The business community

For the past half-century if not longer, 'the business of business is business' prevailed as a mantra in the corporate and financial worlds. While profit-making was assumed to be the natural and primary function of companies, responsibility for the environment was viewed as the purview of government through regulation and the law. Now this supposedly clear divide between the respective roles of business and the state in environmental stewardship is being fundamentally rethought. In more positive terms, some companies do see opportunities in cost-reducing efficiency measures, risk management, and innovation. Yet there remains enormous scope for private sector involvement and even leadership: UNEP estimates the cost of transitioning to a green economy at $1.05-$2.59 trillion per year, with over half of investment opportunities in developing countries.[48] As will be discussed in greater detail, however, most changes undertaken at the initiative of firms can only go so far; they require institutional support not only from governments, but also from two other key stakeholder groups: civil society and the investor community.

Policy-makers

[48] UNEP 2011.

Put plainly, it is impossible to consider how companies might be encouraged to integrate sustainability into their operations without due attention to the regulatory and legal environments in which they operate. For all that voluntary standards, codes, and the like have improved corporate and investor behaviour and drawn attention to a host of issues, it is by now apparent that these would benefit enormously from the support of clear, strong, and properly enforced public policy measures. Governments must thus be encouraged to do their part to facilitate private-sector initiatives.

They can begin by eliminating counterproductive subsidies to sectors such as agriculture and biofuels and tax breaks to energy companies: these measures alone would save the world an estimated $1.2 *trillion*. As a highly respected Harvard Law School professor has recently argued, here more systematic reforms to political campaign finance laws is necessary to curb the influence of the most powerful beneficiaries of these subsidies.[49] Ideally fiscal policies should include a well-designed green stimulus (in contrast to the austerity measures currently being implemented in many developed countries today). More radical proposals include directing investment by issuing green bonds or establishing green banks.

A number of other policy measures – including clarifying key legal concepts such as corporate personhood and limited liability and the nature of fiduciary duty through statute, as well as regulatory reform of commodity futures markets – have been or will be mentioned elsewhere in this section. Certain countries can also broaden access to natural resources by, for example, strengthening property rights for disadvantaged groups; others can relax some IP laws to facilitate international technological transfer.

While it is broadly agreed that the pricing of negative externalities is an integral part of a sustainable economy, the most effective means of doing so remains a matter of debate. Some have argued for replacing incomes taxes (and by extension, cap-and-trade systems) with carbon or consumption taxes. The related concept of payments for ecosystem services (PES), which includes a wide range of market-based solutions to problems as diverse as greenhouse gas emissions, other types of atmospheric pollution, excessive water withdrawals, water pollution, and biodiversity loss, is also a contentious area. Whether such market-based

[49] Lessig 2012.

solutions are a silver bullet[50] or can have serious negative unintended consequences[51] is a question that will need to be debated and addressed.

By the same token, prevailing gross domestic product (GDP) metrics have been criticised for failing to account for the negative impacts of environmental damage on economic growth, on the one hand, and for natural capital's contribution on the other.[52] Alternatives such as the UN's Human Development Index and the Genuine Progress Indicator have been proposed. However, there is far from a consensus on how to quantify environmental variables in monetary terms.[53]

Civil society

For its part, civil society has proven a potentially powerful influence on corporate performance. Given the importance of corporate reputation, brand image, and other intangible assets in financial markets, NGOs, the media, and even public opinion writ large can mount successful challenges to companies' environmental and social behaviour. Reputation and brand image are key intangible assets for firms, particularly listed firms, and negative and positive publicity alike impact directly on a company's share price.

Polls have consistently shown over time that youth and high education levels are strongly correlated with concern across geographic regions. However, the landscape of public environmental concern is shifting. Attention is becoming more focused in emerging economies, while affluent countries have become more apathetic in the past five years.[54] It should also come as little surprise that the news media reflects the public's short attention span when it comes to environmental problems. Studies have even shown that media attention to climate change spikes during key events such as UN conferences, the publication of government reports, and even the release of Al Gore's film *An Inconvenient Truth* and then tails off dramatically.[55] On the other hand, social media has been instrumental

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[50] See Sandor (forthcoming).
[51] See Bumpus and Liverman 2008.
[52] Stiglitz et al. 2009.
[53] For a more detailed discussion see Jones et al. 2013.
[54] Nielsen 2011.
[55] Boykoff and Roberts 2007.

in increasing public awareness of the environment, particularly in regions where the traditional news media may be less reliable in reporting environmental problems.

The investor community

Those investors wishing to adopt a more sustainable, forward-looking strategy face a number of challenges. The length and often dispersed nature of the investment chain means that it is often difficult to hold a single given entity within the chain to account for the environmental outcomes of investments. A number of institutional factors pose further obstacles to adopting sustainable practices. The tools and institutional arrangements currently available to investors encourage portfolio rather than direct investing, which encourages a 'trading' rather than a 'stewardship' mentality. Asset managers' performance is assessed over short time horizons and rewarded accordingly, yet environmental outcomes normally manifest themselves only over the long term. This misalignment of incentives more often results in the discounting of environmental considerations in investment decision-making.

Fiduciary duty is also frequently invoked as a reason why investment managers are severely constrained in their ability to consider extra-financial factors such as the (direct or indirect) impact of an investment on natural resource availability. However, a number of scholars[56] have shown that there is no clear legal basis for such thinking. On the contrary, they have argued that investing in an environmentally sustainable manner is instrumental in helping fiduciaries to meet their obligations of loyalty, prudence, diversification, and impartiality. It has been suggested that this issue could be clarified in statute.

Given the emerging realities associated with environmental change and natural resource scarcity, investment strategies tailored to present-day conditions will prove unsuited to future conditions. A deeper appreciation of these new realities on the part of investors is therefore urgently required, as is the capacity to update their beliefs and strategies in light of new information.

Adapting to these new realities will require innovative investment tools and strategies, a handful of which will be discussed in the sections below. These new tools and strategies

[56] Richardson 2009; Woods 2011.

should be supported by a clear *investment mission* which lays out the goals of managers in investing funds on behalf of asset owners. This in turn should be underpinned by well-informed and well-articulated *investment beliefs*, or the conjectures and working assumptions about the financial system, the wider economy, society as a whole, and environmental realities that inform investment decision-making.[57]

Equally, governance structures will need to evolve to support effective investment decision-making in light of new financial, economic, environmental, and societal realities. This may require increased and ongoing investment in what has been called the 'governance budget'[58] of a given fund. Sustainable investors must be cognizant of their place in the investment chain, linking as they do savings to investment to economic growth to wider socio-environmental outcomes. Financial performance and societal benefit can thus be considered complementary outcomes.

3. SIX AREAS FOR CHANGE

We then highlight six key areas where the need for change has been recognised and, in some cases, begun to be implemented. This is by no means an exhaustive list; nor are these strictly speaking the most 'urgent' issues. Rather, they are perhaps best thought of as the most actionable by the investor community as a whole relative to other areas. Put differently, they may be thought of as the low-hanging fruit which, once picked, can open doors to implementing solutions in related areas. We begin at the macro level with legal and regulatory considerations; narrow our focus considerably to areas where investors acting in consortia can help to bring about change; and finally discuss ways in which individual foundations can support nascent and ongoing efforts.

A. Wider public policy concerns

1. Recasting corporate purpose

For nearly a generation, the wider social purpose of corporations was conceived almost entirely through the lens of 'corporate social responsibility'. Yet CSR is by now a tired

[57] Clark and Urwin 2008; Woods and Urwin 2010.
[58] Clark and Urwin 2008.

concept, and a generation's worth of practical and scholarly effort alike has failed to break down the dichotomy between 'business case' and 'normative case' CSR.[59] Further, the effects of the short-termism that characterises the prevailing business climate are becoming increasingly apparent. The poster child for this tendency has, of course, become BP's failure to prevent the 2010 Gulf of Mexico oil spill, but in many ways the effects are less visible. For example, public companies in the US hold $2.3tn in cash reserves, yet for the most part they have not availed of their financial or human capital and scale to invest in forward-looking research and development.

The prevailing assumption that the purpose of the corporation is the maximisation of (short-term) shareholder returns has been challenged on a number of grounds in recent years. Contemporary legal experts have echoed Milton Friedman's observation that 'shareholder wealth is *not* a modern legal principle',[60] noting that the principal-agent model of the corporation on which 'shareholder value ideology' is based fails to capture the complexity of the legal and economic relationships between managers and owners.[61] While the UK Companies Act of 2006 represents one attempt to recast the societal role of the corporation, it is questionable whether this legislation is ambitious enough in itself, and to what degree its provisions have been implemented.[62]

As well as the question of principle, another dimension to the issue of corporate purpose relates to formal corporate governance structures. Last year a briefing in the *Economist* went so far as to declare the public company 'endangered'.[63] The tyranny of short-termism in capital markets, the IPO crisis, excessive regulation, executive compensation schemes gone awry, and the challenge from state-owned enterprises in emerging markets are all cited as threats to the success of publicly listed corporations. The trend towards other corporate forms, such as private ownership and partnerships, has been one notable outcome. Of course, this need not be seen as a negative in and of itself. Much as in the non-profit world, diversity of institutional forms contributes to the overall health of the private sector

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[59] Handy 2002; Smith 2003; Porter and Kramer 2006.
[60] Stout 2008.
[61] Stout 2012.
[62] Clark and Knight 2009.
[63] *Economist* 2012.

'ecosystem'. More to the point, though, corporate form in and of itself is not a first-order determinant of company behaviour; rather, a suite of factors in the wider financial markets exerts considerable pressure to focus on short-term profit maximisation through investors.[64]

At the same time, the dispersed ownership evident in most publicly traded companies effectively means that there is rarely a 'genuine' owner of any given corporation. For example, the ten largest shareholders in Diageo collectively own less than 20% of the company's shares, and most of the rest own proportions in the low single-digit percentages. Without a genuine owner, it is not clear precisely to whom such companies should be held to direct account; nor is it clear that these owners stand to gain from strong and frequent engagement with corporate boards. It is therefore worth asking whether more concentrated ownership might facilitate holding managers to account.

2. Financialization in commodity markets

The dramatic rise in commodity prices at the beginning of the 2000s caught the attention of financial investors such as pension funds and hedge funds in search of alternatives to disappointing returns in both equity and bond markets. Beginning around 2003, these investors transformed commodities into an asset class. While reliable data on the precise volume of money that has poured into commodity markets, investment in exchange-traded derivatives is estimated to have grown from $80m in 2005 to $375m in 2010.[65]

The question of whether or how this type of investment impacts commodity prices has proven highly controversial. Critics believe that the 'financialization' of commodity markets – here defined as the widespread participation investors who 'regard commodities as an asset class…and do not necessarily trade on the basis of fundamental supply and demand relationships in specific commodity markets'[66] – can cause commodity prices to deviate from levels dictated by supply and demand factors alone. In particular, many have alleged that financialization led to the oil price bubble of 2006-08, during which the oil price rose as high as $147 per barrel, and the food price spike of 2008 mentioned above.

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[64] Davis 2012.
[65] UNCTAD 2011.
[66] Mayer 2009; UNCTAD 2011.

It is important to point out here that although the term 'speculation' is used interchangeably with 'financialization', this is misleading and inaccurate. While there may be some overlap between the two terms, speculation refers to a much broader and ill-defined category of actions, including 'hoarding' in physical markets. By the same token, the line between 'commercial' and 'financial' participation in these markets is blurry. Many academic studies fail to make both distinctions and make liberal use of the term 'speculation' – in the authors' view, very much to their own detriment.

A great deal of academic research has been devoted to these questions. While econometric analysis is inconclusive, evidence from surveys of investor sentiment, as well as abundant anecdotal evidence, suggests that a sufficient number of market agents – be they physical or financial traders – take financialization seriously enough to adjust their expectations accordingly. That is, many trading entities now include financial variables in their forecasting models, and some even train their new recruits in 'financial' rather than 'fundamentals' analysis.[67]

By now there is an emerging academic and policy consensus on at least two broad points. First, while financial investors probably have a negligible effect on long-term commodity prices, they do amplify short-term price movements (i.e. contribute to price swings and bubbles). Of course, the precise nature of these effects varies across commodity types. Second, and at the same time, financialization is now an integral feature of the commodity price formation process. It remains to be seen what effects this will have over the long term, and so developments must be continually monitored.

Since financialization is here to stay indefinitely, the relevant policy question is not 'How do we banish financial actors from commodity markets?' but 'What kind of financialization do we want?' One point often overlooked in these debates is that the influence of financial institutions often extends directly into physical markets. For example, the US Federal Reserve in 2003 began to permit the involvement of investment banks in physical production, transport, and storage of commodities. This issue has come to the fore only recently with the highly publicised allegations against Goldman Sachs for manipulating the

[67] Terazono 2012.

LME's aluminium warehousing system.

B. Areas where consortia of investors could have impact

(1) Shareholder engagement

Shareholder engagement with corporate boards to improve management is not a new phenomenon, but over the past two decades, institutional investors – particularly those with long time horizons such as pension funds – have used their size and clout to push for improvements in company performance in the social, environmental, and governance (ESG) realms in order to enhance long-term shareholder value. They do so through a variety of tactics, both public (e.g. shareholder resolution campaigns, removal of companies from investment portfolios) and private (e.g. one-on-one meetings with company representatives, phone conversations). Such has been the magnitude of the shift of power from management to shareholders that corporate engagement has been called the 'fifth stage of capitalism'.[68]

It has been argued that institutional investors 're-aggregate previously dispersed shareholders with concentrations of ownership unseen since the great industrialists of the 19th century'.[69] Yet as described above, although these investors may be large, the percentage of their holdings in any given company typically is not. Given the dispersed nature of corporate ownership, managerial oversight is far more effective when shareholders act in concert. One way in which investors can increase their impact would therefore be to join independently sponsored 'enabling organisations' focused on specific ESG-related issues. The UN Principles for Responsible Investment (PRI) is by far the best-known such platform for collective action, acting as a convening point on a range of issues.[70] Ceres, the US-based advocacy coalition, also counts organising investors for engagement among its activities. However, this function need not be fulfilled by a non-profit organisation. Investment management companies such as F&C and Henderson coordinate share voting and shareholder dialogue activities with a sustainability focus. In the past, Hermes was also regarded as an industry leader in employing this approach. There is scope for more such

[68] Clark and Hebb 2004.
[69] Clark and Hebb 2004, p. 143.
[70] Gond and Piani 2013.

companies, and more capital, oriented towards active shareholder engagement.

(2) Impact investing

There is a pressing need to address the market failures associated with the lack of investment in solutions to the problems associated with natural resource scarcity, including basic infrastructure and forward-looking technologies. In this context, impact investing is emerging as a new paradigm for investors who desire ancillary social and/or environmental benefits along with financial returns on their investments. Contrary to common perceptions, there is a growing consensus among managers and advisors that impact investing does not *necessarily* require a trade-off between financial and extra-financial returns.[71]

There exists a wide range of investment targets, not only in terms of sector, size, and geography, but also whether the investment target's social or environmental mission is integral or ancillary to its financial objectives.[72] Examples of investment targets in which financial returns are of integral importance include not only clean technologies such as renewable energy, but also municipal water, transportation, or waste management infrastructure.[73] Investments with a more explicitly environmental or social mission include microfinance, community development projects, and support for small and medium-sized business.[74]

Impact investing is showing signs of growing beyond a 'cottage industry', but significant obstacles must be overcome for it to mature. Most fundamentally, the breadth of opportunities also means there is lack of clarity as to the definition of the term. Debate also centres on whether impact investments can be considered a separate asset class or whether this risks constraining the sector to a niche investment category. One survey further suggests around two-thirds of asset managers are unaware of the existence of impact investing.[75]

As is the case for efforts to develop integrated reporting, the issue of how to measure the

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[71] Hagerman and Geballe 2013.
[72] World Economic Forum 2013.
[73] Hagerman and Hebb 2009.
[74] Freireich and Fulton 2009.
[75] CFA Institute 2011 cited World Economic Forum 2013.

ancillary benefits of impact investing remains to be addressed. Similarly, there is a need to develop intermediary institutions – including banks, advisors, brokers, exchanges, ratings agencies – in order to create the infrastructure necessary to support the sector.[76] Particular focus should be given to educating financial advisors about the sector, and to clarifying whether impact investing runs counter to their obligations as fiduciaries. These factors aside, it may be that the main bottleneck to the growth of the sector stems not from a dearth of investable capital, but from the number of investable organisations and deals. If available capital exceeds investable opportunities, there is a risk of creating a bubble.[77]

Impact investing is considered ideal to match the intergenerational time horizon of family offices and foundations. We suggest that, for foundations, the decision to invest in the sector begins with two complementary questions. First, is there consistency between the respective strategies and missions of the 'generating' and 'giving' sides of the foundation's operations? Second, can there be supplementary social and environmental benefits as well as an acceptable rate of return? Having made the decision to invest, in order for foundations to contribute to the growth of the sector they will need to undertake not only internal organisational reforms and education efforts; they will also need to collaborate with each other to share knowledge and resources.

One possible set of innovative approaches to impact investing is a multi-foundation investment platform. This could have the benefit of leveraging the resources of a network of foundations to mobilize the necessary capital to make investments of sufficiently large scale, while bypassing traditional financial intermediaries. Recent research suggests there are three possible models for such a platform. The loosest structure would take the form of an informal coalition of investors around a common investment theme to share deals and resources, and would be managed in-house. A more institutionalised model would take a similar shape, but would be headed by a formal administrator. There already exists an example of this form in the Cleantech Syndicate, which, as its name suggests, draws together $1.5bn from several family offices for targeted investment in clean technologies. Unlike a conventional private equity fund, the Syndicate functions on the basis of shared trust and

[76] World Economic Forum 2013.
[77] Ibid.

informal principles. Finally, a formal legal arrangement would 'seed' an externally managed investment vehicle.[78]

C. Areas where an individual foundation can offer direct support

(1) Corporate and financial reporting and disclosure

Current corporate and financial reporting practices are widely perceived to be key hurdles to the systemic adoption of sustainability in business. In essence, there are two dimensions to this problem. First is the *scope* of reporting: current reporting practices tend to discount or entirely overlook social, environmental, and governance (ESG) factors, particularly those that are difficult to quantify. At the same time, these practices are dominated by financial metrics and models that have been widely criticised as both misleading and lacking sufficient clout. Second is the *time horizon* of reporting: regulatory requirements for quarterly reporting have also been criticised as encouraging an excessively short-termist mentality on the part of all market agents.

A number of transnational investment principles (e.g. the UNPRI, Equator Principles, EIB, OECD Declaration on International Investment and Multinational Enterprises) exist to guide signatories to better ESG performance. However, these principles have been critiqued on a number of grounds as merely papering over more systemic problems.[79] Each of these sets of principles varies according to binding force, geographic scope, institutional scope, and salient issues. Their commitments contain a great deal of vague or qualifying language (e.g. 'where appropriate' or 'as far as possible'), which severely limits their effectiveness. A lack of universal commitment and strong precedent in implementation further weakens all of them, although various institutional factors may make adoption and implementation easier in some context than in others. At best such principles can be considered a first step to 'mitigating the worst effects of investments, rather than to prevent damaging investments in the first place'.[80]

With at least ten existing initiatives to develop and promote integrated reporting, notably the

[78] See Bachher and Monk 2012 for a full description of each model.
[79] Just Economics 2011.
[80] Ibid. p.7.

Global Reporting Initiative (GRI) and the Carbon Disclosure Project, the adoption of a universal standard, let alone a binding one, remains far off. Investor opinion is still deeply divided on how to reconcile a number of issues with all types of reporting, including the quality of both quarterly and annual reporting; the quality of alternative regimes; and reliability of internally and externally generated information.[81] Some believe that it is not necessary to do away with quarterly reporting entirely. In many respects, quarterly reporting can impose discipline on a firm to adhere to a sustainable strategy.[82] However, 'A careful balance must be struck between the need for timely information and its impact on short-termism in the markets'.[83] Similarly, narrative reporting has an important role to play, but it is imperative that it be both concise and of high quality.[84] As much as the need to ensure quality data and reporting, therefore, the key prerequisite for progress in this area will be to select a single, binding standard.

Any new approaches to reporting must also take account of potential unintended consequences of a new regime. For example, on the one hand, greater disclosure and transparency will simply generate even greater volumes of data than exist already. It has been observed that more information is carelessly assumed to be an unqualified good, but in reality even that which is already available has led to information overload among analysts.[85] The addition of ESG criteria to this flood will, by itself, only exacerbate this problem. In fact, there is already plenty of ESG data sitting 'out there' in various company and other reports – it is simply waiting to be analysed. Yet it is not clear who will do this, let alone how they will go about it. One part of the solution could be a new form of cooperation with data vendors (e.g. Bloomberg or Thomson Reuters).[86]

At the same time, the problems associated with current reporting practices are bound up with various associated metrics and incentive systems which also promote the maximisation of short-term financial value at the expense of other, longer-term considerations.[87] The issue

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[81] ACCA 2013.
[82] Eccles and Serafeim 2013.
[83] ACCA 2013.
[84] Kay 2012.
[85] Ibid.
[86] Cheng 2010.
[87] See Generation Investment Management 2012; Kay 2012.

of how to improve reporting practices thus cannot be considered in isolation from these other factors. Ultimately, as well as asking 'How can we improve current reporting practices?' it may be equally fruitful to turn the question on its head and ask 'What types of regulatory instruments would give us the types of institutions that would make quarterly reporting irrelevant?'

(2) Reforming business and finance education

Driven overwhelmingly by student demand, business schools have begun to consider the ways in which they can integrate sustainability considerations into their curricula. Very few schools place environmental concerns at the core of their programmes; one exception may be the Copenhagen Business School. Similarly, the CFA has ongoing efforts to add a sustainability focus to their exams and training programmes. Executive education programmes and programmes for the continuing education of current practitioners have advanced somewhat more quickly here and could provide lessons for lower levels of business education. The challenge here will be to develop curricula based on real-world best practice as well as theory, though in many areas case studies and experience are still lacking due to the novelty of the issues.

CONCLUSION

The purpose of this report has been twofold. First, it has aimed to inform the Foundation's grant-making strategy in areas related to the environment by offering a background to contemporary global sustainability issues through the lens of natural resource scarcity. We have chosen this approach because, in our view, the prevailing tendency to think of environmental issues primarily in terms of climate change has tended to eclipse a number of pressing but only tangentially related problems. As the bulk of the text has shown, resource scarcity must be understood not only by reference to individual categories of resources but also to the complex interactions between resource types, and between resources and society. Underpinning our narrative, too, has been the crucial but too often overlooked point that scarcity is more often than not a product of failures of economic, political, or institutional governance rather than absolute physical limits.

The second aim of the report has been to paint a picture for the investor community of the principal ways in which business and finance impact, or are perceived to impact, resource availability. Here we have highlighted the respective roles played by four key stakeholder groups: the business community, policy-makers, civil society, and investors. Of the myriad challenges and opportunities facing investors wishing not only to adopt a more sustainable strategy for themselves, but also to contribute in a meaningful way to systemic change, we have highlighted six key areas where the need for reform is at the very least being widely discussed, if not acted upon. Of these, two lie at the market and regulatory level; two could be advanced by consortia of investors; and two could be undertaken at the initiative of a single foundation.

As this second part has demonstrated, the scope and interconnected nature of the institutional barriers to sustainable business and finance means that a neat and encyclopaedic description of them is extremely difficult to compile. For this reason, we resist making a laundry list of recommendations here. Instead we would offer the following suggestions:

- Most obviously, foundations and investors alike could channel their financial and other resources through both impact investing vehicles and investment management companies with sustainability as a core focus.

- An individual foundation could lead efforts to solidify, standardise, and mainstream integrated reporting, and to reform business education. In both cases, it could sponsor a convening of an expert group to meet on an ongoing basis and develop clear and detailed proposals. In this vein, too, a foundation could join and encourage efforts to advance impact investing as an asset class.
- Finally and more broadly, investors could promote many of the concepts and tools mentioned in this report among their peers. Clarifications of the legal principles governing corporate purpose and regulatory reforms in commodity futures markets are two examples we have discussed in the most detail, but as the second part of the report has shown, many other proposed public policy measures have as much potential to encourage the transition to economic sustainability.

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