The new politics of scarcity: A review of political positionings, current trends and their socio-economic implications[1]

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I. Introduction

Background

In recent years, there has been a flurry of concern around scarcity. In March 2009, the UK government's chief scientific adviser, Professor John Beddington, declared that the planet faced 'a perfect storm' of food shortages, scarce water and insufficient energy resources which threatened to unleash public unrest, cross-border conflicts and mass migration leading to major upheavals in the world and coming to a head in 2030 (Sample, 2009). In the late 2000s, the global financial crisis as well as dramatic increases in world food and fuel prices were accompanied by growing concerns over climate change, population growth, and increasing global inequalities in wealth and access to crucial resources. The potential role of financial speculation in amplifying price fluctuations also emerged as a major area of concern. Since the 2008 World Economic Forum, key global players, including members of the corporate sector, have highlighted the nexus between water, food, energy and climate change risks (Allouche, Middleton, & Gyawali, 2014; Hoff, 2011; SABMiller and WWF, 2014; World Economic Forum, 2011a, 2014), and have embraced positive alignments between economic growth and the environment. Ideas about resource scarcity and their implications for human well-being, livelihoods, economic and agricultural production as well as ecosystem functioning lie at the heart of these debates.

Does all this suggest a return perhaps to the debates of the 1970s, when resource scarcity was a prominent political concern due to oil shocks and accompanying financial crises? The events and social movements of the 1970s raised critical questions regarding the existence of scarcity amongst plenty and abundance; about the need to set 'limits' to growth before assumed natural limits could be transgressed (cf. Meadows et al, 1972) and about the imperative for all humankind to coexist on 'spaceship earth', our one planet which was increasingly being viewed as fragile and vulnerable. Forty-three years on, and in the midst of another global financial crisis, climate change poses new challenges to both human existence and resource availability. 'Water wars', famine and oil threats still appear as news stories. Resource scarcity continues to be linked with population growth and growing environmental conflicts, and science, technology, governance and innovation are usually evoked as the appropriate 'solutions'. Scarcity remains an all-pervasive fact of our lives. Yet, as identified by WWF in the terms of reference, even though natural resource scarcity is recognised as a major problem, it is not clear how it is to be dealt with, how it should shape our priorities and inform our decisions, either in the here and now or in the future.

What is scarcity?

Scarcity has a long history, and is widely considered to be an all-pervasive fact of human existence. Jean-Paul Satre spoke about human history being a bitter struggle against scarcity (see Mehta, 2010). The word 'scarcity' derives from the Old Northern French word *escarsete* to refer to the quality, condition or fact of being scarce. It also refers to frugality and parsimony, an insufficiency of supply in proportion to the need or demand and finally an insufficiency of supply in a community or the necessities or life connoting a time-bound dearth (Oxford English Dictionary, 1971). From being a time-bound and contextual phenomenon, several authors demonstrate how scarcity now tends to be universalized in academic and policy debates, largely because it is the *raison d'être* of economics (see also Xenos, 1989). Modern economics is largely concerned about the mismatch between unlimited human wants and limited means to fulfill them (Mehta, 2010). In terms of natural resources, scarcity is often understood as a failure to manage finite resources in the face of global population growth, and consequent over-exploitation (Hardin, 1968). Since the 1970s, resource scarcity has been cast and re-cast differently by academics, civil society and policy players, be it around limits to growth (Meadows et al., 1972), sustainability and the future survival of humankind (Brundtland et al., 1987), a problem of economic valuation and accounting (Pearce, Markandya, & Barbier, 1989), violent conflict and security (cf. Homer-Dixon, 1994) and more recently in the context of planetary boundaries and the anthropocene (Rockström, et al 2009). As a result, scarcity and natural resource management (NRM) are now key concerns of businesses, governments, intergovernmental organizations, environmental organizations, social scientists, and members of the development community and there is also a growing effort to break down existing silos across resource domains and also increasingly link local with global concerns.

Luks (2010) attests that, '[s]carcity is to economics what the universe is to astrophysics, the human brain to brain science and society to sociology' (94). In fact, a great number of general definitions of mainstream economics prominently feature scarcity as a, *if not the*, central concern of the discipline see:(Conrad & Clark, 1987; Robbins, 1932; Samuelson, 1948; Stiglitz, 1988). The broad modern conception of scarcity, conceived as the mismatch between unlimited human desires and limited means to fulfil them, originated with the 'marginalist revolution' of the 1870s that laid the foundations of what we know as orthodox, or neoclassical, economics (Fine, 2010). Since then, it has become a commonplace assumption that the interplay between utility (the satisfaction gained from consumption of a good or service) and the perception of scarcity explains consumer preferences and the value of goods, services and labour.

Yet, since then, precise meanings have shifted as definitions, applications and critiques of scarcity have diversified across disciplines and concerns. Over the years, scarcity has had a profoundly influential 'social life' and has become has become intertwined with ideas of growth, progress, abundance and sustainability, and perceived as a natural, universal and self-evident characteristic of the human condition to such an extent that debates around resource management, human well-being, livelihoods, economic and agricultural production, climate change, ecosystem functioning and their policy challenges are most often fundamentally framed around scarcity (Fine, 2010; Luks, 2010; Xenos, 1989). Considering this history begs asking, first, how applications and understandings of scarcity vary across the contemporary disciplines and literature, and second, what implications might differing notions of scarcity carry for our ability to imagine and plan for possible futures?

Problems with conventional notions of scarcity

The scarcity postulate (i.e. that needs, wants and desires are unlimited and the means to achieve these are scarce and limited) that underpins modern economics and *Homo economicus* is considered to be a universal fact. It is often assumed that scarcity is a natural phenomenon that can be isolated from planning models, allocation politics, policy choices, market forces and local power, social and gender dynamics. But needs, wants and desires do not have to be endless and unlimited [see: (Leiss, 1988)] and are also socially mediated and constructed (Rayner, 2010). It has been argued that 'scarcity' has emerged as a totalizing discourse in both the North and South with science and technology often expected to provide solutions, but such expectations embody a multitude of unexamined assumptions about the nature of the 'problem', about the technologies and about the so-called institutional fixes that are put forward as the 'solutions' (see Mehta 2010).

While not denying that scarcities (in many senses) exist for many and that our planet is in peril (not least due to the wanton overexploitation of resources and climate change), it is dangerous to see scarcity as a constant variable that can be blamed for all our woes. Instead, we need to be aware of the politics of allocation and the ways in which scarcity is politicized, especially to suit the interests of powerful players. Often, the problem lies in how we see scarcity and the ways in which it is socially generated. Research has identified how conventional visions of scarcity that focus on aggregate numbers and physical quantities are privileged over local knowledges and experiences of scarcity that identify problems in different ways (Hildyard, 2010; Mehta, 2005; Scoones, 2010). Scarcity is rarely the natural order of things but usually the result of exclusion and unequal gender, social and power relations that legitimize skewed access to and control over finite and limited resources. As such, scarcity is a relational concept that often results from social relationships and market forces dictating issues concerning demand and supply.

Over two centuries have passed since Thomas Malthus falsely predicted that population growth would exceed food production with checks required from deaths, disease, famine and late marriage. Still, Malthusian and neo-Malthusian thinking and their emphasis on growing population and population control have a massive reach and power despite their problematic implications and the huge body of evidence discrediting such thinking (see Hartmann 2010; Hildyard 2010; Millstone 2010). Neo-Malthusian thinking remains highly fashionable, from respected scholars to NGOs and Washington think tanks. While growing numbers can be a burden on the planet, one must crucially ask if the fixation with overpopulation distracts from focusing attention on more crucial aspects of resource availability, such as how power is distributed in society, unequal gender, caste and ethnic discrimination, unfair terms of trade, state planning, centralizing technologies, tenure arrangements, ecological degradation and so on.

Several contemporary policy processes and reports are concerned about natural resource scarcity. In this paper, we review these, their historical antecedents, and their specific global visions and projected scenarios regarding scarcity around land and food, water, energy, minerals and fisheries and their impacts and implications for economic development. In the light of the above discussion, it is important to ask whether these 'wide-angle' approaches to natural resources and scarcities obscure local-level complexities, politics, understandings, uncertainties and varied responses to scarcities, and why notions of scarcity as promoted by multilateral and bilateral donors, government bureaucracies and think tanks usually triumph over local understandings and visions of the problems. Do these aggregate and technical assessments of resources capture their multifaceted nature and embeddedness in culture, history and politics? All of this has a bearing on how resources are valued and thus rendered scarce or not. For example, water is simultaneously a natural element or H_2O, essential for the ecological cycle, a spiritual resource for millions who worship at holy river banks and oceans, a commodity which can be mined, bottled, sold and traded and a life-giving element without which human survival is not possible [see:(Mehta, 2011)]. These multiple meanings of water are rarely captured in global water assessments or dominant water scarcity and 'water wars' debates (see for example, United Nations, 2009).

While it can be argued that perceptions of scarcity can drive positive change and investment in, say, sustainable and low-carbon infrastructure and technology, or can be the catalyst to launching a discussion about how existing resources are distributed, it is also worth asking whether scarcity is often used to justify certain interventions over others. In the name of scarcity, coupled with fears of teeming numbers, controversial interventions such as large dams, nuclear energy, biotechnology and militarisation are often put forward as solutions by politically powerful actors whilst excluding discussions and deliberations of more suitable alternatives [see:(Hildyard, 2010; Mehta, 2010; Xenos, 2010)]. The result is that efficiency arguments usually prevail over equity arguments. The 'scare' of scarcity remains a means of diverting attention away from the causes of poverty and inequality that may implicate the politically powerful. As a result, scarcity is also a powerful tool to colonize the future and to shape it in certain ways (see Hildyard 2010). Thus, the political strategy of scarcity continues to be remodelled as a concept to justify the means and interventions of the powerful, and neo-Malthusianism arguments are given an additional explanatory power when the future is colonized through scarcity arguments.

Scarcity and limits

The Limits to Growth (Meadows, Meadows, Randers, & Behrens, 1972) was released at a key moment in the twentieth century, and remains one of the most influential works in shaping the parameters of global environmental debates throughout the late twentieth and early twenty-first centuries. *Limits* was meant to be synthetic. It brought together intellectual principles of the new field of systems ecology, including a focus on emergent properties and a conceptualization of 'carrying capacity' that gave scientific expression to the 'principle of population' proposed by Thomas Malthus 150 years before, with the new language, mathematics and emerging computer-aided methods of system dynamics that had been developed by Jay W. Forrester at MIT (Forrester, 1960, 1968; Malthus, 1798; Odum, 1953; Sayre, 2008). Published just ten years after Rachel Carson's *Silent Spring* (1962) brought concerns over the environmental hazards of pesticide use to public awareness, *Limits* was timely and relevant to increasing attention by governments to issues of non-renewable resource scarcity. It was also responsive to the concerns of the new popular environmental movement, the growth of which was fuelled by anxieties over hazards of nuclear waste disposal, consequences of environmental pollution from fertilizers and commercial detergents, and building worries around global population growth and its implications for food supplies (H. J. Barnett & Morse, 2011[1963]; Carson, 1962; Ehrlich, 1968; Røpke, 2004). Finally, the premises, methods and arguments originally put forth in *Limits* continue to be reframed and recast as ecological understandings have changed over the decades, and the work remains the subject of continued praise as well as controversy, contestation and debate, most recently revived in the context of policy action around anthropogenic climate change.

Overview of the paper

In this paper we first examine changing and diverse conceptions of scarcity in historical context and critically engage with scarcity's taken-for-granted nature. We then present a heuristic of three dominant and distinct themes that emerge from different contemporary positions regarding resource use and scarcity, and will discuss their implications for patterns of development. These three positions are: (1) The limits to growth/ planetary boundaries/strong sustainability position. Different accounts of this position propose that the scale and character of contemporary global ecological crisis due to human activity is reaching or has reached the point of irreversible, abrupt and detrimental environmental change (Meadows et al 1972; Rockström et al 2009); (2) The technological and institutional and management fix/weak sustainability position which is more optimistic and argues that investment in technical and managerial solutions will allow global society to mitigate, and also adapt to, resource crises without compromising goals of environmental sustainability and inclusive economic growth (e.g. Brundtland 1987); and (3) The 'structural inequality/ distributional' position. This position argues that environmental degradation and resource scarcity are not, in fact, 'natural' but result from inequitable institutional arrangements governing distribution that result in gross inequalities in access to resources (see UNDP 2006). In each of these positions there are different trade offs between economic growth, environmental sustainability and equity considerations.

While we recognize the fundamental overlaps between the three positions, this approach will allow us to create a 'dialogue' among different perspectives as we carry out an analysis of the current literature, trends and prognoses around natural resource scarcity. The paper then presents the basic assumptions of each position, followed by specific information regarding (a) proposed relationships between environmental factors and resource availability, (b) predictions regarding relative future impacts based on geography and growth patterns (i.e. how will scenarios likely play out in wealthy countries, emerging markets, and poor countries), particularly in terms of poverty and inequality, and (c) the main recommendations of each position regarding integrated resource governance and other prescribed courses of action. In addressing each of these positions we will bear in mind that the economics of sustainable resource use varies sharply according to the type of natural resource (renewable/ non-renewable; fast/slow replenishment, etc.). We demonstrate that issues of distribution and equity are usually overlooked in mainstream economic considerations, which are thus as much political as they are technical. Another consideration that is often overlooked are the inherent trade-offs and tensions in reconciling growth with sustainability as well as gender and social justice.

II. Historical conceptual review: Recent intellectual trends regarding scarcity and natural resources

In this section, we present a historical conceptual review of trends in the scarcity and resource use literature by theme, including trends in macro-scale modelling, since the publication of *The Limits to Growth* in 1972. It is difficult to structure this section chronologically and discretely due to a great deal of temporal and topical overlap in the themes covered and the way they feed into policy initiatives and popular discourse. Still, we hope that this section provides a foundation on which to situate contemporary perspectives on scarcity, within broader popular movements and intellectual genealogies. It will also critically evaluate the extent to which major trends in the literature have influenced policy, and evaluate the degree to which predictions of major works have matched or diverged from the 'real world'. Where applicable, we identify serious methodological issues or relevant gaps in evidence pertaining to these predictions.

The Limits to Growth (1972)

As discussed in the introduction, *The Limits to Growth* (Meadows et al., 1972) was released at a key moment in the twentieth century. In *Limits,* Meadows and colleagues discuss how they applied principles of system dynamics, at the time a new approach for understanding and predicting dynamic behaviour in complex systems, to create a mathematical global-scale simulation called World3. The simulation was used to model the demographic, economic, and environmental interactions and outcomes of specific scenarios over time, until the year 2100.

The central premise of the *Limits* argument is that the Earth is a planet of *absolute* physical scarcities and finite physical resources and capacities such as food, raw materials, fossil and nuclear fuels and ecological systems that support the needs of human society. Thresholds for the functioning of natural ecological processes can be breached by unchecked growth, resulting in acute collapse of the world system. The twelve model (table 3.1) scenarios presented in *Limits* focus around the interplay of five key, interconnected trends in growth and scarcity that characterise the behaviour of the world system. These include (1) increasing population growth; (2) increasing industrialisation and capital growth; (3) malnutrition/food availability; (4) depletion of non-renewable natural resources and (5) deterioration of the physical environment due to pollution. Characteristics and 'business as usual' predictions regarding these five crisis areas (in the world system of 1970) are summarised in table 3.2.

A second premise of *Limits* is that, while some things exhibit linear growth (increase of a constant amount in a constant time period, e.g. a child's height), the five critical areas listed above grow exponentially in the world system of the late twentieth century. According to system dynamics, the increasing nature of an exponentially growing quantity is amplified or enhanced by a 'positive feedback loop' that reinforces the direction of change (i.e. growth). In World3, this is the case with the five crisis areas, but especially with growth in rates of global population and industrialisation. In this context, natural delays in ecological processes increase the chances that upper limits will be breached before society realises, and also increases society's chances of underestimating necessary control measures are high. In other words, by the time the problems become apparent, it may be too late for society, and impossible to solve, leading to global collapse (Meadows & Wright, 2008). As presented in Table X, all scenarios presented in *Limits* (business as usual, and business as usual with non-renewable resources doubled), as well as scenarios that introduce technical policies into the model to undermine positive feedback loops influencing growth, predict some form of 'overshoot and collapse' involving continued exponential growth, leading to breached environmental limits to growth, resulting in drastic increase in death rates prior to year 2100. Only scenarios that double non-renewable resources and have technical policies in place to create 'negative feedback' (i.e. drastic reductions or stabilisation) on population and industrial growth can achieve (at least temporarily) a quasi-equilibrium state in which the components of the system can be maintained past 2100.

Subsequent trends in systems modelling: resources, population, capital and scarcity
Saavedra-Rivano (1979) describes World3 (also called the Forrester-Meadows Model) as 'the first to utilize the interest and favourable disposition towards the application of model-building and computational techniques to the design of global models of the 'world system' (Saavedra-Rivano, 1979):384. While *The Limits to Growth* (1972) may have been a highly influential work in applying early system dynamics and modelling to questions of scarcity and growth, it was not without precedent. As mentioned earlier, the very preoccupation with environmental limits and absolute scarcity that runs throughout *Limits* and much work in ecological economics is traced to the articulations of classical economist Thomas Robert Malthus and his followers (Malthus, 1798). In a report commissioned by Resources for the Future, Olli Tahvonen (2000) traces a more recent lineage of pre-system dynamics attempts to conceptualise, model, and also challenge the idea of absolute resource limits (Tahvonen, 2000).

This lineage, and indeed some of the on-going debates between ecological and environmental economics, in many ways can be seen as reflecting conceptual tensions between absolute and relative notions of scarcity. Following Tahvonen, for example, one of the main tenets of the US Conservation Movement of the late nineteenth and early twentieth centuries was the idea that economic growth had clear physical and ethical boundaries that cannot be avoided through technical innovations[3]. In reaction to the ideas of the conservation movement, influential economist Harold Hotelling published a study titled *The Economics of Exhaustible Resources* in 1931, in which he constructed a theoretical model in which social well-being from non-renewable resources was maximized indefinitely, then showed that in a market economy, profit maximizing mining firms could and would extract nonrenewable resources at a 'socially optimal rate' (Hotelling, 1931). Thirty years on, in *Scarcity and Growth* economists Barnett and Morse (1963) used historical price and cost time data on agriculture, non-renewable and renewable resources to test whether there is empirical evidence for increasing natural resource scarcity in an absolute sense, and found that for agriculture and minerals, price and production costs had fallen or remained steady between 1870 to 1957 while price and production costs in forestry had increased. These results were attributed to due to processes of technological development and substitution (H. J. Barnett & Morse, 2011[1963]).

Mathematically based computer-aided ecosystem and Earth system modelling remain popular among researchers, particularly in interdisciplinary fields of environmental studies, sustainability science, climate science and Earth system science (ESS). As they are widely considered empirical and rigorous scientific approaches, they are also influential with members of the public and policymakers. As they are also highly technical, based on specialized techniques, programming language and mathematical formulae that are difficult for non-experts to grasp, they are also controversial and frequently misinterpreted in the contemporary public sphere. It is important to note that despite the complexity and sophistication of modelling techniques, it is uncontroversial to mention that their predictions remain hugely uncertain; there are difficulties in predicting specific resource horizons and adaptation needs with any degree of certainty (e.g. it is going to get much wetter or much dryer, but hot how much). Some contemporary and high profile applications of systems modelling, namely as manifest in the concept of the anthropocene and the Planetary Boundaries (PB) framework are discussed in detail in Section 4 of this paper.

Ecological economics and 'strong sustainability'

Ecological economics is not a sub-field of mainstream economics, but a transdisciplinary field was institutionalized with the establishment of the International Society for Ecological Economics in 1988, yet the twentieth-century roots of the discipline can be traced to a rejection of the narrow focus on marketed natural resources in mainstream economics and several scientific and popular social trends of the 1960s and 1970s. These include advents in the fields of systems ecology and ecological anthropology, increasing academic, governmental and popular concerns with and urgency around issues of natural resource scarcity and population growth since the end of World War II, new public concerns over the nuclear arms race, chemical pollution and its environmental consequences, and the growth of popular environmentalism and accompanying discourses around the ecological limits of 'Spaceship Earth' see:(Boulding, 1966; Ward, 1966) and resource sustainability (Costanza, Perrings, & Cleveland, 1997; Luks, 2010; Martinez-Alier, 2003; Røpke, 2004). Of the fields discussed in this paper, the principles and assumptions of ecological economics are most closely aligned with notions of scarcity that guided *The Limits to Growth*.

[3] In addition to influencing notions of scarcity, the US conservation movement also had a dramatic influence on later concepts of sustainability, justifications for state regulation of natural resources and strict conservation areas.

Key principles of ecological economics include, first, the idea that the material economy is embedded in society, which is embedded in the ecological life-support system. Costanza (2012) calls this conception the 'economy-in-society-in-nature' (Costanza et al., 2012). This means that the economy cannot be understood without understanding the whole complex, interconnected system. It follows that a fundamental goal of ecological economics is to 'clarify human-nature interrelations' that exist in the context of complex, nested systems (Fikret Berkes & Folke, 1992). Second, ecological economics includes a strong critique of economic growth, and holds that growth and 'development' are not always linked. Rather than assessing development in terms of GDP or consumption-based econometrics, in this view true development should be defined in terms of the improvement of sustainable well being, not merely increased material wealth or improvement in material consumption. Third, and related to the second point, ecological economics draws influence from British classical economists, and particularly Malthusian notions of 'absolute' scarcity or limits in order to 'radicalise' another central assumption of mainstream (and environmental) economics, the assumption of relative scarcity and substitutability among forms of capital (Luks, 2010). The basis of this departure is the role of un-substitutable forms of 'capital' (natural, human, social, and cultural assets, and well functioning produced or built assets), the use of which must be balanced and carefully managed in the pursuit of development. The term 'capital' is meant here in the sense of a stock or accumulation or heritage – a patrimony received from the past and contributing to the welfare of people in the present and future. Because other forms of capital/assets depend entirely on the natural world and the functioning or transformation of 'natural capital'[4], and because many forms of natural capital are non-substitutable (i.e. unique and irreplaceable), achieving sustainability requires that human societies live off of the 'interest' (i.e. sustainable yields) generated by natural capital without depleting the capital itself since it is scarce in an *absolute* sense (Costanza et al., 2012). This is the central concept characterising the 'strong sustainability' position, also called the 'non-substitutability paradigm' that characterises ecological economics and differentiates it from other fields that focus on issues of natural resources, scarcity and sustainability. As Neumeyer states, 'the essence of strong sustainability is that natural capital is regarded as non-substitutable, both in the production of consumption goods and as a direct provider of utility' (Neumayer, 2003):1.

Environmental and natural resource economics

Environmental economists[5] have traced the origin of the field to the 1950s. Politicians' concerns about natural resource scarcity and the founding of Resources for the Future, a US-based research institute dedicated to applying economics to a number of natural resource issues led to several seminal early

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[4] In ecological economics, a 'capital' is considered to be a stock of materials or information that existed at point in time and generates a flow of services that may be used to transform materials or the spatial configuration of materials to enhance the welfare of humans (Costanza, d'Arge, et al., 1997). 'Natural capital', as distinct from human-made capital or cultural capital, for example, consists of three main components. These are: non-renewable extractive resources that exist in absolute amounts (e.g. oil; diamonds; coal), renewable resources (e.g. fish; fresh water; wood) and environmental services (e.g. hydrological cycles; atmospheric maintenance; soil regeneration; genetic biodiversity), the latter two of which are produced through the processes and functions of healthy ecosystems.

[5] Environmental and natural resource economics are two sub-fields of economics following the neoclassical tradition. According to David Pearce (2002), the primary distinction between the two is that, early on, natural resource economics tended to focus on issues of optimal resource use and causes of resource depletion, focusing on specific resource types, while environmental economics was primarily concerned with issues of environmental pollution (D. Pearce, 2002). Because of the substantial overlap between the two sub-fields, in this report both will be glossed under the term 'environmental economics' since contemporary environmental economics includes focus on optimal natural resource use.

reports such as *Scarcity and Growth* (1963) and *Trends in Natural Resource Commodities* (1962). Luks (2010) characterizes the development of environmental economics as a movement to bring 'nature' back into economics in a way commensurate with dominant neoclassical thinking, whilst treating natural resources and the natural environment as something more complex that a free input to production. One of the most coherent articulations of the rising discipline of environmental economics in the 1980s was the work of David Pearce and co-authors in the report for the UK government, *Blueprint for a Green Economy* (D. W. Pearce, Markandya, & Barbier, 1989). This book was the first and what was to become a series with volumes on topics like 'greening' the world economy, measuring sustainable development, capturing environmental value, and estimating the true cost of road transport. The central idea was that the environmental degradation was a market failure, but the proposed 'green economy' would be one in which environmental externalities would be fully accounted for (Death, 2014).

The dominant framing of environmental economics considers 'economy', 'environment' and 'society' as conceptually discrete and distinguishable domains, with nature and natural processes framed as neglected dimensions of an 'immanent market-world' (McAfee, 2014b). Environmental problems are treated as problems of allocation, specifically as 'market failures' that become evident as economic agents fail to integrate full costs into calculations and decisions about resource use, resulting in 'external effects', or 'externalities'. This viewpoint implies that nature, resources, and relative environmental health can be measured in economic terms, and that market forces, technological innovation and substitution processes can overcome problems of scarcity. In other words, once external effects are internalized, market processes will signal scarcity of different resources, drive substitution processes and technological 'fixes' will bring about sustainability (Luks, 2010).

It is generally uncontroversial among most economists that economic development (e.g. growth) leads to depletion of non-renewable resources and other forms of environmental damage, but at the same time there is widespread debate as to whether development is inherently unsustainable. From an economic standpoint, the critical issue of debate is not whether natural capital is being irreversibly depleted, but whether future generations can be compensated for current losses of 'natural capital', and what would constitute just compensation (E. Barbier, 1989, 2007). In terms of thinking about natural resources, environmental economics takes a relative, or Ricardian approach to issues of resource scarcity, which holds that processes of economic growth may lead to increasingly scarce stocks of a particular resource as it is exploited, but that this does not necessarily lead to an absolute constraint to growth. Such scarcities are viewed as temporary for the most part, because the economic system is assumed to respond to price signals by increasing innovation and substituting substances with different physical or locational characteristics for more expensive, increasingly hard-to-extract substances (H. J. Barnett & Morse, 2011[1963]). In absence of widespread market failures, such substituting processes are seen as ameliorative to specific resource shortages (E. Barbier, 1989).

It follows that, in terms of their view regarding sustainability, environmental economists tend to take a pro-growth, 'weak sustainability' or 'substitutability paradigm' approach.
Weak sustainability is conceptually straightforward, and it builds upon well-established principles of neoclassical welfare economics. It is based on 'the belief that what matters for future generations is only the total aggregate stock of man-made and natural capital (and possibly other forms of capital as well)' (Neumayer, 2003):1. Loosely speaking, it does not matter whether the current generation uses up non-renewable resources or releases CO_2 as long as the market drives innovation and increased efficiency in

production that allows for adjustments in inputs and substitutions in the production process. Natural capital is regarded as being essentially substitutable in the production of consumer goods, and as a direct provider of utility. While this position may be a source of contention between environmental economists, ecologists, biologists and heterodox economists, it is consistent with dominant economic thought, in which scarcity is not so much a concrete constraint linked to actual physical limits, but an abstracted, value-related concept as discussed above (Conrad & Clark, 1987).

Sustainability & the sustainable development paradigm

Despite noted conceptual vagueness, ambiguity, and different applications and implications in different disciplines, contemporary ideas about sustainability are fundamentally about managing scarcity over time, in both an ecological and an economic sense. Mebratu (1998) traces notions of sustainability to diverse traditions, including indigenous and folk perspectives regarding societal concerns around appropriate relationships between humans and the natural world, to Malthusian ideas about environmental limits from classical economics, to Ricardian ideas about diminishing returns and the substitutability of resources, political economic thinkers in the libertarian/anarchist tradition who were concerned with organic and de-centralist economic practices and systems, and the global justice and environmental movements of the twentieth century (Mebratu, 1998).

Sustainability and sustainable development are historically-changing and much debated concepts. In resource management, most groups favour an ecological or human-ecological orientation around the concept, conceiving of it as the conditions necessary to support systemic functioning (or human life) at a specified level of functioning (or well-being) into the future (Lele, 1991). But it also has field-specific meanings. For example, in terms of renewable resources it is usually taken to mean maintenance of productivity of a particular resource for an indefinite length of time (Lele, 1988).

In recent decades, sustainability has come to be a crucial concept in global political, scientific and public debates around environmental, economic and development futures, and this is reflected in the rise to prominence of the concept of sustainable development (Becker, 2011). Sustainable development, which seeks to bring social, economic, and environmental dimensions of sustainability, in addition to an implicit notion of justice, into the policy realm, has been variably discussed as an expression of vision, value change, morality, social reorganization, and transformational process towards a better world (Gladwin, Kennelly, & Krause, 1995; Luks, 2010):876. In terms of philosophy and vision, Baumgärtner and Quaas (2010) and Becker (2011) state that in a broad sense sustainability focuses on three relationships or relational dimensions of justice 'in view of the long-term and inherently uncertain future' (Baumgärtner & Quaas, 2010):3. These include (1) intergenerational justice, or justice between humans of different generations, (2) intragenerational justice, or justice between different humans of the present generation and (3) what they term 'physiocentric ethics', justice between humans and nature (Baumgärtner & Quaas, 2010; Becker, 2011).

These first two dimensions of justice, intergenerational and intragenerational, are clearly reflected in the now-classic core conception of sustainable development was articulated in the United Nations World Commission on Environment and Development report titled *Our Common Future*, and defined sustainable development as a pathway, '…to ensure that [development] meets the needs of the present without compromising the ability of future generations to meet their own needs This involves integrating three 'pillars' of sustainability: environmental, economic and social. The notion of scarcity is also implicit in the Brundtland definition, reflected in the reference to environmental 'limits' to achieving inter- and intragenerational justice by ensuring that basic needs, especially of the poorest, can be met into the future (Baumgärtner & Quaas, 2010; Luks, 2010).

Since the publication of the Brundtland report, the core definition has been reaffirmed in a stream of UN publications, including the 1992 Rio Declaration, Agenda 21 and the Millennium Development Goals (UN, 2013; UNCED, 1992a, 1992b), but definitions and applications of the term sustainable development have proliferated and found specific niches in a number of disciplines and sub-disciplines, some of which are summarised in table 3.3 (Gladwin et al., 1995). A commonality across most definitions is an attempt to reconcile the goal of continued economic growth / maximization and the constraint of environmental scarcities (expressed variously in terms of carrying capacity, bounds, limits, viability and integrity) (Edward B Barbier, 1987; Meadows, Meadows, & Randers, 1992; Tahvonen, 2000), etc.

More recent approaches have called for the need to be more specific about the values and goals at stake around different issues and contexts, across temporal and spatial scales, and according to the perspectives and priorities of different groups. There may be multiple possible sustainabilities at stake, and negotiating these is a political, not just a technical and managerial challenge. Second, it is important to attend not just to equity across generations, but within them. Here, gender equity and equality are central [see:(Leach, Mehta, & Prabhakaran, 2014)]. The UK STEPS Centre (see http://steps-centre.org) has developed a pathways approach which helps conceptualise how institutions, power and knowledge can interact to create and sustain pathways that are either unsustainable, or – alternatively – offer routes to sustainable development. Central to the pathways approach is to recognise that there are multiple ways of understanding and 'framing' systems and change. Different actors – whether different local people, scientific, policy or business actors – will often hold different views, depending on their particular backgrounds, perspectives, interests and values.

Most sustainability issues involve multiple, contested framings and narratives. Thus, for example, environmental problems may be attributed to rising populations in Malthusian narratives; or alternatively as the result of political-economic processes that lead to poverty-related resource degradation. Food sustainability challenges may be framed as problems of production, to be solved by new agricultural technologies and enhanced markets; or alternatively in terms of distribution, access and entitlements.

The point is that not all narratives are equal; some dominate, supported by powerful institutions and relations, while others remain marginalised or hidden. And narratives have material consequences: they underpin and legitimate particular policies, institutions, interventions and patterns of investment, while excluding others.

Scarcity, conflict and security

The concern termed 'environmental security' was officially introduced at the 42nd session of the United Nations General Assembly in 1987, most likely due to the published results in the same year of the findings of the Brundtland Commission, which concluded that, '…environmental stress is both a cause and effect of political tension and military conflict. Nations have fought to assert or resist control over raw materials, energy supplies, land, river basin, sea passages and other key environmental resources' (Brundtland, 1987). The concept gained greater recognition in 1988 when former Soviet Minister

Eduard Shevardnaze told the General Assembly that global environmental threats are quickly 'gaining an urgency equal to that of the nuclear and space threats' (El-Ashry, 1991). As a result, the relationship between violent conflict (both national and international) and environmental degradation or scarcity of resources came to be an increasingly relevant policy issue on the international front (Renner, 2004).

Environmental degradation has long been a preoccupation of social scientists, many of whom consider that the logical consequence of such degradation is violent conflicts or war. In the early 1980s, sociologist Johan Galtung argued that, 'the destruction of the environment may lead to more wars over resources', and suggested that 'environmental effects make a country more offensive because it is vulnerable to attack and because it may wish to make up for the deficit by extending the ecocycles abroad, diluting and hiding the pollution, getting access to new resources' (Galtung, 1982). Some go as far as presenting environmental degradation as an extreme threat to world security. Renner (1989) writes that environmental degradation imperils nations' most fundamental aspect of security by undermining the natural support systems on which all of human activity depends (Renner, 1989). Other authors like Ophuls go as far as imagining dramatic scenarios in which, 'the pressures of ecological scarcity may embroil the world in hopeless strife, so that long before ecological collapse occurs by virtue of the physical limitations of the earth, the current world order will have been destroyed by turmoil and war' (Ophuls, 1977). Most of these arguments date to the 1970s and 1980s when social scientists urged politicians and decision makers to consider environmental issues as possible threats to international security, and belong to Rønnfeldt has called the first generation of environment and security research (Rønnfeldt, 1997).

Following these trends, through the 1990s and 2000s, a great deal of political science research has dealt with questions of causality and around the so-called 'resource curse', the role of high-value extractive resources (e.g. oil, diamonds, gold) and rents in sustaining violent civil conflict in the global south, and the question of whether relative resource scarcity or resource abundance predicts resource conflict or peace (Bond, 2014; Grossman & Mendoza, 2000; Humphreys, Sachs, & Stiglitz, 2007; M. Ross, 2013). Some authors associated civil conflicts with resource scarcity due to deprivation that is the result of three basic processes: human-induced resource degradation that results in a faster rate of decline of natural resources than the rate at which the resources can be replenished by natural processes; rapid population growth, which reduces the amount of resources available per person, and unequal resource distribution that results in resources being concentrated in the hands of the few to the deprivation of the many [see:(Homer-Dixon, 1994)]. This line of research draws on Malthusian notions of human-environment interactions and scarcity (Duffy, 2014). Conversely, others working on political economy and governance perspectives have presented what appears to be a contrary causal association: that resource abundance, or perceived future resource abundance, combined with primary commodity dependence increases the risk of violent conflict because it fosters political and economic settings in which 'bad' governments and grievance-based insurgencies are prone to emerge [see:(Collier & Hoeffler, 2005)].

Since the mid-2000s however, the social science study of resource conflicts has shifted quite a bit from the search for generalisations and linear predictability to emphasise the significance of contextual dynamics to understanding conflicts involving natural resources. In addition to strong consideration of contextual variables in understanding conflict dynamics, this shift incorporates empirical consideration of a 'multitude' of factors contributing to complexity in processes of social, political, and economic change, a mutual interplay between politics and natural resources, and the role of non-linear and nonsequential dynamics that influence both context and conflicts involving natural resources (Basedau, 2005a, 2005b; Bond, 2014; Collier, 2010).

Yet, despite these analytic shifts, narratives of scarcity continue to figure heavily in environmental and economic policy discussions and, increasingly in the context of the 'neoliberalization of nature', environmental conflict, issues of global environmental change, the integrity of the global resource base, and even biodiversity conservation have passed from the primary concern of regionally-focused researchers and professionals to be considered international security concerns, leading to new trends in the militarisation of natural resources and biodiversity, particularly in areas with relatively weak state capacity that are particularly rich in non-renewable extractive resources and conservation 'hotspots' (J. Barnett, 2003; J. Barnett & Adger, 2007; Duffy, 2014; Hanson et al., 2009). Section IV of this paper further demonstrates how current reports and approaches draw on the notion of scarcity and resource 'hotspots'.

Challenges and the scarcity fallacy: Substantivist, institutional and entitlements approaches

The discussion above has focussed on mainstream approaches to scarcity that either take an absolute position or a relative position on scarcity. These lead to the notions that resources and property must be allocated or managed either through market mechanisms, state-centred governance regimes or through formal rights regimes. Yet, heterodox economists, anthropologists, and others have put forth alternative perspectives and framings around human society, resources and scarcity that carry different implications for development futures and policy action.

Karl Polanyi stands out as one of the few economists who argued that economic theory and several of its core tenets (such as scarcity) are not universally applicable. To make this case, Polanyi analyzed modern market society and compared it with pre- or non-market societies around the world, some of them in historical perspective. In *The Great Transformation* Polanyi argues that before the 19th century, market was 'embedded' in society and was both shaped by and subordinated by ideology, social relations and politics. However, the great transformation that ensued after the industrial revolution and the accompanying political and economic changes led to the emergence of the 'self-regulating' market, disembedded from social control and both unleashing negative social impacts and making market forces dominate over society. However, in non-market societies, people satisfy their wants through different logics and practices, including reciprocity, redistribution and exchange (Polanyi, 1944).

In *Trade and Market in the Early Empires* that Polanyi and his collaborators criticized the scarcity postulate. Crucial for this is the distinction between the formal and substantive meaning of 'economic'. Substantive economics is concerned with 'man's dependence for his living upon nature and his fellows. It refers to the ways in which people interact with each other and nature to satisfy their basic material wants. By contrast, the formal meaning of economics draws on the choice between the alternative uses of insufficient means' (Polanyi, Arensberg, & Pearson, 1957):243. According to Polanyi, the two are quite distinct. While the formal meaning implies choice between alternate uses of scarce means, the substantive meaning need neither contain choice nor insufficiency of means. He then goes on to caution that the current concept of economic fuses the 'subsistence' and the 'scarcity' meanings of economic without a sufficient awareness of the dangers to clear thinking inherent in that merger (Polanyi et al., 1957):244. These debates are very relevant, for example, in the water domain where the multiple characteristics of water (e.g. social, cultural, symbolic resource) are often negated in favour of promoting water as an economic good.

Institutional approaches in economics and political sciences have also contributed significantly to challenging conventional notions of scarcity. Transaction cost and the collective action approaches are two key approaches within the New Institutional Economics (NIE) literature, and both focus on the role of institutions in managing scarcity and property regimes. Institutions are either the 'rules of the game in society' (Ostrom, 1990) or the formal rules and conventions, including informal codes of behaviour or norms, which emerge to regulate human behaviour and interaction. An impressive body of work by common property theorists has successfully discredited neo-Malthusian notions concerning population growth, resource availability and environmental degradation, and many empirical studies from Europe, Africa and Asia have shown how people cooperate in times of resource pressure and scarcity (Firket Berkes, 1989; Bromley & Cernea, 1989; Ostrom, 1990). They have also drawn attention to the importance of institutions in managing resources. Here the work of Elinor Ostrom, who was awarded the 2009 Nobel Prize in Economic Science, stands out. Ostrom and other common property scholars have also shown how Hobbesian notions of anarchy, where states, regions and people fight over scarce resources, may not be an accurate or predictable real-world scenario. Instead, through detailed empirical studies from all around the world, they have demonstrated that local and global actors have deep understanding of their immediate environment and cooperate with each other in times of adversity to avoid high transaction costs attached to their failure to comply (Keohane & Ostrom, 1994; Ostrom, 1990).

Common property analysts such as Ostrom (1990) tend to take their theoretical grounding from game theory, looking at collective action dilemmas and focusing on the ways in which institutions or rules can be purposively crafted to produce collective action. The now large literature on Common Property Resource management has been central in establishing the significance of local institutions, particularly in natural resource management. Initially formulated in response to Hardin's (1968) pessimistic *The Tragedy of the Commons* (Hardin, 1968), early work in this area tended to overly rely on the notion of a universal rational, self-maximizing actor rather than looking at the embeddedness of economic action in on-going social and personal networks, and the socially constructed nature of economic institutions. By contrast, socioeconomic theorists e.g.:(Etzioni, 1985)and economic sociologists e.g.:(Granovetter, 1985) have argued against such methodological individualism to stress the embeddedness of economic action in on-going social and personal networks, and the socially constructed nature of economic institutions. Moreover, anthropologists and sociologists have also shown how institutionalism often tends to ignore the rootedness of economic action in the specifics of local history and sociality (Cleaver, 2000; Mehta, 2005; Mosse & Sivan, 2003). These criticisms notwithstanding, institutional analyses have played a key role in highlighting that people can cooperate to manage scarcity and that scarcity problems are more linked with institutions or the lack of them, rather than with absolute quantities and numbers.

Amartya Sen's work also stands out as another economic perspective that promotes an alternative to conventional scarcity postulates. His work is concerned with how to ensure the access of all to an initial basic amount of resources to ensure their survival and wellbeing and for a necessary level of functioning e.g.:(Sen, 1981, 1999). To avoid a scramble for perceived scarce resources that involves the trampling of the poor and not-so-well-off, a framework is needed whereby all individuals that make up a population are guaranteed a modicum of wellbeing by ensuring their access to a basic level of resources. Such a framework is provided by Sen's entitlements approach. 'Entitlement' refers not to rights in a normative sense (what people *should* have), but rather to the range of possibilities that people *can* have. Sen sees entitlements as the 'the set of alternative commodity bundles that a person can command in a society using the totality of rights and opportunities that he or she faces' (Sen, 1983a):754 (Sen, 1999).

The thinking underlying Sen's entitlements approach chimes well with the idea of scarcity as a 'constructed' concept, rather than as a real-world fact. The idea that a famine may occur even when there is no decline in food supplies is attributed to people's lack of purchasing power, rather than a physical dearth of food. The same logic has been applied to water scarcity (Anand, 2001) where it is argued that some people's lack of water does not necessarily imply that water is scarce; it may simply mean that certain parts of the population are unable to gain access to water for one reason or another, be it due to an excessively high price for water, to lack of infrastructure, or to social exclusion (Mehta, 2014). For example, water scarcity is most commonly assessed by the use of a national metric, such as aggregate water availability in a region, or average water consumption per capita, but this tells us little about the distribution of water within the society as a whole (Mehta, 2014). Hence, while water may not be scarce in aggregate terms, water 'poverty' may prevail in certain regions due to a variety of social, economic and political factors. Sen outlines the manner in which such forces may play out to construct localized scarcities, in terms of people's inability to gain access to a given resource. Ben Fine (Fine, 2010) and other commentators question whether the macro, social and the cultural have been appropriately addressed in Sen's work and whether the social and contextual specificities of resources such as food, water and so on can be captured in an individualist and formalist methodology which may not take into account the role of cultures, ideologies and practices, each with their own construction of scarcity.

This chapter has provided an overview of key trends in the literature on resources scarcity. By no means exhaustive, it helps us to create a typology of three basic positions through which we analyse current discussions by resource type regarding natural resource scarcity to which we now turn.

Overview of the three dominant positions on natural resources and scarcity

In this section, we present three positions that reflect dominant contemporary perspectives on scarcity and natural resources. These are: (1) the systems, boundaries and thresholds position, (2) the technological, managerial and market fix position and (3) the structural-distributional position.[6] We describe each of these and situate them within their intellectual genealogies, and discussion their implications for development futures. This includes a necessary discussion of key trade offs of each position regarding economic growth, environmental sustainability and equity considerations. Throughout the section, we illustrate the three positions using examples from major publications, reports, policy initiatives and social movements.

Systems, limits, boundaries and thresholds

The foundational premise of this position is that the Earth is a complex ecological system that involves relationships between biophysical and social elements and processes, and that human activities have

[6] These three positions reflect important historical debates and different meanings around scarcity and, to varying degrees, the four distinct paradigms, or sets of perceptions, around natural resource availability documented by the World Economic Forum in 2014, namely: (1) threats of material exhaustion (i.e. physical limits); (2) concern about rising costs; (3) long-term abundance and (4) social injustice focused on distributional challenges (World Economic Forum, 2014).

cumulatively brought about profound changes to the Earth's biophysical characteristics and ecological processes to the extent that the capacities of the planet to support human life and social / economic development is threatened resulting in global financial instability and growing economic inequalities. See for example, Steffen and colleagues' (2011) call for planetary stewardship:

> *The challenges of the twenty-first century—resource constraints, financial instability, inequalities within and between countries, environmental degradation—are a clear signal that 'business-as-usual' cannot continue. We are passing into a new phase of human experience and entering a new world that will be qualitatively and quantitatively different from the one we have known* (Steffen, Persson, et al., 2011):756.

The origins of this position can be directly traced to the 1970s and debates originating in the environmental movement around the relative contributions of population, technology and growing affluence to negative environmental impacts, and ultimately crisis (Chertow, 2000; Saunders, 2014). This position in many ways can be viewed as the early twenty-first century legacy of *The Limits to* Growth and similar work modelling economic-ecological systems and their limitations and thresholds. This position is closely aligned with the transdisciplinary field of ecological economics and, in broad terms, shares with it a deep concern with systems dynamics across timescales, the environmental consequences of increasing consumption, an absolute conception environmental scarcity and a 'strong sustainability' orientation (Røpke, 2005, 2009). This position is also reflected to varying degrees in work in a number of other interdisciplinary areas use systems-focused approaches to understand human-environment / society-nature relations and engage with the challenges of sustainable development and global environmental and climate change. Such areas include, for example, human ecology, environmental studies, sustainability science and Earth system science (ESS) (Rasmussen & Arler, 2010).

Exemplars of the 'Systems, limits, boundaries and thresholds' position that have recently risen to prominence include, for example, the concept of the anthropocene and the Planetary Boundaries approach. The controversial concept of the anthropocene, a term originally coined by Paul Crutzen [see:(Crutzen, 2002, 2006)] over a decade ago, is often associated with the interdisciplinary field of Earth System Science (ESS). The anthropocene concept views the Earth as an evolving 'planetary' system that has entered a geologic time interval in which human activities rival global geophysical processes in terms of influencing changing global conditions (Rockström, Steffen, Noone, Persson, Chapin III, et al., 2009; Steffen, Grinevald, Crutzen, & McNeill, 2011; Steffen, Persson, et al., 2011). While the geological epoch in which humanity arose, the Holocene, was overall a period of great climatic stability, that stability is no longer the norm, primarily due to human activities that have altered a number of fundamental ecosystemic functions. These include, for example, altering global carbon, nitrogen, phosphorous and sulfur cycles cycles, and significantly modifying terrestrial water cycles for human use (Steffen, Grinevald, et al., 2011).

The anthropocene concept is fundamentally about limits, and in fact Steffen, Grinevald and colleagues list antecedents to the concept, including the rising awareness of the global environment in the 1970s, NASA's *Earthrise* photography and *The Limits to Growth* (843). However, rather than a primary focus on finite quantities of specific renewable and non-renewable resources per se, the concept shifts concern over absolute limits to the cumulative effects of human activities, specifically industrial activities, on systemic thresholds to maintaining global stability at the planetary level.

The planetary boundaries (PB) approach complements and builds upon the anthropocene concept and its conception of systemic thresholds as 'non-linear transitions in the functioning of coupled human-environmental systems' that, through degradation to particular ecological functions, cause functional collapses that trigger feedback loops affecting other processes and thresholds (Rockström, Steffen, Noone, Persson, Chapin III, et al., 2009, p. np). Embracing the anthropocene metaphor, Rockström and colleagues (2009) state that the exponential growth and impact of human activities (as articulated in the anthropocene literature) raises concerns that further pressure on the Earth System could destabilize critical biophysical systems and trigger abrupt or irreversible environmental changes that would be deleterious or even catastrophic for human well being (Rockström, Steffen, Noone, Persson, Chapin III, et al., 2009). PB disaggregates and conceptualizes these proposed changes in terms of nine 'planetary boundaries' (some of which remain un-quantified) related to key Earth system processes (table 4.1) that represent a 'safe operating space' for humanity. These nine system processes / boundaries, some of which have already been breached according to the framework, include climate change; ocean acidification; stratospheric ozone depletion; atmospheric aerosol loading; biogeochemical flows that interfere with nitrogen and phosphorous cycles; freshwater; land systems change; biodiversity loss and chemical pollution (Rockström, Steffen, Noone, Persson, Chapin III, et al., 2009):np. However, as Galaz and colleagues (2012) argue, '[p]lanetary boundaries' are not fixed nor certain, but represent model-derived estimates 'of how close to an uncertainty zone around a potential threshold' (Galaz et al., 2012):1. In this perspective, we see not only the cumulative effects of human activities on particular thresholds, but a concept of scarcity implicitly applied to the resource uses and patterns of consumption that comprise the ecological 'safe operating space' for the human species' supporting crucial systems and processes.

Variations of the 'Systems, limits, boundaries and thresholds' position is also taken in a number of key reports that seek to address national and international political dimensions of natural resource use and widely perceived increasing scarcities in key resources. For example, the Chatham House (2012) report, *Resource Futures*, describes natural resources as systemically interconnected on local and global levels through markets, trade, and environmental processes, and therefore vulnerable to unintended consequences of regulatory choices and the deployment of new technologies. The report contends that the world has entered a period of intensified resource pressure as a result of growth in global consumption led by emerging economies, 'with the potential for high and volatile prices becoming the norm, accelerated environmental degradation, greater risks of supply shortages and disruptions, as well as intensified political tensions over control and access to resources' (Chatham House, 2012):6. In addition, the report warns that the 'knock-on effects of unmitigated climate change and environmental degradation may cause social instability, generate mass movements of human population and ultimately trigger political instability and conflicts over access to water and other increasingly scarce resources' (7).

It is important to note that, while proponents of the anthropocene and planetary boundaries viewpoints have often positioned themselves as carrying out objective science, their concepts and frameworks contain similar crisis messages, moral warnings and political urgencies to the older limits debates of the 1970s, and among the most recent publications are calls for specific policy action (Saunders, 2014):824. From this perspective, 'developmental activities' are primarily responsible for destabilizing critical biophysical systems and triggering environmental changes that are hazardous to humanity (Rockström, Steffen, Noone, Persson, Chapin III, et al., 2009). According to Steffen and colleagues, '[t]he pathways of development followed by today's wealthy countries after the Second World War – built on plentiful, cheap fossil fuel energy resources, an abundance of other material resources, and large expanses of productive land to be developed – cannot be followed by the 75–80% of the human population who are now at various stages of their trajectories out of poverty, and are beginning to compete with today's wealthy countries for increasingly scarce resources' (Steffen, Persson, et al., 2011, p. 739) leading to a 'global sustainability crisis' (Steffen, Persson, et al., 2011, p. 740).

While the science is still developing, the concept of planetary boundaries has become influential within policy debates[7] – but also critiqued. Some actors, including some developing country governments interpret it as anti-growth and development. Others suggest that planetary boundaries thinking privileges universal global environmental concerns over diverse local ones, justifying top-down interventions that protect the environment at the expense of people and their livelihoods. The renewed narratives of impending scarcity and catastrophe implied by some interpretations of planetary boundaries arguments risk a return to draconian policies and unjust responses that limit people's rights and freedoms (e.g. population control and control over women's bodies and fertilities). That steering development within planetary boundaries should not compromise inclusive development that respects human rights has been proposed by Raworth (2012) whose 'doughnut' concept takes the circle of planetary boundaries and adds an inner 'social foundation' (Raworth, 2012). Raworth notably introduces gender equality as one dimension of this social foundation, but otherwise discussion and advocacy arising from the planetary boundaries concept has largely been gender-blind.

The technological and institutional management fix

The 'Technological and institutional management fix' position is more optimistic and argues that investment in technological, market-based and managerial solutions will allow global society to mitigate, and also adapt to, resource crises, across sectors of society and scales from local to global, without compromising goals of environmental sustainability and inclusive economic growth into the future. This position is reflected in contemporary ideas about sustainability and sustainable development that dominate international political discussions, which are fundamentally about managing scarcity over time, in both an ecological and an economic sense.

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If growth is assumed to be the means to progress and development, then scarcity of resources that enable this growth is seen as an obstacle and solutions need to be sought. These solutions usually lie in deploying innovation, science and technology. But usually technology is evoked as a means to assure long-run resource abundance (Norgaard, 1994).

For the 'technological optimists' scarcity is a 'normal' reaction arising due to flawed policies and poor research and development. The focus on abundance highlights human technological inventiveness in

[7] See for example, the Planetary Boundaries Initiative which advocates for policy action around the planetary boundaries concept, partially funded by WWF-UK (http://planetaryboundariesinitiative.org)

time of need ('necessity is the mother of invention') and projects that into the future, too. Technological optimist policies include the search for the new 'blue revolution' and more irrigation systems for Africa, the biotech revolution, expansion into space and so on.

Literature taking a 'technological and institutional management fix' approach is heavily influenced by work in the fields of development economics and environmental economics and, to a lesser extent, ecological economics. It generally demonstrates faith in markets, donor- and state-leg governance and resource management solutions to problems of environmental degradation to rectify global as well as localised environmental problems, notions of 'weak sustainability' and substitutability and furthermore often juxtaposes Malthusian and neo-Malthusian reasoning about causation of resource scarcity with ideas about the relative scarcity and substitutability of natural resources. Much of this genre uses the language of ecological limits (particularly in the framing of narratives of crisis), natural capital, the global commons and global goods, ecosystem services, all of which originated in or possess particular salience in ecological economics (Richardson, 2013). Key contemporary examples of the influence of this position include the UN-led 'Green Economy' approach, Nexus thinking, and more focused approaches like the one taken in the 2015 WWF report on *African Ecological Futures,* all of which are discussed in more detail below.

The Green Economy and Sustainable Development

In recent years, widespread uncertainty around global economic and environmental futures has contributed to growing advocacy for a global 'greening' of the economy involving the coordinated establishment of pro-environment economic policies and programmes around the world (Edward B. Barbier, 2010; UNDESA, 2009). This has resulted in the emergence of 'green' growth policy approaches that are meant to implement environmental pricing techniques in order to correct assumed market failures around environmental goods and services, to regulate the environmental impacts of industrial and consumer technology, to promote investments in low carbon and low environmental impact production processes and infrastructure and, overall, to build capacity for the mitigation of the environmentally harmful effects of growth while building adaptive capacity for climate change challenges (Dercon, 2011):9.

According to UNEP, which launched its Green Economy Initiative in 2008, a green economy is one that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities; it is low carbon, resource efficient and socially inclusive (UNEP, 2013). The trajectory of the green economy is oriented around preserving and rebuilding 'natural capital as an economic asset and a source of public benefits', especially for the poorest (UNEP, 2011). According to the UNEP (2011), the purposes of green economic development schemes include promotion of investment-driven economic growth, reduction or offset of carbon emissions and pollution, enhancement of energy and resource efficiency, preservation of biodiversity, and enhancement of ecosystem services (16). UNEP (2011) explains that, '[t]his development path should maintain, enhance and, where necessary, rebuild natural capital as a critical economic asset and source of public benefits, especially for poor people whose livelihoods and security depend strongly on nature' (16).

This general definition integrates social, ecological and economic concerns in ways akin to sustainable development. Yet in practice, there are many versions of green economy thinking. Dominant ones assume continued, even enhanced, market-led economic growth, through green business investments and innovations that enhance energy and resource efficiency, and prevent the loss of ecosystem services. It is argued that the emerging green technology economy will be worth $4.2 trillion annually by 2020.[8] Other strands emphasise market-based approached to environmental protection through financial valuation of 'natural capital' (e.g. Natural Capital Committee 2013), payments for ecosystem services, and schemes for trading carbon and biodiversity credits and offsets.

A number of UN-affiliated international and regional intergovernmental organisations and development banks have developed their own complementary green growth strategies and frameworks that link up with the UN approach through a number of collaborations, agreements, mechanisms and partnerships (African Development Bank, 2014; Fay, 2012; UNDESA, 2013).

The foundations of the vision of the green economy advanced by the UN and allied environmental and development agencies today, like the 'Technological and institutional management fix' position more broadly, are based strongly in conventional development economics, environmental economics and, to a weaker extent, in ecological economics. The dominant framing considers 'economy', 'environment' and 'society' as conceptually discrete and distinguishable domains, with nature and natural processes framed as neglected dimensions of an 'immanent market-world' (McAfee, 2014a):239. The underlying logic is that economic growth and environmental preservation are compatible policy objectives, but only when environmental assets and functions are priced correctly. When they are not, environmental degradation, and accompanying scarcity, results from market failures and accounting omissions (Death, 2014; D. W. Pearce et al., 1989; Ring, Hansjürgens, Elmqvist, Wittmer, & Sukhdev, 2010).

Others argue that environmental constraints require a rethink of growth and market strategies. UNEP's 'decoupling' (Fischer-Kowalski & Swilling, 2011) suggests that economic growth should be de-linked from the increasing consumption of material resources such as construction minerals, fossil fuels, and biomass. Jackson (2011) argues for a shift in focus towards prosperity and wellbeing with reduced or no growth, in which investments in services and care, as well as in 'green' action in the areas of sustainable food production and marketing and clean energy, are key.

The broad appeals green economy and green growth approaches to development lie in a bundle of policy promises – to mitigate the effects of global climate change, to preserve crucial ecosystem functions, and to capture what are termed 'triple-win' opportunities for achieving socially inclusive environmental sustainability, economic growth, and poverty alleviation through policy reform and coordinated action (UNDP, 2012). The triple win of the green economy also encompasses promises of scale from global to local.

Yet, despite being presented as a sustainable development panacea, much of the literature around 'green growth' and 'green development' is lacking in terms of specific implications for poor settings (Dercon, 2011). While it is widely acknowledged that 'environmental damage is not equity-neutral' (Dercon, 2011, p. 7), these policies remain controversial due to a number of unresolved questions around equity outcomes, and the environmental, economic, and social projections of their proponents are widely contested. On a basic level, policymaking for green development often occurs without guidance on means of assessing unanticipated conflicts, trade-offs, and synergies that arise as programmes and

[8] (http://nupge.ca/content/%5Bnid%5D/economy-or-environment-its-false-choice).

projects are implemented, and evidence-based studies that objectively document triple win outcomes are rare (Baker, Milner-Gulland, & Leader-Williams, 2012; Suckall, Stringer, & Tompkins, 2014; Tompkins et al., 2013).

In fact, green growth schemes may be particularly risky in terms of potential negative consequences for poor people, which might outweigh any direct or indirect benefits resulting from aggregate economic growth. This is due to the distribution of risks associated in particular with environmental pricing and regulation, which may have considerable negative consequences for the poor as consumers and as producers. According to Dercon (2011), 'specific social protection measures would be required to compensate for the rising price of basic goods and land. In terms of regulation, there is a risk of potential capture by the rich, excluding the poor from the benefits of regulation or even make them worse off, for example by displacing pollution' (16).

Underplayed are also questions of power and of social values, distribution and justice – including gender – both in how problems of sustainability emerge and how they, and responses to them, are experienced. It has also been argued that green economy type of thinking has paid little attention to their differentiated implications for women and men (Guerrero & Stock, 2012). Feminist analysis and activists have provided cogent critiques of these approaches. Schalatek (2013), Wichterich (2012) and Unmüßig and colleagues (2012) see the green economy as a market-based approach that justifies the commodification and enclosure of resources and commons, undermining livelihoods, justifying land and green grabs (Borras, Hall, Scoones, White, & Wolford, 2011; Fairhead, Leach, & Scoones, 2012) and dispossessing local people – especially women food producers(Schalatek & Burns, 2013; Unmüßig, 2012; Wichterich, 2012). Feminists variously call instead for 'green development' that respects commons and livelihoods (Agarwal, 2010); for recognition and value of care and social reproduction in green economy debates (Mellor, 2006; Vaughan, 2007) for replacing efficiency with sufficiency (Salleh, 2009, 2012), and for a focus on commons and communing and 'enough' and more fundamental 'green transformations' that restructure production, consumption and political-economic relations along truly sustainable pathways (Wichterich, 2012). The Women's Major Group at Rio plus 20 argued for social equity, gender equality and environmental justice to be placed at the heart of a 'sustainable and equitable' (as opposed to green) economy, grounded in ethical values such as respect for nature, solidarity, caring and sharing (see also UNDP 2013 and *www.womenrio20.org*). These arguments link with growing narratives and action around alternative economies and solidarity economies (Unmüßig, 2012) from around the world. In sum, these critiques are calling for a redistribution of labour and value creation that goes beyond the market, efficiency and remuneration (Wichterich, 2012) and for a new conception of what constitutes 'the good'. In different ways, these strands are all calling for new transformatory politics that will lead to different pathways across different scales, contrasting with those being advocated in mainstream versions of the green economy.

The resource nexus

The World Economic Forum's food-water-energy 'nexus' is a relatively new conceptual policy framework that is meant to facilitate the design of business and government strategies that build systemic resilience by accounting for the complex interconnections and feedback processes between energy, water and food systems (SABMiller and WWF, 2014). The nexus idea emerged from the WEF at a time of various overlapping resource 'crises' in the sectors of food, energy and global finance in the late 2000s, including fears linked to the food and energy price shock of 2007-2008 (Allouche, 2011).

Nexus is a "new kid on the block" so to speak in the development policy discourse. While international and national agencies and academics are currently in a stage of adjustment, the concept has gained salience and has made great gains as a new lexicon for sustainable development. This is evidenced in a proliferation of high-level workshops, seminars and conferences around the concept. The 2011 Bonn Conference, the Sixth World Water Forum in Marseilles in 2012, the Rio +20 negotiations in the same year, and the 2014 Stockholm Water Week, all had the nexus as a key topic. New policies and perspective papers from the World Economic Forum (WEF), the European Commissions' Report on Development for 2011/12, the Global Water Partnership, and the World Bank amongst others are indicators of that growing interest in the nexus. Despite the buzz in global policy circles, however, the nexus and the debates around it have permeated relatively less to the level of national governments of the South, as the bureaucratic capacity for nexus mainstreaming remains weak. At the grassroots level, its practice has existed for centuries but has not been connected to the conceptual and policy debates yet.

The nexus concept has been articulated by the key actors as one that is fundamentally about natural resource scarcity, with a tendency towards a managerial security framing that highlights the framework's technical dimensions. This discourse is often carried out against a general background narrative of the failure to manage development of resources effectively or equitably, and to anticipate the painful surprises that ensue every so often from unexpected quarters. Along these lines, the food and energy crises have fuelled a growing perception of scarcity that has inevitably been reinforced by climate change and environmental degradation narratives, including the rise of anthropocene and planetary boundaries thinking, climate related political uncertainties (e.g. Hartmann, 2014), and the rise of new crisis narratives specifically focused around the relationship between food, energy, water and the climate. For example, mentions of the nexus are often accompanied by metaphors such as the 'perfect storm' to quote John Beddington, the Chief Scientific Adviser to the British Government in 2009.

The language that has emerged since the WEF's 'discovery' of the nexus in 2008 is significant in that it is the first time a wide and powerful business community came to acknowledge limits to growth, although the limits acknowledged are not necessarily absolute. The WEF sees water security as central, arguing that it is a key natural limit to economic growth, and suggesting for example that water is 'the single constraint to expanding cities' (World Economic Forum, 2011b: xxi). This growing momentum has led to a proliferation of special bodies within the WEF to deal with water issues, including the creation of a Global Compact CEO Water Mandate and the Water Security Global Agenda Council.

The WEF's formulation of the nexus has primarily been driven by international private actors, who see the nexus – and subsequently also the concept of Green Economy – both as opportunity and a constraint to business. Rather than a discrete focus on absolute physical limits to resources, as in the Green Economy context, the WEF emphasizes market failures as a cause and market mechanisms as a solution to resource scarcity. Indeed, one of several explanations that the WEF gives for claims of a growing water scarcity and its risk to economic growth is the under-pricing of water as a resource. Unless the pessimism of *Limits* discourses, the main thrust is that market innovation and substitution could rectify issues of resource scarcity while sustaining growth (see Nordhaus et al, 1992; Robbins et al 2010: 11-45).

Nexus language has sought to frame debates around acute pressures on the world's natural resources as generated through a combination of factors, including climate change, global demographic trends of burgeoning population size and increased consumption levels. From a public policy perspective, these crises have revealed the limits of existing institutional approaches that have hitherto sought to manage these resources by compartmentalizing them into individual silos and relying on mainly market-based economic policy tools to address them. In nexus thinking, sustainable solutions to interrelated resource challenges depend on market-based, technical and managerial solutions that cross sectors and scales. In addition, like climate change, the nexus has also been undergoing securitisation, with the US National Intelligence Council highlighting in its 2030 Global Trends report the important geopolitical consequences – for conflict, national security and global economy – if the nexus is not properly managed. Through discourses of complexity, scarcity and securitization nexus is portrayed as a matter of shared economic, environmental, demographic and international security emergency, and an urgent matter of survival for all humanity.

The **African Ecological Futures** ***report (2015)***

A popular approach that is emerging from the policy dynamics around nexus and similar thinking relates to the development of assessments and toolkits to assess and prioritise different policy options based on their appropriateness to particular dynamic contexts. One very recent example of such an approach is represented in the WWF's (2015) *African Ecological Futures* report, which seeks to understand possible future scenarios for Africa's environmental and economic development.

The report focuses on spatial patterns concerning resource endowments, agricultural expansion, ecosystem characteristics, extractive sector development, infrastructure development and population growth to forecast scenarios in which particular managerial and technical activities are then recommended to balance 'trade-offs' between the need for economic growth and the need to sustain ecosystems in particular contexts.

The justification for the approach and the report is framed around a goal of applicability across countries with different development trajectories and social and economic goals. There is a narrative of multidimensional growth that results in increasing scarcity both in terms of localized resource depletion and ecological vulnerability affecting ecosystem services that are valuable both locally and are considered global public goods. These scarcities end up affecting African nations and locales and even global economic and ecological futures cumulatively. This is due to a confluence of drivers affecting African ecosystems and sustainability, which include growth in population, urbanisation, production, consumption, international investment and global resource demand. As summarised in the following passage:

> *If Africa continues to pursue its current production and consumption models, then compelling evidence suggests that its ecological systems will be undermined and the quality of growth on the continent may be limited. There is growing concern that 'ecological frontiers' (hot spots) will emerge across the continent where expanding industrial, extractive and economic activity intersect with sensitive ecosystems. These hot spots will likely suffer from the cumulative impact of degraded natural resources and intensifying conflict over remaining stocks. These impacts could have disproportionate consequences for these often fragile ecosystems, as well as for the communities and activities that depend upon their sustained functioning. (18)*

The report explores four primary scenarios – named 'Going global', 'All in together', 'Good neighbors' and 'Helping hands' –in which environmental degradation, non-renewable resource exhaustion, different levels of government regulatory capability, and different local development processes can be managed through particular combinations of response options while fostering growth in different African settings. For example, the 'All in together scenario' describes a decentralized, community-led approach facilitated with international donor support as applicable in an areas with weak central government capacity, rich agricultural resources and rainfall and rich ecosystems, but few extractable mineral resources.

While the situations and drivers underlying the four scenarios described in *African Ecological Futures* are quite different, all of the scenarios identify similar technical and managerial responses to avoid unsustainable outcomes, increasing scarcities and promote economic growth. Options in different settings include developing strategic planning capabilities regarding use of ecological resources; investing in 'safeguards' for investors and frameworks that limit and 'change the nature of investment in ecologically damaging projects'; developing new public-private-community partnership models that promote sustainable management of ecologically sensitive areas and reconfigure relationships between states, businesses, and civil society; and articulating clear institutional mandates that support coherent and comprehensive management of natural resources.

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In nexus and in the 'technological and market innovation as a fix' thinking, technological choices that are exercised are often considered to exist outside of politics. But in reality, these are deeply political – and contestations around technological, institutional or market solutions are sites of politics and cannot be seen as neutral arbiters to resolve decisions around how best to deal with and manage resource scarcity.

The nexus perspective has ushered in a new brand of 'resource realism' (Wales & Winston, 2012). Large transnational corporations such as Coca Cola, Nestle and SABMiller are putting forward the private sector's technical-managerial 'comprehensive value-chain viewpoint' to tackle nexus governance. While nexus debates are attracting a lot of attention in research and policy circles, local viewpoints and perspectives are often missing. At the local level, there has always been a nexus between issues such as water, food, energy, land, etc. The problems have existed more at higher levels of policy making. It is unclear how the nexus will be operationalized and realised at different scales and lessons should be learnt from other and earlier initiatives such as Integrated Water Resources Management (IWRM), which sought to create such nexus thinking within the water sector but have remained rather abstract and difficult to implement (Mehta et al., 2014). Finally, while the nexus seeks to manage trade offs, it is unclear who will bear the costs of these trade offs and how the rights and interests of the most vulnerable will be protected in the process.

Often technology and market fixes are be both the 'problem' and the 'solution' – for example, interventions such as large dams are made out to be the 'solution' for scarcity in water-starved areas but they are also 'problems' around which prominent social movements have emerged. There are also challenges for institutional and bureaucratic organization given their ambitious scope as well as a site to debate how best to manage water in western India. Similarly, privatization models or large scale FDI investments in water and land are purported to be the 'solution' to efficiently manage scarcity – but their impacts on human wellbeing and people's basic rights can often be problematic, especially in the world's poorest countries. These issues are taken up directly in the structural inequality/distributional position to which we now turn.

The structural inequality/ distributional position

This position argues that environmental degradation and resource scarcity are not, in fact, 'natural' but result from inequitable institutional arrangements governing distribution that result in gross inequalities in access to resources (Dasgupta, 1997; UNDP, 2006a; Watkins, 2006). This position advances a socio-political perspective of scarcity drawing on a variety of disciplinary approaches including political ecology, political economy, discourse analysis and human development approaches. It raises questions about how scarcity is perceived and experienced at different scales (from the household, to community, nation, globe) and the extent to which the definition is context-bound and determined by relations of power and production (see Yappa 1996). It also focuses on how access to and control over resources are contested in a wide range of areas: the household, community, state and world and how these result in competing claims and conflicts over resources (Peet & Watts, 1996).

The historian Ross distinguishes between socially generated scarcity (insufficient necessities for some people and not others) versus absolute scarcity (insufficient resources, no matter how equitably distributed). For him, neo-liberalism has encouraged a pro-scarcity climate distinguished, economically, by deep concessions and cutbacks, and politically, by the rollback of 'excessive' rights. He argues that the two kinds of scarcity have been conflated either intentionally in order to reinforce austerity measures against the poor or inadvertently due to ignorance about how natural resources are produced and distributed (A. Ross, 1996).

Mehta (2005) distinguishes between 'lived/ experienced' scarcity (something that local people experience cyclically due the biophysical shortage of food, water, fodder etc.) and 'constructed' scarcity (something that is manufactured through sociopolitical processes to suit the interests of powerful players). Her focus was water scarcity in western India and the role of the dam-building lobby and rich irrigators and agro-industrialists in promoting large dams over more decentralised approaches to deal with water scarcity in the drylands. A similar approach to water is provided by the 2006 Human Development Report entitled 'Beyond Scarcity: Power, Poverty and the Global Water Crisis' (see UNDP, 2006) which has explicitly focussed on the role of power relations and unequal access in determining water scarcity.

The human development approach to scarcity breaks down macro and aggregate understandings of scarcity. It would argue that scarcity regarding access to basic resources is unacceptable in the twenty first century. This is particularly so because scarcity is not 'natural' but generated through socio-political processes, through exclusion, biases and discrimination (see also UNDP, 2006 and Mehta, 2005). For example, in India, so called lower caste women are still denied access to certain wells. In apartheid South Africa, the inequalities based on discriminatory policies were huge. Consequently around eighty per cent of the poor in rural areas had no access to water or sanitation in 1994 at the birth of the new South Africa (see Movik, 2012). A human development approach draws on Amartya Sen's entitlements analysis already discussed in this paper. In sum, approaches such as political ecology, political economy and entitlements analysis look at questions of power and of social values, distribution and justice in how problems of scarcity emerge and how they, and responses to them, are experienced.

Finally, a human rights approach to resource scarcity would seek to integrate the norms, standards and principles of the international human rights system into the plans, policies and developmental process related to resource security at the international, national and sub-national levels. The norms and principles include accountability, transparency, empowerment, participation, non-discrimination (equality and equity), and attention to vulnerable groups (UNHRC, 2008). Human rights approaches can assist in building social consensus and in mobilizing commitments to facilitate a more fair use of resources and to empower poor people. Policies and programmes that are designed from a human rights point of view are more likely to be equitable, sustainable and have the potential to eliminate extreme poverty. Clearly there are indisputable causal links between the violation of human rights, and the economic, social, cultural and political deprivations that characterise poverty. It follows, therefore, that the realisation of all human rights and efforts to eliminate extreme poverty are mutually reinforcing, and human rights norms and principles can guide efforts to reduce, and ultimately eradicate, poverty (Sepulveda, Nyst, & Hautala, 2012).

All human rights impose three types of obligations on governments: namely to respect, protect and fulfil human rights in a non-discriminatory, participatory and accountable manner. When related to the case of access to water, this would mean that states must refrain from interfering with or curtailing the enjoyment of existing rights of access to water, must protect individuals and groups against human rights abuses in relation to their access to water and must take action to enable people to get access to water for basic human needs (see also de Albuquerque, 2012). As with other economic and social rights, these rights are to be 'progressively realised' by states that are enjoined to take targeted steps to realise their human rights commitments despite political, economic and other constraints. There is also an emphasis on "substantive" rather than formal equality: that is all people, regardless of their race, class, gender, or other differences should be allowed to enjoy their fundamental human rights, and this may require positive discrimination to favour the most vulnerable.

Finally, due to growing international investments in resources, there is a need to protect the rights of vulnerable and marginalised groups. While there have been several initiatives to protect the interests of foreign investors in international trade agreements, there is no concomitant protection for communities affected by these investments; Their rights are assumed to be protected by their national governments, which is not always sufficient. Even national states have found it hard to protect public policies in the courts set up to arbitrate for investors. Defining the extra-territorial obligations of the investors as well as the government in the host country is essential to ensure that vulnerable people's basic rights are protected. It is also important to consider the human rights obligations of states towards persons outside their territories, including state obligations to protect people from the extra-territorial activities of private sector actors based in their country.

Extraterritorial obligations require states parties to the relevant agreements to respect the human rights of people in other countries. With regard to the obligation to protect, states must prevent third parties, for example, a company based in one state and functioning in another, from violating basic human rights in other countries (UN Special Rapporteur, 2014). The latest development in this area, spelling out these obligations in detail, are the 'Maastricht Principles on Extraterritorial Obligations of States in the area of Economic, Social and Cultural Rights', adopted by a group of experts in international law and human rights in 2011 (Maastricht Principles [ETOs], 2011). Several of the Maastricht principles are especially relevant in the context of basic rights: '…states have the obligation to protect individuals ESCRs by regulating non-state actors (Principles 23-27). States are obliged to regulate and/or influence the business sector in order to protect those affected by them outside their territory'.

In the context of human rights violations associated with IFI investments, state parties have asserted in their submissions that 'the right to life not only emanates from specific international human rights treaties but that it now constitutes a general principle of international law. On account of this, the rights bind the entire international community and not just States Parties to human rights treaties' (Gibney and Vandenhole, 2013):X. This implies that extra-territorial obligations can be assessed not only in the context of agriculture-related investments but also other investments, through development cooperation or international trade when these impact the rights (right to food, right to water, and right to life) of local communities. The land acquisitions on the part of foreign investors around the world are a good case in point. In some cases, there are severe violations to rights to food, livelihoods, water etc. (Borras et al., 2011; Franco, Mehta, & Veldwisch, 2013).

IV. A dialog on natural resources, scarcity and development (including break-down by resource type, as applicable)

In this section, we 'create a dialog' among the three contemporary perspectives on natural resources and scarcity discussed in the previous section around two resource types: land and water. In doing so, we hope to make clearer sense of the contested 'facts' of natural resource use and projections for natural resource scarcity in the future, and highlight different pathways and implications around scarcity and sustainability as well as the different limits and relational dynamics are at play.

It is important to note that across major models used to project future demands for water, energy, food and minerals, etc. there is a high level of uncertainty. For example, the level of uncertainty for the 2035 scenarios is very large indeed, as the differences among the projections for energy demand vary significantly, from a massive, nearly seventy per cent increase to a small ten per cent decrease. Water availability is a compounding factor in models for energy and extractives; overall, 38 per cent of viable shale gas deposits worldwide are in areas where water supplies are a potential problem. Of those with the biggest shale reserves, forty per cent have severely limited freshwater supplies (World Economic Forum, 2014).

Land and food: perspectives on land scarcity and resource challenges

Aside from its value as a natural resource, any given area of land is generally used to satisfy many material and cultural purposes, and land can simultaneously connote areas of ground, earth, soil, forest, pasture, patrimony, place of ancestors, or any number of particular designations exclusive of that of 'natural resource' (Li, 2012). Even in its status as a productive natural resource, conflicts and 'resource grabs' can emerge around competing ideas and priorities for what is often viewed as a resource in increasingly short supply – is an expanse of land best used for subsistence production, food crops for domestic markets, biofuel production for export or to house a standing carbon forest? Furthermore, although it comes out most strongly in literature around 'the nexus', land has important linkages to a number of important activities and other resources, including food and timber production (which grow from the land), water (which flows through and soaks into the land), and minerals and fossil energy resources (which lie 'inside' or 'beneath' the land). It has also become commonplace for analysts to acknowledge relationships and linkages among types of natural resources that cross scales as well; land is increasingly linked to other resource systems at a local level through markets, trade, and global environmental changes, and increasingly at a global level through international trade and finance (Chatham House, 2012).

In the scarcity debates of the 1970s around *The Limits to Growth*, 'land' specifically meant land that could be used for food production and was the natural resource most prominently associated with limits to population growth, highest in poor countries, due to limits to productive capacity, as well as degradation as a result of pollution from industrial growth, highest in wealthy countries (Meadows et al., 1972)[9]. This distinction between land as a resource that is finite in amount as well as prone to degradation in quality and productivity continues to be relevant in debates around land scarcity and land management. In the early 21st century, the greatest pressures on land as a natural resource come from competing uses, primarily including needs for agriculture (food and feed production), fibre production and oilseed-based biofuel production as well as various processes of conversion in which previously undeveloped land becomes 'built-up' in the process of urbanisation and industrialisation, or land is set aside for reforestation or conservation activities (UNEP, 2014).
Each of the three contemporary positions introduced in Section IV maintains different interpretation and focus around land use trends, and differs on implications and recommended actions going forward.

Systems, boundaries and thresholds and land and food scarcities
Three overlapping issues related to scarcity characterise a broad *Systems, boundaries and thresholds* position relative to land and its productive capacity: the finite nature of land as a resource, land-use change, and land degradation. In this frame, even considering technological improvements that can be made to land to increase yields, land for food production is considered finite, and under a number of competing pressures see:(Chatham House, 2012; Meadows et al., 1972; UNEP, 2014). Intersecting processes of population growth, industrial growth, urbanization and growth in global consumption are a concern as thy simultaneously decrease land dedicated to food production even as they drive rises in food needs (Chatham House, 2012; Meadows et al., 1972; Meadows et al., 2004; UNEP, 2014).

Of the thirteen billion hectares (bha) of land on the planet, the global agricultural area[10] in 2012

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[9] In 1972, the authors of *The Limits to Growth* predicted that growth in population would result in growth in demand for food to the point at which demand far outstripped supply. In this scenario, the cost of food would increase due to the increased cost of rendering land more productive through technological inputs, while the land available per capita would decline due to population increase and soil degradation. In *Limits* and its two follow-ups (Meadows et al., 1992; Meadows, Randers, & Meadows, 2004), the authors estimate that productive agricultural land is limited to a range of between 2-4 billion hectares globally. In 1972, approximately half of that land was stated to be already under cultivation, which was assumed to be the richest and most accessible half, whereas the other half would require immense and prohibitively expensive capital inputs to produce food for a growing population. The authors acknowledged the potential of technological advancements to improve crop yields and reduce the average per capita requirement of arable land from 0.4 to 0.28 hectares between 1972 and 1992, yet the World3 computer model projected that, even with increasing land production (doubling and quadrupling of agricultural yields), the limits to growth would only be delayed by few decades before systemic collapse, assuming the population growth rate remains constant and is not brought to below replacement level. Ultimately, in this scenario, food prices would rise and diets would shift to lower quality before widespread malnutrition and starvation result in population collapse.
[10] In this report, we conform to FAO definitions regarding land use for food production. The FAO Statistics division (2015) defines 'agricultural area' as 'the sum of areas under: (a) arable land - land under temporary agricultural crops (multiple-cropped areas are counted only once), temporary meadows for mowing or pasture, land under market and kitchen gardens and land temporarily fallow for less than five years; (b) permanent crops - land cultivated with long-term crops which do not have to be replanted for several years (such as cocoa and coffee); land under trees and shrubs producing flowers, such as roses and jasmine; and nurseries (except those for forest trees, which should be classified under "forest"); and (c) permanent

comprised just over 4.9 bha, while cropland (arable land plus that used to produce permanent crops) took up about 1.5 bha, or eleven per cent of that and permanent meadows and pastures comprised about 3.35 bha (figure 5.1) (FAOSTAT, 2015b). Table 5.1 describes changes in total agricultural area, croplands, and permanent meadow and pasture area since 1962 based on FAO sources.
According to the UNEP (2014), between 1961 and 2008 overall land used for crop production (arable and permanent) increased by about eleven per cent (about 150 million hectares) globally, yet there were sizable differences in changes across different geographic regions (figure 5.2), which also included changes by land use category (table 5.2). The EU (in particular Italy and Spain), Eastern Europe (Poland, Bulgaria, Romania) and North America (the US) showed a decline in cropland use in this time period, whereas more cropland was used especially in South America (Brazil, Argentina, Paraguay), Africa (Nigeria, Sudan) and Asia (China, Indonesia) (UNEP, 2014).

Agricultural area lost to urbanization and industrial use or converted for biofuel production and reforestation projects cannot be used to produce large amounts of food. As a result, food demand can shift agriculture geographically, causing activities to expand into marginal lands that may be prone to degradation (decreasing productivity), with poorer soils and weak infrastructure, and into areas housing sensitive and non-replaceable ecosystems and high rates of endemic species of plants and animals (Natural Capital Committee, 2013). Growth-driven expansion of agricultural production can therefore entail major consequences for biodiversity and rising deforestation (Jackson, 2011). For example, according to Jackson (2011), in the tropics, deforestation occurs at a rate of about 12.5 million hectares annually, representing not only a serious potential loss of ecosystems and biodiversity, but also accounting for one-fifth of anthropogenic CO_2 emissions. This is particularly the case in sub-Saharan Africa, which still has the largest reserves of unexploited arable land in the world (Chatham House, 2012; UNEP, 2014).

Growth-driven processes of land use change entail further dimensions of concern due to strong indirect and direct linkages to climate change. First, land use change is linked to carbon emissions. According to UNEP (2014), about twenty per cent of global CO_2 emissions were related to land-use change in the 1990s, and palm oil biodiesel produced on land converted from rainforest could release up to 2,000 per cent more CO_2 than conventional diesel. Second, climatic changes can induce environmental degradation, pushing agricultural expansion (UNEP, 2014):28. Third, according to Steffen and colleagues (2015), changes in the integrity of the global environment are initiated at the level of land-use changes affecting specific terrestrial biomes, and particularly forest biomes. In other words, localized land-use changes contribute to the cumulative degradation or integrity of the global 'safe operating space' for humanity because of significant feedback relationships existing between, for example, tropical and boreal (coniferous) forests and global climatic stability as a consequence of the forests' roles in regulating exchange of energy and water between the land surface and the atmosphere (Jackson, 2011; Natural Capital Committee, 2013; Steffen et al., 2015).

The technical and managerial fix position and land and food scarcities

The *Technical and managerial fix* position is more optimistic than the *Systems, boundaries and thresholds* position and argues that, although global land area may indeed be finite, its productive capacity is not, or

meadows and pastures - land used permanently (five years or more) to grow herbaceous forage crops, either cultivated or growing wild (wild prairie or grazing land)' (FAOSTAT, 2015a).

not immediately at least. Investment in technological, market and managerial solutions will allow society to circumvent natural limits to land and food production, across sectors and scales, without compromising goals of sustainability and inclusive economic growth into the future. Scarcity is not often posited as absolute, but temporary and relative, pending technological innovations and integrated land governance solutions.

For example, between 1961 and 2008, the global population more than doubled (growing from 3.13 billion in 1962 to 7.9 billion in 2012) and, despite the relatively modest increase in area of total cropland discussed above, global production of primary crops nearly tripled in an absolute sense (figure 5.3) and per capita food production, assessed in terms of kilocalories available per person per day increased by about one third (2360 kcal/person/day in the mid-1960s to 2800 kcal/person/day in 2015) (Bruinsma, 2003; UNEP, 2014). This was primarily achieved through the application of technology that increased yields through increased inputs including irrigation, improved seeds, fertilizers (primarily nitrogen-based), machinery and pesticides (figure 5.4) (UNEP, 2014):29.

A good example of the governance and resource management dimensions of this position is represented in WWF's *African Ecological Futures* report, the authors of which emphasize developing specific integrated strategies for sustainable resource governance in particular types of African resource contexts (WWF, 2015). Another example comes from the UNEP International Resources Panel (IRP), which highlights that unsustainable production and consumption patterns of land-based products are exerting unprecedented pressure on land resources across the globe, a situation that requires coordination across scales and sectors, involving local communities, businesses and governments, to create innovative approaches and solutions to contemporary resource crises (UNEP & International Resource Panel, 2011). It follows that one of the core challenges of the post-2015 development agenda will therefore be alleviate absolute poverty for one billion people, meet the energy, land, water, food and material supply needs of nine billion people, whilst keeping climate change, biodiversity loss and other impacts within 'acceptable limits' by 2050 (UNEP & International Resource Panel, 2011). The Panel's examples of targets and indicators demonstrate the need to consider complex inter-linkages and synergies among different goals on energy, food, water, oceans and sustainable urban development.

The nexus approach introduced in detail in section IV attempts just such a response to increasing land scarcities that result from relationships between water, energy and land / food production resources and increasing tensions between competing needs at the global, national and local level (European Commission, 2012; World Economic Forum, 2011a, 2014). According to SABMiller and WWF (2013), nexus policymaking primarily centers on building resilient government and business strategies to account for interconnectedness among food, water and energy systems (SABMiller and WWF, 2014).

In this frame, scarcity is primarily created through market- and governance failures and is directly relevant to concerns around resource pricing and volatility. In the report titled *Confronting scarcity: managing water, energy and land for inclusive and sustainable growth*, the authors estimate that, based on present patterns, to meet global demand for land-based resources by 2030, an additional 47 million hectares of land will be needed for food and animal feed production, 42-48 million hectares for large-scale afforestation / reforestation, and 18-44 million hectares for producing biofuel feedstock (European Commission, 2012).

If land for food production is not connected to markets through infrastructure, the risk of supply disruptions increases, and supply becomes less responsive to rapid changes in demand. As this happens, small changes in demand can result in significant changes in prices (Dobbs et al., 2013). The European Commission contends that land resources are currently at risk of severe degradation because they are under-valued (some resources may not be priced at all, such as water and ecosystem services, which can lead to distorted levels of demand and an absence of incentives and supply signals) and thus neglected in decision making about land use (European Commission, 2012; World Economic Forum, 2014). According to the European Commission report, the consequences of under-valuation in the process of developing these land resources include weakened ecosystems that perform vital functions for humanity, and lost opportunities for growth and development, and missed chances to increase the productivity of land. At the same time, in nexus thinking, increasing scarcity is also viewed as a potential catalyst for investor-led innovation and growth in the context of sound, cross-sector coordination of development planning, and public expenditure to establish economic and regulatory instruments that incentivize investment (8-9).

According to the WEF (2014), few models of resource availability account for dynamic price effects when estimating natural resource supply and demand, but rather commonly assume a constant or trending resource price level. In reality, price levels and volatility are important indicators of and factor in investment for resources linked to commodity markets (World Economic Forum, 2014, p. 19). In relation to this, the principle of resource substitutability, key to economic notions of relative scarcity, can in practice be problematic when it comes to stabilizing prices for land-based commodities.

The most prevalent example of this is biofuels. For example, prior to the mid-2000s, the prices of maize and (fossil) oil were largely uncorrelated. However, this has changed because rising energy prices have increasingly encouraged the use of land for energy production. Since autumn of 2007, there has been a very strong positive correlation between the prices of maize and oil, a correlation that has been driven by the fact that the ethanol industry has become a leading user of maize, when it was previously a crop used primarily for food and animal feed (Dobbs et al., 2013):9. The competition for land between food and biofuels clearly played a part in rising food commodity prices (figure 5.5). And these demands in their turn are intimately linked to accelerating environmental impacts: rising carbon emissions, declining biodiversity, rampant deforestation, collapsing fish stocks, declining water supplies and degraded soils (Jackson, 2011). Such price relationships have strong implications for the price of food globally, and this is by no means the only example of this process. To extend the example, researchers have further demonstrated price relationships between fossil oil, maize, wheat, and rice, with causality flowing from oil to the crops. This relationship is primarily an effect of cost factors such as the growing reliance of agriculture on energy-intensive fertilizers, transportation, and fuel used in planting, cultivation, and harvesting, in addition to the conversion of large amounts of cereals cropland to maize to supply the ethanol boom (Arshad & Hameed, 2009; Dobbs et al., 2013).

The *Technical and managerial fix* position also shares concerns with the *Systems, boundaries and thresholds* position over land use change and particularly with land degradation, although again, the approach is somewhat different. Cross-country comparisons show that nexus issues play out very differently in contexts with differing resource endowments. Countries with abundant natural resources for food, energy and water, such as Brazil, face a different set of questions from countries with limited or unbalanced resource endowments, and the emerging economies lie at the epicenter of the new and evolving political economy of critical resources (Chatham House, 2012; SABMiller and WWF, 2014). As stated in the McKinsey report, as urbanization proceeds on an unprecedented scale, new and expanding cities could displace up to thirty million hectares of the highest quality agricultural land, approximately two per cent of land currently under cultivation, by 2030, while it is estimated that over eighty per cent of available cropland is subject to high political risk and substantial infrastructure challenges (Dobbs et al., 2013):6. The increase in consumption in energy, land, food and water will lead to an increase in land pollution from industrialization. In addition to generalized notions of degradation, one should note that the *Technical and managerial fix* position tends to particularly emphasize the significance of localized processes of environmental degradation. This emphasis is two-fold. First, degradation – decreasing the productive potential of an area of land – is part of a particularly strong narrative linking localized processes at play in contemporary landscape change to global environmental and economic crises. Second, degradation is the enemy of growth because it increases the cost of a unit of yield due to the need for remediation or extra inputs.

Projections cited by WWF in the *African Ecological Futures* report suggest that the existing trends of environmental degradation and deforestation – according to the UNEP (2011), about a quarter of the earth's land area is highly degraded (up from 15% in 1991) and 5.2 million hectares of forests are lost every year – are likely to continue into the future (UNEP & International Resource Panel, 2011; WWF, 2015).

Processes of degradation and lack of investment in infrastructure, skills and enabling frameworks for investment limit the productivity of land, while the increased global demand for land will further increase tensions among competing needs at the global, national and local level. There is a call for visionary political and business leadership in both developed and developing countries to foster the necessary policy co-ordination in the public and private domain, needed to increase efficiency and thereby effectively decouple economic growth rates from the escalating use of energy, land, water and materials (UNEP & International Resource Panel 2014). Concrete actions that policy-makers could take to preserve water and land include creating incentives for rainwater harvesting, the use of marginal land for production or the adoption of agricultural practices such as intercropping as well as smaller, decentralized dams and mini-hydropower (ODI, ECDMP 2012).

With the current rate of productivity increases, notably in sub-Saharan Africa, demand is not likely to be met, which means that expansion of agricultural frontiers and conversion of land will continue unless countries with valuable land and water resources attract sustainable infrastructure investment to meet the growing agricultural demands for local consumption and export (European Commission, 2012). African Ecological Futures: In the scenarios presented in the *African Ecological Futures* report, the result of the continuing trends due to management failure would be significant forested area being lost to pasture and crop land by 2050 due primarily to mining activities, grazing and fuel wood collection, and the conversion of forests into cropland (WWF, 2015). The report predicts that this loss or shrinkage of woodlands will have negative implications for livelihoods, terrestrial and aquatic biodiversity, as well as lost opportunities for forest carbon storage, which could otherwise feed into national level green growth schemes. Furthermore, both mining and market-oriented agricultural expansion and intensification have serious consequences for 'downstream' land degradation effects due to land and water pollution. This deterioration of the land and water ecosystems reduces resilience to climate variability associated with flood attenuation, flow availability and waste assimilation, and the possibility for sustained and diversified agricultural productivity (WWF, 2015).

That said, expanding agricultural production in Africa is perceived to be central to feeding the world in the future, as there remain large tracts of land available for agricultural expansion and, with effective resource management regimes in place, this position holds that there remains significant scope for increasing the productivity of yields achieved in Africa, in addition to the increasing land brought under agricultural production (WWF, 2015). While large-scale land deals give rise to serious equity concerns (discussed below) they also provide opportunities from the *Technical and managerial fix* perspective. Investors may introduce new technologies and skills, expedite the development of contextualised production systems with higher productivity, and spark innovation. Innovative business models can offer different approaches to raising agricultural production (ODI, ECDMP 2012). The opportunities created by greater commercial interest will lead to increasing the value of land. The higher prices for agricultural commodities heighten the potential for new employment as well for higher returns on public goods (such as infrastructure, services, extension) (ODI, ECDMP 2012).

The Structural inequality/ distributional position on land and food scarcity

From the *Structural inequality/ distributional* position, as discussed in section IV, scarcity results from inequitable institutional arrangements around distribution that cause gross inequalities in access to resources. As it includes many aspects of human development and human rights approaches, this position sees significant overlap with other perspectives as ideas about equity, social safeguards, social and environmental justice, resilience and inclusion of less-heard voices and experiences in development planning have seen widespread uptake across the spectrum. While scarcity can, in this framing, be described in terms of absolutes, a situation in which there is simply not enough of something, regardless of how it is distributed, the primary concern of this position is socially generated, or 'constructed' scarcity which is created through socio-political processes and institutions, and results in insufficiencies that effect some people and but others (Mehta, 2001, 2010). In other words, scarcity is real, but it is not 'natural' nor a 'given', which is in stark contrast to the assumptions of the *Systems, boundaries and thresholds* and the *Technical and managerial fix* positions.

For example, trends in increasing food production per capita have occurred since the 1960s, but this does not mean that the problems of growth or equity have been overcome, rather than temporarily displaced or at times exacerbated. Regardless of overall increase in caloric availability globally, the distributions of rates of caloric consumption (table 5.3) and insufficient nutrition (table 5.4) vary quite a bit by region (figure 5.6), as do the negative environmental and health effects of agriculture, which increased salinization, soil erosion, eutrophication, and agrochemical contamination in productive areas (UNEP, 2014):29. On top of this, some of the regions where food insecurity is most prevalent are also regions where climate change is expected to pose the greatest challenges for agriculture (SABMiller and WWF, 2014).

It is a widely held assumption in conventional economics that land-based resources held in common are prone to overexploitation and that privatisation of land will lead to more sound management and increased efficiency in resource use (Firket Berkes, 1989; Fikret Berkes, Feeny, McCay, & Acheson, 1989; Hardin, 1968). However, institutional research and the literature on common property resource management have been central in establishing the significance of local institutions to effectively governing the use of common property resources without private individual ownership. Institutional analyses have played a key role in highlighting that people can cooperate to manage scarcity and that scarcity problems are more linked with institutions or the lack of them, rather than with absolute quantities and numbers. Privatisation of village commons and forestlands can eliminate such management institutions have disastrous distributional consequences, increasing inequalities in access to productive land and income within communities, and disenfranchising entire classes of people. Alternately, studies have also shown that public (state) ownership of such resources is by no means necessarily a good basis for equitable resource allocation either. In these cases, decision-makers are usually far removed from site in both a geographic and social sense; they have little knowledge of local ecologies and agricultural realities, and they work in short time horizons. Frequently, their decisions are overly influenced by interest groups even farther far removed from the land resources in question (Dasgupta, 1997, 2009).

From the *Structural inequality/ distributional* position, land scarcities are perceived and experienced by people in different ways at different scales and in different contexts. Some viewpoints carry more weight due to the social and political positionality of their adherents, while others may be easily ignored, dismissed or 'swept under the rug' in national and international policy fora. This is important because competing notions of scarcity and resource management can be at odds and can lead to conflicts that cross scales, sectors and legal jurisdictions with clear implications for winners and losers. According to the Earth Security Group (2015), local conflicts arising due to tensions around land-use change and food availability and energy instability in many developing countries can trigger political and economic risks that can quickly spread to the global economy. Some authors contend that neoliberal policies have resulted in structural changes that have exacerbated upward trends in global and local inequalities in access to opportunities and resources, and have encouraged an international pro-scarcity policy climate that is distinguished by deep concessions to private capital investment, public sector cutbacks, and the rollback of what some consider to be 'excessive' rights (Mehta, 2010; A. Ross, 1996).

A prime example of this regards relationships between dominant discourses on scarcity, perceptions of global environmental change, resulting trends and the challenges faced by rural producers in the context of competition among possible land uses. Whether originating from notions of absolute land scarcity, pervasive degradation narratives, concerns over climate change or in response to price volatility, or a convergence of these factors around the global crises of food, feed and fuel in the late 2000s, the European Commission (2012) links the widespread perception of increasing land scarcity to an alarming trend in large-scale land deals. These are leases or purchases of vast swaths of land, usually in developing countries, by capital-rich international and domestic parties seeking to secure access to what are perceived as dwindling reserves of productive land (Borras et al., 2011; European Commission, 2012; Scoones, Hall, Borras, White, & Wolford, 2013; Wolford, Borras, Hall, Scoones, & White, 2013; World Economic Forum, 2014). The land in question is put to a range of purposes – logging, harvest of tropical forest products; plantation forestry; ranching; production of narcotics; gaining access to water resources; securing rights to extract precious minerals and metals, oil, and natural gas; capitalizing 'carbon sinks' and protection of flora and fauna and global biodiversity – but are frequently framed around the intensive production of export-oriented food, fuel and fiber crops (D. Hall, 2011; Wolford et al., 2013; Zoomers, 2010). According to Wolford and colleagues (2013), while many of these acquisitions remain speculative (i.e. not under current production once the deal has been made), there is serious concern based on precedent that these deals will ultimately privilege intensive production for external markets whist facilitating neglect, disenfranchisement or displacement of local communities who directly depend on the land in question for livelihoods but may have insecure formal property rights and land tenure protections (1). In the process described, which is often referred to as 'land grabbing', one set of ideas about global land scarcity and supply has initiated a trend that is resulting in widespread socially generated, or 'constructed' scarcity resulting in insufficiencies and vulnerabilities that effect a great many people but not others. Social risks are worse where land tenure insecurity, food security, and health and safety reinforce one other (Earth Security Group, 2015).

As discussed in Section IV, human development approaches to scarcity challenge and break down macro and aggregate understandings of scarcity and argue that resource crises are the result of poverty, inequality and unequal power relationships, as well as flawed resource management policies that exacerbate scarcities. A good example of this approach in regards to food access is Amartya Sen's entitlements approach. The thinking underlying Sen's entitlements approach chimes well with the idea of scarcity as a 'constructed' concept, rather than as a natural fact of human existence. The idea that a famine may occur even when there is no decline in food supplies is attributed to people's lack of purchasing power, rather than a physical dearth of food or absolute scarcity of productive land.

Increases in cereal prices are of major concern to the majority of developing countries as they are the staple diet of the population and an increase in the price of rice will affect the poor consumers much more than the well to do ones (Arshad & Hameed, 2009):92. In his seminal study of starvation and famines, Sen argued that a focus on the per capita food availability decline (FAD) is a misleading way to look at hunger and famine, since hunger is more about people not having access to food due to wider social and political arrangements as opposed to there not being enough food to eat (Sen, 1981, 1983b). Looking at per capita availability of a resource lacks relevant discrimination and is misleading when applied to the population of the world as a whole (Sen, 1981). Thus, scarcity in food should not be seen in terms of per capita availability, but in terms of inequality in access. Usually, resource access is governed by a combination of social and political institutions, cultural norms and property rights (HLPE, 2015). Some groups may suffer from lack of land and food even when there is no decline in availability in the region. Thus, resource shortages (like famines) are entitlement failures. Entitlements[11] analysis is valuable because it helps us to move away from flawed utilitarian and neo-Malthusian assumptions and arguments, as well as reliance on national and global aggregate numerical portrayals of resource availability. Instead the focus should be individual and group entitlements and endowments to resources, taking into account factors such as gender, caste, ethnicity, race, occupation and location.

Water: perspectives on scarcity and resource challenges

Water resources have their particular characteristics that make them distinct from other natural resources. Water is fluid in nature: it flows, does not stay in one place, and at the same time water is in most places a renewable resource. This means that the availability of water fluctuates in space and time and these are relevant when assessing water allocation and actual water distribution. The fluidity of water also implies downstream effects on people and uses and the need to look at wider impacts across a range of scales (i.e. within a watershed or basin. Thus, due to the fluid nature of water, far-reaching impacts such as scarcity and pollution can extend across entire river basins. Most water resources are often investments in 'virtual water' (Allan, 2011) for agribusiness development: given the water resources that

[11] An entitlement set includes the full range of goods and services that a person acquires by converting her 'endowments' (namely, assets and resources including labour) through 'exchange entitlement mapping.' (see Sen 1981 and 1983).

are required to produce agricultural products, global agricultural trade can also be seen as a massive transfer of water, in the form of commodities.

Control over water is as old as the hills, just as land control is. Water is a contested resource and access to water reflects power asymmetries, socioeconomic inequalities, and other distribution factors, such as the ownership of land. Since time immemorial, water as a finite but multifaceted resource has been subjected to contests rooted in relations of power both at the discursive and material level (Mehta, 2005; Mosse & Sivan, 2003). However, while control over water resources has traditionally been associated with state control and domination by national rulers, recently new corporate players are showing an interest in in water resources management. Neoliberal trends in the water sector began twenty years ago in 1992 at the Dublin International Conference on water and the environment where the still-controversial declaration of water as an economic good led to greater adherence to free-market capitalism and the commodification of water (Allouche & Finger, 2003; Nicol, 2012; Nicol, Mehta, & Allouche, 2012). The economic valuation of the resource rapidly became part of wider debates on environmental resources and 'water scarcity' more generally (Mehta, 2010) but these processes largely concerned water service delivery, ostensibly as a means to increase efficiency and enhance access. Now, twenty years on, we are witnessing the privatisation not just of the service or the accompanying infrastructure but of the resource itself, manifesting itself in processes such as water grabs (see below).

Finally, water is life. Safe drinking water and sanitation are fundamental to the nutrition, health and dignity of all. Without access to water there can be no food security. Besides basic human needs for water for satisfying drinking and sanitary needs, water is an important input factor for agriculture and energy, and land use and energy have direct implications for water quantity and quality (European Commission, 2012). Water is also essential for food production (fisheries, crops and livestock), food processing (industrial to household level) and food preparation (at household level as well as by formal and informal food vendors). Water is also a key input for industry and to support economic growth. Finally, it is the lifeblood of ecosystems on which all humans depend, including forests, lakes and wetlands, and which are central specifically to the food security of those communities that engage in small-scale production systems. Irrigated agriculture (including food and non-food crops) is by far the largest water user globally, accounting for seventy per cent of water withdrawals globally, while twenty per cent is for industrial use and ten per cent is for domestic uses. This makes small and large farmers the stewards of the world's freshwater resources.

Although not a primary focus of *The Limits to Growth*, even in the early 1970s the authors highlighted to significance of water in the context of demographic and industrial growth, stating that the upper limit to the annual fresh water runoff as well as exponentially increasing demand curve for that water indicates that in some areas of the world, this water limit will be reached long before the land limit becomes apparent (Meadows et al., 1972). Even though the water MDG was met in 2012, 768 million people around the globe lack access to safe drinking water. This includes eighteen per cent of the rural population worldwide of which 47 per cent are in Sub Saharan Africa. 2.5 billion people lack access to improved sanitation with over one billion defecating in the open.

How much water is available for human uses in a given period of time? The earth's land surface receives about 110,000 km^3 of rainfall annually. More than half of this water is evapotranspired (transmitted from soils and through plants to the air); and about 40,000 km^3 becomes available in dams, lakes, rivers, streams and aquifers for human and environmental uses (UN WWAP, 2012). Aquifers receive approximately 13,000 km^3 of this annual runoff (Döll, 2009).

While annual renewable fresh water resources are adequate at global levels to meet human water needs (HLPE, 2015), these resources are very unevenly distributed across the globe. Per capita annual renewable water resources are particularly low in the Middle Eastern, North African and South Asian regions (see table 5.4.1). There are also significant variations in water availability within regions and countries. Uneven water resource distribution can translate into uneven capacity to grow food and affect food availability and access.

A key element of water is the concept of increasing water scarcity (Falkenmark and Lannerstad, 2005). Water scarcity is a complex phenomenon and can be analysed differently from social, political, meteorological, hydrological and agricultural perspectives. Scarcity of water is typically examined through two lenses. The first is "physical water scarcity", which compares the amount of renewable water annually available per capita in a particular area (for example, Table 1) with pre-determined thresholds, such as 1700 m^3 and 1000 m^3 per person per annum, to identify water-stressed and water scarce areas, respectively (Falkenmark and Widstrand, 1992). The second lens is "economic water scarcity" (CA, 2007). This refers to the fact that physical availability of water does not necessarily mean that water is available for use or is accessed. In some areas, while there may be abundant water available, the lack of infrastructure means that the water is not available where is it needed, or of an appropriate quality for use. For example, according to UNEP (2011), an estimated 51 million people in the Democratic Republic of the Congo, around three quarters of the population, had no access to safe drinking water in 2011, even though the country is considered water rich, with more than half of Africa's water reserves. In such countries, the challenge is economic water scarcity or lack of investments, appropriate infrastructure or management, rather than physical water scarcity, to provide for the needs of the population, including water for FSN. Both these portrayals of scarcity, however, tend to direct attention to natural and economic forces rather than look at human-induced land and water use practices and at socio-political considerations and how scarcity can be socially mediated or constructed (Mehta, 2005; UNDP, 2006).

It must be mentioned that predicting with precision the actual impacts of climate change on water availability is difficult for a number of reasons. First, different general circulation models and global climate models can result in significantly different predictions of rainfall changes, especially at finer geographical scales. Second, changes in rainfall do not linearly correlate with changes in water availability: factors such as rainfall duration and intensity, surface temperature, and vegetation, all play a role in determining what percentage of rainfall is converted into surface water run-off into rivers, dams and wetlands, or into groundwater. Current models only imperfectly capture these mechanisms, and it is critical that more research is done to be able to more accurately assess national, regional and local impacts of climate change on water, particularly in areas of greatest vulnerability.

Systems, boundaries and thresholds and water scarcities

Water is a critical limiting factor for food production, but is also central to energy production, and it is widely agreed that freshwater scarcity presents one of the most pressing crosscutting challenges in the future (Chatham House, 2012; SABMiller and WWF, 2014). According to the European Commission (2012), pressures on water availability will continue to grow – not only through the need to feed and hydrate a growing global population, but also from changes in patterns of consumption across the board. The growth of water demand for global resource production is both a result of the overall increase in the amount of resources needed to meet global needs, as well as increases due to the mounting intensification in production systems. Some estimates suggest that 723 km3 of water currently used in industrial processes (mining, transport, processing or transforming of energy), accounting for about 35 per cent of water use global industrial water use in the industrial sector (Chatham House, 2012, p. 69). Further, resource production methods are becoming even more water-intensive with the shift from conventional fuel resource production techniques to those involving extraction of fossil fuels from shale and tar sands and production of crops for biofuels –the average water footprint of biomass is 70 times bigger than that of fossil oil (European Commission, 2012) – and for the extraction and processing of increasingly lower-quality mineral ores, which is also highly water intensive (Chatham House, 2012, p. 29).

Lee and colleagues (2012) cite the Water Resources Group's 2030 scenarios, which predict that global demand for water already exceeds sustainable supply, as unsustainable water withdrawals from non-renewable aquifers are coupled with unreliable availability in many places. Further, global freshwater demand could be as much as forty per cent higher than supply by 2030 (Chatham House, 2012, p. 67). In the context of the OECD's 2050 scenarios, global water demand is projected to increase by some 55 per cent, due to an estimated 400 per cent increase in demand from manufacturing, a 140 per cent increase in demand from thermal electricity generation and a 140 per cent demand increase for domestic use (figure 5.7). In these same scenarios, groundwater depletion is highlighted as potentially the greatest threat to agriculture and urban water supplies in several regions, and that contestation around environmental water flows will put crucial ecosystems at risk (OECD, 2012:4). This is increasingly important to regions that are reliant on groundwater resources to sustain large-scale irrigated agricultural production, including parts of the US, Mexico, Saudi Arabia, Libya, Egypt, Australia, northern China, India, Pakistan and Iran (figure 5.8). The major concern here is that aquifers are becoming depleted as large annual groundwater withdrawals far exceed natural recharge rates (Chatham House, 2012, p. 49).

In a business-as-usual scenario, water and energy provision will be increasingly interdependent by 2050, and increasingly important to non-agricultural sectors (table 5.5) (UNDP, 2006b). Water needed to generate electricity is predicted to more than double, with the effects of water stress felt most keenly in the hydropower sector in hydro-dependent regions in Latin America, South Asia and sub-Saharan Africa especially vulnerable (Chatham House, 2012). Nuclear and thermal power stations are indirectly reliant on water as well, primarily for coolant systems. Production-related demand for water is associated with changing global consumption patterns and future projections can be bleak. According to Professor John Beddington, former UK Government Chief Scientist, by 2030 the world fresh water supply will be burdened under the need to produce fifty per cent more food and energy, together with thirty per cent more available fresh water for consumption, while mitigating and adapting to climate change, a situation that, from Beddington's point of view, threatens to create a 'perfect storm' in terms of resource scarcity (SABMiller and WWF, 2014). Urban and middle-class growth mean that the challenge of resource scarcity is more acute and more complex than simple provisioning (SABMiller and WWF, 2014). For example, Chatham House predicts that by 2030 water scarcity will be driven in part by three billion additional urban and middle-class people in emerging economies. Water inputs for municipal supply and agriculture will become more expensive, particularly as urbanization progresses and as meat and dairy foods increasingly replace water-efficient cereal produce in diets (Chatham House, 2012):68-69.

Amidst this projected increasing demand and competition among competing uses of water resources, climatic change means that rainfall and water availability are likely to become more uncertain (Steffen et al., 2015). The ocean and the atmosphere are the two great 'fluids' of the planet, and the distribution of energy by latitude, over the land and sea surfaces and within the ocean, plays a major role in their flow and circulation. In Earth's current climate context, a range of global surface temperatures and atmospheric pressures allows the three phases of water to be present simultaneously, with ice and water vapour playing critical roles in the physical feedbacks of the global climate system (Steffen et al., 2015). According to SABMiller and WWF (2013), there is already evidence of climate shifts putting greater stress on some already over-exploited river basins that are also damaged by pressures from the growing water needs of agriculture and industrialisation (figure 5.9) (SABMiller and WWF, 2014; UNDP, 2006b).

From the *Systems, boundaries and thresholds* position, degradation of water resources from pollution is also a crucial consideration. Agricultural and extractive activities are major contributors to freshwater pollution, which is a key threat to water supply security and integrity in many developing countries(Chatham House, 2012; Steffen et al., 2015). This may occur through, for example, agricultural expansion, a context in which tree removal can cause the saline water table to rise, which is a driver for depletion of the global stock of non-salinized soils and undermines ecological resilience in agricultural area (Natural Capital Committee, 2013). Additionally, eutrophication, or 'nutrient pollution' from urban wastewater and agricultural fertilizer runoff is projected to worsen in most regions. This intensifies damage to freshwater biodiversity, one-third of which, according to some estimates, has already been lost, with further losses is projected by 2050 (OECD, 2012).

The technical and managerial fix position and water scarcity

The *Technical and managerial fix* position shares a concern with the *Systems, boundaries and thresholds* position regarding the degradation of water resources due to agricultural intensification and competing pressures on water resources in a rapidly changing world characterised by global population growth, rapid urbanisation and changing preferences for consumer goods. Here however, the emphasis tends to shift from the physical consequences of these factors to the market dimensions (including internalisation of externalities to correct 'market failures'), trade-offs, for example between the provision of water and infrastructure to agricultural and extractives sectors and the role of water availability and price in decisions on where to invest and where to produce (Chatham House, 2012; WWF, 2015). According to SABMiller and WWF (2013), the demand for increasingly scarce resources to fuel development is shaping trends in resource control and commodity markets across the world. International businesses 'experience the effects in terms of higher and more volatile input and raw material costs', while consumers see their patterns of spending altered by the ever increasing cost of basic necessities (SABMiller and WWF, 2014, p. 4). At the same time, while agriculture is dependent upon renewable resources, and thus may have a long-term outlook, a judicious management of land and water resources (as well as transport corridors and associated infrastructure) is viewed as necessary to avoid declining productivity, reduced access to the necessary renewable resources, and potentially isolated assets (WWF, 2015).

Resource management, infrastructure investment, technical improvements that increase production efficiency or substitutability, mitigation and policymaking for resilience are, from this perspective, in the best interests of businesses, governments and consumer populations alike as such measures can reduce the sorts of risks and disruptions that cause prices to rise and account for global market volatility. For example, in the mining sector, risks associated with water scarcity are often beyond the control of individual companies (Earth Security Group, 2015). Increased incidence of floods, heat waves, extended droughts and higher variability in weather patterns brings substantial operational and technical challenges (such as a more variable hydrogeology) and requires higher capital expenditures to maintain extractive and processing activities. In addition, increased incidence of production and transport disruptions and the risk of catastrophic failures will result in higher insurance costs (Chatham House, 2012).

From a nexus perspective, the use and management of water requires an integrated approach that takes into account both land and energy issues (European Commission, 2012). The integrated water resource management (IWRM) approach sees water services as both a social and economic good and is usually associated with the idea that water resources should be directly managed at the level of river basins. This which requires better coordination and decision-making among different water-using sectors (European Commission, 2012). However as discussed earlier, IWRM has tended to be rather idealised and abstract and difficult to implement, especially in sub-Saharan Africa where complex formal and informal rights as well as customary land and water arrangements prevail. Moreover, there is greater uncertainty in water flows than in temperate countries and inadequate data to capture this uncertainty.

The water footprint of biofuels (e.g. from ethanol) varies widely across countries and contexts, which underlines the need to monitor the effects of biofuel production on water and land use. In countries such as China and India, which have large populations and high economic growth, the stress on water and land from the production of hydropower and biofuels may be particularly severe, although in the case of water this relates more to changes in basin flow regimes (including trans-boundary) rather than consumptive use (European Commission, 2012). Countries with abundant natural resources for food, energy and water, such as Brazil, face a different set of questions from countries with limited or unbalanced resource endowments. South Africa, for example, has limited water and agricultural land, but considerable reserves of coal and opportunities for solar power. The choices facing its government are quite different from those in Brazil (SABMiller and WWF, 2014)

In a broad sense, water sector reforms have been influenced by the concept of Integrated Water Resources Management (IWRM), which calls for 'co-ordinated development and management of water, land and related resources, in order to maximize welfare in an equitable manner without compromising the sustainability of vital ecosystems' (GWP, 2000, p. 22). IWRM is thus broadly in line with a water-energy-land (WEL) nexus perspective (European Commission, 2012). Particularly in many water-scarce areas, energy is an important input factor for water supply, e.g. for pumping or seawater desalination (European Commission, 2012). The nexus approach holds that strategies to meet a country's development and sustainability goals are most resilient where they build on a clear analysis of the particular nexus resource challenges faced in that country context. According to this perspective, water, energy and food resource planning on a national level requires an understanding of the country's particular development and sustainability goals, overlain on a distinction between the natural resource endowment and the infrastructure and institutional systems designed to deliver particular interrelated resources (SABMiller and WWF, 2014, p. 8). As water scarcity becomes a critical health and economic issue in many regions, governments are likely to turn to engineering solutions that have uncertain impacts and risks as well as trans-boundary implications. In addition to conventional dams and irrigation infrastructure, other countries may follow in China's footsteps on large-scale river redirection projects (Chatham House, 2012, p. 134).

While acknowledging that every country follows its own unique development path, recent reports By SABMiller and WWF (2014) and WWF (2015) identify three key 'stages of evolution' that countries that countries pass through in terms of planning around water- energy-food resources and building resilience (SABMiller and WWF, 2014; WWF, 2015). First, developing countries focus on infrastructure development to enable primary economic activity and social development. For example, according to SABMiller and WWF (2014), despite obvious differences, as developing countries Chad, Tanzania, Mozambique and Vietnam all share a common need to develop infrastructure that will enable these countries to harness their water, energy and land resources, serving dual goals of facilitating economic growth and ensuring safe and reliable water supply for their citizens (9). Second, emerging economies like Brazil, Turkey, India and South Africa, which face trade-offs in scarce resource development and allocation to diversify economic development, increase urban consumption and respond to stagnating rural livelihoods, should focus on institutional mechanisms to allocate resources between competing productive and consumptive demands. Third, developed countries and territories like the UK, California and Western Australia that are 'shifting towards more resource-efficient, environmentally sustainable, low-carbon, consumption-based tertiary economies that are integrated into the global trade economy', should update infrastructure and focus on regulatory and economic instruments to achieve efficient and sustainable consumption and development patterns (SABMiller and WWF, 2014, p. 12). These characteristics, decisions and pathways are not necessarily mutually exclusive and depend upon the country's natural resource endowment and histories of decision-making around resources, infrastructure and regulation (WWF, 2015, p. 29).

Other approaches within this theme seek to manage degradation and/or its costs to production indirectly by facilitating technical restoration or substitution. In some cases, the benefits of natural capital can be replaced with man-made alternatives when human activities overwhelm natural processes and capacities. For example, the response to coastal flooding has been to build sea walls rather than relying on coastal wetlands to buffer sea levels, and water treatment works are constructed to purify water to supplement natural purification processes (Natural Capital Committee, 2013).

Still other technical approaches encourage the establishment of resource stewardship incentives and / or mitigation and trading schemes. More than seventy per cent of the world's freshwater use is in agriculture (SABMiller and WWF, 2014). While all agricultural production requires water, it makes a difference to water quality whether the agriculture is rain-fed or irrigated, and whether (and to what degree) fertilizers and pesticides are used (European Commission, 2012). Payments for Ecosystem Services (PES) are one of the principal ways in which a market for ecosystem services can be established. When a PES scheme is initiated, governments or water companies that pay land managers to undertake certain conservation activities in order to reduce water pollution at source, particularly in settings characterised by high pollution risk. This in turn can lower water treatment costs (Natural Capital Committee, 2013). While PES schemes are thought to control costs at the source in some contexts, other practices may be more oriented toward lowering direct cost of environmental regulation to production. For example, companies or governments can participate in compliance-based or voluntary market mitigation schemes that either require payment for or offsetting polluting behaviour, or involve trading in polluting rights (Ecosystem Marketplace, 2013). Ideally, these programmes are meant to help companies and other polluting parties compensate for unavoidable water impacts or weather the transition to a tighter regulatory context without incurring significant losses, and operate in a similar way to greenhouse gas emissions schemes. Efforts are being undertaken as well to identify the amount of water embodied in international trade, which is also called 'virtual water', the amount of water required to produce a good or service. The concept of virtual water is applied mainly to the trade in biomass and biomass products, but can apply to manufactured goods as well (UNEP, 2014). Virtual water trade can also play an important role for water-scarce areas by enabling them to import water by purchasing water-intensive food grown in areas with sufficient available water (European Commission, 2012; World Economic Forum, 2014).

The structural inequality / distributional position and water access and scarcity

In general, the lenses of physical and economic water scarcity discussed earlier do not consider the way in which the distribution of and control over water is social differentiated by gender, caste, race, occupation and other categories. As discussed, Amartya Sen has argued that the per capita food availability decline (FAD) is a misleading way to assess hunger and famine, since hunger is more about people not having access to food due to wider social and political arrangements as opposed to there not being enough food to eat (Sen, 1981, 1983b). Similarly, aggregate views of water scarcity can be problematic because they can hide real inequalities in water access determined by property rights, social and political institutions, and cultural and gender norms. People's lack of access to water may have little to do with physical scarcity per se but may instead be due to exclusions arising from social positioning, gender or because of the way water is managed, priced, and regulated (Mehta, 2014; UNDP, 2006b). For example, deeply rooted traditional or historical inequalities can limit women and other vulnerable groups' access to land and thereby to water for agricultural uses, which hampers livelihood strategies and negatively impacts food security.

Gender and other markers of identities continue to mold water allocation and access among users. Cultural norms in much of the developing world dictate that women and girls are responsible for water collection, and they may spend several hours per day collecting water. Unequal power relations within the household, and women's minimal control over household finances or spending, can force women into a daily trudge (taking precious time) for fetching cheaper or free untreated water, which may result in health problems or increased poverty and destitution. This time could instead be used to focus on livelihood and agricultural activities, attending school and to improve maternal and infant health (Mehta 2014; WHO/UNICEF Joint Monitoring Programme 2012). This situation is worsened by the fact that women are often excluded from decision-making processes regarding water management projects or natural resource allocation (FAO 2012b).

One of the core challenges of the post-2015 development agenda is to lift one billion out of absolute poverty and meet the needs of nine billion people in 2050 in terms of energy, land, water, food and material supply, while keeping climate change, biodiversity loss and other impacts within acceptable limits (UNEP & International Resource Panel, 2014). Water security is defined by the European Commission (2012) as the availability of, and access to, water sufficient in quantity and quality to meet the health, livelihoods, ecosystem and production needs of populations, coupled with an acceptable level of water-related risk (European Commission, 2012). Projections regarding equity in water access are not optimistic; from a human development perspective, the primary challenge going forward is to strengthen water security for vulnerable populations. The European Commission estimates that nearly one billion people globally have no safe water and at current rates, and that by 2030 demand for water will have grown by forty per cent globally (European Commission, 2012). The OECD predicts that globally more than 240 million people are expected to be without safe water access by 2050 (OECD, 2012).

According to the 2006 *Human Development* Report, which focuses in-depth on water scarcity from a human development perspective, the global water crisis is overwhelmingly a crisis for the poor. The distribution of water access in many countries mirrors the distribution in wealth, and vast inequalities exist in both. The UNDP estimates that almost two in three people who lack access to clean water, and over than 660 million people without adequate sanitation, live on less than two dollars per day. Furthermore, not only do the poorest people get access to less water, and less to clean and safe water, but they also pay some of the world's highest water prices (UNDP, 2006b, p. 7). Overall, the public sector retains, at least in principle, the reach and the mandate to clarify rights, set prices, resolve trade-offs, and ensure safe water and sanitation access for the poor and excluded, whether as a service provider or supporter, or through contracts with private firms but in many water scarce regions, the largest local water footprints are due to industrial and extractive activities (Chatham House, 2012; European Commission, 2012).

Wealth and income inequality is compounded and reinforced by unequal access to sustainable resources, and water stresses play out very differently across the globe, depending on factors such as resource endowments, income levels and governance (World Economic Forum, 2014). Economic access to resources between social and economic groups within nations presents important distribution issues as well, and a significant 'global water gap' in access (figure 5.10) (World Economic Forum, 2014, p. 14). In terms of future projections for water equity, the number of people with access to an improved water source (although not necessarily safe water for human consumption) is expected to increase, essentially in the BRICS countries (Brazil, Russia, India, China and South Africa) in coming decades. However, Sub-Saharan Africa will not to meet the Millennium Development Goal (MDG) of halving the 1990 level of the population without access to an improved water source by the end of 2015. Globally, the MDG for sanitation will not be met by 2015 either and by 2050 1.4 billion people are projected to be still without access to basic sanitation (OECD, 2012). The relative costs (including opportunity costs) of water and energy faced by rural households in poor countries are quite different from those faced by households elsewhere (Dasgupta, 1997). In addition to cultivating crops, caring for livestock, cooking food, and producing simple marketable products, members of a household may have to spend as much as five to six hours a day fetching water and collecting fodder and wood. These are complementary activities. They have to be undertaken on a daily basis if the household is to survive (Dasgupta 2009).

In recent years, reforms based on the IWRM have brought water rights to the forefront of the policy agenda. Two primary reform strategies have emerged, both aimed at facilitating adjustment to growing competition. Some countries, including Ghana, Indonesia, South Africa, Sri Lanka, Tanzania and Thailand, have declared water resources to be property of the state, which allows governments to allocate water rights within an integrated resource management framework. In other areas, reforms have involved formal water permitting based on government discretion within a formal water economy as an alternative to 'pure' market pricing. With some notable exceptions, both approaches have failed to incorporate substantive pro-poor redistributive provisions, an equity failure that has been exacerbated by poor implementation practices that reflect drastically uneven power relationships, backing urban, industrial and high-growth industry claimants against agricultural and rural claimants (HLPE, 2015;

UNDP, 2006b, pp. 182-183). In Tanzania, for example, even though the government owns all land and water, water extraction is fee-based and requires a permit potentially excluding the poor from water use rights. Although customary rights are recognized (but require conversion to permits), the tension of recognizing them alongside formal rights has meant poor treatment of customary users of land and water (Vorley, Cotula, & Chan, 2012) despite the fact that smallholders produce most of the food in the country.

In an even more severe situation, such uneven power relationships and the absence of appropriately implemented water rights frameworks can open up the possibility of 'water grabs' (UNDP, 2006b). According to Franco and colleagues (2013), 'water grabbing is a process in which powerful actors are able to take control of, or reallocate to their own benefit, water resources used by local communities or which feed aquatic ecosystems on which their livelihoods are based' (Franco et al., 2013, pp. 1653-1654). Franco and colleagues further elaborate how water grabbing extends beyond simply agriculture into the water, energy, climate and mineral domains in ways that highlight its unique material character as a resource:

> [I]n agriculture-driven grabs, water is a crucial context for land grabbing—determining for example 'which land located where' is desirable or most coveted by investors, usually having some irrigation potential. Water can also then become the object of what is primarily an agriculture-driven land grab. In other cases water itself is the primary object of the grabbing, resulting in reallocations of formal and informal water rights and their benefits of use. For example, hydropower development in Turkey is made possible through neoliberal reforms that have transferred exclusive access rights to hundreds of rivers and streams to private companies for 49 years. In Cajamarca, Peru, large-scale private mining operations are prompting big changes in how water rights are allocated, leading to detrimental changes in the amount and quality of water available to downstream users (1652).

Conflict situations can exacerbate unequal or lack of access to water, and can threaten provision of water and divert attention from food production to other priorities, and the poor become the victims not only of the conflict itself but also of hunger and water borne diseases. Water insecurities also persist in occupied areas such as Palestine when restricted water withdrawals enforce unequal access and use. For example Israelis consume over three times as much water per capita per day as another (300 litres compared to 73 litres), but strict military orders restrict water withdrawals and access (Gasteyer, Isaac, Hillal, & Hodali, 2012).

Rather than focus on power inequities and exclusions, current policy documents however tend to focus on how unequal access to clean water will be a serious potential trigger of conflict and instability, particularly in already water-stressed areas like India, China and South Africa as municipalities' and smallholders' water needs increasingly must compete with demand for power generation, hydrocarbons extraction and processing (Chatham House, 2012, p. xix). There is also the widespread and problematic narrative that local conflicts arising due to water stress, land-use change, food availability and energy instability in many developing countries can trigger political and economic risks that quickly spread to the global economy (Earth Security Group, 2015).

V. Conclusions

Most sustainability issues involve multiple, contested framings – namely, deeply held assumptions – and narratives that explain causation, prescribe types of intervention and predict outcomes. This is a central idea to the conceptual and methodological orientations of, for example, the STEPS Centre's Pathways approach to understanding sustainability issues as well as to the World Economic Forum's integrated paradigms approach discussed in the 2014 report, *The Future Availability of Natural Resources*. In this paper we have examined diverse and changing notions of scarcity in historical context to uncover some of the conceptual roots of contemporary approaches to resource scarcity, then introduced and dialogued three dominant positions ways of framing information and recommendations regarding natural resources, and their future prospects. In the previous section, we used information from a number of institutional and academic sources to construct a dialogue across these three dominant positions around issues related to land / food, water, energy, mineral resources and fisheries. In doing so, we attempted to highlight the ways in which the assumptions about scarcity that inform each of these approaches lead to differing understandings of what resource scarcity is, what causes it, different forecasts of outcome related to scarcity, and the implications that different framings have for development futures. This is important because not all narratives are equal in policy discussions or the public mind. Crucial facts about environmental change and sustainability are contested, and scientific language and knowledge is often put in the service of political agendas that can ultimately undermine goals of justice and sustainability. Some narratives dominate, supported by powerful institutions and relations, while others are marginalised or hidden. Most crucially, narratives have material consequences as they underpin and legitimate particular policies, institutions, interventions, patterns of investment and voices while excluding others. The value of a dialogic approach across dominant perspectives and paradigms is that it can help us unpack the political complexities of issues like resource scarcity to guide the identification of feasible, ethical, and sustainable possibilities and pathways that may otherwise be masked.

Three distinct approaches to scarcity

From a *systems, boundaries and thresholds perspective,* scarcity is a consequence of the biogeochemical limits of the planetary resource systems, which are demonstrably altered through synergistic interactions with processes of growth in production and consumption. Human activities have cumulatively brought about profound changes to the Earth's biophysical characteristics and ecological processes to the extent that the capacities of the planet to support human life (the 'safe operating space') and socio-economic development is threatened, resulting in increased global financial instability, increased vulnerabilities in the face of environmental change and threats to the integrity of the planetary life support system itself. Rapid and radical action to subvert detrimental changes to the planetary system must be taken. Recommendations include regulating extraction and production to ensure that unique and irreplaceable natural capital stocks (including crucial ecosystems) are neither depleted nor degraded. When viewed through this lens, achieving sustainability means that human societies live off of the 'interest' (i.e. sustainable yields) generated by natural capital without depleting the capital itself since it is scarce in an *absolute* sense. Achieving this type of sustainability means fundamentally rethinking the nature of development by shifting away from growth- and consumption-centred approaches. Conventional ideas about development pathways and economic growth are untenable.

From a *technical and management fix perspective*, scarcity is not a problem of physical limits per se, but rather a set of economic problems that arise due to market failures. Natural capital is regarded as being essentially substitutable in production, and as a direct provider of utility. Resource scarcities are viewed as temporary for the most part, because the economic system should be tuned to respond to price signals by increasing innovation, internalizing external costs, and substituting substances with different physical or locational characteristics for more scarce (expensive, increasingly hard-to-extract) substances. Through this lens, scarcity is not so much a concrete constraint linked to actual physical limits, but an abstracted, value-related. Sustainability is achieved through growth via market-driven processes of innovation and increased efficiency in production that allows for adjustments in inputs and substitutions in production processes. In absence of widespread market failures, such substituting processes are seen as ameliorative to specific resource shortages. Recommendations, in the face of such scarcities, involve facilitating investment in technological, market-based and managerial solutions will allow global society to mitigate, and also adapt to, resource crises, across sectors of society and scales from local to global, while enhancing opportunities for growth.

The *structural inequality / distributional position* holds that environmental degradation and discrepancies in resource access are the result of inequitable institutional and governance arrangements. Following a human development approach to scarcity breaks down macro and aggregate understandings of scarcity and argues that scarcity affecting access to basic resources is unacceptable in the twenty first century; scarcity is not 'natural' but generated through socio-political processes, through political decisions resulting in exclusions and discrimination. From this viewpoint, solutions should be oriented towards dismantling the structures that focus and direct disproportionate environmental risks and vulnerabilities on some groups and not others, as well as dismantling the structural barriers that cause suffering deprive people of capabilities in life, the ability to have a satisfying life and be well.

If one had to 'distil' the three different perspectives into their respective 'essences' regarding scarcity, one could propose that each approach asks a fundamentally different question about sustainability:

1. *How can development be pursued (differently) whilst maintaining the integrity of specific natural resource systems and achieving stability regarding planetary biogeochemical processes?*

2. *How can investments, technologies, and management strategies best be applied to particular resource situations be applied to keep development-related environmental degradation at a tolerable level whilst ensuring continued economic growth into the future?*

3. *How can adjustments to structural and institutional arrangements governing extraction, production, access to and control of natural resources lessen or eliminate socially generated, or 'constructed' scarcity and environmental vulnerabilities?*

Although each of the three dominant positions addressed in this paper is dealing with scarcity, scarcity does not mean the same thing in the three different positional contexts.

Areas of consensus and disjuncture regarding scarcity

Aside from such 'essential' differences, our dialogic approach allows the identification of specific areas of consensus and disjuncture around scarcity across the three perspectives, which can be particularly useful for informing a comprehensive and carefully considered approach to scarcity going forward. These areas of agreement between all three positions include the following:

- **Resource relationships.** Complex relationships and even what can be thought of broadly as 'feedbacks' among resources and social systems (including economic systems) exist, particularly in the context of growth.

- **Limits to sustainable use of resources.** Limitations exist in regards to sustainable use of natural resources. This is an area of consensus even if notions of sustainability, the nature of the limits (ex: absolute vs. relative vs. social), their causes (ex: growth processes vs. external costs vs. structural barriers to access for example) and appropriate solutions (ex: degrowth strategies vs. green growth strategies vs. pro-poor structural intervention) are contested.

- **Resource dynamics.** Different limitations and relational dynamics are at play in regards to different types of resources. Different resources do not exist in isolation from one another, nor from social, economic and political forces, although ideas about the implications of these dynamics for different stakeholders, policymakers, businesses, and ultimately development, are debated.

- **Complexity in the resource environment.** Even with technological progress, increasing complexity in the operating environment constrains the exploitation of existing and future resources. Complexity arises from biophysical factors (e.g. major weather events), technical factors (e.g. deep-water drilling) and political factors (e.g. operating in politically fragile economies; histories of social conflict; bureaucratic complexity).

- **Resource politics matter.** Whether thought of in terms of policy decisions or in terms of substantive relational politics, the politics of natural resources carry profound implications for the global economy, global inequalities, environmental justice and conflicts.

In addition to the above listed areas of agreement, there are further areas of consensus and disjuncture between the Systems, boundaries and thresholds position and the Technical and managerial fix positions that are not shared by the Structural inequality / distributional position. These areas include:

- **Scarcity is a fact of nature vs. the politics of scarcity.** Despite differences, both of the above positions naturalise scarcity, viewing the respective processes that result in scarcity as occurring or existing largely outside of, or regardless of, politics. In contrast, what we have called the structural inequality / distributional position places politics at the centre of understandings of scarcity.

- **Economically valuing / pricing natural capital is essential vs. ethics.** Both positions concur that 'capturing environmental value' is crucial for sustainability. A systems, boundaries and thresholds position would emphasise the importance of accounting for the value of renewable and renewable natural capital stocks, as well as the marginal value of the ecosystem service that they produce, because un- or under-valued resources are prone to degradation and are neglected in policy decisions. From a technical and managerial fix position, un- or underpriced resources result in 'market failures' that become evident as economic agents fail to integrate full costs into calculations and decisions about resource use, resulting in 'external effects', or 'externalities'. These and further distinctions flow from the positions' respective adherence to 'strong' versus 'weak' notions of sustainability.

An important area of disjuncture relates to the role of ethics, equity and environmental justice concerns to the different positions. Neither *Systems* nor *Technical* positions highlight these as primary concerns. Additionally, many global indices and debates in the natural resource domains are highly generalized and often too aggregate to take on board local nuances and differences. In terms of conceptual framing, with its overarching emphasis on biogeochemical processes, global environmental integrity and the survival of the human species, the *Systems, boundaries and thresholds* orientation omits consideration of the trees for the forest, so to speak. Likewise, the *Technical and managerial fix* is primarily concerned with capturing opportunities for increased efficiency and growth but rarely mentions key equity issues related to labour, occupational health and safety, 'downstream' impacts of development projects or the social and environmental consequences of large-scale land deals and infrastructure projects. This is very important because the understandings that dominate policy debates at the international and national levels are frequently at odds with the perceptions, knowledge and experiences of local resource users (Mehta and Movik, 2014). Some examples provided in this report concern the interconnected nature of land and water as well as the domestic and productive uses of water at the local level alongside the politics of scarcity and access. These issues highlight the importance of paying attention to the politics of knowledge and data around natural resources, and how current and future crises around natural resources are portrayed.

A final area of disjuncture relates to technological and managerial optimism. While the world is often asked to trust technological progress and market forces will resolve crises, it may bear reminding that often technology and market fixes are both the 'problem' and the 'solution'. For example, interventions such as large dams are made out to be the 'solution' for scarcity in water-starved areas but they are also 'problems' around which prominent social movements have emerged. Hydroelectric power is the 'solution' to growing energy demand in emerging economies, but hydroelectric projects are associated with downstream 'problems' that threaten fisheries and livelihoods. There are also challenges for institutional and bureaucratic organization required to realise governance transitions like the green economy, nexus, and those suggested in the *African Ecological Futures* report, given their ambitious scope and capacity requirements. Similarly, privatization models or large scale FDI investments in water and land are purported to be the 'solution' to efficiently manage scarcity – but their impacts on human wellbeing and people's basic rights can often be problematic, especially in the world's poorest countries.

Conceptual issues and gaps in knowledge

Determining which lenses, assumptions and courses of action are most conducive to identifying the most feasible and ethical pathways of sustainability can be complicated by the fact that approaches are not always articulated or clear-cut in individual reports and can be difficult to pin down, with different actors often slipping between different positions, narratives and language depending on specific aims, audience and emphases. For example, along the lines of the above critique, the language of social inclusivity, justice and equity is often used in reports that advocate increased bureaucratic and managerial control over local resources, privatisation and large-scale investment schemes, but include no clear guidance or substantive vision of how inclusivity, equity or justice fit into planning. In such cases, one is left to wonder if these concerns are incorporated out of convention or to soften the blow of potentially exclusionary and structurally violent courses of action, or whether social equity is conceived as a 'trickle down' phenomenon rather than a course of action requiring concrete decision making and concerted effort to incorporate the views and challenges of often unheard people into planning. Similarly, the language of planetary crisis, limits, and 'strong sustainability' is often used to communicate a sense of urgency and to 'green' proposals that ultimately take a 'weak sustainability', pro-growth approach to development. In such situations, framings and prescribed courses of action are fundamentally at odds as they are based on conflicting assumptions and conflicting notions regarding the appropriate focus of attention or action (ecological functioning vs. economic performance) and the notion of scarcity itself.

Other potential issues are methodological. Mathematically based computer-aided ecosystem and Earth system modelling remain popular among researchers, particularly in interdisciplinary fields of environmental studies, sustainability science, climate science and Earth system science (ESS). As they are widely considered empirical and rigorous scientific approaches, they are also influential with members of the public and policymakers. As they are also highly technical, based on specialized techniques, programming language and mathematical formulae that are difficult for non-experts to grasp, they are also controversial and frequently misinterpreted in the contemporary public sphere.

It is important to note that despite the complexity and sophistication of modelling techniques, it is uncontroversial to mention that their predictions remain hugely uncertain; there are difficulties in predicting specific resource horizons and adaptation needs with any degree of certainty (e.g. it is going to get much wetter or much dryer, but hot how much). As Galaz and colleagues note in reference to Planetary Boundaries modelling, '[p]lanetary boundaries' are not fixed nor certain, but represent model-derived estimates, based on abstracted aggregate data and proxy data, 'of how close to an uncertainty zone around a potential threshold' the planet might be (Galaz et al., 2012):1.

Like systems modelling, econometric models are also popular means of obtaining projections regarding future relationships between supply and demand for specific resources, or groups of resources, to inform regulatory and market interventions in price volatility (essentially to control an economic notion of scarcity). Future projections based on econometric models, like systems models, are fraught with uncertainty as well due to complex relationships among different resources in production contexts, and uncertainty regarding the unfolding of future policy decisions.

Additionally, numbers can be put to many ends, highlighting again the importance of understanding issues of framing and interpretation.

Data quality is a huge methodological issue. Using low quality data can impede rather than assist in activities such as monitoring, evaluating and cleaning data. There is often a lack of transparency in sharing data between countries especially around issues concerning transboundary resources, poverty levels etc. Many resource management tools and accounting and modeling approaches require a sophisticated knowledge base and assessments of past and existing rates of use by different sectors (e.g. agriculture, industry, etc.). This can be a challenge in data-poor environments, such as sub-Saharan Africa, and significant financial and donor resources can go into improving the data base, instead of actually enhancing access to resources (e.g. water infrastructure).

In the case of water, while estimates of global freshwater use in long time series are available, no country-by-country database is available to support an analysis of the coupling between economic activity and water use (UNEP 2011a). Furthermore, few models of resource availability account for dynamic price effects when estimating supply and demand (to do so requires a step change in model complexity). Prices may not exist for certain resources, particularly water and ecosystem services associated with forests or healthy fisheries or in domestic and agricultural contexts in which water resources are not privatised nor regulated by a regional authority (i.e. considered a free common good). In such cases, water resources are not reflected in national economic statistics leading to distorted levels of demand and an absence of incentives to protect or increase supply (UNEP, 2014; World Economic Forum, 2014).

Assessments of global hotspots of water scarcity, floods and droughts are often very aggregate and focus on the volumetric aspects of water. There are currently few reliable statistics at more disaggregated scales. Much of the available data are either modelled or estimated for hydrological units or national levels, and then disaggregated using algorithms or statistical tools. They also tend not to disaggregate users and their entitlements or look at the politics of distribution (Mehta and Movik, 2014). Until recently, alarmingly, MDG progress ignored peri-urban and 'slum' areas, which are some of the fastest growing areas in the world (WHO/UNICEF Joint Monitoring Programme, 2012). There has also been little comparable international data on gender indicators and most agencies lack proper sex-disaggregated data, making it impossible to monitor progress or devise gender sensitive policies. For instance, most official indicators do not question the time taken by women and girls to collect water. There is also not enough data or understanding regarding how much food is produced by women or resource users that lack formal land and water rights.

Large-scale land deals and resource 'grabs' have featured prominently in this paper. A range of global and continental assessments in the past few years have attempted to grapple with questions of the scale and distribution of land deals, including the Land Matrix project, as well as the on-going monitoring of land deals by GRAIN, based on media reports, but also influential reports by the International Institute for Environment and Development (IIED), the International Food Policy Research Institute (IFPRI), Oxfam (2010), the Oakland Institute, International Land Coalition and the World Bank among numerous others (Scoones et al., 2013). However, attempts to quantify land deals in an aggregate sense remains plagued by methodological problems to the extent that Scoones (2013) has suggested that the attempt to build up an aggregate understanding shift to favor more specific, transparent and grounded methodological approaches.

There is a high level of uncertainty around projected energy and minerals demand. This uncertainty stems from, for example, a lack of knowledge regarding the impact of energy efficiency policies in the bigger economies, which have a large influence on the overall demand trends. Further, resource relationships, and particularly those having to do with water, compound uncertainties regarding future demand and production of energy and minerals.

Uncertainties plague fisheries projections as well. For example, according to the Natural Capital Committee, the limited evidence that exists suggests that stocks of fish in UK waters have been falling for many decades; however, we do not have good time series data on a range of fish stocks to definitively demonstrate this. This illustrates the importance of having good data on the stocks of our natural capital and how they are changing if they are to be managed in a way to maximise our wellbeing (Natural Capital Committee 2013).

Forward directions

Transforming Our World, the 2030 action plan for sustainable development, proposes an action plan for the next fifteen years for 'people, planet and prosperity' that aims to realise a world of 'peaceful, just and inclusive societies which are free from fear and violence' (2). In the framing of the Sustainable Development Goals (SDGs), development challenges—including persistent poverty and denial of dignity and opportunity for billions of people, rising inequalities and growing wealth disparities within and between countries, gender inequality, unemployment, global health threats and disparities, spiraling conflict and related humanitarian crises and forced displacement of people—are unfolding in a global context haunted by concerns over mounting environmental scarcities. Considering the information and perspectives covered in this paper, informing strategies for achieving the new SDGs requires asking hard questions around how substantive social, environmental and economic equity and sustainability can be achieved in a global system that is demonstrably characterized by social, environmental and economic inequity and environmental destruction that is driven, at least in part, by fears, ideas and crisis narratives about mounting scarcity itself.

In part, scarcity debates have been reinvigorated due to the relatively recent triple-crises of food, feed and fuel of the mid-2000s. These crises have demonstrated the complex interconnections, first, between systems of resources, economy and politics and second, between different political-economic scales and geographically distant localities. While political discussions have tended to centre on the impacts to global markets and international finance the establishment of new markets to facilitate recovery and growth, there has been until recently little widespread recognition of the diverse and spiralling impacts and reactions of these events across sectors, regions and localities and their implications for local livelihoods and rights to resources.

These crises have become inextricably entwined with overarching concerns about environmental crisis, with direct implications for our understandings of the goals of sustainable development and, by extension, strategies for achieving SDGs. The idea of sustainable development that was articulated in *Our Common Future*, and is embodied in the SDGs is oriented around ensuring 'that [development] meets the needs of the present without compromising the ability of future generations to meet their own needs'. But what does this mean? Can human societies live off of the 'interest' generated by natural capital without depleting the capital itself, while at the same time supporting continued processes of market growth and substitution? Attempts to reconcile these two notions have resulted in, for example, novel (yet not uncontroversial on many levels) techniques of mitigation and management that involve privatising, monetising and financializing nature and natural processes in order to economically account for, offset and trade abstract units of environmental integrity and degradation. What are the implications of these techniques for the third position on sustainability that our dialogue has highlighted, that of achieving justice among humans and between humans and the natural environment? While such mainstream approaches may help businesses and governments green their environmental balance sheets, they have also exacerbated trends in resource deals and the establishment of resource 'fortresses', often in developing countries with large endowments of natural resources. These have often led to inequitable land and water reforms and resulted in disputes and conflicts over rights, displacement of people from their homes as well as the disarticulation of local people from the basis of their livelihoods through restricting access to resources and demographic shifts that contribute to urban and peri-urban expansion and degradation of ecosystems.

There is also the question of the feasibility of the various solutions proposed. As discussed in the paper, resorting to technology is often both a key problem and the solution and this tends to lead to a self-perpetuating cycle of resource crises, their apparent solutions and new forms of managerialism and bureaucratic interventions over resources and people, often leading to new forms of scarcities for some. Also technological and institutional arrangements while intended to reduce scarcities, due to elite and other biases, can increase the insecurities of disenfranchised and marginalized groups and can lead to increasing risk of conflict among stakeholders.

Several approaches that are currently en vogue, for example, the nexus are calling for much needed integration across sectors and domains but there are questions regarding their on-the-ground implementation and feasibility across scales. There are also serious questions of capacity, especially in low-income countries, regarding the institutional ability to carry out this integration and lessons should be learnt from earlier approaches that have remained abstract and difficult to implement (e.g. IWRM). As discussed, there are also serious knowledge gaps to implement such approaches. These include data that cannot adequately capture ecological uncertainty and also the unintended consequences of technological interventions.

As demonstrated in this paper, many usual and unusual suspects (e.g. WEF, WWF, the EU, the World Bank as well as global corporations etc.) are now concerned with resource scarcity. It follows from this review that such a mission is not a neutral act, and developing an organisational position around scarcity requires the consideration of a number of issues and questions. Confronting or even rejecting simplistic scarcity narratives and politics that can end up causing more harm to people and the planet is crucially worth considering. Questions that emerge immediately include: Where should sustainability priorities lie? How should issues of scale be approached? Whose nature are we talking about? Which people (rich, poor, women, men, northern, southern etc.)? Who decides, who benefits and what the impacts of diverse interventions to protect the diversity of life on Earth?

In terms of identifying ways to mitigate and address scarcity conditions confronting vulnerable and marginalized groups, if one adheres to the third position that emphasizes social and environmental equity, distribution and political economy, it follows that there is enough land, food and water to go around and there is no need to resort to any gloomy Malthusian arithmetic. It also follows that people and nature must be seen together as they interact, and not be analytically isolated.

This doesn't deny the existence of resource scarcity but it means that looking at the politics of scarcity and how it affects different groups differently is an important first step when making decisions about interventions. It also means confronting the causes and impacts of scarcity, which tend to most directly impact vulnerable and marginalized groups. Mostly resource scarcity is not natural – it is usually the result of historical imbalances and legacies, misdistribution, exclusions and imbalances of power. Growth-focused projects, mitigation schemes and conservation projects that are established at significant cost to local or marginalised people – in terms of rights, capabilities, dignity or in terms of opportunity costs – can actually create new or exacerbate existing scarcities and can create or intensify environmental risk. Understanding these causes of scarcity and associated environmental problems, which unfold in unique ways in different localities and ecological contexts, and empowering local people to make decisions that affect their lives in fundamental ways, can go a long way toward dismantling the structures that focus and direct disproportionate environmental risks and vulnerabilities on some groups and ecologies and not others.

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