Thinking Sustainability _
Shifting Back the 'Shifting Baseline'

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ABSTRACT **The chapter explores the broadest conceptual frame-of-reference for issues related to sustainability, before any specific architectural design and urban planning solutions are considered. The main argument is that narrow disciplinary solutions cannot contribute very much if the overall systemic complexity is not grasped, greater continuum of required practices understood, and dominant narratives challenged. The text first explores the dim *term* 'sustainability', its connotations, use, and politics, and then proceeds to the corresponding *notion* by introducing a wide scope of complexity. The city and the building activity are viewed through the lenses of ecology and environmental history. Discussion further continues to present material, ecological, and systemic limitations and constraints regarding energy, land use (primarily agriculture), climate, and economy. The consideration of probabilities and scenarios in the context of different socio-environmental outcomes is illustrated using the example of Holmgren's 'future scenarios', while solutions are structured through the hierarchy of *technical, strategic,* and *cultural*. Finally, the syndrome of the 'shifting baseline' (a propensity to view a current or recently known state of environment as normal) is discussed, and the regenerative power of overall design is speculated upon.**

KEYWORDS sustainability, complexity, energy, resources, scenarios, shifting baseline

1 Introduction

For several decades now, the way the term 'sustainability' appears in public discourse has been strongly unsynchronised with what the notion of (un)sustainability has to tell us. On the one hand, we are presented with series of unconnected ways in which *usual* activities of our daily life or our professions can acquire just one – among many – improvements called 'sustainable', while on the other we (can) understand that unsustainable can refer to such things as an uninhabitable planet and societal collapse. It even appears that the global culture (including our politics, economy, cities, down to the most trivial aspects) has become incapable of articulating a discussion on threats to its own existence. There are two main reasons for this. The first is that our (globally distributed) culture effectively (though not formally) prohibits all elements of the discussion being on the same table; some key elements, processes, as well as ideas, beliefs, and worldviews appear to be beyond questioning. The second is that the issues of (un)sustainability are deeply complex – and deeply woven into a contemporary complex world – and yet all too often approached with the specialist perspective of individual disciplines.

This chapter will thus use its introductory role to first list and then interconnect all aspects and all main factors related to humankind's ability to achieve sustainable inhabitancy of the Earth. In fact, there seem to be many ways in which sustainability can be achieved, and these ways, as well as some (cultural) *values* that determine them, will also be brought forth to inform an adequate discussion.

In advance, it should be underlined that sustainability is not merely a matter of application of thermal envelopes, public transport, photovoltaics, or any such specific approach or isolated technique. Neither is it just a matter of laws and regulation. Sustainability is, before anything else, a matter of cultural choices and socioeconomic determinants (including power and interests). With 'sustainability', and especially with 'sustainable development', we are presented with narratives, apt of course to be supplemented or confronted by other narratives. This chapter will thus inescapably contain elements of critique, as well as several different narratives, entry points, and sets of scenarios. The text should be read as a web with the key questions being: "What is the importance of this aspect of (un)sustainability?"; "What is at stake?"; "How is it connected to other aspects and factors?"; "If this aspect slides further down to unsustainability, what happens?"; "How – in response to that – the complex system changes?"; "What are the cultural roots of specific unsustainable practices?" etc. Not all answers can be given here, but all the relevant questions should be asked when we plan, build, or otherwise act in our endangered world.

2 Approaching Sustainability Issues

2.1 Strictly Speaking: The Term Initiates the Discourse

The staple definition of sustainability – the version endorsed (in word) by almost any institution, organisation, or individual with a public face and a power leverage – comes from the Brundtland Commission report: "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987, para 27). After three decades of use – and despite its many positive effects of formalising the nominal discourse of resource limits, future generations etc. – this definition continues to misdirect the discussion by standing on several problematic connections: It provided a pretext for not separating sustainability from expansive economic activity ('development'); it does not distinguish such economic activity – or any form of 'development' – from 'meeting of needs'; it conflates needs and available resources and, generally, sees the world as not much more than progression of (human) generations. To enable a more complex thinking on sustainability, we will have to start from the foundation of the discourse: the terms selected and circulating. Though used today with considerable emotional charge, the term 'sustainability' is actually value-neutral and not necessarily related to the state of the environment. This sometimes creates confusion, especially when the term is applied to a complex mix of ecology, economy, energy, and material resources. Besides the more archaic (English) meaning of 'sustainable' as being 'defendable', there are two basic notions at our disposal:

'Sustainable' as in: a process that can – under current conditions – continue indefinitely. By this general definition, many different 'sustainabilities' can be recognised. For example, a certain rate of economic growth can (or can't) be sustainable under certain market conditions (such as specific level of demand), or a demanding task can be accomplished by putting greater pressure on those performing the task to exert greater effort, but it cannot be expected for such effort to become the norm (and the situation is thus unsustainable in the long turn), etc. It is noticeable that both examples do not imply any immediate material limits. Regarding this view and a certain abstraction and detachment brought by the term itself, it is worthwhile to compare 'sustainability' with a notion/term that was concurrent for a long time and up until the 1980s in domains of agriculture and soil conservation - *permanence* (Russell Smith, 1929; Mollison, 1988). Just questioning whether any resource-based arrangements of today's global society can remain as permanent brings forth many insights.

The other meaning of 'sustainable' is best described by its negation – unsustainable, as in, a process that by continuing over a long time endangers other processes. It can be, up to a point, that by ruining other processes the problematic one undermines itself, or to a point at which it is considered unacceptable because it compromises things far more important.

In fact, a total of three faces of (un)sustainability can be observed in the above extrapolations: by depletion, by (overall) destruction, and by unacceptability. It can be said that contemporary (aggregate) concerns about sustainability stem from all three aspects and from (a new) systemic understanding that no process is an island and that the long-term fate of every process lies in fates of its connections, ultimately always dictated by the limits of the natural world. Nonetheless, it took a whole history of human population growth (and a lack of new places to go) for these limits to become immediate and palpable. Still, most of the confusion about sustainability issues in general discourse – besides coming from vested interests – comes precisely from this combination of exact material limits, destruction of vital systemic links (not just the destruction of specific organisms, populations or landscapes), and the values that determine what is desirable, unacceptable or even what is considered to be a norm (as in the 'shifting baseline' syndrome discussed in Section 4.2). If concerns for general human health or social justice are added in, this confusion rises even more, culminating in the paroxysm of "green", which is as imprecise as much as it is suitable for (and used by) the market.

The history of the concept speaks mostly of the difficulties in mobilising cultural, societal, and economic forces for change. The awareness of human-induced environmental damage and resource depletion has been the subject of a number of writings. Among the first, Plato had depicted eroded hillsides and silted river mouths (Hughes, 1994, p. 81; Montgomery, 2007, p. 51). Strabo, Columella, Varro, and Pliny the Elder, besides describing the degradation, proposed practices that would ensure the Earth's 'everlasting youth' (Du Pisani, 2006, p. 85). Practice rarely followed, and societal degradation and collapse often ensued (Montgomery, 2007, p. 55-68). When problems were averted, it was mainly for the reasons other than revised policies based on new awareness, except in a few isolated cases, like Edo-period forestry in Japan (Junichi, 2002, p. 5). Although the subject of human relationships with the environment and key resources ran modestly but continuously through the writings of western authors for several centuries (Du Pisani, 2006, pp. 87-89), the efforts to develop complex working norms appeared at two distinct points in time: The first one was in the 18th century, with treatise on sustainable (*nachhaltende*) forest management by Hans Carl von Carlowitz (*Silvicultura Oeconomica* (Du Pisani, 2006, p. 85)) and the second in the 1970s (Club of Rome (Meadows, Meadows, Randers, & Behrens III, 1972)) and 1980s (World Commission on Environment and Development, 1987) in a much wider (global) context. In the 18th century, not only in Prussia but in the whole of Europe, wood – as a primary industrial source of energy – was becoming ever scarcer. New practices, though employed significantly in some instances, did not save European forests, but a shift to coal (and eventually to all fossil fuels) did. (A major turning point was the Darby family shift from already very scarce wood/charcoal to coke in iron smelting (Hyde, 1977)). Likewise, contemporary concerns for 'sustainable development' coincide with the first impacts of the fossil fuel bonanza in the 1970s (Yergin, 2008, p. 134), with a public discourse again oriented more towards maintaining the *status quo* than towards assessing the overall position of an energy-intensive socioeconomic (and cultural) model.

2.2 The Web of Problems and the Network of (Discursive) Solutions

Being immersed in immediately available information, images, and narratives of the *global* and its many networks, we can find it hard to imagine today how vast (and larger-than-humans) the world might have seemed just a few decades ago – even to the most observant individuals within a given society. It is perhaps the (trans)historical human collective experience that this large world can recover after any insult made to the environment, or, for new resources to spring at another place when everything at home is thoroughly consumed. The first to recognise a system of global limits were individuals, groups, and institutions in position to gather and cross-analyse large (global) data. This perspective – and its computational tools - truly arose only in the wake of the World War II. The Club of Rome (established in 1968), widely known for its 1972 report *The Limits to Growth* (Meadows et al., 1972) is only one such example in the streak crowned by the official reports (Bruntland, 1987) and conferences (Rio 1992). Within such a milieu, the basic elements of the public discourse of 'sustainable development' were set: the task is to make already established processes of industrial extractive economy (termed 'development' and undistinguished from development of literacy, health care etc.), with all its growth, consumption and re-distribution of power, somehow compatible with finite resources and fragile ecosystems. Although these contradictions were objected from the start (Turner, 1988), and although within specialist disciplines (such as ecology, mining etc.) quantifiable data were the only relevant, the public discourse, as well as the commerce (with new branches of marketing emerging around 'green'), continued to rely almost solely on slogans related (in word) to sustainability. Many professional disciplines and administrative practices operating with complex and multifaceted systems faced the same pressure to develop their own sub-narratives of sustainability. This is especially true for construction, architecture, and urban planning – disciplines and practices that commonly derive their essence and identity through the transformation of natural resources and the environments, hence being elements of 'development' *par excellence*.

Even though urban planning and architecture deal with values, aesthetics, and preferences (both personal and cultural), operate through a very diverse set of parameters, and lack single 'correct' answers, a very narrow approach came to dominate the disciplinary strivings towards an ecologically responsible and resource-wise future. Besides some marginal efforts (Šukalo, 2016), the pursuit of sustainability in these disciplines is almost exclusively an approach of a technically advanced and energy conservative execution of the usual demands of industrial society (Buchanan, 2012).

The thinking process in architecture, as well as the strategic decision-making in urban planning, needs a complex yet operative set of interconnected understandings about environment, resources, and society before any design intention is considered. By exploring the notion and the term of sustainability, we have already delved into some aspect of one such set. Other fundamental considerations are as follows:

Understanding the scale
Eventually, it is the *whole of the world*. The environmental transformations that climate change promises to bring are vast (that is, all-encompassing). Forces producing these transformations are many and they act combined. Constrained resources are almost universally relied upon. Within such a perspective, sustainability efforts of architecture and urban planning can indeed appear as token, thus implying approaches and narratives of *adaptation* to be at least as important as those of *prevention*. Initiating a (public) discourse on the adaptation to great and dismal changes, might even prove sobering enough to improve the prevention.

Understanding the complexity
It is, again, as complex as the world – by now globally interconnected and interdependent. Building industry and city management cannot choose connections and influences (for example, only energy). Every context relies on numerous (interlinked) supportive systems; often much more on diesel-run rice paddy tractors thousands of kilometres away than on a photovoltaic-charged system on the roof of a local office building. High complexity is also often connected with fragility. Perhaps starvation is not an issue if, for example, rice imports cease, but increased food production on a local level would mean a different kind and different level of complexity (often at the expense of a tertiary sector and high culture – and at the expense of the spaces built for those).

Understanding the seriousness
Formulated most directly, climate, resources, and ecological crises threaten, almost literally, with the destruction of the *world* – both in terms of immediate physical elements such as food-producing systems, energy for heating etc., as well as in terms of the overall *image of the world*, as a place worthy and beautiful enough to support us psychologically and spiritually. Confronted with a threat so serious, there stands either an indifference or an array of technical solutions aimed only at narrow particularities. It is practically self-evident that general narratives about the perils of depleted resources and energy, transformed climate, and destroyed ecosystems – let alone depleted soils or water scarcity – failed to mobilise adequate reaction from the general public, economy, and governance. This lack of systemic, overreaching responses permeates every kind of business-as-usual sphere, including contemporary architecture, building industry, and urban planning. Therefore, the means of communicating the seriousness must be altered. An adequate reaction, for example, might be the sharpening of specific (professional) *ethics* that clearly recognises – and denotes – those instances where the best answer is *not to build* (even with all of the technological improvements considered).

Understanding the timeframe

Understanding the timeframe, that is, *the future*. If depletion of a resource, extinction of a species, or destruction of a habitat is predicted (based on specific trends) to happen in the future, it will most probably happen, if the trends remain the same. If a set of new predictions postpone a precise date, the depletion, extinction, and destruction are still bound to happen – again, lest the trends are changed. It belongs to a central logic of sustainability: the *trend* (of use or of destruction) dictates the outcomes, not the time remaining for the continuation of usual ways or yet-to-be-invented solutions. A responsible society (and even any non-irrational one) is not absolved of its duty to apprehend events of unsustainability, no matter how far removed in the future these events may seem. A responsible society plans in accordance with the probability of dire events, not on the basis of its own wishes and aspirations.

The future is easily colonised by whoever dictates the narrative. Its problems should not be discussed only in enclosures of specific technical, disciplinary, or economical/market domains, but always in conjunction with greater debates about possible (future) societal trajectories (though collective discussions about societal futures seem to have passed with passing of the Modern era). Every outcome (desirable or not) of environmental and energetic dynamics has its social, cultural, political, and economic aspects. To put this another way, when talking about an (un)sustainable future, *how (and by whom) questions are asked* is of paramount importance.

Understanding the forces of unsustainability

Despite usual narratives describing challenges ahead in terms of technical solutions or (middle class) consumer choices, there are social and economic forces that confront overall sustainable choices on another plane. It is far beyond the scope of this text to explore the complicated workings of environment-destruction denial (Weart, 2011), policy influencing, (Kamieniecki, 2006; Monbiot, 2013,) and the (poor) economy's vicious cycles (Shah, 2003), but at the core of the problem is an overall understanding that forces of *status quo* are *immediate*, regardless of social status (What to eat today?' 'How to acquire/maintain social status?' 'How to keep balancing daily life?)'. At the same time, the idea of sustainability is governed by abstract concepts derived by analysis of processes that are not immediately observable and which occur over long spans of time. This idea is also guided by a regard for the common good, a regard thoroughly repressed under the current global socioeconomic regime. Finally, it is necessary to understand that there is an aspect of *confrontation* to the whole challenge of sustainability. Like any other it may involve both seeking a consensus and choosing sides.

Understanding the significance of *discourses*

Understanding the significance of discourses and of frames of reference. Writing off preventive actions (and shifting focus to adaptation), insisting on assessing complex influences even before simple professional tasks, labelling some usual buildings and developments (whole types and categories, in fact) as needless and wasteful, promoting the attitude of 'confrontation' – and many other such approaches in the face of complex problems of sustainability – these are not some universally applicable 'solutions', but crucial points of missing general public discussion about how space is being managed and buildings are being built in the face of energy shortages, soil degradation, natural area destruction, and all else. Not only are these positions not intended to be solutions, but they can't be. Architecture and urban planning are not at the source of decision-making, but are in the executing middle (with lower social classes often being on the 'receiving end' of environmental degradation). These disciplines most certainly cannot, at will, steer global inertia of the industrialised economy and multi-billion human population. Acknowledging complexity means recognising all the significant forces at play and within them usually a small window of possible action (Meadows, 1997) – as far up the hierarchy of the system as possible. Discourses, world views, and cultural preferences often stand relatively high in these hierarchies.

2.3 The City in History: Origins in Extraction, Transformation of the Environment and Prospects for Collapse

Within a collection of processes that have, after more than ten thousand years, brought the whole human endeavour and the entire ecosphere to the verge of catastrophic events, one phenomenon stands out: the city. It is the most visible aspect of human capability to build, to create, and generally to transform the face of the earth. It also vividly displays the heights to which human numbers have grown worldwide. Before advocating any specific approach to urban planning and design (however 'green' that approach might be), a complex context of the city, with regard to sustainability, needs to be examined.

General phenomenon
The city – as a topologically positioned collection of buildings, streets, infrastructure, and people – is not (nearly) a complete phenomenon. It exists in continuum with the places and environment(s) from which it draws resources. Conversely, the largest negative influences of the city mostly happen far from its location (though obliteration of local ecologies within city limits is not negligible). This distant influence is especially true for post-industrial cities of wealthy societies with industries outsourced and the third sector of economy inflated.

Historically (and ever since), the city has been most immediately related to agriculture: food production was a cause of ample population as well as a reason and a model for organising the power (Allen, 1997; Mumford, 1961). Most forms of agriculture (including pastoralism) have, historically and in recent times, been destructive to environment, with several (partial) exceptions (Bezerra, 2015; Montgomery, 2007; King, 1911). The union 'city-agriculture' has seen numerous historical cases of environmental destruction, predominantly through poor agricultural, pastoral, and forestry practices, followed by an imminent societal collapse (Ponting, 2007; Diamond, 2005).

The contemporary city is similar, but also different to the historical one. Urban areas are now home to a larger part of humanity (United Nations, 2014). The resource base of every individual urban centre is no longer local but is spread globally; cities consume ever more resources and energy and, consequently, the specific culture (produced and perpetuated in/by the city) require input of more and different things than mere products of agriculture. It is true that the economy and the culture of surplus were historically also essential traits of urban centres, but the complexity is now raised, fragility increased and – at the source of both complexity and fragility - the amount of energy entering the system is higher by orders of magnitude.

The city as a culture

The city is important to humans. It has been deeply embedded in our imagination for several thousand years. It has been ascribed a divine origin and has been used as a model of heavenly realms. More recently it has been understood – together with its historical twin, 'civilisation' - as (trans)historical inevitability and the only outcome worthy of humans. However, the city can also be viewed as a 'vessel' (Mumford, 1961) – both a product and a source – of *a specific form of culture*, among many other forms exercised by humans, such as hunting and gathering, nomadic herding, rural sedentarism, etc.

No practical conclusions could be easily drawn here except that – unlike in general discourse – problems of 'city culture' should not be emotionally inflated and equated with the fate of 'humanity', and thus many other routes for searching for sustainability could be made open for creative investigation.

The city is about the division of labour and specialisation. The 'great change' brought by the resource crisis does not necessarily mean hunger, insecurity, water scarcity etc. It is possible that many cities would balance out key-resource shortages smoothly, but with significant transformations in what most people do for a living. If anything, a 'great change' is a great change in a (contemporary) city's culture of specialisation, 'opportunity', 'variety', 'choice' etc. (Refer to *Understanding the Complexity* in Section 2.2)

The city as an object of planning

Architecture and urban environment, viewed narrowly, in their usual scope, really offer few possibilities for significant improvement in the field of sustainability. What is to be explored are rearrangements in the greater whole of the city and its resource base – from highly conceptual and farfetched to immediate and practical, together with possible changes in dominant culture oriented at consumption.

On a more abstract level of understanding, all concentrated human dwelling places are nodes in flows and fluxes of energy (Forman, 2014; Odum, 1971). Products of photosynthesis (counted both as energy and biomass), reserves of fossil energy, other direct and indirect gains of solar energy (heat concentrated in mass, photovoltaic, wind, hydroelectric etc.) all enter cities in higher proportions than in naturally occurring concentrations and circulations. Human/spatial densities (and cultural attitudes) thus enabled often appear wasteful – such as in contemporary dense inner cities relying exclusively on imports of resources or in a senseless sprawl across underutilised landscape. Yet these (or at least similar) densities have prospects for high ecological efficiency (due to optimal care and resources given to productive systems), such as through historical urban agriculture, with cities like Paris exporting humus and 'being able to produce enough food to feed London' (Illich, 1992), or in possible future rearrangements of energetically ideal (but so often underappreciated) densities of *suburban* (Holmgren, 2006).

A reminder: though city culture (together with its resource base) today operates as a global process, individual cities and their contexts do vary significantly, as does their reliance on abundant energy and their fate in a future of constrained resources and climate instability.

3 (Un)Affected by Discourse: A General Framework of Material and Systemic Resources

The continuous use of finite resources cannot continue indefinitely. This is especially true if this use is intensive and encouraged (through socioeconomic imperatives) to constantly grow. The same applies to finite – and ever more compromised and fragile – ecological systems. These are almost truisms that few arguments can counter. Yet, the 'debate' is still on. How? One class of arguments does tacitly admit finiteness of resources, but with an uncertainty of available data it sides with reports and projections of a much more plentiful state, thus postponing the moment of 'depletion' considerably further into the future. Translated into a socio-political and cultural discourse, this quickly becomes a simple (and simplistic) reassurance for the usual "way(s) of life": '(A) supply of natural gas that can last (USA) nearly one hundred years' (Obama, 2012). The reason behind this kind of argument assumes several stances:

- it is impractical to consider such a long timescale;
- at the expense of important economic processes. Further, it requires
- a stance of denying or ignoring the ecological consequences of using said resources (such as greenhouse gas emissions) and
- a faith in the ability of industry ('humanity') to come up with an adequate replacement (in what essentially amounts to a belief in *progress*).

Discussions like this continue throughout the global public arena (with operative decisions all too often siding with the needs of business), but perspectives beyond simple 'full' and 'empty' are not adequately represented. When inquiring into processes and material assets that maintain something as complex as global industrial society, several key concerns need to be addressed. This text will focus most heavily on three cornerstones of large and complex industrial civilization, all three having their 'sustainability' challenged in a different, interdependent, and mutually amplifying way: abundant energy supply, stability of (climatic) conditions, and the way (not just the amount) that the food is being provisioned for population multitudes. The fourth cornerstone of societal and intimately human aspects will be touched upon only briefly, due to its reliance not on facts and amounts, but on cultural consensus.

3.1 Energy

With regard to energy, there are few non-contested facts; this is the field of most complicated confrontation (and obscurity) of data, views, interests and powers. Some sources of energy (like oil and gas) are deemed so important that major wars are regularly fought over them. On the other hand, fossil fuels, with immense pollution generated by their use - and with wars fought over them - are seen as some of primary drivers of the destruction of the biosphere. For now, and in this format, we will talk about *probabilities* and in a presumption of a wider picture – that of society planning for both a high and low energy future. Key points follow:

Energy is intimately tied to economy, and fossil energy is intimately tied to the dominant form of the industrial economy of the past 200 years (Landes, 1969). It is the economy that relies on growth and asks for the ever-increasing supply of energy and other resources. It can be further speculated that cultural views and expectations of continual human 'progress' were tailored according to this expansive relationship between easily available energy and economy based on the assumption of growth.

Coal, oil, gas and their various derivatives, from the point of view of an energy intensive system, are very convenient sources of energy. They are concentrated (thus indispensable for specific tasks), versatile, easily transportable, independent of specific infrastructure grid (unlike electricity), relatively easily storable, and non-intermittent (unlike solar or wind sources). Renewable sources can replace them relatively easily only in limited scope, like household use, light vehicles etc. For other uses, such as road transportation and large scale industrial agriculture it is less probable, while for an array of usual activities of industrial society, such as mining, air travel, and large-scale inter-continental sea transportation, it borders on impossible (Heinberg and Fridley, 2016, pp. 71-80). Finally, to 'replace' current usage might sound plausible, but to maintain a similar rate of growth to that which has been maintained by once plentiful oil, coal, and gas is outright impossible – as well as it is impossible for fossil fuels and for anything that aims for a perpetual increase.

It takes energy to get energy. In that respect, from the point of view of an energy intensive system, energy extraction is different than extraction of most other kinds of resources where proper demand will justify every effort. At some point, no demand (market or other) will justify spending more energy to obtain less. The ratio of energy acquired over that expended in extraction – *Energy Returned on Energy Invested* (EROEI)

(Gupta & Hall, 2011, p. 1796) has been steadily decreasing for fossil fuels ever since the beginning of their utilisation. The improvements in extraction and refinement technologies has, from time to time, managed to offset this decrease; nevertheless, the conventional oil sources have dropped from a ratio of almost 100:1 in 1930s, to roughly that of 30:1 in recent years (Hall, Lambert, & Balogh, 2014), while 'unconventional' sources like tar sands and shale oil stand at about 1:5 to 1:1 (Nuwer, 2013). The EROEI of wind and photovoltaic technologies is a matter of debate (also of regular technical improvement) but remain relatively low, from 1:1 up to a promising 1:30 (Heinberg & Fridley, 2016; Dale & Benson, 2013).

Non-renewable sources of energy cannot really be 'depleted' and this, again, comes from the logic of EROEI. It is directly linked to a phenomenon common in extraction enterprises (especially in the context of lightly regulated economies): that of 'lowest hanging fruit'. The richest, most concentrated, highest in quality and most easily available resources are often taken first (Heinberg 2011 pp. 36-41). In the context of energy this means that there can be vast reserves left but of low quality and availability; once again extracting them would mean spending more energy to get less. This further combines with the aforementioned need for a dominant form of economy to constantly increase its energy use. It is at the point when global extraction of (combined) energy sources cannot meet this constantly increasing demand that complex socioeconomic problems are likely to arise – not at some imagined point of 'depletion' of very abundant reserves (Illig & Schiller 2017; Heinberg 2011 pp. 78-80).

Once influential narrative of *peak oil*, built on theories and projections of geologist Marion King Hubbert from the 1950s and 1960s (Inman, 2016), was based precisely on this reasoning of decreasing net energy gains, increasing economic demand, and on the perception of contemporary economy being dependent on growth. 'Peak' is a conceptual point when production (either of one specific oil-field or of many combined fields - for example, at the global level) cannot be further increased and enters a stage of terminal decline (Hirsch, Bezdek & Wendling 2005). This narrative fell out of prominence with the failure of some of its prognoses (conventional oil 'peak' in 2006, combined 'peak' around 2012 and similar) as well as with discoveries of new reserves and technical improvements in extraction process (Edmonds, Murray, Hughes, & Heinberg, 2015). While accurate prognosis and actual performance of these new reserves – together with anticipated economic dynamics of peak - continue to be debated (Illig & Schiller, 2017) it is important to remember that such peak is bound to happen ('*Understanding the timeframe'* in Section 2.2) and that the only protective element the global society has placed between that point in the future and economic and social collapse is the widely held and encouraged *belief* that renewable energy technologies will be able, by that point, to replace oil and other fossil fuels.

The problem of coal, oil, and natural gas is exacerbated by the fact that these fossil hydrocarbons are not only energy but a raw material for numerous products of industrial society – from pesticides and fertilisers to plastics and pharmaceuticals.

Nuclear fission, as a process that releases energy, is also a part of the overall energy equation with a modest ~5% (International Energy Agency, n.d.). Even though it stands as a 'part of the problem' with very high human and environmental risks, and though it is prone to mid-term 'peak'-dynamic, nuclear fission is sometimes debated, even among prominent environmental publicists and activists (Monbiot, 2011), as an inescapable part of the solution to averting the most serious consequences of fossil fuel induced climate change. Nuclear fusion technologies, on the other hand, though imagined – when invented – to be clean, in public discourse still stand as an obstacle to serious discussion about the future of energy.

3.2 Agriculture

The usual focus on available energy and on environmental consequences related to particular sources of energy (for example, fossil or nuclear) conceals other aspects of un-sustainability. These environmentally harmful and unsustainable processes, unlike the recent phenomenon of global warming, have been running for several thousand years. Among them, agriculture is of primary concern.

It is important to mention however that even the emergence of agriculture should not be – as is often done – considered the first (pre)historical step of humans towards unsustainability. In a wide paleontological and anthropological debate about whether numerous extinctions of large mammals on every inhabitable continent except Africa (prior to agriculture, population explosion, and cities) were caused by human over-hunting, the answer currently leans toward 'yes' (Koch and Barnosky, 2006). With the advent of agriculture – primarily in the form in which it was known in Southwestern Asia – several destructive practices and processes were initiated:

– **Land clearing** for crop planting, that is, the destruction of local ecosystems, usually endowed with far more ecosystem services (like, among others, ability to 'seed' rain) than cropland. It sometimes resulted in immediate or very quick degradation, making land immediately unsuitable for agriculture (Montgomery, 2007, pp. 11-13). This continuous process, which subsided only with local human population crashes like Black Death (Ponting, 2007, pp. 87-89), is the biggest visible human change on the face of the Earth. The expansion continues incessantly even as almost all limits of the biosphere are reached;

– **Tilling of the soil**. It may be hard to comprehend that this deeply embedded agricultural and cultural practice stands among environmentally harmful ones. It exposes soil to erosion by wind and rain, over-oxidizes and releases soil-held carbon (Corsi, Friedrich, Kassam, Pisante, & De Moraes Sà, 2012, pp. 11-17) and degrades or destroys the complex ecosystem of soil that is invisible to naked eye but essential for natural fertility (Coleman & Crorsley, 1996 p. 207, 311). These processes also contribute to the reduction of soils' ability to hold water (Montgomery, 2007, p 205), which not only lowers agricultural production and puts greater pressure on irrigation sources (sometimes also resulting in soil salinisation), but amplifies cycles of wet and dry, flood and famine.

– **Carbon release.** Carbon sequestered in soil by natural processes is released into the atmosphere where it is added to carbon from other sources, including processes of both traditional and industrialised agriculture (e.g. native vegetation burning, crop residues burning, farm machinery, production of synthetic materials, long distance transport, etc.) combining to almost one third of all anthropogenic carbon release (Gilbert, 2012).

As an effect of the aforementioned processes, healthy and productive soil (not just any tillable land surface), being a primary resource of agriculture, has been steadily degraded and destroyed worldwide for thousands of years. This trend is clearly not sustainable; it has its limits. With current agricultural practices and the current rate of soil (fertility) loss, it is estimated that there's about 60 more years left before world food production is very seriously endangered (Arsenault, 2014).

Contemporary (industrialised) agriculture deepened the un-sustainability even further. The list of additions is long: synthetic fertilisers disrupt the symbiotic relationship between plants and soil organisms, thus additionally reducing natural their fertility and slowly destroying soil structure (Coleman & Crorsley, 1996, p. 324); they also leach intensively into the environment, with an array of resultant problems (Odum & Barret, 1953, 2005) together with leaching of synthetic biocides whose negative effects are widely acknowledged. Transition to mined sources of phosphates has additionally made food production dependent on a depletable key resource (Mohr & Evans, 2013). When talking about dependence on non-renewable resources, fossil fuels (and petroleum-based raw materials) step into picture, together with often high dependence on constantly diminishing resources of underground aquifers. Finally, there are practices of growing annual crops (thus already including the negative aspects of tilling, etc.) to be used as a feed for confined animals, taken out of agroecosystem processes, with wastes concentrated to produce large amounts of methane (a highly potent greenhouse gas).

Why was it necessary to present all of these aspects of agriculture in some detail? Primarily to demonstrate that even if miraculous advances are made in renewable energy production and energy conservation, not all is solved in other domains. There are still grave concerns to be addressed on the level of specific (agricultural) techniques, but more importantly on levels of economic, social, cultural, and spatial arrangements within the most basic field of all – that of food production.

Fortunately, on the level of specific techniques and more complex approaches, food production doesn't need miraculous advances.

The world has seen many local historical examples of sustainable agriculture, and contemporary methods (both conventional and 'alternative') are numerous. Even more, adequate practices of agriculture can easily be regenerative, not only conservative. For example, carbon that was continuously released throughout the centuries can be incorporated back into soil (FAO, 2017; Toensmeier, 2016), not through any high-tech geo-engineering but through proper play with plain old photosynthesis - while growing food.

Forests too belong to the continuum of biological and ecological 'resources' that humans regularly use. Forests have been slowly recovering throughout many parts of Europe (and other temperate humid climates) since they were replaced by fossil fuels as a primary source of industrial and domestic energy (Williams, 2006, p. 473) and with gradual abandonment of rural areas. At the same time, assaults on forests in more brittle ecosystems (in the tropics) have been carried out in a quest for commodity wood and for plantation land (Williams, 2006, pp. 397-402). Without going further into the state and trends of forest dynamics and its sustainability, a question needs to be asked: What will be the consequences in the event of the possible return to wood as primary source of energy? How can it be anticipated through planning?

3.3 Climate

Even though high (fossil) energy use and soil destruction are unsustainable in their own right through the diminishing of critical resources, climate change also meets them half way; it renders them unsustainable yet again by making them 'unacceptable' (Section 2.1). Climate change amplifies all systemic consequences of unsustainable uses of natural resources. It is not only that coal and oil cannot be relied upon in the long term because their net energy eventually approaches zero (see EROEI in section 3.1), but burning of these substances eventually changes the whole planetary environment to the point of being uninhabitable. Not only we cannot rely for long on the current model of food production because it destroys its own soil base, but global changes of climate – caused in large part by agriculture and land use change - are bound to bring this production even lower by droughts, floods, and other events of unstable climate and broken ecosystem links. Finally, if we find contemporary socio-political arrangements around the world to be less-than-perfect, the age of 'climate refugees' (Byravan & Rajan, 2005) promises to aggravate these arrangements even further.

For the opposing view of human influence on climate (usually marked as 'denial'), it is worthwhile to consider the aforementioned in reverse: even without anthropogenic climate change, current ways (of food production, energy use etc.) cannot continue indefinitely and are to be replaced by alternatives.

It is beyond the scope and the intent of this text to recount the range of predictions about greenhouse-gas levels, climate forces, feedback loops, and the dire consequences of the average temperature exceeding the pre-industrial average by more than 2°C (IPCC AR5, 2014). Equally outside the scope (and off the point) of this text would be listing the practical approaches and procedures aimed at averting, mitigating, or adapting to climate change – even only within the domains of building and urban planning. These approaches and procedures are mostly well crafted to reduce the climate impact of buildings and cities, yet the real engines that push us towards catastrophic global warming continue to hum unabated. It is the overall framework of culture and economy (and their demands on energy) that needs adjustment in order for change to fall short of the 2°C threshold. To illustrate the way in which the most basic and fundamental among harmful processes continue despite agreed upon complex solutions, let us consider the following example:

If it really wanted to abide by latest UN climate agreement, negotiated by representatives of 195 countries (USA withdrew in June 2017), in Paris in 2015 (Paris Agreement, 2015), the global fossil fuels industry would need to stop any further exploration of new sources, since what is already in production (capacity to release 942 gigatons of CO_2) is sufficient to override the limit of the 2°C increase (800 gigatons) (Muttitt et al., 2016). Not surprisingly, prospecting for new oil discoveries (only oil, without coal and gas) continue - although 2016 marked a 70-year low with 2.4 billion barrels (due to low prices of oil). It is expected to resume at full steam after voices are raised about such 'small' amounts being a 'concern for global energy security'. It will probably soon return to the average 9 billion barrels (IEA, 2017). This single example, among many, depicts how political, economic, and, in the end, cultural narratives remain confronted with the physical realities of constrained resources and climate change. Processes of environmental degradation continue to run at a faster pace than the pace of implementation of solutions – with predictable consequences. Herein lies a further and a more consequential logic of 'thinking sustainability':

Emotional and subjective responses, together with logical, technical, and practical ones, are integral parts of a complete stance and action on sustainability issues; they are a legitimate part of a systemic view. Personal and group emotions of despair (or such) emerging because of the ensuing *loss of the world* shouldn't be buried by limited immediate action, but should instead be encouraged to enter general discussion – partly in order to help shape the 'understanding of the seriousness' and to instigate a search for different approaches. After all, there is a whole aspect of sustainability related precisely to values and emotions (see 'un-sustainable as unacceptable' in Section 2.1) and there are whole parts and layers of the world whose loss threatens almost nothing but themselves - and our humanness. Apart from pollinators and other similar key groups of organisms, the whole peril of biodiversity loss is related to mostly what (some) humans find dear: from river dolphin and rhino to salamander and lynx.

Educated socio-economic perspective is crucial for adequate stance and discourse on climate change. Responsibility for proper action is not homogenously distributed and vague appellations on 'humanity', 'human civilisation' and the collective 'us' are often used more to obscure interests and positions of power than to initiate a meaningful change. Leverages of politics and economy are much more powerful than, for example, a 'consumer choice' is. Leverages in hands of *professionals* (such as architects, planners, and engineers) also rank relatively high, not so much in the sense of technical improvements, but in the collective awareness of the critical position that professions hold in the smooth operating of a clearly harmful system. The combat against climate change has occasionally been likened to a state of war (McKibben, 2016), both in (acute) awareness and in the resource mobilisation needed. Unfortunately, or not, neutrality is rarely possible.

3.4 Culture

The previously described dynamic of material limitations to the endless continuation of growth, 'progress', or *business-as-usual* is altered, modified, and steered by societal influences of quite a different kind. We will present them only through rather wide and speculative theses, for consideration.

Any discussion about sustainability is incomplete without addressing the number of people living on this planet. This number has been growing almost constantly for thousands of years and the unimpeded growth alone highly qualifies it among the 'unsustainable'. Yet it is advisable not to indulge in simplifications and treat 'population' as a biotic factor. Cultures and economies set the birth rate. Cultures and economies - not 'humans' - consume the Earth today. Currently, far more important environmental pressure than the increasing numbers are increasing cultural demands caused by the aspirations of poorer countries to reach the wasteful material standards of wealthier ones (Pankiewicz, 2015). Reasons for which the talk about 'population control' is somewhat a taboo are obvious; rather than being imposed by policies, it should be *enabled* by culture and economy. Easing of global (and *globalist*) economic pressures thus becomes an immediate task in tackling population growth as one of the most serious sustainability challenges.

An additional factor needs to be considered: the current state of the discussion about population growth reflects the current state of energy use and it also reflects the overall form of the economy. The stability of human numbers (potentially) achieved in one energy regime, might not be viable in another. For example, a possible (or probable, or inevitable) transition from high to low energy-use (and low-tech) economies brings about the possibility of an increased demand of (physical) human labour, and with it resumed growth of human numbers even in areas that have long had stable or decreasing populations.

A complex economy - and *complexity* itself – are the primary filters of events related to resource limits. While endangered resources are by themselves *primary* (raw energy, food etc.), the effects are bound to manifest mostly in domains of *secondary* (range and diversity of products, maintenance of already existing buildings and products) and *tertiary* (services, extensive range of specialised knowledge, diverse high culture).

In complex societies, complex governance (for example a *democratic* one) requires, among innumerable other prerequisites, a certain surplus of energy. In possible future energy transitions, a little more than a semblance of democratic social relations might only thrive (or even only be possible) primarily in *smaller scale* socioeconomic arrangements.

4 Envisioning the Future

4.1 Envisioning Contraction

The collective dreams of technologically advanced utopian future slowly started to fade from the 1970s onwards, probably as a result of multiple factors, including disappointment with outcome of the '60s social movements, the first crises of energy prices in 1973 and 1979, the first recognitions of biosphere limits (and the ecological consequences of 'development') as well as the (re)turn to a heavily deregulated market economy in many countries. While prospects of such things as interplanetary expansions and colonisation continue to be discussed with some seriousness and resources invested, together with more earthly expectations from "digital", "nano" etc., it is quite clear that overall collective visions of the future have been shaped to their current state as much by concern as they have by hope (Szeman, 2007).

The lack of a common agreed understanding of the future of society and the planet does not mean that it should be, once again, crafted as a single narrative, but as a complex set of parameters and *probabilities*. Let us here examine just one, relatively simple, example of this way of thinking, akin to logic presented in this text so far.

David Holmgren, co-originator of the *permaculture* concept (Mollison & Holmgren, 1978), has put forth a relatively prominent system of 'future scenarios'. He recognises four 'culturally imagined and ecologically likely futures over the next century or more':

- **Techno explosion**, associated with presumptions (wishes actually) about new concentrated energy sources (the aforementioned nuclear fusion and the like), human technical ingenuity and eventually expansion towards other planets;

- **Techno stability**, also counting on intense technical invention, but mostly within the domain of renewable energy and on the level of energy use similar to what is consumed currently. The 'stability' is presumed to reign also within social and cultural realms;

- **Energy descent** assumes inadequate replacement of decreasing fossil fuels and other non-renewables with other sources. This further draws gradual and 'soft' decreases in (industrial) economic activity, complexity, and eventually in population;

- **Collapse** that depends on much more abrupt changes in energy supply and/or a strong destructive effect of climate change (Holmgren, 2009, pp. 7-9).

Holmgren, obviously ignoring dreams of space flights and fusion, further systematises and investigates future possibilities primarily through two axes: oil decline (slow or fast) and climate change (benign or destructive). While finding energy descent inevitable, he derives four basic scenarios and supplements them with societal trends that would be required or would likely emerge:

- **Brown-tech** scenario has decline in oil that is slow enough to allow ever more polluting sources (like coal or tar sands) to be utilised, while climate change delivers strong effects. Incentives to maximise economic production, and pressure to deal with problems of food supply and climate displacement, offer pretexts for the emergence of more authoritarian social systems (Holmgren, 2009, pp. 35-38);

- **Green-tech** also includes slow fossil energy decline, demands political and cultural will for a shift towards renewable energy, and assumes more benign effects of climate change. More democratic political models prevail (Holmgren, 2009, pp. 38-40);

- **Earth steward** sees the fast decline of oil and benign climate change. A fast decline prevents adequate and timely replacement by renewables, but still-bountiful biosphere (with favourable climate) enables sustenance of large populations - at the expense of profound shifts in economy, culture, and societal scale (from global to regional and local) (Holmgren, 2009, pp. 41-43);

- **Lifeboat** scenario combines the fast decline of available fossil fuels with the destructive effects of climate change. It results in virtual breakdown of global socioeconomic scale, severely (and possibly abruptly) decreased human populations with highly patchy and ephemeral economies set around rare opportunities spotted in a radically altered climate. *Brown-tech* eventually converges to *Lifeboat* (Holmgren, 2009, pp. 43-45).

Holmgren's assessment was written during the height of *peak oil* debate and it assumes some kind of imminent start of decline in available fossil fuels. It sees decisions (both voluntary and forced) between *brown*, *green*, *hi-* and *lo-tech* set into context of energy constraints. However, the global supply of oil, gas, and coal has been well maintained – mostly as a result of improved extraction technologies able to alleviate some consequences of low EROEI. Mere lack of availability will thus not spare global industrial society from making critical decisions: either to use still abundant energy to enter *inevitable* decline prepared and in a preferable manner or to continue to work incessantly towards the aforementioned convergence between *Brown-tech* (actually our current reality) and *Lifeboat*. Furthermore, lack of any centralised 'global' decision does not abstain any community, group, or individual from making their own decisions: Holmgren himself has recently explored possibilities of abstention from global economy by a relative minority (of around 10%) that could possibly trigger economic collapses capable of substantially reducing green-house gas emissions (Holmgren, 2014).

4.2 Envisioning Solutions

Although the *probability* of fragmentation and degradation of industrial civilisation in the near future seems to be quite high (if we are willing to look) and although severe climate change is claimed to be almost inevitable, the work on sustainable 'solutions' is far from futile. Such work nonetheless needs to be constantly examined within the complex framework that this text has tried to present so far. In such examination, a specific structure (or hierarchy) emerges:

What might be called the *technical level* encompasses efforts aimed at decreasing harmful side-effects of current established socioeconomic and daily life practices. The increased thermal efficiency of a building will thus decrease unnecessary losses of energy; a well organised bus system will replace many individual automobiles in commuting; ecologically sound agriculture will deliver its products without further degrading its own (soil) base; wind turbines will add far fewer greenhouse gasses while delivering energy to the same established and unquestioned processes. Most actions branded today as 'sustainable' remain at this stratum and its range of options.

Strategic level should, generally speaking, understand that current modes of socioeconomic (and spatial) reproduction are situated within specific trajectory of energy use – a trajectory eventually aimed downwards. It should also understand the seriousness of climate perils. Simply put, it understands 'reality' and the inevitable. Thus, strategies will deal with the organising and scheduling of the (controllable) events towards future states of contracted economy and sparse energy. Several such approaches, though still clearly marginal, have been developed, e.g. Transition Town Initiative (Hopkins, 2008).

Cultural level, as might be expected, has several aspects. First, it should question all of the established notions, values, and practices that demand increased use of resources. It should, before anything else, question the (economic) growth and lifestyles based on wasteful consumption of material resources, but it can also focus on social (and spatial!) fragmentation and its severance of ties between humans and the environment. The second aspect of *the cultural* understands that not all perils of unsustainability are related to human survival and material wellbeing. It understands how deeply sad and almost palpably degrading for humans (that is: for members of this 'city culture') it is to be the cause of a global species extinction akin to the impact of a large asteroid (Carrington, 2016). Consequently, any argument and any 'solution' reckoning only with humans to find some form of their own salvation cannot really be deemed viable.

Finally, cultural level needs to undertake a very broad envisioning of other ways of interaction between human cultures and their local and global environments. It must not only fight against the unnecessary use of resources, but it needs to question the very notion of 'resources' – parts of a living planet somehow standing at our unquestioned disposal and waiting to be used for however trivial purposes. It must not only profess less consumption, but less 'production' – that is, less of such interactions with the environment that are aimed solely on the satisfaction of narrowly defined human needs.

Today, we rarely bother to imagine further than windmills spread through agricultural landscapes, but let us briefly explore some of these different visions and different possible cultures.

4.3 Humans and the World

An extra-ordinary perspective: world without humans

In a hypothetical perspective in which humans never existed, or in which they remained modestly incorporated into their environments, the world would look quite different. This is practically self-evident, but the full implications are far more interesting than the vision of the mind's eye trying to draw before it a forest where now a mine, a motorway, or a city stands. The absence of humans *is* the presence of other forms of (animal) life. Paleontological and paleoecological findings (Malhi et al., 2016) from the very recent geological past (either in a similar climate of the most recent interglacial and early Holocene, or in glacial maximums) point to a vision of the whole terrestrial world as rich with animals large and small as it is now with humans – at least. Fertile lowlands of Europe and Asia, upon which streets of cities now lie, would be roamed by large herds of at least one species of elephant, many rhinos, countless aurochs and bison, swaths of wild horses, elk, deer, wild boar; maybe even hypos and water buffaloes in rivers filled with as much fish as water. And, of course, the predators: lions, hyenas, leopards, lynx, wolves, bears, and eagles. North America would see similar landscapes, also filled with elephants and lions, but also with cheetahs, giraffes, camelids, bison, and flocks of birds that would darken the skies for several days. Every other continent except Antarctica would sport a similar (or less similar, in Australia's case) suite of large animals. (Africa still has the species - in miniscule areas - but does not have the numbers.) The oceans and seas are probably beyond description; even a few hundred years ago they seemed otherworldly for the life swimming in them (Monbiot, 2014, p. 228).

Still, it is not only the number (and the beauty, and purpose!) of species or the size of populations that was – would be – the normal state of the planet Earth. The ecological processes taking place inside this magnificent web of life were equally far removed from the contemporary state of the environment. Oceans were capable of absorbing vast amounts of CO_2 – in large part thanks to abundant whale populations (Pershing, Christensen, Record, Sherwood, & Stetson, 2010). Forests, savannas, and grasslands were able to significantly improve and moderate rainfall distribution. Soils, rich with living and dead carbon, organised a perfect hydrology beyond drought and flood. Large (often far-traveling) animals distributed seeds and circulated nutrients around whole continents; the absence of these cycles is still felt today, and it even limits natural productivity of places as fecund as the Amazon basin (Gross, 2016).

Such was – or 'is' or 'should be' – the *normal* state of the planet. It gradually – and often abruptly – deteriorated through human influence. Even if local overhunting was not the cause of many extinctions, the rise of 'city-culture' (with its numbers, agriculture, and the great habitat destruction) certainly precluded natural fluxes and re-settlements (Malhi et al., 2016). Yet, even in historic times, the remnants of these riches could still be found, such as in writers of *Gilgamesh* describing their hero entering deep dark forests - in what is desert today (Kovacs, 1985, p. 22), or with Xerxes' army, on its way to Thermopylae, encountering lions in Macedonia (Beach Combing (alias), 2013). The immense flocks of passenger pigeons were exterminated from the skies of North America only during the 19th and early 20th centuries.

The *normal* and its variants

Although this great deterioration and change of global environment happened quite quickly in terms of geological time, the changes were hardly noticeable for every passing human generation, even with written record. This 'shifting baseline' syndrome, named this way by landscape architect and pioneer in ecological planning Ian McHarg in his prominent *Design with Nature* (McHarg, 1969, p. 31), operates in a way in which individuals, groups, and whole cultures tend to define their known particular state of the environment as 'normal', rarely reckoning with long processes of decline (that might even be widely known). Many questions thus arise when a contemporary state of (unsustainable) affairs is compared to a different baseline than its own: Do we already live in a world unbearably simplified and poor? Is to 'sustain' this level of planetary health the most we can strive for – in all our glorious human genius? Is 'sustainable' even an adequate term? How can we define problems not only in terms of defence and conservation but in those of regeneration and enrichment?

A design perspective: shifting back the 'shifting baseline'

So then, are humans – or, to be precise, their cultures and economies – inevitably akin to some kind of locust swarm that in each and every case devours what it lands upon? We ('humans' or cultures) have certainly contributed to environmental health so rarely throughout history as to earnestly deserve this kind of comparison, but the recipe for optimal ecological functioning is not merely an absence of people (a fictitious absence by itself), but their inclusion in this functioning – inclusion that directs our desires, our ingenuity, our designs and our cultures towards this integration.

Even (impossibly) walking away and turning nature loose probably wouldn't be enough to avert dramatic changes that are by now fully set in motion. On the other hand, we can have a profoundly positive impact: *designing* our inclusion around already established densities and fluxes of energy (as in, individual- and community-centred urban agriculture), beneficially organising (rain)water in landscape in a way that nature never would (yet gently, cautiously, and with very simple technology (Yeomans, 1958)), sequestering carbon while growing food (Toensmeier, 2016), mimicking ecological impact of now gone wild herds with appropriate management of both domestic and wild animals (Zimov, 2005; Savory & Butterfield 1999), setting aside space (near and afar) and actively reintroducing species for wild processes only (Monbiot, 2014), building in accordance with our true modest needs (Šukalo, 2016), while simply using less – all these are just glimpses (and existing practices) of positive human influences that can recover environment from this starting point far more quickly than through 'natural' processes alone. They also far surpass an outlook of conservation and replacement-by-lesser-evil, an outlook pervading our well-known images and aspirations of 'wind and solar', 'energy efficiency' and the like. These positive influences would be – in a true sense of the word – a sustainable development.

A rich intellectual tradition (Mollison & Holmgren, 1978; Papanek, 1972; McHarg, 1969 etc.), which stresses the importance of general design in our relationship to environment seems to be right: the *whole* of our engagement within the environment should be set and organised as carefully as we have for centuries been careful with the narrow technical side of things – and the positive changes would equal in scope those of our historical technological advances. However, there is a deeper prerequisite: as much as being a 'source' and a provider, as much as being an endangered and fragile system, our *world* can be a universal object of interest, cultural focus, and a design playground. It shouldn't be a mere 'resource base'.

5 Conclusion

Any serious examination of sustainability issues has only one conclusion: If global industrial society doesn't radically change its ways, the world we know will most probably disappear. This "world we know" is composed of almost all of the material goods we use, the services we receive, and the complex social interactions we engage in. It is also composed of tigers, elephants, honeybees, healthy forests, and of any bearable and functioning (local) climate. It must be said that "most probably" does leave some doors open for miraculous technological fixes, as well as for the prolonged agony of the environment in case of prognoses that are missing a decade, or even a few, but probabilities will always abide by fundamental laws of cause and effect: If a finite amount of resources is used, eventually it will become unavailable; if the natural world is constantly being stressed, its parts (species, habitats, processes) will eventually fall one by one; if the environment is incessantly being degraded (through sprawl, agriculture, and industry) global warming is not even necessary to bring about misery and deprivation; infinite (economic) growth is impossible on a finite planet. That is all there is to know about sustainability as such.

TOC

Confronting this utter (and shrill) simplicity there stands the buzzing and humming cosmos of "business as usual": water being delivered, food being transported, cars rolling, schools working, careers developing, bank accounts swelling etc. It is as complex as the natural world (the one of cause and effect) and humans mostly find it unavoidable, dear, and even the only reality. It is progressively considered more precious the further we look up the social and power ladder – and certainly more fiercely defended. Within such a framework, the realisation of simple ideas - decreasing material consumption, building only when really needed, transitioning from fossil fuels and reforming the way the food is being grown - start to seem complicated. Within and because of that framework specific disciplines (architecture and urban planning, for example) have devised elaborate concepts aimed at adjusting the processes of globalised industrial society in order to make these (often irredeemable) processes more 'energy efficient', 'responsible', and a little bit less wasteful. It is the framework of a very narrow manoeuvring space in which any broader systemic perspective is relegated to margins, bound to dealing with change only in narratives.

Pessimism can thus seem a quite expected, and even a genuinely healthy, stance (for optimism – apart from being detached from the realities of the material and ecological world – quickly becomes integrated into ideological currents of *progress* and *growth*), yet, inaction is impossible. Inaction is actually a complicity. Whether we engage in fighting political battles of environmental advocacy, improving the efficiency of existing processes, promoting *less* as a way or devising designs of (non-industrial) abundance, we do it equally out of the hope for problems to find their solutions, and out of sense that, even if irreparable, our *world* simply asks for us to act.

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Shifting Forward _

Resilience Thinking in Out-of-Order Urban Systems

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ABSTRACT **Complex interplay between spatial, social, economic, natural, political, and other factors made cities more vulnerable and less capable to respond to more frequent uncertainties, sudden upheavals, and disturbances that lead to different types of spatial dynamics such as urban sprawl, shrinkage, brownfield sites, degradation of built environment as a consequence of natural disasters, etc. In response to these multiscale disturbances, the paper introduces and elaborates upon *resilience* as a new term, approach, and philosophy. Based on a review of a large body of literature from the field of ecology, the paper presents origin, history and development of the concept, definition, types and key principles of the resilience approach, i.e. state-of-the-art knowledge and basic ideas about current matters related to the resilience. In the final part, the paper sets the conceptualisation of *urban resilience* by raising the assumption that the city is a *complex adaptive urban system*. Through conceptualisation, the paper gives an interpretation of key resilience concepts from the urban perspective, explains relationships and links among them, proposes classification of resilience applicable in the context of urban studies, and opens the key topics and questions for further research. The main objective of conceptualisation is not to provide ultimate definitions and interpretations, but to open new horizons, create fertile ground for dialogue among scientists and practitioners, as well as to encourage further research in the field of urban planning and design.**

KEYWORDS resilience, complex adaptive system, urban resilience, climate resilience, adaptive management