

The Compact City: Sustainable or Just Sustaining the Economy?

Harry Gugger¹, Gwendolyn Kerschbaumer²

1 Professor of Architecture at EPFL (Swiss Federal Institute of Technology Lausanne), Head of laba (Laboratoire Bâle), Switzerland

2 Head of Research at laba (Laboratoire Bâle), EPFL (Swiss Federal Institute of Technology Lausanne), Switzerland

Preface

Over the last decades, the *compact city* has been the urban model recommended by the majority of urbanists, architects and territorial planners as the most sustainable settlement typology.

Several large-scale studies however do not support this conclusion in a clear manner. The ecologic footprint of an inhabitant of London or Helsinki for example, is equal or higher to that of his rural and semi-rural countrymen.¹ From a social point of view as well, it is not clear that the compact city, is favourable to more vulnerable parts of society, such as lower income groups.² Furthermore, the actual development of urban areas suggests the opposite trend – that towards de-densification. De-densification can be observed both in the developed and the developing world.³ Moreover, very dense areas – mainly present in the developing world – showcase an array of serious ecologic and social problems, such as poor sanitary conditions, high levels of pollution, and severe overcrowding.

While actual settlement patterns vary in different areas of the world, continuous urbanization and the formation of centres and peripheries can be observed throughout. Economist Paul Krugman and sociologist Immanuel Wallerstein have written on the strong impact of economic forces on these settlement patterns. Both explain the continuous urbanization, the creation of urban centres and peripheries through economic models such as the economies of scale (Krugman) or the core and periphery model (Wallerstein), which apply not just to urban conglomerations, but larger regions as well.

Given that in general urbanization is thought to further economic growth⁴, how does the compact city model compare to other settlement typologies in this respect? Does it further economic growth, and if so does it equally further social and ecologic aspects? And how does economic growth relate to economic sustainability in the case of urban settlements?

The observations and questions above outline our interest in revisiting the compact city model within the context of this 2013 Holcim forum for sustainable construction. While at first we did not find it evident to focus in on the interaction between the three complex themes of economic forces, sustainability and the compact city, the more data and studies we analysed, the more several key issues became clear. Of particular importance were a series of studies^{5 6 7}, which outlined that the ecologic footprint of an inhabitant in a western compact city is not necessarily smaller than that of an inhabitant in a rural or semi-urban settlement type in the same country. The main reason being that the ecologic footprint of a person is very closely linked to his income and living standard, rather than the type of urban / rural settlement he lives in.

The compact city at first seems like a sustainable type of settlement because it is efficient in using resources (minimizing transport, building material per housing unit, heat load per housing unit, etc.). It also uses technological advances better (new means of transport, more efficient heat plants, etc.). Surprisingly though, these savings in resources and pollution (CO₂ emissions for example) are offset by the fact that what has been saved is spent elsewhere – leisure travel, consumer goods etc. This is called the ‘rebound’ effect.⁸

The ecologic footprint of a society is the product of its affluence x the population x the technologic intensity of economic output. As our GDP and our population keeps growing, so does our ecologic footprint. Technological advances do not nearly make up for this growth in the other two areas.⁹

¹ Jukka Heinonen, 2011, The Impact of Urban Structure and Consumption Volume on Carbon Emissions of Communities; Brook Lyndhurst, 2003, London’s ecological footprint, Greater London Authority

² Elizabeth Burton, 2000, The Compact City: just or just compact?, Urban Studies Journal Foundation

³ Shlomo Angel, 2012, Planet of Cities, Lincoln Institute of Land Policy

⁴ Urban trends: Urbanization and economic growth, UN Habitat, State of the World cities 2010 / 2011, <http://www.unhabitat.org/documents/SOWC10/R7.pdf>

⁵ Jukka Heinonen, 2011, The Impact of Urban Structure and Consumption Volume on Carbon Emissions of Communities

⁶ Brook Lyndhurst, 2003, London’s ecological footprint, Greater London Authority

⁷ Tim Jackson, 2009, Prosperity without growth – a transition to a sustainable economy, Sustainable Development Commission

⁸ Sorrell, Steve 2007, The Rebound Effect: an assessment of the evidence for economy-wide energy savings from improved energy efficiency. A report by the Sussex Energy Group for the UK Energy Research Centre. London: UK Energy Research Group.

⁹ Gross Domestic Product and Ecological Footprint, Europe 2007, Global Footprint Network; Tim Jackson, 2009, Prosperity without growth – a transition to a sustainable economy, Sustainable Development Commission

So called relative decoupling, that is a rise in GDP, as well as population yet a rise in environmental footprint at a lower speed has been observed in technologically advanced countries such as Switzerland or Germany, but not in a scale that is significant enough to counter the other two factors (see figures 3 – 9). An absolute decoupling, that is a stagnation or even diminution of the environmental footprint whilst a growth in GDP and population has not been observed and is very unlikely to happen (except for a breakthrough technology, making energy with virtually no environmental footprint).

Ecologic, social and economic sustainability¹⁰ imply a fair distribution of resources and opportunities amongst all people in the world and future generations. Given the limited natural resources, and given an already a large population of 7 billion, the development of already wealthy countries and countries in development cannot be based on the same recommendations. While wealthy countries need to reduce their environmental footprint per capita, developing countries have the need to improve the living standard of their population and thus will inevitably increase their environmental footprint per capita.

These findings lead us to investigate several issues surrounding the compact city and economic sustainability within the framework of this workshop:

- a) Is the compact city as defined today the most sustainable settlement typology?
- b) Why is the income of inhabitants in a given settlement more indicative of the ecologic footprint than the settlement typology itself? How should recommendations for nations with different GDP's / HDI¹¹ differ?
- c) What is a sustainable economy and why is it important for the design disciplines to have a more solid understanding of this subject?
- d) Within an economic system that is not very sustainable, what strategy can the design disciplines develop in pursuit of more sustainable settlement typologies?
- e) Despite serious shortcomings, the compact city offers a sensible base as a sustainable settlement typology as it makes efficient use of resources. How then, can the compact city model be adjusted to respond to current shortcomings?

1 How is the compact city defined?

In his paper 'The Politics and Planning of Urban Compaction: The case of the London Metropolitan Region', Philipp Rode provides an introduction to the concept of the compact city:

'The compact city model stands out as the most generic spatial interpretation of the sustainable city and represents an umbrella term for various other related concepts such as the European city model, transit oriented development, new urbanism, decentralised concentration and smart growth.

All share the idea of reinforcing city access based on proximity and highlight the importance of higher density and mixed-use urban form [...]. A central consideration of compact city development is to reduce the need to travel [...] with the overarching objective of increasing accessibility [...]

Besides transport and accessibility related benefits [...] a range of additional co-benefits are frequently referred to [...] the conservation of the countryside, more efficient utility and infrastructure provision, and the revitalisation and regeneration of inner-urban areas.

In addition, the potential for energy efficiency at the building level, mainly heating and cooling [...] as well as for supplying decentralised grid-based green energy such as combined heat and power have been added [...]. A lower embedded energy demand for urban infrastructure due to greater utilisation as a consequence of higher densities is also frequently referred to (UNEP 2011).'

2 How does the compact city model compare to current trends in urbanization?

In his book *Planet of Cities*, in chapter 11 - *The Consistent Decline in Urban Densities*, Shlomo Angel shows that overall, urban densities decline everywhere in the world. This means, regardless of the recommendations made by planners and formally adopted by many government officials, the density of urban areas continues to decline.

'Any cursory survey of the literature on urban sprawl, from the purely abstract treatise to the purely polemical tract, would reveal that low population density or density decline is its most salient characteristic [...]. The empirical evidence presented and explained [...] shows that average urban population densities in different world regions [...] are now in decline practically everywhere, and that they have been in decline for a century or more. In other words, [...] urban land cover has been growing at a faster rate than the urban population.'

¹⁰ The three pillars of sustainability as defined by the United Nations General Assembly (2005). 2005 World Summit Outcome, Resolution A/60/1, adopted by the General Assembly on 15 September 2005

¹¹ Human Development Index

At the same time, Angel points out that de-densification in many areas of the developing world, does not mean that these areas are not dense. He further explains how praise of densification, is a fairly recent phenomenon, and that the problems associated to overcrowding, which still exists in developing countries, cannot be played down. These countries are experiencing similar problems as Europe did during the height of the Industrial Revolution, with people sharing overcrowded rooms without sufficient light or clean air:

‘While Americans continue to debate the merits of densification, I believe that this agenda should be firmly rejected in cities that already have very high densities and need to be decongested; in cities where densities are declining but are likely to remain high enough to support public transport in coming decades; or in cities that are growing rapidly in population and need ample room for their expansion at their projected densities. [...]

There is nothing romantic about a Dhaka family of five still living in a 10 m² room with no light and air and sharing a water tap and a toilet with six or more other families. I, for one, find it disconcerting that Stuart Brand (2010), a leading environmentalist, chooses to celebrate the greenness of slums — their very high densities, their minimum energy and material use, and the preponderance of walking, rickshaws and shared taxis — while strictly avoiding any mention of overcrowding lest it interfere with his global densification message.’

3 A scientific basis

Angel Shlomo’s work is an extensive overview of urban developments using GIS. His group’s data clearly shows that contrary to many people’s assumption urban areas are not densifying.

Scientific studies analysing the development of urban areas, the carbon emissions linked to various types of settlements, etc. are necessary to objectively assess the current situation. This is not to say that a scientific basis is sufficient and that subjective perception is less important. (For example, we look at ‘perceived quality of life’ through the work of the European commission on ‘perceived’ satisfaction on a variety of factors pertaining to urban life¹².)

Yet often, the actual situation is revealed to be different from how it is perceived. It is thus crucial for the design disciplines, to also base their work on studies in fields relevant to their work, such as geography or sociology. It is precisely a few studies using this type of analysis, which pointed out that contrary to our intuition, urban dwellers in the UK do not have a significantly lower ecologic footprint than rural dwellers¹³ and that in Finland¹⁴, urban dwellers have a higher carbon emission than rural dwellers.

Furthermore, a study on London for example, showed that the main factor of a person’s ecologic footprint is not the land his dwelling occupies or that his city occupies (less than 1%), but food (41%) and material and waste (44%).¹⁵ The other components were direct energy (10%), transport (5%) and water (less than 1%). This study (see Figure 1) also shows that the London ecologic footprint per capita is 6.63 gha, while the biocapacity of the London area is only 0.16 gha per capita and the UK biocapacity is 1.34 gha. With the world average biocapacity being 2.18 gha (if everyone had an equal share), a UK resident consumes about 3 times the average share:

	Ecological footprint (gha per capita)	Biocapacity (gha per capita)
London	6.63	0.16
UK	6.3	1.34 (source: Wikipedia)
World average	2.8	2.18
World average expected (2050)		1.44

Figure 1: The ecological sustainability of London (source: City Limits Report (<http://citylimitslondon.com>))

¹² *Perception survey on quality of life in European cities, 2009*, Conducted by The Gallup Organisation, Hungary upon the request of Directorate General for Regional Policy / European Commission

¹³ Brook Lyndhurst, 2003, London’s ecological footprint, Greater London Authority

¹⁴ Jukka Heinonen, 2011, The Impact of Urban Structure and Consumption Volume on Carbon Emissions of Communities

¹⁵ Brook Lyndhurst, 2003, London’s ecological footprint, Greater London Authority

¹⁶ City Limits – a resource flow and ecological footprint analysis of Greater London, 2002, Best Foot Forward

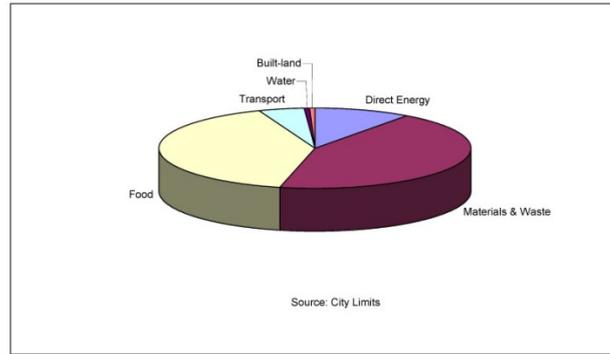


Figure 2: Main components of the ecologic footprint of a London inhabitant

Another study in the field of sociology, carried out by Elizabeth Burton, *the compact city: just or just compact*¹⁷, revealed that the compact city affects low income households not only positively, but also negatively in several social aspects such as reduced living space, poor access to green areas, lack of affordable housing and to some degree poorer health.

Given several studies, such as the three mentioned above, reveal that the compact city is not clearly leading to a more sustainable built environment, it seems necessary to begin with known facts relevant to the compact city debate:

- 1) Global population is expected to continue rising sharply in the next decades, reaching a population of over 9 billion in 2050. The population increase will mainly take place in the developing world.¹⁸
- 2) The world is urbanizing – currently more than 50% of the population lives in urban area.¹⁹
- 3) Urban areas themselves are becoming less dense.²⁰
- 4) There are different ways to measure density and built density: people per area, households per area, built up area per area; built up area, urban area, ...²¹
- 5) In general, density can be connected to several other circumstances (affluence / living standard, number of people in a household, ...)²²
- 6) Urban areas in the developing world are denser than in Europe and in Europe they are denser than in the USA and Canada.²³
- 7) Urbanization goes hand in hand with ‘development’. No society that was rural was able to put forth high cultural, scientific etc. achievements; conversely, all societies that did achieve these feats were highly urbanized.²⁴
- 8) Around 40% of urban dwellers in the developing world live in ‘slums’.²⁵
- 9) According to life quality surveys, life quality in cities of medium density (medium on European scale) is the highest. However density alone is not a very strong predictor of life quality.²⁶
- 10) When measuring the ecologic footprint of urban dwellers, it becomes visible, that the actual built space accounts for a small percentage of the footprint (see the example of London above).
- 11) Living standards are rising, and thus the burden on the environment is rising²⁷ (see also figures 8 and 9)
- 12) The ecologic footprint of a person in the developed world is several times higher than that of a person in the developing world. The ecologic footprint is directly related to our GDP, living standard and consumer pattern.²⁸

¹⁷ Elizabeth Burton, 2000, *The Compact City: just or just compact?*, Urban Studies Journal Foundation

¹⁸ World Population Projection, 2005, UN, <http://www.un.org/News/Press/docs/2005/pop918.doc.htm>

¹⁹ Urbanization, 2012, Wikipedia, <http://en.wikipedia.org/wiki/Urbanization>

²⁰ Shlomo Angel, 2012, *Planet of Cities*, Lincoln Institute of Land Policy

²¹ Urban Density, 2012, Wikipedia, http://en.wikipedia.org/wiki/Urban_density#Measurement

²² Shlomo Angel, 2012, *Planet of Cities*, Lincoln Institute of Land Policy

²³ Shlomo Angel, 2012, *Planet of Cities*, Lincoln Institute of Land Policy

²⁴ Edward Glaeser, 2011, *Triumph of the City*, Penguin Press

²⁵ The Millennium Goals Report 2007, United Nation, <http://www.un.org/millenniumgoals/pdf/mdg2007.pdf>

²⁶ Mercer life quality in cities survey, 2012, Mercer – Perception survey on quality of life in European cities, 2009, Conducted by The Gallup Organisation, Hungary upon the request of Directorate General for Regional Policy / European Commission

²⁷ UN Human Development Index

²⁸ Europe 2007 Gross Domestic Product and Ecologic Footprint, Global Footprint Network, http://www.footprintnetwork.org/images/uploads/europe_2007_gdp_and_ef.pdf

13) Decoupling the ecologic footprint from the rise in GDP and living standard has been a declared goal of many developed countries such as Switzerland in the past decades (ex. 2000 watt society) Such a decoupling has only been relative though and not absolute and often even the relative decoupling has been modest.²⁹

14) A nation's ecologic footprint is linked almost 1:1 to its GDP. Given the GDP rises faster than the rate at which decoupling has occurred, the ecologic footprint keeps rising.

4 The compact city: drawing the boundary of the inhabitant's ecologic footprint

As points 10 – 14 show, in principle, the compact city does allow for reductions in carbon emissions because people might have to travel shorter distances, they can rely on public transport, they consume less for heating their smaller apartment than they would their larger detached house and infrastructure in general can be managed more efficiently. What this picture leaves out though, and J.Heinonen's study points to, is that what urban dwellers save on fuel and heating cost, they spend in other areas such as leisure travel or consumer goods. Heinonen's study points out that the ecologic footprint is mostly linked to a persons' disposable income. To analyse the ecologic footprint per inhabitant in a compact city vs. a rural area, without including the entirety of a persons' activities thus leads to a wrong conclusion.

This crucial link between the ecologic footprint and the living standard is the main topic in Tim Jackson's report 'Prosperity without Growth'³⁰ commissioned by the British Government as a study on a sustainable economy. The report points out that the developed nations so far are relying on what T. Jackson calls the 'myth of decoupling' – the belief that our society can continue to grow its economy indefinitely without the economic footprint growing at an alarming speed as well. While technology does develop, it does not develop fast enough to offset the growing fossil fuel and other raw material consumption. While evidence for this 'relative decoupling' of fossil fuel consumption and GDP can thus be found in the technologically most advanced nations (Figure 3 and 4) there is no evidence for absolute decoupling, meaning an actual drop in fossil fuel / material consumption (Figure 5 and 6).

'Despite declining energy and carbon intensities carbon dioxide emissions from fossil fuels have increased by 80% since 1970. Emissions today are almost 40 % higher than they were in 1990 – the Kyoto base year – and since the year 2000 they have been growing at over 3 % per year (see Figure 14).'³¹

Furthermore, such official figures do not paint the full picture because the boundary is drawn such that not all material resources are included. It is very difficult to account for all the embedded grey energy in traded goods because of how trade is conducted (products assembled in the UK can consist of many parts manufactured abroad etc.)³² Drawing a boundary is thus difficult, yet very necessary if we want to truly asses the environmental consequences of people in various societies and settlement typologies.

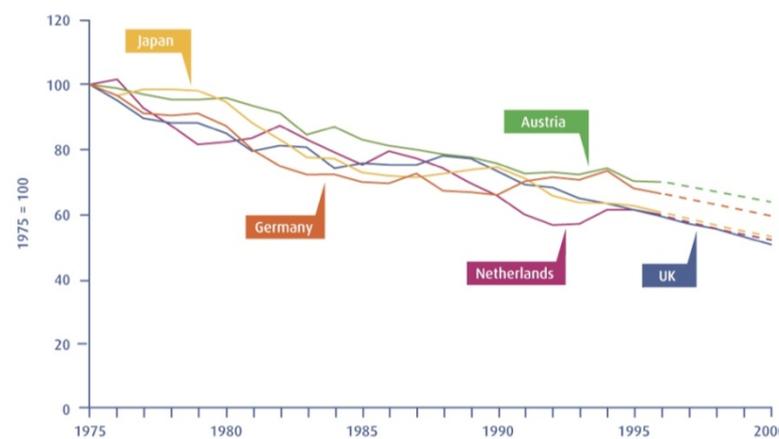


Figure 3: Relative decoupling in OECD countries 1975 – 2000
Source: Prosperity without Growth report

²⁹ Tim Jackson, 2009, Prosperity without growth – a transition to a sustainable economy (Chapter 5), Sustainable Development Commission

³⁰ Tim Jackson, 2009, Prosperity without growth – a transition to a sustainable economy, Sustainable Development Commission

³¹ Tim Jackson, 2009, Prosperity without growth – a transition to a sustainable economy (page 50), Sustainable Development Commission

³² Tim Jackson, 2009, Prosperity without growth – a transition to a sustainable economy (page 51), Sustainable Development Commission

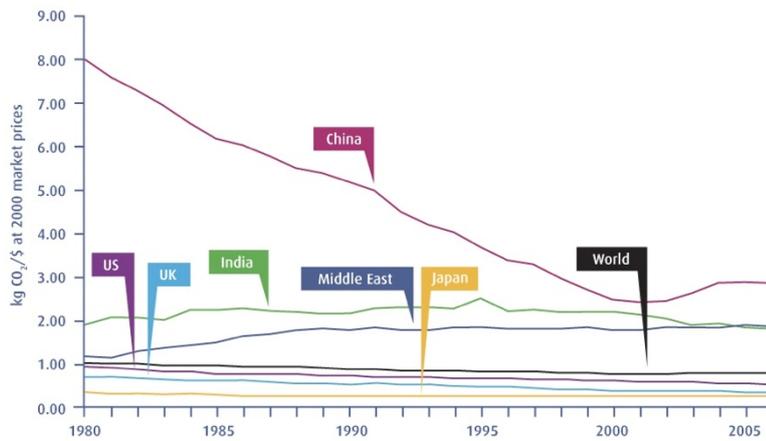


Figure 4: CO₂ intensity of GDP across nations: 1980 – 2006
Source: Prosperity without Growth report

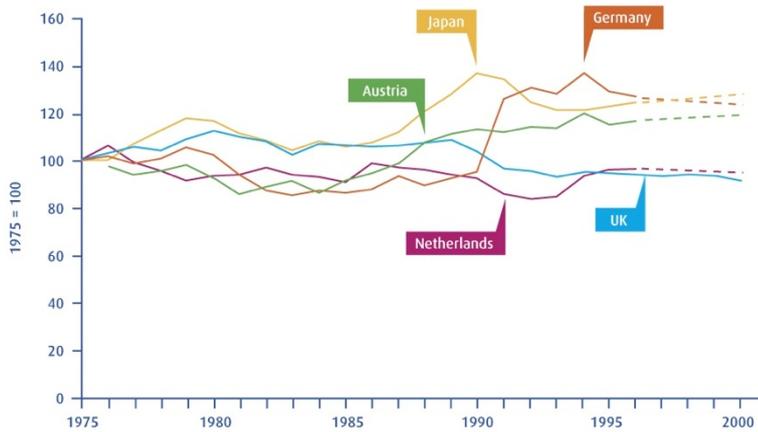


Figure 5: Direct Material Consumption in OECD countries: 1975 – 2000
Source: Prosperity without Growth report

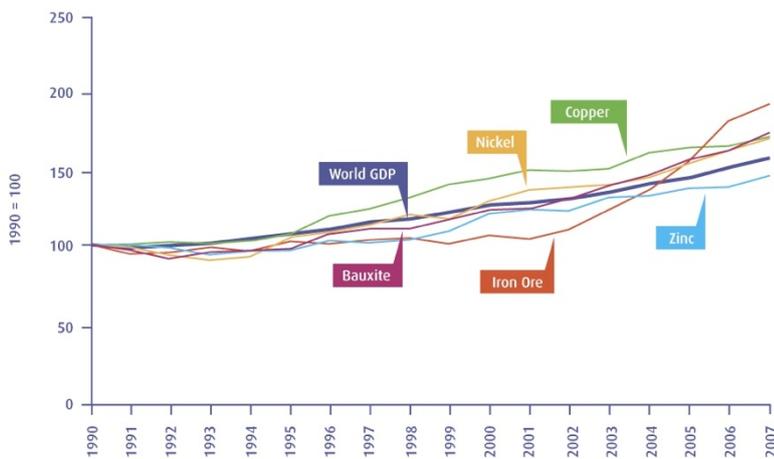


Figure 6: Global trends in primary metal extraction 1990 – 2007
Source: Prosperity without Growth report

About the compact city it can be said, that while it has the potential to be more sustainable, as it ‘hosts’ our consumer society, many benefits seem to be offset by the fact that the savings in energy, resources and money, are spent in other ways. Insofar as it is an environment that is conducive to high levels of

consumerism, it sometimes can even be less sustainable than other more rural types of settlements as shown in the Finnish report.

Efficiency in transport, infrastructure and the built environment and technologic progress are thus not necessarily a good measure of sustainability, as efficiency in one area can actually be driving growth forward:

‘... efficiency brings down the cost of goods over time. This has the effect of stimulating demand and promoting growth. Far from acting to reduce the throughput of goods, technological progress serves to increase production output ... (Solow 1956, Swan 1956)

The phenomenon of ‘rebound’ attests to this. (see Sorrell 2007 for an in-depth discussion of the rebound effect) Money saved through energy efficiency, for example, gets spent on other goods and services.

These goods themselves have energy costs that offset the savings made through efficiency, and sometimes wipe them out entirely (a situation described as ‘backfire’). Spending the savings from energy-efficient lighting (say) on a cheap short-haul flight is one sure-fire recipe for achieving this.

This somewhat counter-intuitive dynamic helps explain why simplistic appeals to efficiency will never be sufficient to achieve the levels of decoupling required for sustainability. In short, relative decoupling sometimes has the perverse potential to decrease the chances of absolute decoupling.³³

5 Relative and absolute decoupling and the role of technology

The ‘Prosperity without growth report’ lays down the simple rules that govern the impact of human activity on the environment. The equations and data on co2 reduction in the past decades show that absolute decoupling, that is a reduction or at least stabilization of co2 emissions cannot be achieved through technologic progress alone (except for a major unexpected breakthrough):

$$I = A \times P \times T \text{ (by Paul Ehrlich and John Holdren)}$$

where (I) is the impact of human activity; (P) is the size of the population (P); (A) is the affluence (income per person); and (T) is the technology factor (environmental impact associated with each dollar spent)

For absolute decoupling to happen, (I) needs to go down. If the population and the affluence keep rising as they have in the past decades (and are expected to in the next decades), the only factor able to bring (I) down is (T).

As T. Jackson writes, it is tempting to hope that technologic progress will allow for a further rise in population and affluence, without further burdening the environment – how probable is this though, given the data we have so far? Figure 9 shows what degree such technologic progress and efficiency would need to reach: ‘By 2050 the average carbon content of economic output would need to be less than 40 gCO2/\$, a 21-fold improvement on the current global average ...’

Except for a scientific breakthrough allowing for economic activity with virtually no CO2 output, it is thus impossible to achieve absolute decoupling. This 21 fold improvement furthermore depicts scenario (1) - that of an unequal wealth distribution. Scenario (3) which depicts an affluence at the level of Europe today for all people, would require a roughly 100 fold improvement; scenario (4) which depicts a world in which the developing nations would have the same living standard as the developed world today and the developed world keeps growing its economy at 2% a year would necessitate a carbon intensity that is 130 lower than today, if co2 emissions are to stay within the IPCC’s emission target.³⁴

Technologic progress is thus very unlikely to suffice, yet as one of the three factors it remains essential and so far, it has not nearly been sufficiently explored:

‘Technological change is essential, with or without growth. Even a smaller economy would face this challenge: declining fossil energy requirements and substantially reduced carbon emissions are vital.

We can never entirely discount the possibility that some massive technological breakthrough is just round the corner. But it’s clear that early progress towards carbon reduction will have to rely on options that are already on the table: enhanced energy efficiency, renewable energy and perhaps carbon capture and storage. Just how much decoupling could be achieved in this way is an open question. The truth is, we haven’t yet tried that hard to achieve it. As Paul Ekins pointed out in his contribution to *Redefining Prosperity*, current policies barely scratch the surface of what could be done to deliver decoupling. Substantial early investment in low carbon technologies is obviously essential. The need for this kind of investment could transform the economics of the 21st Century.³⁵

³³ Tim Jackson, 2009, Prosperity without growth – a transition to a sustainable economy (pages 62, 63), Sustainable Development Commission

³⁴ Tim Jackson, 2009, Prosperity without growth – a transition to a sustainable economy (page 55), Sustainable Development Commission

³⁵ *ibid*

6 Sustainability – a truly fair distribution of resources and opportunities?

If we truly believe that the long-term goal is for every person on this planet to have similar opportunities, simple calculations thus prove, that some restrictions are needed as technologic progress is necessary, but will not suffice.

Tim Jackson addresses this issue in this study:

‘... none of the existing stabilization scenarios (including those in the Stern review) deliver global income parity. Income growth in the developed nations is taken as read. Parts of the developing world are assumed to catch up a little with the richer nations. But no attempt is made to develop scenarios in which incomes are distributed equally across nations. Unless growth in the richer nations is curtailed or some kind of completely unforeseen technological breakthrough happens, the carbon implications of a truly shared prosperity are even more daunting to contemplate.

The truth is that there is as yet no credible, socially just, ecologically-sustainable scenario of continually growing incomes for a world of nine billion people.

In this context, simplistic assumptions that capitalism’s propensity for efficiency will allow us to stabilise the climate or protect against resource scarcity are nothing short of delusional. Those who promote decoupling as an escape route from the dilemma of growth need to take a closer look at the historical evidence – and at the basic arithmetic of growth.

Resource efficiency, renewable energy and reductions in material throughput all have a vital role to play in ensuring the sustainability of economic activity. But the analysis in this chapter suggests that it is entirely fanciful to suppose that ‘deep’ emission and resource cuts can be achieved without confronting the structure of market economies.’

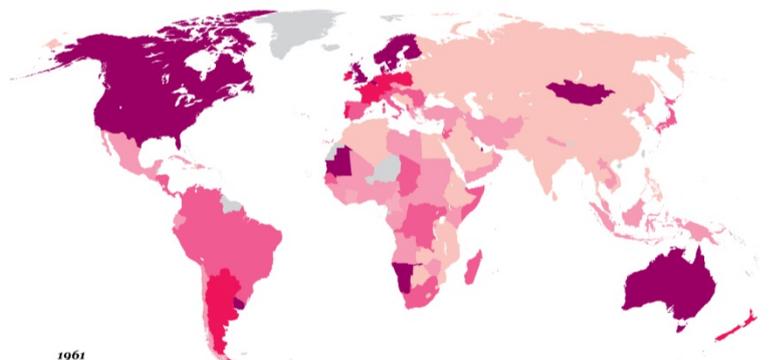


Figure 7: ecologic footprint per person shown for each nation (1961)
source: Living Planet Report 2012, WWF

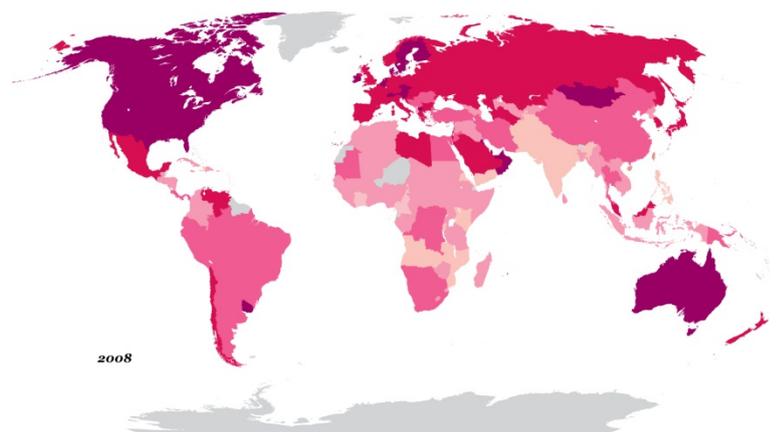


Figure 8: ecologic footprint per person shown for each nation (2008)
source: Living Planet Report 2012, WWF

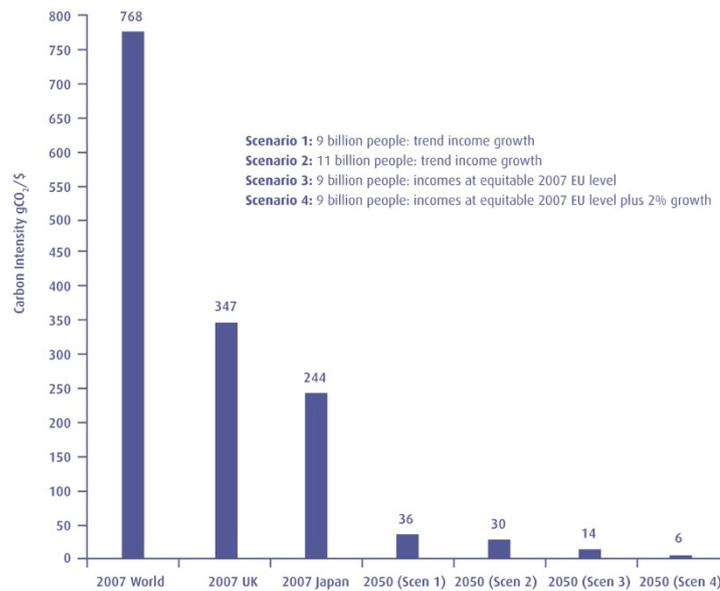


Figure 9: Carbon intensities now and required to meet 450 ppm target
 Source: Prosperity without Growth report

7 Prosperity without growth?

Points 4-6 show that the term ‘economic sustainability’ is quite deceptive. Usually ‘economic sustainability’ is understood to mean an economic system that secures employment and a growing economy. What government officials, but also architects and planners thus generally understand under the term ‘economic sustainability’ is therefore actually ‘economic growth’. Yet economic growth in its current form is inherently counteracting ecologic sustainability and in some areas social sustainability. And as the term ‘sustainability’ is meant to address all three areas, the concept of what ‘economic sustainability’ means, clearly needs to be investigated further.

It is impossible in the context of this paper to explore the possibilities of an economic base for our society that would further environmental and social aspects more. Yet we would like to point out the 3 main conclusions of the report ‘prosperity without growth’ which addresses just this possibility, as they are informative for our investigation on the compact city:

- a) a fair distribution of resources and opportunities means that wealthier nations need to significantly reduce their material consumption pattern,
- b) this implies an economic model that does not rely on growth, and
- c) a lifestyle that is significantly more frugal with respect to material consumption, but richer in other immaterial values (ethical, spiritual, social, ...) has shown to result in a higher life satisfaction as revealed through several studies in the fields of sociology and psychology.³⁶

➔ **With these findings in mind, we now want to re-examine the compact city as a settlement typology.**

8 The compact city and social, ecologic and economic sustainability

While at first it sounds impossible and limiting, there is plenty of evidence from the social sciences, from philosophy, from psychology, that limiting one’s material consumption – to the degree that important material needs are covered - does not lead to a reduction of happiness and life satisfaction.^{37 38 39 40} When done consciously and even more so within a society whose core values are not strongly linked to material

³⁶ Tim Jackson, 2009, Prosperity without growth – a transition to a sustainable economy (page 88), Sustainable Development Commission

³⁷ Tim Kasser, 2002, The High Price of Materialism, Bradford Books

³⁸ Richard Gregg, ‘voluntary simplicity’ as cited in Prosperity without Growth, 2009, Prosperity without growth (page 89)

³⁹ Elgin, Duane 1981. Voluntary Simplicity – towards a way of life that is outwardly simple, inwardly rich. Reprinted 1993. New York: William Morrow.

⁴⁰ Csikszentmihalyi 2000, 2003, as cited in Prosperity without Growth (Page 89)

possessions and who has less income disparity, more life satisfaction across all income groups has been observed.⁴¹

Next to material needs and desires, humans also have psychological needs, and often these needs tend to fall short in western societies oriented towards material consumption.⁴² A so-called 'social recession' in our consumer society has been widely reported in the social and economic sciences.⁴³ People report more loneliness and less support in the form of a social network in societies geared towards material consumption.

If our goal is a world that is more sustainable and fair for everyone, and if consuming less in the developed countries is not diminishing life satisfaction, what does this imply for the compact city model?

➔ **How are issues of social, ecologic and economic sustainability played out in the compact city at the moment?**

We have already pointed out in previous chapters, why the compact city is no guarantee for a reduction in the inhabitant's ecologic footprint. We now look at how social sustainability fares in the compact city.

Elisabeth Burton examined how socially 'just' or fair the compact city is in the case of the UK through an analysis of 25 towns with a population between 80 000 and 220 000. Burton looked at how more vulnerable parts of society, such as low-income groups, fare in the compact city compared to less dense towns. In summary, the compact city seems to be having positive effects as well as negative effects for this income group with benefits including improved public transport, reduced social segregation and better access to facilities, while the main problems are reduced living space, lack of affordable housing and lack of access to green space.⁴⁴ In her detailed study, Burton shows that housing prices tend to be high in denser cities and that as a result lower income groups are forced to live in small spaces without much choice regarding location or quality.

Both in developed and developing countries, we can thus observe⁴⁵ that strongly limiting space for urban expansion negatively affects lower income groups. A very limited supply of land drastically increases density and housing prices meaning that middle to lower income groups will not be able to afford adequate housing.

Next to allowing for enough land for expansion, other measures such as rent control can regulate excessively high housing prices. Certain cities such as Vienna have long imposed stricter regulations on rent prices and as a result, even lower income groups have more space per person and more options regarding location and quality.

The MERCER life quality ranking of cities classifies the living conditions in 420 cities worldwide, looking at 39 factors grouped in 10 categories: political and social environment, economic environment, socio-cultural environment, medical and health considerations, schools and education, natural environment, public services and transport, recreation, consumer goods, housing. It thus takes into consideration all aspects of sustainable development, with the ecologic one falling somewhat short of the others. The result of MERCER's survey is fairly consistent: Overall, the cities with the highest quality of life are European cities with a medium density such as Vienna, Zurich or Frankfurt. These are larger cities of course, but in terms of density (FAR between 2.7 and 3.5) and size, they seem small and not dense on a global scale.

This leads us to ask the question, whether there are threshold densities, that is, is there a range of densities that seems preferable with respect to social, ecological and economic sustainability? Is there a size and density after which a city's quality and sustainability visibly decline? Do dense and large cities become less efficient as this is for example the case with high-rises (where beyond a certain height, the core becomes so large, that the overall efficiency relating to usable space is decreased)?

The simple answer seems to be yes and no. No, because it depends on the context - the environmental context, the social context, the economic context. A very well planned and organized city can be very large, yet still function well. (The amount of 'Hinterland' needed to support such a city and how sustainable it is to get enormous amounts of things in and out of the city is another question.) Given that the larger and denser the city, the more organized it must be, not many large and dense cities seem to work. An example is Singapore⁴⁶. Strict planning and rules allow for a relatively smooth functioning despite

⁴¹ Tim Jackson, 2009, Prosperity without growth – a transition to a sustainable economy (chapter 9), Sustainable Development Commission

⁴² Tim Jackson, 2009, Prosperity without growth – a transition to a sustainable economy (chapter 9), Sustainable Development Commission

⁴³ Juliet Schorr, 1999, the Overspent American, William Morrow Paper backs

⁴⁴ Elisabeth Burton, 2000, The Compact City: just or just compact?, Urban Studies Journal Foundation

⁴⁵ Shlomo Angel, 2012, Planet of Cities

⁴⁶ Michael Furger, 2012, 'Ist das die Zukunft' NZZ, relating to work of the 'Future Cities Laboratory' of the ETH Zürich in Singapore

its size and density (although it must be pointed out, that this also seems possible because Singapore is an authoritarian regime). Many other cities in the developing world though lack the necessary organization, such that beyond a certain size their productivity decreases⁴⁷ and health and pollution issues rise.⁴⁸

It thus seems that certain criteria used to determine the quality of life in a city, such as public transport, pollution, crime, etc. can be monitored even in very dense cities under certain conditions. According to this picture, even higher densities are possible; there would simply be a need for good planning and organization.

If we look at the question from the point of view of desirability though, it seems evident that there is a range of densities that is preferable from a social, ecological and economic sustainability point of view. If we pick up on Burton's definition of justice being related to people of varying social and economic situations having the choice of enjoying desirables and avoiding undesirables, then there are different limits to density. Given the choice, most people (except where special circumstances distort the picture) would choose to live in a neighbourhood that is less dense rather than more dense. On a historic scale, we can witness this as cities become less dense overall, the more the living standard rises. Angel Shlomo's book 'planet of cities' lays this connection out in detail.

Besides exceptional cases such as NY, Hong Kong or Singapore, it can also be said, that the more affluent nations have cities with a much lower density when compared to developing nations. Within the 50 densest cities (city proper), 80 per cent, and the first 13 are occupied by developing nations.⁴⁹ Within cities themselves, we can see this in areas of gentrification.

'The profiles of gentrifying tracts show large increases in their proportion of young adult households, dramatic reductions in household size, rapid increases in university educated population, and had more mobile populations between 1981 and 2001. The gentrification of the inner city reduces population density while increasing dwelling unit density. Gentrification in Canada is changing the composition of the inner city but is not repopulating the inner city and it is contributing to the overall decentralisation process in Canadian cities.'⁵⁰

The same phenomenon has been observed in most gentrified neighbourhoods; as affluence rises, household sizes and population density decrease. Evidence thus shows, that except for special situations, it seems desirable to have more space and live in a less dense neighbourhood. However, preferences for different types of urban living do vary (within a certain moderate span) and so does the fabric of cities. The compact city model must better address the phenomenon of spatial differences in density that are inherent to any metropolitan area.

'Some areas, especially employment centres - the CBD and other transit hubs - may have higher densities, while other areas may have lower densities. Densification may occur in some areas but not in others. There may be preferences, [...], for higher-density living [...], but there is also [*a part of the population*] that does not prefer higher-density living. The city may be able to create optimal environments for both without compromising the 'compact city' agenda.'⁵¹

Finally, evidently, some densities are too high to serve as general recommendation. To the same extent that the compact city model is supportive of higher densities where densities are indeed low, it should recommend lowering the density, where it is too high. It is not possible within the context of this paper to make precise recommendations with respect to FAR etc. as these would also be context specific. It is clear though, that as there are lower limits for density, there are upper limits and for many cities in the developing world, following existing compact city guidelines developed in the USA and Europe which praise density, is entirely inappropriate, when these cities are already suffering from high density.⁵²

Another negative effect of the compact city as revealed through Burton's study, is the difficulty for lower income groups to access green space. The theory that the compact city preserves green space outside the city and is thus beneficial because people will have a short distance to green space is not supported by Burton's study. This finding is supported by other studies as well:

'Better-off urban neighbourhoods are full of amenities that poorer neighbourhoods may lack, but a simple examination of greenery in satellite photos may be the most simple indicator.'⁵³

⁴⁷ City limits: Productivity in Latin America, Once a source of economic dynamism, mega-cities risk becoming a drag on growth, 2011, The Economist

⁴⁸ Urban Air Pollution, 2012, United Nations Environment Programme, http://www.unep.org/urban_environment/issues/urban_air.asp

⁴⁹ cities proper listed in order of density, 2012, Wikipedia, http://en.wikipedia.org/wiki/List_of_cities_proper_by_population_density

⁵⁰ Andrejs Skaburskis, 2011, Gentrification and Toronto's Changing Household Characteristics and Income Distribution, Journal of Planning Education and Research

⁵¹ Shlomo Angel, 2012, comment on a draft of this paper

⁵² Shlomo Angel, 2012, Planet of Cities

⁵³ Tim de Chant, 2012, Mapping neighborhood inequalities by mapping trees from space, <http://persquaremile.com/2012/05/24/income-inequality-seen-from-space/>

Unlike expected, low income groups in Burton's study are also less likely to cycle or walk in a dense city, than in a less dense cities. The report concludes that this is probably due to the fact that walking and cycling are not as safe and pleasant in many dense cities.

Another finding regarding the compact city, is that inequality tends to be greater in denser cities:

'While there is certainly plenty of rural inequality as well, the density of cities and urban regions makes the contrast of rich and poor particularly striking. (There is a ...) 45 per cent correlation between density and income inequality, measured with the Gini coefficient, across counties with more than one person per every two acre. The tendency of dense places to be more unequal motivates this survey of inequality in metropolitan areas, multi-county units containing a dense agglomeration of population.'⁵⁴

Inequality is linked with higher crime rates and greater unhappiness; unsurprisingly it is one of the factors that has no positive correlation.^{55 56}

The 'Prosperity without growth' report expands on this topic: inequality is a major cause of stress and unhappiness, regardless of the actual material wealth – the proximity of different income groups makes the difference more visible and thus increases the perception of lack of wealth in lower income groups.

With respect to job accessibility, the compact city also did not show clear results according to Burton's study. Low-income groups might have long commuting distances, even if they work within the city.

As expected, advantages with respect to social sustainability and lower income groups were better public transport possibilities, and thus a better access to facilities.

Surprisingly, the compact city also has the potential to reduce social segregation under certain circumstances. These are for example the type of housing because it often reflects tenure types as well. Flats and terraces tend to be rented rather than owner occupied.

'Lower levels of social segregation are more strongly associated with higher housing density than with any intervening variable. Where there is a large proportion of high density housing, segregation tends to be low, especially if it also contains a small proportion of wealthy households. Looking at more general measures of compactness, density still emerges as the key factor in limiting segregation, but the strength of the association is increased when it is also accompanied by a high proportion of local authority tenants and car-less households.'⁵⁷

We have so far emphasized the shortcomings rather than the advantages of the compact city model, with respect to social and environmental sustainability. The main reason being, that we set out to question the universal recommendation of the compact city model as is, and that the advantages are widely known and have been presented under point 1. Nevertheless, after having exposed the weaknesses, it is necessary to point out that whilst these shortcomings in connection with the compact city need to be studied and addressed, they are not necessarily an argument against the compact city.

If urbanists are asked to propose a settlement typology that is sustainable, the compact city might still have the best potential to fulfil this goal. The fact that any savings in energy might be spent elsewhere for example, cannot discredit the compact city model as such, it only shows, that in itself it is not sufficient.

A simple comparison to choosing a mode of transportation makes this clear: If an engineer is asked to come up with an energy efficient car or transport system and proposes an energy efficient car or communal transport such as the train, these must still be evaluated in comparison to other transport options. The fact that users of this transport system might spend any savings from the energy efficient transport type on other consumer goods, does not discredit the transport type in itself.

The fact that property prices in the compact city lead to lower income groups having very poor housing choices, also is not speaking against the compact city model entirely, partly it points to the necessity for governmental regulations (for example by regulating housing prices). Partly though, it does point to problems that are inherent to the compact city model and that require fundamental re-conceptualizations.

Where densities are so high that adequate housing becomes unaffordable for the middle to lower income groups, artificial containment policies must be loosened such that land becomes available for planned expansion. The lack of green space, both in the form of parks as well as in the form of trees on streets or the lack of adequate pedestrian and bike lanes for example, must be addressed. That interior spaces (especially housing) should be small can also be questioned. Given that compact construction already implies an efficient use of resources (material, infrastructure, ...), more generous interior spaces could be argued for, if they make the compact city more attractive than equivalent spaces in a considerably less dense urban sprawl environment.

⁵⁴ Edward Glaeser, Matthew Resseger, Kristina Tobia, *Urban Inequality*, 2009, National Bureau of Economic Research

⁵⁵ Elizabeth Burton, 2000, *The Compact City: just or just compact?*, Urban Studies Journal Foundation

⁵⁶ Edward Glaeser, Matthew Resseger, Kristina Tobia, *Urban Inequality*, 2009, National Bureau of Economic Research

⁵⁷ Elizabeth Burton, 2000, *The Compact City: just or just compact?*, Urban Studies Journal Foundation

Finally, density must remain within a sensible range that allows for the efficient use of public transport etc., yet also allows for adequate living conditions. The compact city model must argue for decreasing density where it is too high in the same manner as it argues for increasing density where it is too low.⁵⁸

As Shlomo Angel argues, we must stop denying the fact that cities expand and thus artificially keep land supply low through harsh containment policies. We must stop refusing to plan adequate infrastructure for expansion, thus later having to adapt to inefficient or even unregulated expansion. Rather we must look at reality and plan for expansion. This allows us to secure adequate infrastructure, public works and green space, it allows us to allot adequate land for housing and it allows us to guide density such that is in a range that is sufficiently high for public transport, yet not as high as to result in overcrowding and poor living conditions.⁵⁹

9 Governmental regulations

Important areas of governmental regulation relating to ‚planned expansion’ have been referred to in the section above. Next to those necessary measures, a truly more sustainable compact city would also require governmental regulations relating to a more sustainable economy. Evidence presented under points 4, 5 and 6 shows that incentives and guidelines relying on the good will of individuals are not nearly sufficient to keep CO₂ emissions, material depletion and waste from rising sharply. Yet currently efforts to install stricter environmental regulations are at best slow and partial.

‘... private transport is incentivized over public transport; motorists are prioritized over pedestrians; energy supply is subsidised and protected, while demand management is often chaotic and expensive; waste disposal is cheap, economically and behaviourally; recycling demands time and effort: ‘bring centres’ are few and far between and often overflowing with waste.’

But not only are efforts to behave in a more environmentally friendly manner not sufficiently supported. Individuals are embedded in a society that gives out conflicting messages. On the one hand, we are asked to recycle, to use public transport, etc., on the other hand, we are bombarded by companies and the government to spend and consume – thus to keep increasing our environmental footprint. An important part of this spending is not to satisfy basic needs, but is to give in to a cycle of consumption that is artificially created.

‘Opening the huge new Westfield Shopping Centre in White City in October 2008, London Mayor Boris Johnson spoke of persuading people to come out and spend their money, despite the credit crunch. Londoners had made a ‘prudent decision to give Thursday morning a miss and come shopping’, he said of the huge crowds who attended the opening.

[...] Urging people to Act on CO₂, to insulate their homes, turn down their thermostat, put on a jumper, drive a little less, walk a little more, holiday at home, buy locally produced goods (and so on) will either go unheard or be rejected as manipulation for as long as all the messages about high street consumption point in the opposite direction.’⁶⁰

It is in this context, that the question about whether the compact city is the most sustainable type of settlement model, must be understood. Unless our society adopts a more sustainable economic model, a significant reduction in our environmental footprint is not possible, regardless of the settlement typology. At the same time, it is clear that an adoption of a more sustainable economy is not imminent. What then does this imply for the design disciplines?

10 Actors involved, role of the design disciplines

This is not a new debate: In *Architecture and Utopia* architectural historian and critic Manfredo Tafuri famously treats this subject. He concludes that until society (its government and the economic system) is more just and good, there can be no just or good architecture and urban planning on a wide scale. Good architecture / urban environments do happen, but on the scale of exceptions or ‘islands’. Where does this leave the practicing urbanist and architect though?

As explained under point 8, regardless of the governing political and economic system, the question of what kind of settlement typology is sustainable arises. Even in a more ideal society that is more fair and environmentally sustainable, the question of how to best house 7 billion people on this planet would arise. And it is specialists - urbanists, architects, landscape architects - basing their research and work on adjacent disciplines from the social sciences, to psychology, to geography, environmental sciences and agriculture etc., who would be best prepared to tackle these questions.

⁵⁸ Shlomo Angel, 2012, *Planet of Cities*

⁵⁹ *ibid*

⁶⁰ Tim Jackson, 2009, *Prosperity without growth – a transition to a sustainable economy*, Sustainable Development Commission

It is the task of the design disciplines to provide a solid and deep understanding of this question as well as sensible proposals to society, to government officials, to NGO's etc. The impact will not be immediate and absolute, but there will be a positive impact.

Even within a society with an economy that is not sustainable, decisions have to be taken and they can go towards a more sustainable or a less sustainable future. Every decision taken can be a step in the right direction or a hurdle for the future. It is thus the task of the design disciplines to understand within the given context, what the best options are and to defend them publicly as to raise awareness for these issues. In this paper we have tried to briefly point at what direction such work could take.

In his paper *Infrastructural Ecologies*⁶¹, Pierre Belanger argues for a more proactive role of the design disciplines, despite and in spite of their diminishing range of influence. He says that the design disciplines are missing opportunities to get involved in certain technical and economic issues bordering with other disciplines such as engineering. By not actively tackling the challenges facing the built environment on wider infrastructural levels, the design disciplines have effectively shut themselves out of important debates. By restraining what is considered architecture and landscape architecture to buildings and streets and parks and gardens, the design disciplines have missed out on having a say on larger infrastructural and spatial projects that shape our built environment as profoundly as buildings and streetscapes.

This plays a role in the debate on the compact city, because the compact city model concentrates the field of intervention of the design disciplines to the streets, buildings and parks of the city and suburbs. Belanger's research suggests that new approaches to regional planning should consider proximity and symbiosis of different programs (he presented examples such as energy production in the form of windmills and agriculture combined or energy production through tidal differences and waterfront projects combined). These projects which heavily depend on engineering, are strongly shaping our environment and a stronger involvement of the design disciplines would broaden both our understanding of the built environment as well as our field of action. Bringing the expertise of the design disciplines to areas currently dominated by engineering, such as the construction of infrastructure, industrial sites, etc. would hopefully add a social, ecologic and aesthetic quality to such spaces which are often in proximity to traditional urban and suburban fabric.

The built environment has a relatively high environmental footprint compared to other human activities and it tends to have long term consequences. Rectifying a poor urban organization is very difficult and costly; every wrong decision makes the next step more difficult.

There is thus tremendous need for urban planning, especially in the rapidly growing urban areas of the developing world. To this effect, Rahul Mehrotra is currently participating in the creation of the *Indian Institute for Human Settlements* that will educate and send hundreds of urban planners and designers to rapidly growing mid-sized towns (500 000) in India, which tend to receive virtually no attention from planners and architects.

The need for research and studies on the compact city and settlement typologies is certainly significant, both in the developed world and in the developing world.

Conclusion

Urban settlement typologies in both the developed and the developing world must be understood and elaborated with each other in mind, if the goal is a sustainable society.

In a world with over 7 billion people, the compact city model represents a sensible and sustainable settlement model. Nevertheless, there are significant shortcomings within the model itself as well as within its application in the real world.

With respect to ecologic sustainability, the environmental footprint is mainly linked to living standards - without a reduction in material consumption, no significant improvement can be expected, regardless of the settlements typology. Money saved in one area (transport, heating, ...) is spent elsewhere (holidays, consumer goods, ...). Advances in technology (efficiency in using fossil fuel, alternative energy sources...) are not progressing fast enough, to offset economic and population growth. As a consequence, material consumption in already wealthy countries needs to be significantly decreased.

With respect to social sustainability, it is clear that there needs to be a radically different approach for wealthy countries and for developing countries if by social sustainability we mean a truly fair distribution of resources. While density can be sensibly increased in many cities in the developed world without creating unpleasant living conditions, in the developing world, densification is unnecessary in many urban areas.

⁶¹ P. Belanger, 2012, *Infrastructural Ecologies*, An unauthorized Autobiography of Engineers

Furthermore, even within wealthy societies, the compact city model is not always beneficial to more vulnerable parts of society, such as low income groups due to the lack of affordable housing, green space etc. Adding green spaces and more living space would make the compact city more just with respect to different income groups.

In general, it is necessary to accept that cities do grow and thus plan for expansion, rather than having to retrofit unplanned expansion.

With respect to economic sustainability, the most important finding is that without a world economy that begins to steer away from being based on continuous growth and material consumption, ecologic, social and one day economic sustainability are no longer viable. Significant positive changes in urban settlements are only possible if on the governmental level, significant changes take place. It is the role of the architect and urban planner to understand the complexity of this subject and contribute to the discourse as it applies to the discipline.

Acknowledgements

The authors would like to thank the 4 experts Pierre Belanger, Shlomo Angel, Rahul Mehrotra and Philipp Rode for their papers as well as for their very useful comments on this frame-text. Their critical comments have allowed us to consistently re-question our existing assumptions about the compact city.

Bibliography

- Angel, Shlomo, 2012, *Planet of Cities*, Lincoln Institute of Land Policy, Fourth Holcim Forum for Sustainable Construction
- Belanger, Pierre, 2012, *The Strategy of Decentralization - Reviewing the Club of Rome's 1972 "Limits to Growth" and the World Problématique*, Fourth Holcim Forum for Sustainable Construction
- Bradford, Eleanor, 2012, *Indoor laundry drying poses a health risk*, BBC News, <http://www.bbc.co.uk/news/uk-scotland-20176376>
- Burton, Elizabeth, 2000, *The Compact City: just or just compact?*, Urban Studies Journal Foundation
- cities proper listed in order of density, 2012, Wikipedia, http://en.wikipedia.org/wiki/List_of_cities_proper_by_population_density
- City Limits – a resource flow and ecological footprint analysis of Greater London*, 2002, Best Foot Forward
- City limits: Productivity in Latin America*, Once a source of economic dynamism, mega-cities risk becoming a drag on growth, 2011, The Economist
- Csikszentmihalyi 2000, 2003, as cited in Prosperity without Growth (Page 89)
- de Chant, Tim, 2012, *Mapping neighbourhood inequalities by mapping trees from space*, <http://persquaremile.com/2012/05/24/income-inequality-seen-from-space/>
- Elgin, Duane 1981. *Voluntary Simplicity – towards a way of life that is outwardly simple, inwardly rich*. Reprinted 1993. New York: William Morrow
- Europe 2007 Gross Domestic Product and Ecologic Footprint*, Global Footprint Network, http://www.footprintnetwork.org/images/uploads/europe_2007_gdp_and_ef.pdf
- Furger, Michael, 2012, *Ist das die Zukunft NZZ*, relating to work of the 'Future Cities Laboratory' of the ETH Zürich in Singapore
- Gaigné, Carl, Riou, Stéphane, Thisse, Jacques-François, 2010, *Are compact cities environmentally friendly?*, GATE Groupe d'Analyse et de Théorie Économique Lyon-St Étienne
- Glaeser, Edward, 2011, *Triumph of the City*, Penguin Press
- Glaeser, Edward, Resseger, Matthew, Tobia, Kristina, *Urban Inequality*, 2009, National Bureau of Economic Research
- Gregg, Richard, *voluntary simplicity* as cited in Prosperity without Growth, 2009, Prosperity without growth (page 89)
- Gross Domestic Product and Ecological Footprint, Europe 2007, Global Footprint Network
- Hassler, Uta, Wang, Wielfried, Kohler, Nicolas, 1999, *Umbau*, Wasmuth Verlag
- Heinonen, Jukka, 2011, *The Impact of Urban Structure and Consumption Volume on Carbon Emissions of Communities*
- Jackson, Tim, 2009, *Prosperity without growth – a transition to a sustainable economy*, Sustainable Development Commission
- Kasser, Tim, 2003, *The high price of materialism*, Bradford Books
- Leibundgut, Hansjürg, 2012, *Von der Sonne zur Erde und wieder zurück*, www.solergie.org
- Lyndhurst, Brook, 2003, *London's ecological footprint*, Greater London Authority
- Mehrotra, Rahul, 2012, *Mumbai - Density and the KINETIC CITY*, Fourth Holcim Forum for Sustainable Construction
- Mercer life quality in cities survey*, 2012, Mercer
- The Millenium Goals Report 2007*, United Nation, <http://www.un.org/millenniumgoals/pdf/mdg2007.pdf>
- Perception survey on quality of life in European cities, 2009*, Conducted by The Gallup Organisation, Hungary upon the request of Directorate General for Regional Policy / European Commission
- Loveridge, Russell, 2012, *Bifurcation of the Digital Chain*, Doctoral Thesis EPFL
- Rode, Philippe, 2012, *The Politics and Planning of Urban Compaction: The case of the London Metropolitan Region*, Fourth Holcim Forum for Sustainable Construction

Schorr, Juliet, 1999, *The Overspent American*, William Morrow Paper backs

Schumacher, E. F., 1966, Buddhist Economics, in *Small is Beautiful: Economics as if People Mattered*

Skaburskis, Andrejs, 2011, *Gentrification and Toronto's Changing Household Characteristics and Income Distribution*, Journal of Planning Education and Research

Sorrell, Steve 2007, *The Rebound Effect: an assessment of the evidence for economy-wide energy savings from improved energy efficiency*. A report by the Sussex Energy Group for the UK Energy Research Centre. London: UK Energy Research Group.

Tafuri, Manfredo, 1979, *Architecture and Utopia*, MIT Press

UN Human Development Index

United Nations General Assembly (2005). 2005 World Summit Outcome, Resolution A/60/1, adopted by the General Assembly on 15 September 2005

Urban Air Pollution, 2012, United Nations Environment Programme, http://www.unep.org/urban_environment/issues/urban_air.asp

Urbanization, 2012, Wikipedia, <http://en.wikipedia.org/wiki/Urbanization>

Urban Density, 2012, Wikipedia, http://en.wikipedia.org/wiki/Urban_density#Measurement

Urban trends: Urbanization and economic growth, UN Habitat, State of the World cities 2010 / 2011, <http://www.unhabitat.org/documents/SOWC10/R7.pdf>

World Population Projection, 2005, UN, <http://www.un.org/News/Press/docs/2005/pop918.doc.htm>