

Urban Patterns for Sustainable Development: Towards a Green Economy

UN-Habitat Draft Working Paper
January 2011

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EXECUTIVE SUMMARY

Cities have a vital role to play in the realisation of sustainable development and poverty eradication in the context of a Green Economy. As more and more land is converted to urban uses, the patterns that this development assumes within the region around cities will have far-reaching effects both upon the world's economies, energy use and climate change. Combining the perspectives of economic competitiveness, strategic spatial planning and landscape ecology leads to seven strategies for achieving urban patterns for sustainable development. Local officials should:

Embrace land mosaic patterns that provide for large green patches and more sustainable urban development. Two urban patterns, the 'compact concentric zone' and 'satellite cities' models, can best provide for both human and ecological systems. These patterns preserve a greater number of large patches of land within which nature can thrive, whereby flooding and landslides can be prevented, while at the same time allowing for population and economic growth. On the other hand the patterns of urban sprawl and uncontrolled development along corridors yield inferior results.

Promote compact cities and planned extension of urban areas. Urban densification allows people and businesses to take advantage of agglomeration economics while protecting the environment. Planners can promote dense growth by redeveloping inner city brownfields. Urban upgrading can maintain the density of informal settle-

ments while improving the quality of life for residents. This would contribute to enhancing the role of the street as the prime locus of public intervention. Compact development around public transport stations can support planned extension of urban areas. The coordination of land use development and infrastructure investment is critical in this regard.

Balance strategic facilities with diversified local economic opportunities. As an urban centre grows, the range and number of the functions that it supports generally increases. Facilities such as good harbours, an international airport, universities and a financial centre strengthen the competitiveness of a city-region and support value chains throughout the area. At the same time, diversifying local economic opportunities diminishes the demand for mobility, hence reducing energy use. Meanwhile, individual cities may play to some extent specialised roles within a polycentric urban region.

Expand network infrastructure while getting the most out of existing networks. Multi-modal transportation systems help to reduce dependence on the automobile. Commuter rail lines can support compact patterns of urban growth. Energy and fibre-optic cable facilities are crucial for economic competitiveness, while basic services help to protect the environment. At the same time new technology and policies can help operators to squeeze more use out of existing capacity.

Construct 'greener' built environments that use water and energy efficiently. Both regulatory approaches (e.g. strengthened building codes) and incentive-based strategies (e.g. green building rating tools, green mortgages) can promote green building.

Protect valuable ecosystems services and biodiversity hotspots while increasing resilience to some natural disasters. Safeguarding ecosystems involves understanding how those systems work, and conserving blue-green patches and corridors accordingly. Some ecosystems provide valuable services for humans, including protection from natural disasters; making those benefits explicit helps decision-makers understand why they should be preserved. At the same time biodiversity hotspots should be protected for more purely ecological reasons.

Promote clusters of green industries and jobs. Officials also can support the growth of clusters of green industries and green jobs, e.g. through three-way links between universities, business and local authorities.

These strategies can contribute to developing the city-region, within the context of the Green Economy. Challenges remain, however, including those related to governance models, benchmarking for competitiveness and comparing urban energy efficiency profiles. UN-Habitat stands ready to help city-regions to pursue these strategies within the context of sustainable urban development and urban poverty eradication.

Introduction

Citizens, governments and the United Nations increasingly are embracing a new paradigm for development: the Green Economy. Proponents seek to develop their economies along pathways of higher, more equitable growth at lower carbon, energy and resource intensity. The Green Economy is pro-growth and pro-jobs, as well as pro-environment.

With the majority of the world's economic activity and now more than 50 percent of its population concentrated in urban areas, cities have a central role to play in the realisation of a Green Economy.

Moreover the world continues to urbanise. At the same time that more and more people are living in cities, so land continuously is being converted to urban uses. The patterns that urban development assumes as it continues to spread out from historically compact urban cores will have far-reaching consequences both upon the world's economies and its environment. The present paper focuses on the spatial development of the 'city-region' – that area generally not more than 80-100 km across (up to 10,000 km²) within which interactions between one or more cities and the surrounding hinterlands are intense. Looking ahead to the UN Conference on Sustainable Development in 2012 ('Rio +20'), UN-Habitat reflects on what we currently know, and how we can better support, urban patterns that contribute to sustainable development within the city-region.

The disciplines of landscape ecology, economics and strategic spatial planning all have produced insights as to how to achieve more sustainable economic development within this area of study. On the one hand landscape ecologists are interested in the patterns formed by relatively large-scale parcels of land; they refer to groupings of large chunks of land and the corridors that connect them as the 'land-mosaic pattern'. This scale of analysis lends itself to examination of the city-region (Forman 2008 & 2009). Meanwhile economists analyse the factors that enhance the competitiveness of local economies, and planners offer the tools that can provide for coordinated and compact urban growth. To realise the Green Economy within the city-region all of these perspectives are required. At all times but particularly during financial crises local officials confront powerful pro-development interests that may block sweeping environmental mea-

asures with unknown price tags. Not least of the strengths of the Green Economy movement is that it may be more politically persuasive than a purely environmental campaign since it is pro-growth.

Combining the perspectives of landscape ecology, urban competitiveness and strategic spatial planning begins to yield a set of strategies that decision-makers can embrace, preferably in combination, to achieve patterns of urban development that lead to more sustainable results. Within the city-region, decision-makers can:

Embrace land mosaic patterns that provide for large green patches and more sustainable urban development

Landscape ecologists seek to identify those patterns of urban growth that yield the most optimal results for both people and natural systems. After examining urban patterns in a large number of city-regions around the world, Richard Forman concludes that two patterns of urban growth (i.e. 'urban morphologies') yield particularly favourable results. The 'satellite cities' and 'compact concentric zone' models of development generally yield more optimal results, in part because these patterns preserve a greater number of large patches and corridors of green spaces for ecosystems while providing for human development (see Figure 1a). Compact patterns generally confer other benefits as well (see below). Medellín and Berlin are examples of fairly compact cities (see Figure 2a-b).

Other patterns of urban growth yield less optimal results. Firstly urban sprawl, which jumbles together fine-scale patches of people and nature on the land, is one of the least attractive designs (see Figure 1b). In addition to conserving fewer large patches of land for ecosystems, sprawl also tends to increase vehicle miles driven by commuters, resulting GHG emissions, and infrastructure costs. We tend to think of urban sprawl as a problem that plagues developed countries, and indeed it does: sprawl occurs in wealthy market economies (particularly those with weak planning controls) where families have the means to own large-lot houses and travel by car (e.g. Phoenix; see Figure 2c). Yet this urban pattern, resulting from rapid population growth, weak land use controls and dysfunctional land markets, is also a phenomenon that plagues many fast-growing cities in developing countries

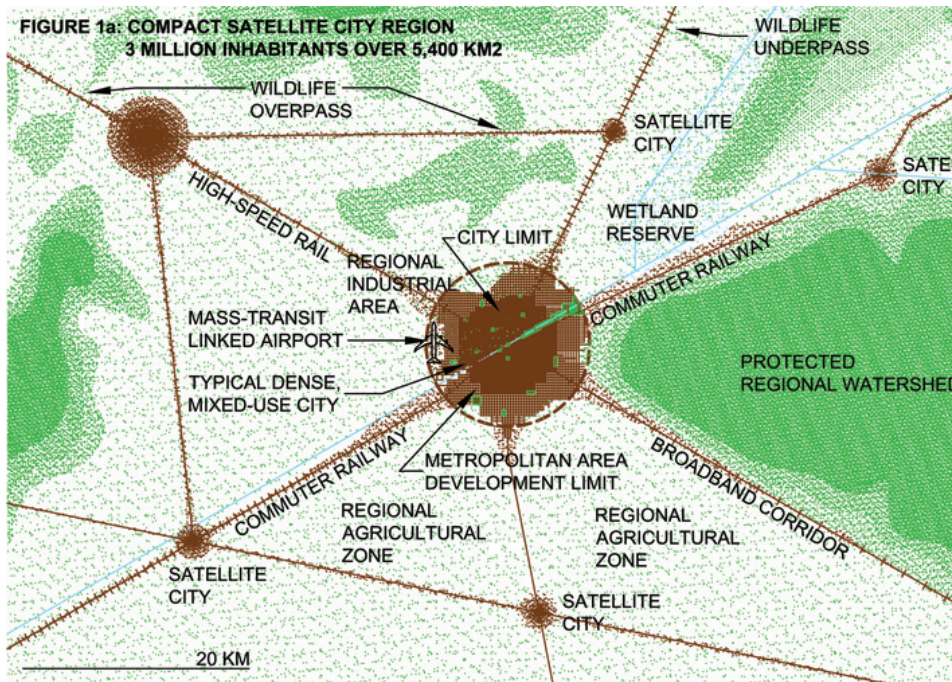
such as Nairobi (see Figure 2d). Whether sprawl is officially permitted or occurs informally, it can occupy lands where development is environmentally disadvantageous, as the example of Greater Cairo shows (see Box).

Greater Cairo tries to combat sprawl and preserve agricultural land

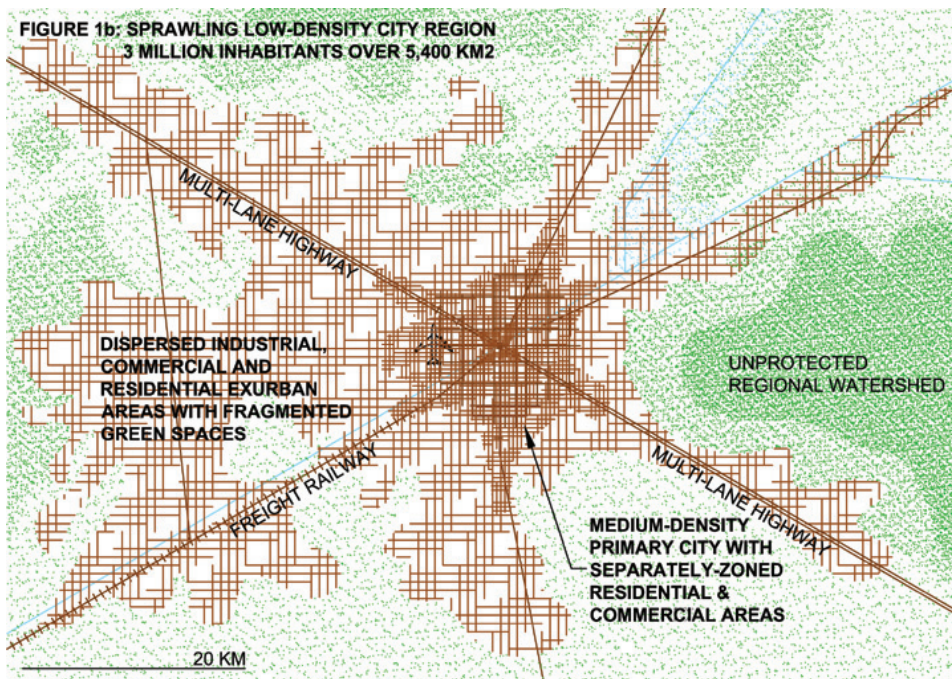
The Greater Cairo Region is home to close to 20 million people. While the population has mushroomed in recent decades, only 40 percent of housing development has taken place within formal land markets. These circumstances have led to sprawling informal development on scarce arable land – a food security concern. At present 81 percent of informal units in Greater Cairo sit on privately owned agricultural land.

Since 1982 the Government has sought to redirect urban growth out of the fertile Nile Valley onto satellite communities on the adjacent desert plateau. To this end the Government has prohibited the conversion of private agricultural land to urban uses while investing heavily in housing and infrastructure in desert areas. These measures have been partly – but only partly – successful in meeting goals. Between 1995 and 2007, for example, developers urbanised 110 km² of desert land – but at the same time 55 km² of dwindling agricultural lands were urbanised as well. Furthermore, development on desert land brings its own share of challenges, including the sustainable provision of potable water (UN-Habitat 2010c).

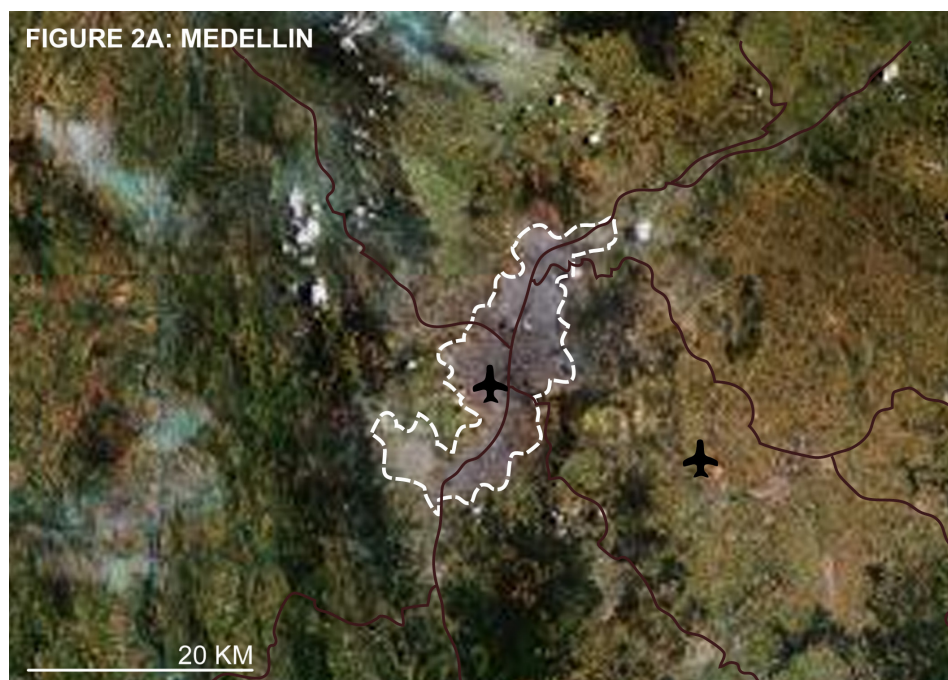
Likewise Forman concludes that a second major spatial pattern yields undesirable results as well: uncontrolled development along transportation corridors (Forman 2008 & 2009). As with sprawl this pattern is springing up all over the developing world, from Africa (e.g. on the highway from Dakar to Thiès in Senegal) to Asia (e.g. along highways leading from cities in India to Nepal's Pokhara and Kathmandu) to Latin America. Intense human activity along supposedly limited access thoroughfares is a safety hazard; this pattern no doubt contributes to the 1.3 million traffic fatalities that occur globally every year, over 90 percent of which take place in low- and middle-income countries. Likewise such patterns often cross and disrupt natural corridors such as waterways along which wildlife moves. These patterns also increase the risk of natural disasters such as flooding and landslides.



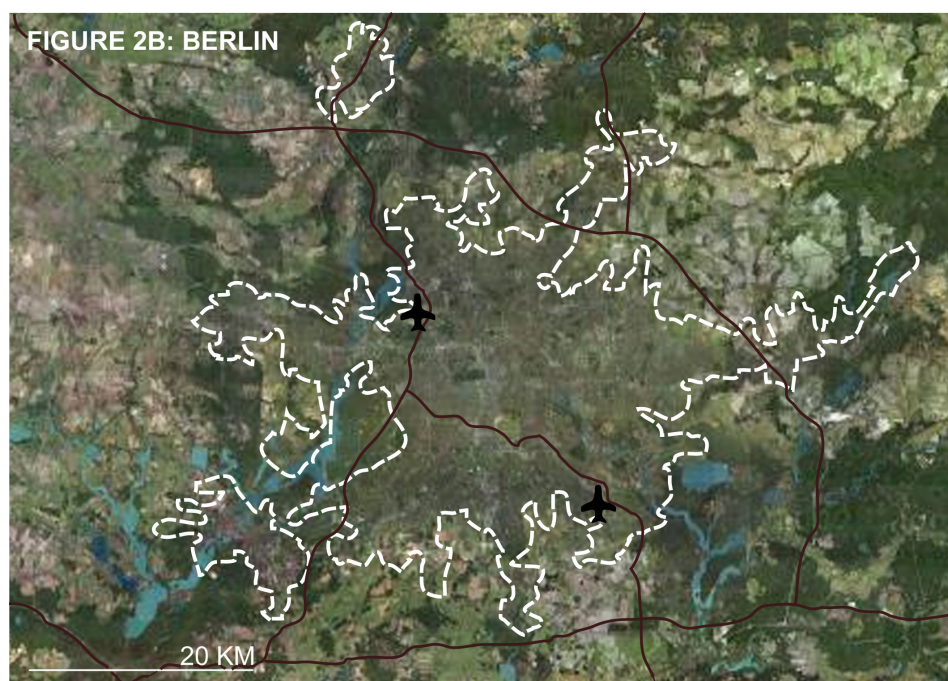
A regional system of multiple, compact, interactive satellite cities linked by strategically-located transit lines reduces resource consumption and emissions while preserving an overall land mosaic in which ecological systems can interlink and thrive.



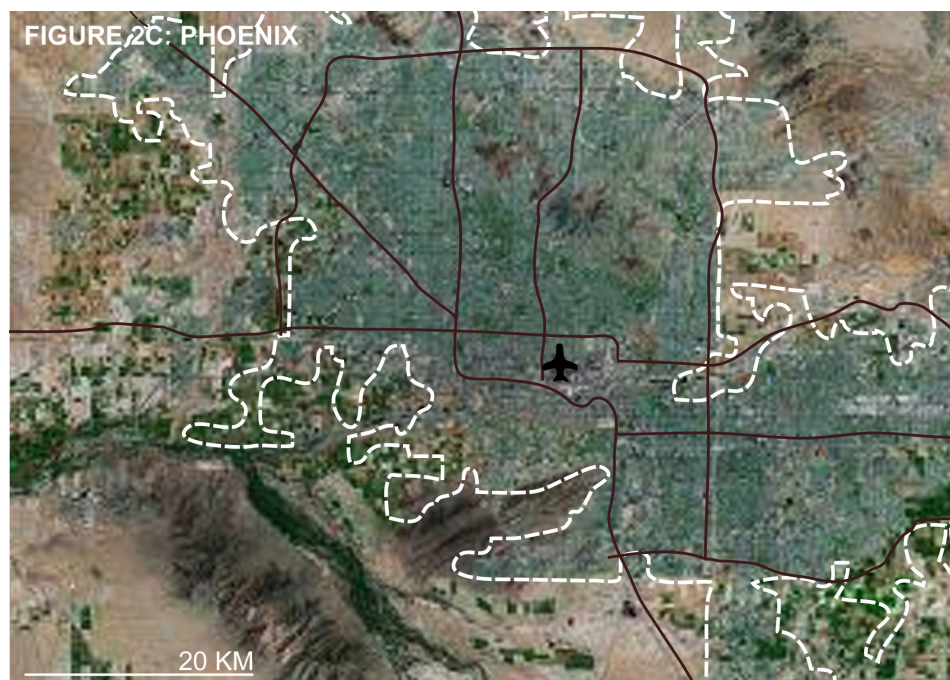
An urbanised region composed primarily of one low-density, sprawling conurbation is poorly suited to mass transit and strategically-located facilities, increases consumption and emissions and fragments the wider landscape in a manner that is detrimental to the functioning of ecosystems.



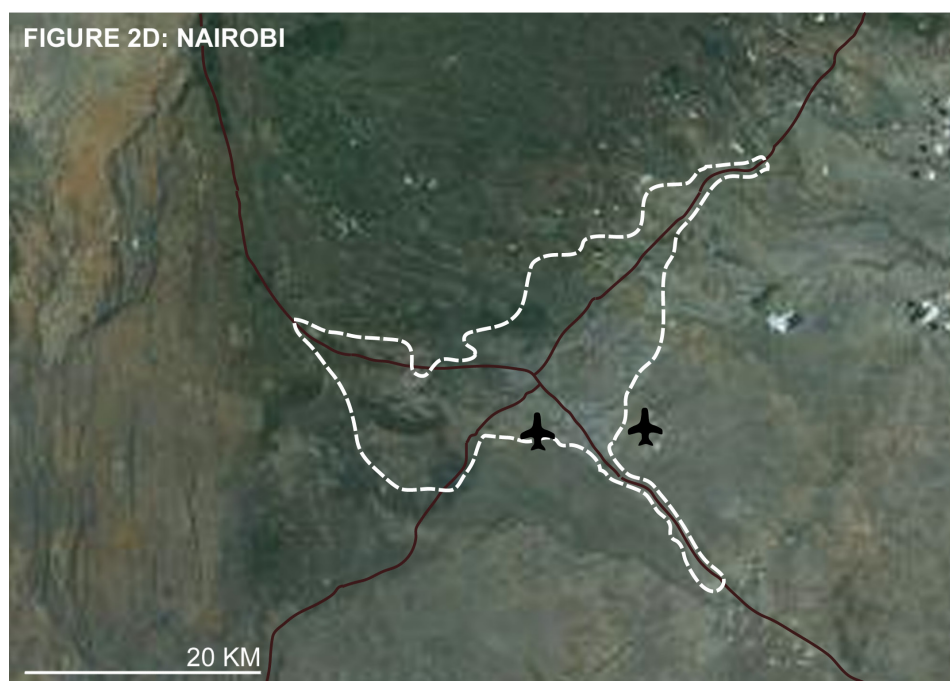
While Medellín accommodates its 3.5 million inhabitants within a small spatial footprint, it is partially at the expense of highly dense informal settlements that have spread up the steep hillsides surrounding the central core. These informal areas are difficult to service and vulnerable to landslides, though infrastructural efforts like extending public cable cars up the hillsides have begun to ameliorate the situation.



Berlin is composed of high- to medium-dense settlements which are well-served by local and regional public rail and roads. This development pattern accommodates 3.5 million residents along with peri-urban agriculture and a mosaic of natural areas, many of which protected.



With a spatial configuration that privileges the private automobile and sprawls in virtually every direction, Phoenix's 3.5 million inhabitants spread over a relatively vast area served almost exclusively by multilane motorways. The developmental sprawl has virtually no boundaries and creates discontinuities in the surrounding landscape that ecological systems have difficulty bridging.



Exhibiting recent tendencies to sprawl along the main roads exiting its central core, Nairobi's medium-high density masks two unsustainable extremes: an array of very low-density wealthy residential neighbourhoods in contrast to several highly-dense, poorly-serviced informal areas which accommodate more than half of the city's 3.5 million inhabitants. The city is becoming increasingly congested due to inadequate mass transit planning. At the same time, a large park to the city's south protects a wide variety of wildlife.

The most favourable land mosaic patterns, then, provide for compact and more sustainable urban development while preserving large patches of green space. One can distinguish between three types of green space: natural spaces such as forests (e.g. close to Bucharest), semi-natural areas that receive some human use (e.g. the Ajusco Volcano and mountain chain that falls within the Federal District of Mexico), and intensive use spaces including parks and farmlands. People are interested in preserving different types of green space within the city-region for various reasons. Landscape ecologists, on the one hand, favour the preservation of large patches of natural green space because they find that 'nature best thrives (is least altered or degraded) in large patches' (see below). Economists, on the other hand, support the conservation of different types of green patches and corridors for various reasons including their value as urban amenities. Officials increasingly are becoming aware that green space amenities bolster a city's competitiveness by helping it to attract and retain a talented labour pool. Richard Florida argues that people in what he terms the 'creative class' highly value outdoor recreation as a quality-of-life issue: cities seeking to attract private investment should spend less money on sports stadiums and more on trails for running or bicycling (Florida 2002). Rankings such as AsiaWeek Magazine's annual scoring of the best Asian cities in which to live share this emphasis: among the indicators they measure are square metres of parks per person, levels of air pollution and the existence of a mass transit rail system. Curitiba, Brazil increased the amount of green space per inhabitant from 0.5 m² in 1970 to 52 m² today while undertaking other environmentally friendly initiatives. By no means have these measures hurt the city's competitiveness (see Box). Economists also are beginning to measure the benefits to human beings of ecosystems services (see below).

Green Curitiba attracts outsourcing giants

Curitiba is famous for launching an innovative 'surface metro' scheme while turning down subsidised financing to construct motorways. Environmentally friendly innovations in transport have rippled out to other urban and natural systems as well, e.g. the planting of 60,000 trees a year for a number of years and the establishment of riverside parks that retain water during floods. What is less well known is that such measures clearly have not hurt the city's competitiveness. In recent years Indian outsourcing giant Wipro and others have opened IT centres in the Brazilian city. In 2007 the business community singled out Curitiba as one of the world's 'top 50 emerging outsourcing cities' – a sign that green initiatives have not blunted the city's competitive edge.

That urban form matters is an optimistic message in that it offers hope that we can, with proper planning, preserve crucial ecosystems even while accommodating population and economic growth. This point is further driven home by comparing the land mosaic in Figure 1a (satellite cities) with Figure 1b (sprawl), while noting that each scenario accommodates roughly equal levels of population in the same area. Likewise in 1990 both Barcelona and Atlanta were home to around 2.8 million people – but the average density of Barcelona was 28 times that of Atlanta (Bertaud 2007). Yet this message is urgent as well, given the rate at which greenfields are being converted to urban uses in many areas. Since 1987 the Atlanta region, for example, has lost an average of 20 ha of tree cover a day.

Promote compact cities and planned extension of urban areas

One way for local governments to provide for more sustainable patterns of development such as described above is by permitting the orderly densification and extension of cities, through land management tools, incentives, swaps of building rights and so on. From an economic perspective, compactness is advantageous (at least up to a point) in that it reinforces the reasons why urban settlements sprang up in the first place: the advantages of urban agglomeration. Agglomeration in cities provides for labour market pooling, input sharing and knowledge spillovers. At the same time compact cities yield economic savings in constructing and operating infrastructure and in providing basic urban services.

From an environmental perspective, in addition to the ecological benefits noted above compact cities may well result in lower consumption of energy and emission of greenhouse gases (GHGs) than sprawling urban areas. One study (for Finland) suggests that, by embracing compact patterns of urban growth, planners eventually could reduce GHG emissions from passenger traffic by 27 per cent (Harmaajärvi).

Cities can work to redevelop their inner cities through brownfields redevelopment. The reuse of inner-city land that has been abandoned by industry, rails, military barracks, ports or related uses not only decreases development pressure at the urban fringe, but also can yield significant co-benefits in terms of tax revenues, job creation, reduced GHG emissions, and lower investments in infrastructure (Smith 2010). Stockholm, for example, redeveloped an underutilised small-scale industrial area near its port into the successful Hammarby Sjöstad environmental community. Such brownfields redevelopment, however, does not occur without leadership and hard work, given that land ownership may be fragmented and soils contaminated.

Land use planning also should provide for compact growth around public transport stations. In addition to slowing the conversion of land to urban uses this strategy of 'transit-oriented development' can reduce greenhouse gas (GHG) emissions due to lower dependence on private vehicles. Furthermore this strategy can support both the densification of existing urban centers as well as the orderly extension of cities. Such transit-oriented development (coupled with other measures) has helped economic powerhouses such as Singapore and New York City to maintain high levels of public transport ridership in recent decades, even while such levels have declined steadily in other urban centres. (In cities like Mumbai, on the other hand, land use policies that promote deconcentration tend to work at cross purposes to goals of high transit ridership [Bertaud 2009].) Public transit (particularly in the form of commuter rail lines) also can support a satellite cities pattern of urban extension, e.g. in Sapporo, Japan. Furthermore, if mechanisms are in place to capture part of the 'unearned increment' that results when urban growth is properly coordinated with service provision, local governments also can realize some fiscal benefits from such development.

While planned densification or extension thus confers benefits, overcrowding may be highly disadvantageous. Overcrowding and congestion may mean that the diseconomies of agglomeration, e.g., health problems from pollution and overcrowding, safety and emergency issues due to insufficient access, economic losses due to traffic jams, begin to outweigh the benefits (Soja 2000). The spread of informal settlements such as in Nairobi's Kibera slum neighbourhood often results in overcrowding and inefficient land use. Such informal settlements often provide insufficient space for public services such as roadway networks. This would contribute to enhancing the role of the street as the prime locus of public intervention. It would also support integrated service provision options and consolidation of urban spaces as economic and social assets.

With the cities of the developing world full of such informal settlements, the redevelopment of decayed neighborhoods and the upgrading of slums are important approaches to bridge the urban gap. When slum upgrading is well done, such as in Medellín, the provision of new forms of housing such as high-rise apartments can actually provide residents with better living conditions and more living space per person, and make more land available for streets and other public uses, while maintaining current high levels of density.

Likewise, with cities in many developing countries (e.g. Phnom Penh, Sana'a) growing at rates sometimes well above three per cent a year, the planned extension of urban areas is required. New neighbourhoods, defined and developed in proximity to existing urban areas and in coordination with the extension of urban networks, such as achieved in Shanghai Pudong, can prevent slum formation and help to contain urban sprawl. In Morocco, planned urban extensions helped to significantly reduce slums. While in theory a 'satellite cities' model is an ecologically advantageous method of expansion, experiences from countries such as Egypt and Chile, however, suggest that one must ensure that residents have adequate access to jobs for such settlements to be successful.

Balance strategic facilities with diversified local economic opportunities

As an urban centre grows, the range and number of the functions that it supports generally increase. For example, virtu-

ally all urban settlements down to small hamlets typically will offer at least basic health and education services, and have stores that sell groceries and newspapers. Only a smaller number of larger cities, however, will offer specialised medical services, advanced education and professional sports stadiums. Within the city-region, this arrangement (predicted by 'central place theory') can result in a hierarchical and often-times pyramidal system of centers of various sizes, with many small towns and only a small number of larger cities. This type of urban system reflects consumption patterns: more specialised services need to draw from larger market areas. While this development pattern is thus economically efficient, there may be environmental benefits as well: consumers' daily and weekly transportation trips are kept short, while only infrequent errands involve travel over longer distances. Likewise such a hierarchical system of centres of various sizes may be consistent with the environmentally desirable 'satellite cities' pattern of urban development.

The specialised facilities that 'higher order' services rely on are often vital to the competitiveness of the city-region – particularly those that provide directly or indirectly for export (Rondinelli et al 1997). Such economic assets may include a good harbour with international-class freight-handling facilities, research universities, a financial centre, and an international airport (Yusuf 2007, Ohmae 1993). Clearly not every city-region will boast all of these specialised facilities.

Across a given city-region, then, such specialised facilities can support the development of the 'long tail of promising niches' that depend upon those facilities. The specific location within the region of the various links in export-oriented value chains may reflect in part the 'urban land value gradient', whereby one expects land prices generally to decline as the distance from the city centre increases. Likewise the location of higher- or lower-order support services and the way that human resources are concentrated within the city-region may mirror the urban hierarchy predicted by central place theory. The spatial patterns of development in the Pearl River Delta outside of Hong Kong increasingly reflected such economic considerations as China began to open up beginning in the 1980s. Manufacturing processes that relied on readily available unskilled or semi-skilled labour migrated out of Hong Kong (further encouraged by the establishment of Special Economic Zones), while the port city retained higher-value and more skill-intensive activities such as finishing, packaging, insurance and finance. A similar spatial-economic pattern may be emerging in the city-region that includes Singapore and the Iskandar Development Region of Malaysia (2864 km²) – although in that case the movement of the factors of production within the area has been partly constrained by the presence of a national boundary (Yusuf 2007).

While the range and number of functions may increase in a fairly uniform



way as cities grow, that is not to say that all cities of the same size will play the same economic roles; on the contrary, larger cities within a single polycentric region gradually may become more specialised. For example, within the Multimedia Super Corridor of Malaysia (around 750 km²), Putrajaya City offers governmental functions while Cyberjaya City furnishes industrial and educational resources. Likewise the principal cities in the Randstad city-region of the Netherlands (8287 km²), Amsterdam, Rotterdam and The Hague, all have evolved relatively distinct profiles (see Box). This sort of city specialisation model may well yield superior results to efforts to force all urban centres within an urban region to develop along a one-size-fits-all pattern. As an economic development strategy, then, local officials can help such cities to progressively adopt higher-order functions while at the same time developing their comparative advantages.

The Randstad area faces opportunities & challenges in functioning as a coherent city-region

The Randstad area in the Netherlands (8,287 km²) features several sizeable cities that have evolved relatively distinct economic roles – Amsterdam (professional, financial, tourism), Rotterdam (freight logistics, manufacturing) and The Hague (international law) – as well as Utrecht and numerous other small municipalities. Local officials, concerned about the possible erosion in importance of the port of Rotterdam (once the busiest in the world), and aware that ‘the tremendous growth of the economies in Asia and Eastern Europe has put pressure on the international competition among urban regions’ (Rotterdam 2007), have actively sought to make their city-region function more coherently as an economic whole. For example, in response to a conclusion aware that low internal mobility within the region represents a key weakness, they have sought to establish a ‘Randstad circuit’ – a public transport link between the four big cities. More fundamentally they have tried to create a new institutional framework for regional governance; however to date none of the various solutions proposed (including a ‘Randstad Province’) have come to fruition (Salet 2003, Meijers 2005, van der Burg 2008).

Expand network infrastructure while getting the most out of existing networks

To be competitive city-regions also require adequate network infrastructure, including transportation systems. Transportation infrastructure is vital: when interviewers asked stakeholders in 25 megacities around the world what aspect of their city’s infrastructure was the most vital in attracting private investment, transportation was by far the most mentioned (Siemens 2007).

Efficient multi-modal transportation systems are environmentally advantageous in that they help to reduce dependence on the private automobile while supporting compact development. The TransMilenio Bus Rapid Transit (BRT) system in Bogotá, for example, uses elevated stations in the centre of avenues and dedicated bus lines to provide rapid transit at a fraction of the cost of an underground subway system. Transportation in Bogotá has improved as the city increasingly has strengthened inter-modal connectivity: the BRT system is now coordinated with routes for conventional feeder buses, and also provides bicycle riders with ample parking areas at stations. Lagos has followed suit and become the first city south of the Sahara to establish a BRT system. The Randstad city-region has sought to improve mobility between its urban centres via public transport, as one way to remain internationally competitive (see Box above).

Another important form of network infrastructure is energy. Frequent power rationing stunts economic and social development in a number of emerging economies. Alternative energy sources offer a promising approach to meet much of the pent-up demand for energy in an environmentally friendly way in certain countries, e.g. Kenya, where a geothermal power in the Rift Valley as well as a wind farm in Ngong Hills provides part of Nairobi’s energy needs. As the price of fossil fuels continues to climb as these finite resources become depleted, and as the price of alternative energy continues to fall as technologies improve and economies of scale are achieved, alternative energy solutions are becoming more and more feasible – and cities should prepare to take advantage of these changes.

Another form of network infrastructure that strengthens competitiveness is broadband fiber-optic cable. This infrastructure helps outsourcing centres such as Bangalore to stay competitive. Finally from an environmental perspective, basic infrastructure such as the facilities that support water and wastewater services are important. The economic development of the Pearl River Delta noted above took place at an unprecedented rate, but at a high environmental price: at present the Chinese government is trying to reduce the pollution of the Pearl River and South China Sea brought about by this growth, through massive investments in wastewater treatment facilities (Yusuf 2007, World Bank 2004).

While extending networks thus is important, motivated by environmental and financial concerns decision-makers are also working to get the most service out of existing infrastructure networks, including via improved real-time information flows. Bogotá’s TransMilenio System, for example, uses a global positioning system to help manage traffic flow. Cisco Systems, Inc. and the Clinton Global Initiative have worked with partner cities to find ways to reduce global carbon emissions while promoting economic development. Pilots to date include the Personal Travel Assistant, which allows people to access real-time transportation data and multi-modal routing services from any web-enabled device, from any location (in Seoul), and Intelligent Traffic Management, a multi-modal traffic management project (in Hamburg; Metropolis 2009).

Construct “greener” built environments that use water and energy efficiently

Building more efficiently and reskinning existing edifices can halve (or more) their use of energy and water. Given that 75 percent of the building stock that will be standing in developing countries in 2050 likely will be built over the next 40 years, in some energy-poor economies building ‘green’ therefore is not so much a luxury as a necessity from an economic development perspective. Furthermore green buildings not only use less energy and leave a smaller carbon footprint – they also result in economic benefits such as higher classroom attendance rates and fewer office sick days (UN-Habitat 2010b). At the same time many technologies

for improving the energy and water efficiency of buildings are mature and financially viable: the long-term savings outweigh the upfront costs. In the worldwide effort to reduce GHG emissions, improving the building sector thus represents low-hanging fruit.

Governments can modernise building regulations so that they require more green features, such as the solar water heaters that are winning acceptance even in low cost housing developments in developing countries (e.g. via a Clean Development Mechanism project in Cape Town). Yet social change theory reminds us that legislative reform often follows, rather than precedes, modifications in social behaviour. For this reason progressive builders in a number of countries (including Nigeria) are banding together in Green Building Councils to develop voluntary green building rating tools, educate members in new technologies, and lobby the government for change. A complementary approach is to design attractive financial products (e.g., 'green mortgages') that allow property owners to match up the operational savings achieved by building green with debt amortization over time.

Protect valuable ecosystems services and biodiversity hotspots while increasing resilience to some natural disasters

According to landscape ecologists, planning for the Green Economy within the city-region must be grounded upon a firm understanding of how ecosystems function. This understanding will inform

what large green patches are protected, and how. At the same time preserving ecosystems involves protecting the corridors between these patches along which wildlife travels, or at least green 'stepping stones' along those routes (e.g. in Ulaanbaatar, Mongolia). Planners may, for example, extend vegetated overpasses across highways for wildlife and walkers (e.g. Amsterdam).

Decision-makers are becoming aware that at least certain natural systems serve human populations. Such ecosystems services include the climate control and recreational uses provided by green spaces within city limits such as Tiergarten Park, the 'green lungs' of Berlin, which also shelters rare meadow plants (see Figure 2b). But cities also may take steps to protect key natural areas that lie well outside of city boundaries, including watersheds that provide drinking water. To protect its sources of fresh water in the Andes Mountains, Quito has established a trust fund that currently collects and deploys more than USD 1 million a year. From a climate change perspective, the mangrove swamps adjacent to some human settlements in Vietnam may offer both adaptation and mitigation benefits, by buffering communities from typhoons while acting as carbon sinks (UNEP 2010c). So as to make decision-makers aware of the economic value of such ecosystems services, recently analysts have begun to quantify these benefits, e.g. in Kampala, Uganda (see Box).

Kampala, Uganda values ecosystems services

The Nakivubo Swamp, which covers some 5.5 km² and runs from the City of Kampala's central industrial district to Lake Victoria, provides wastewater purification and nutrient retention services for the City. The area has been under urbanisation pressures through the expansion of human settlements and industrial uses. In the late 1990s this swamp was under serious consideration to be drained and developed. A study carried out in 1999 estimated that the Swamp provided USD 1 million of benefits per year in terms of the 'avoided costs' of replacing natural wetland functions with manmade alternatives such as a sewerage treatment plant, or USD 1.75 million/year in terms of the expenditures that would be required to mitigate the effects of wetland loss. Additionally draining the swamp would eliminate small-scale income activities for slum dwellers such as papyrus harvesting. These economic arguments helped to convince decision-makers to halt plans to drain the wetlands. Officials subsequently designated Nakivubo as part of the city's greenbelt zone (Emerton 2010).

Landscape ecologists, however, argue that certain natural areas, particularly those rich in biodiversity (e.g. Important Bird Areas identified by Birdlife International), merit protection even if they do not directly confer economic benefits. For this reason Cape Town, which covers much of a Global Hotspot of Biodiversity, mapped out important sites and adopted a Biodiversity Strategy. Wetlands and the blue-green strips along waterways typically are biologically rich and so should be protected or restored – as, for example Kigali, Rwanda is attempting to do by relocating industries out of the swampy Gikondo Valley to a new industrial park. When they can, however, local officials may try to articulate an economic rationale as to why to preserve such areas, e.g. by arguing that they serve ecotourism. Similarly local officials in Cape Town try to quantify the employment benefits of their conservation efforts, e.g. the semi- and unskilled labour required to clear invasive non-native plants from hotspots of biodiversity, even while struggling to more fully implement their Biodiversity Strategy.



Promote clusters of green industries and green jobs

A final, complementary approach to promoting environmentally-friendly economic development involves focusing on 'green' industries and trying to create more green jobs. While the impact of this approach on urban patterns may be less direct, focusing as it does more on the economics of industrial location and growth and less on those of urban agglomeration, still this strategy directly addresses green economic growth within the city-region.

In recent decades, building on the observation that many cities and urban regions tend to embrace a certain economic specialisation, economic development professionals have sought to nurture 'clusters' of industries in their areas. In some areas three-way partnerships between local governments, the private sector and local universities may support the growth of such clusters. More recently environmentally-minded officials and stakeholders have begun to support clusters of green industries. One such collaboration is the East Bay Green Corridor Partnership in and around Berkeley, California. This partnership of eight cities and three universities seeks to build on the region's strengths as a centre for emerging green technology and innovation. In addition to supporting the incubation of cleantech start-ups including those spinning out of local universities, stakeholders have laid out a roadmap for expanding the region's market share in green building, energy efficiency, environmental consulting, recycling and solar energy (Chapple 200_). Another such example can be found in Gauteng Province, home to the financial and manufacturing centre of Johannesburg and the South African capital of Pretoria (Tshwane). Their proposed 'Strategy for a Developmental Green Economy' emphasises job creation and clearly focuses on the 'equity' dimensions of the sustainable urban development paradigm (see Box). Such roadmaps developed by key public and private stakeholders also could address investment priorities.

Remaining challenges

At the same time that such promising strategies are beginning to emerge, significant challenges remain to achieving green economic development in the city-region, including, firstly, a set of hurdles related to governance. Lo-

Gauteng Province in South Africa focuses on building an equitable green economy

Recently residents of Gauteng Province have begun to devise a 'Strategy for a Developmental Green Economy' for their Province. This roadmap is notable in its call to create green skilled, semi-skilled and even unskilled jobs. For example the study's authors project that embracing a solar water heater strategy would generate 6,700 new jobs. Local equity priorities become clear when one reads that, while some proposals may 'lead to a zero impact on GDP, [they would] significantly increase jobs and reduce carbon emissions'. Another interesting feature of the Gauteng strategy is its call to support local food production. In addition to employment and environmental benefits including reduced travel time from farm to kitchen table, proponents argue that encouraging market gardening close to cities would lead to greater food security and healthier schoolchildren (Gauteng Province 2010).

cal governance is all-too-often atomised; few sub-national jurisdictions correspond to the natural economic boundaries of a city-region. Within an urban region, officials may establish specialised agencies either to address a specific environmental issue such as air pollution (e.g. Los Angeles area), or to promote economic development (e.g. the Welsh Development Agency in Wales); rarely, however, will one such agency have both mandates along with land use planning responsibilities. In some cases visionary local leaders who recognise the value of collaboration can forge solutions within the existing governance structure. For example, stakeholders of the 21 member municipalities of the Greater Vancouver Regional District (2,877 km²) forged a Liveable Region Strategic Plan that reinforced and expanded the region's green zone and called for a regional transit authority. Likewise local authorities within the Country of Greater Manchester (1276 km²) signed Multi-Area Agreements, a form of collaboration promoted by the government of the United Kingdom, to collaborate on economic development activities. In other instances decision-makers still need to create new governance arrangements to realize common interests, such as local officials have sought for years in the Randstad (see earlier Box).

Another set of challenges relates to measuring and benchmarking the competitiveness of city-regions. In recent years analysts have begun to compare individual cities in this manner, not only in the Global North (e.g. the US Metro Area Competitiveness Index) but also in some middle- and low-income countries including Mexico and India (Jurado 2008, Lall 2010); however to date this approach has been little applied to city-regions, particularly in the Global South. While as the preceding discussion indicates analysts have begun to identify the factors of competitiveness of these natural economic areas, efforts to strengthen their comparative advantages may become more focused when we can better quantify and compare their competitiveness (see Webster 2000). Such indices would be useful, firstly in allowing local officials to understand how their city-region compares to other similar areas. Secondly, when such analyses unpack the factors of competitiveness from a composite index, they can promote a common strategic vision among stakeholders as to how to work together strengthen their city-region's comparative advantages while protecting their environments. One of the difficulties here, however, is the 'fuzziness' of the frontier of the city-region, and the fact that (as suggested above) this border generally does not closely match existing administrative borders for which data are available.

More broadly we will need to learn how to better support economic development within the city-region that is at once vigorous, equitable and environmentally friendly.

UN-Habitat: Cities and the Green Economy

The preceding discussion hints at a number of ways in which UN-Habitat, working with partners, can help city-regions to embrace the Green Economy with a pro-poor and social equity focus.

UN-Habitat has begun to help member states and local governments to develop their local economies (see UN-Habitat 2005), develop capacity for strategic spatial planning, for instance in Kenya, Morocco, Vietnam and Cuba (see UN-Habitat 2004) and find paths towards the green economy. For instance, with funding from the Global Environmental Facility (GEF), UN-Habitat is promoting sustainable transport solutions for the eastern Africa capital cities of Addis Ababa, Kampala and Nairobi. But much further work is required to test hypotheses in pilot city-regions, and to convert that knowledge into the practical tools, policy briefs and capacity-building packages that local officials and stakeholders around the world need to more fully achieve green economic growth in their communities.

Next steps in this vision-sharpening, knowledge sharing and work planning process include the following:

- (1) Feb 2011 – an Expert Group Meeting on *What does the green economy mean for sustainable urban development?* to help us validate and sharpen our normative and operational approach to the issue, identify capacity development needs and set the research agenda;
- (2) April 2011 – a dialogue on sustainable urban development and the green economy at the 23rd meeting of UN-Habitat's Government Council;
- (3) March 2012 – a dialogue on the same topic at the 6th World Urban Forum in Bahrain; and
- (4) May 2012 – Rio +20 in Rio de Janeiro, at which the Green Economy, within the context of sustainable development and poverty eradication, will be a major theme.

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