GREENING THE CITY

by Lindsay Frost

SUSTAINABLE URBAN AREAS (ecocities) are difficult to create, as the pressures from a large number of people in one place are huge. Urban areas make it easy to provide services and infrastructure, but if a city gets too big, problems increase (e.g. damaging the natural environment), and impacts are not only at the site but also in the region around it. Over half of the world's population is now urban and may reach 70% by 2050. There are major challenges ahead if cities are to be 'green'.

A 'green city' is characterised by sustainable use of resources (including renewable energy use), low pollution levels, natural open spaces, and citizens with a culture of minimising damage to the environment (e.g. recycling,

Figure 2: **The roof garden on The Willis Building, Ipswich, UK**
Source: Photo by Valerie Frost

eco-friendly transport, buying local products). The Institute of Sustainable Communities defines sustainable urban areas as 'towns and cities that have taken steps to remain healthy over the long term. These communities value healthy ecosystems, use resources efficiently, and actively seek to retain and enhance a locally based economy.' Many cities have made efforts to 'green' themselves, such as Brisbane (Australia), which has many environmentally friendly buildings, low pollution, and high biodiversity. Scandinavian cities do well in Europe's Green City Index (2010), with Copenhagen (Denmark) coming top due to energy saving and carbon dioxide emission reductions (e.g. efficient district heating system, wind energy, and electric-powered buses).

Large amounts of money are required to make cities 'greener'. This generally means councils working with private companies to install green technologies. It often involves small-scale initiatives, such as in Chicago (USA), where there has been an attempt to literally turn the city green with parks, gardens and

semi-wild areas in streets and on modern flat rooftops (Figures 1 and 2).

However, there is no single correct approach for all cities: much depends on the human and physical geography of the area and region. This unit explores three examples of 'city-greening', in Brazil, Singapore and the USA.

Case Studies

Curitiba, Brazil

Curitiba is noted for its well-developed sustainable policies and was judged top of the Latin American Green City Index in 2010.

- In the 1960s the first 'bus rapid transit' (BRT) system was created, with a radial pattern of dedicated roads (72 km) linked to other transport networks, carrying 1.8 million people per day.

- From 1989 environmental education became a cross-curricular topic in schools.

- Since 2009 carbon dioxide emissions have been monitored in order to measure the efficiency of green spaces in absorbing carbon dioxide.

- Street lighting is fitted with energy-efficient bulbs.

- Landowners who create parks are exempt from land taxes.

- Residents receive food in exchange for waste handed in for recycling. Neighbourhoods also receive credits towards community services. People separate recyclable waste (collected three times a week – 6,800 tonnes is collected each year).

- An east–west highway, or 'green line', has four out of seven lanes reserved for buses (half run on biofuel); bus travel times have been

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- Slows runoff and reduces flood risk

- Allows clean water collection

- Reduces reflected light/heat so cooling urban areas significantly

- Lower temperatures on a green roof allow solar panels to be more efficient

- Vegetation provides habitats for wildlife

- Vegetation increases oxygen levels

- Noise is reduced when absorbed by gardens

- Plants and soil protect roofs from weathering

- Air pollution particles are collected by plants (e.g. a single roof garden can remove air pollution from 30,000 vehicles)

- Food can be grown for the urban population

- There is an aesthetic value and 'feel good' factor

Figure 1: **Advantages of roof gardens in urban areas**

Figure 3: **A park in Singapore**
Source: Photo by Martin Callow

Figure 4: **S Ashland Avenue, Chicago, USA**
Source: Photo by Mark Frost

greatly reduced, so encouraging people to use them.

- Riverside shanty towns (favelas) have been removed or provided with a water supply and sanitation infrastructure (e.g. Vila Zumbi dos Palmores). This enables people to live healthier lives, and stops the Palmital River (the source of the city's water supply) becoming polluted. An estimated 18,000 people are to be moved to better, low-cost housing by 2012.

Singapore

Singapore topped the Asian Green City Index in 2011, and is noted for tackling water and waste issues. Its progress is helped by an organised, educated, honest local government, and a wealthy business community. Businesses see an opportunity to make Singapore a global hub of green technology (18,000 jobs by 2015).

- Since 1965 trees have been planted and green areas developed (50% increase since 1986) including exotic tropical species (Figure 3). By 2020 it is planned to add 900 ha of parkland, including 50 ha on rooftops, facades or terraces
- Eco-links between parks provide wildlife corridors (100 km in 2007, to be extended to 360 km by 2020).
- $40 billion is to be spent on the rail network with connectivity to the bus network; this is part of a strategy to make 70% of all commuter journeys by public transport by 2020.
- The number of vehicles in the city is limited daily, with preference for smaller, fuel-efficient cars. Vehicles using alternative energies have tax rebates; electric cars and a network of charging stations have been introduced, and buses are planned to be hybrid (diesel-electric).
- $43 million has been invested in new cycle lanes.
- Five special water filtering plants purify wastewater, providing 30% of the city's needs (mostly industrial). An electrical field desalination plant was opened in 2010 (using 50% less energy than a conventional desalination plant). A 'Water Efficient Homes' programme encourages households to conserve water.
- In 2008 a research centre (Centre for Liveable Cities) was set up to centralise information and ideas on sustainability.
- Solar power is promoted with 5,000 smart electricity meters, in order to reduce natural gas consumption.
- The government plans to recycle 65% of the city's waste by 2020.
- 80% of buildings must meet energy-efficiency standards by 2030, and new buildings complying will receive financial incentives.

Chicago, USA

Chicago, with its deindustrialisation and ageing infrastructure, is not yet the greenest city in North America (number 1 is San Francisco) but that is its target. The momentum towards this target is due to Richard Daley (former Mayor) who started initiatives. However, there is still much to do: air quality is poor, research into combined heat and power (CHP) has stalled, and a recycling programme did not work.

- Since 1989, 500,000 trees have been planted and there are plans to create 65 ha of rooftop gardens (more than all other US cities together); streets have been greened – by 1995, 130 km of main streets had landscaping and 50 km of boulevards had been renovated (Figure 4). In 2001 a 1,900 m^2 green roof on the city hall was opened, and in 2004 Millennium Park (10 ha) was built over underground car parks and railway lines.

'The garden serves as a huge air conditioner and filter that is helping stem the urban heat island effect. Replacing the black rooftop with green vegetation has dropped the summer air temperature around the building … and decreased stress on the energy grid from overworked air conditioners.'

B. Burton, *Outdoor Illinois*, January 2004

- In 1993 an initiative was started to redevelop brownfield land (365 ha has been restored with help from private investment).
- Since 1999 the city has promoted alternative fuel (e.g. biodiesel) use

in vehicles (part of a Clean Cities initiative); hybrid buses save $7 million per year.

- Since 2005 the city has many Leadership in Energy and Environmental Design (LEED) certified buildings (e.g. Centre for Green Technology, household chemicals recycling plant).

- Green Urban Design (2007) and the Energy Conservation Code (2008) ensure that all new residential buildings, and many others, meet minimum standards of energy efficiency.

- A 2008 Climate Action Plan set the target of an 80% reduction in carbon dioxide emissions by 2050, identifying actions linked to buildings, energy, transport and waste.

- The 2010 Green Office Challenge encouraged businesses to reduce emissions (54,000 tonnes in the first year).

- In 2010 the USA's largest (10 MW) urban solar power station opened on a 17 ha brownfield site, reducing carbon dioxide emissions by 12,700 tonnes.

- Public transport is a priority, with a BRT pilot project. Bike 2015 aims to increase the use of bicycles for short journeys by providing on- and off-street cycle paths, bike racks, bike and ride schemes, and a bike commuter station in the main CBD park (with showers, etc.).

- In 2011 the city started a Sustainable Backyard Programme, providing information and financial help for people to improve their gardens by planting trees and native plants, installing compost bins and rain barrels. (A single tree is estimated to provide $1,200 in 'services' over its lifespan.)

Conclusion

As cities increase their economic development they consume more resources and increase their impact on the environment (Figure 5). However, as wealth increases, better-quality infrastructure is built, secondary industries close and service industries increase, political changes take place, and the public are more aware of environmental issues and how to
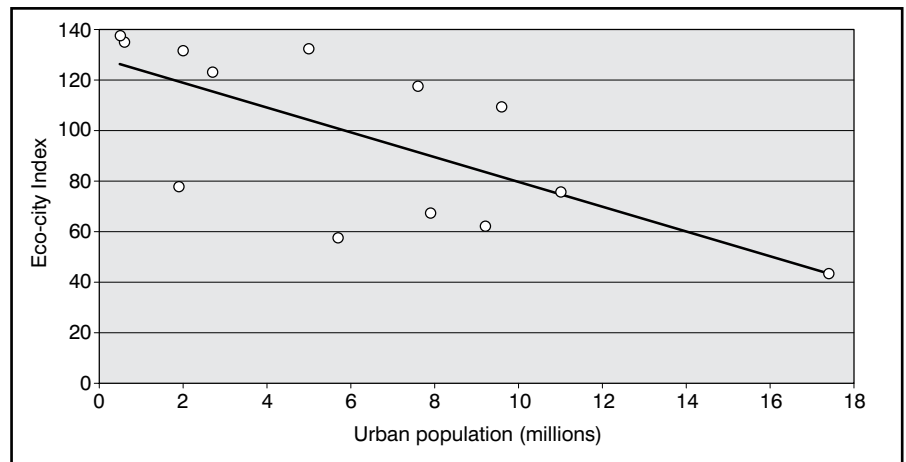
Figure 5: **Scattergraph showing correlation between urban population size and the Ecocity Index**
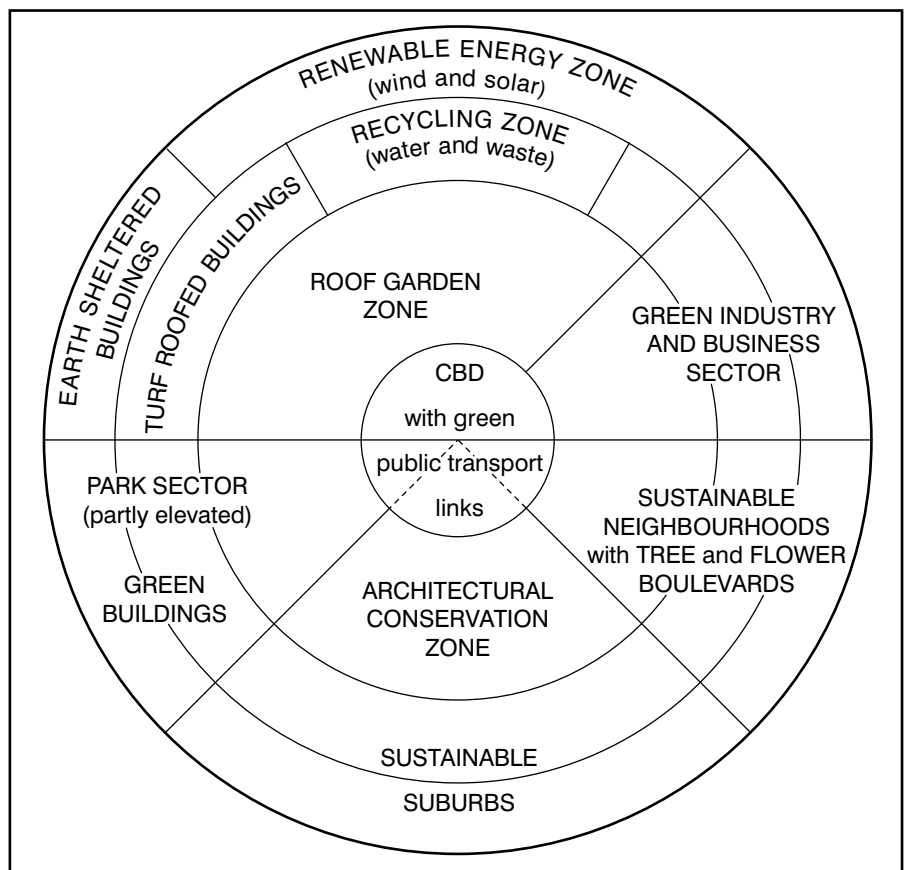
Figure 6: **Model of a 'green city'**

reduce them in a city. Wealthy cities are able to afford green technologies, provide subsidies and grants, train people, employ technical assistance, and invest for the future.

To 'green' a city it is necessary to reduce consumption of resources (energy) (as in Chicago), introduce efficient public transport systems (as in Curitiba), encourage the growth of 'green' industries (as in Singapore), and minimise

pollution and waste through recycling and preventative measures (Figure 6). Many urban governments are looking ahead and introducing standards and regulations within cities, but with increasing world urbanisation, major challenges remain.

Activities

1 What impacts may an urban area have on its surrounding environment?

2 Write a definition of a 'green city' (ecocity).

3 Study Figure 4.
(a) Describe the evidence in the photograph which shows that this city is trying to be more eco-friendly.
(b) What evidence is there in this photograph that may make the eco-footprint worse?

4 (a) How can creating green roofs help a city to become more environmentally sustainable?
(b) Which one of the advantages do you think the people living in the city would benefit most from?

5 (a) Study Figure 7 showing possible green schemes. On a copy of the table, name the countries in which the named cities are located.
(b) Think carefully about the schemes and put them into a rank order from best (rank 1) to worst (rank 10).
(c) Using the internet, investigate further the scheme that you have ranked **best**. Explain in detail how it would help the city to become environmentally sustainable.
(d) Using the internet, investigate further the scheme that you have ranked **last**. Explain the problems and issues associated with this scheme which may make it less effective.

6 Study Figures 5 and 8 which show the links between population size of cities and the Ecocity Index for selected urban centres. Describe the link between urban population size and environmental sustainability.

7 Suggest why Chicago is finding it difficult to become USA's greenest city.

Figure 7: **Selected sustainable city schemes**

Scheme	City	Country	Rank position
LED street lighting	Regensburg		
Bus Rapid Transit (BRT)	Jakarta		
Biofuel promotion	Bangkok		
Solar energy power station	Osaka		
Waste credits	Puebla		
Eco-clubs in schools	Delhi		
Convert landfill methane to energy	São Paulo		
Electric car charging points	London		
Zero emission Pearl River Tower	Guangzhou		
All components on trains recyclable	Oslo		

Figure 8: **Comparative data for selected cities**

City name	Ecocity Index (Mercer)	Population size (millions)	Wealth (GDP per person $)
Delhi	43.4	17.4	2,004
São Paulo	75.7	11.0	15,090
Chicago	109.4	9.6	45,400
Jakarta	62.2	9.2	7,636
Guangzhou	67.4	7.9	16,834
London	117.6	7.6	37,410
Bangkok	57.8	5.7	9,095
Singapore	132.4	5.0	36,520
Osaka	123.1	2.7	70,927
Brisbane	131.6	2.0	37,900
Curitiba	78.0e	1.9	10,796
Oslo	135.6	0.6	49,500
Copenhagen	137.4	0.5	42,700

e = estimated

Sources: www.siemens.com and www.mercer.com

8 Study the information on Curitiba, Singapore and Chicago.
(a) What are the similarities and differences in the attempts of these cities to be more sustainable?
(b) Which of these cities do you think will be the most successful? Explain your choice with reference to the areas of transport, energy, and waste.

Extension activities
9 Study Figure 6 showing a model of a 'green city'. Will this type of city be able to function effectively?

10 Outline how urban residents can become 'green' consumers.