



Green Infrastructure and Climate Change in Cities

Sustainable Cities – How can civil society contribute?

Bordeaux, France

15th June 2010

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*IUCN is the world's **oldest and largest global environmental network** - a democratic membership union with more than 1,000 government and NGO member organizations, and almost 11,000 volunteer scientists in more than 160 countries.*

*Our **vision** is a just world that values and conserves nature.*

*Our **mission** is to influence, encourage and assist societies throughout the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable.*

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Slide 2

c1

ON this slide I would be tempted to just have the text for our vision over a nice picture

colemana; 28/05/2010

Human alteration of the environment



Urbanisation and green infrastructure

Urbanisation replaces vegetated surfaces which provide shading, evaporative cooling, and rainwater interception, storage and infiltration functions, with impervious built surfaces.”

(Gill et al. 2007)

“Green infrastructure is the interconnected network of green space that conserves natural ecosystem values and functions and provides associated benefits to human populations”

(Benedict and McMahon 2002)

“The battle for biodiversity will be won or lost in cities”

(A. Djoghla, Executive Secretary, UNCBD)



An urban forest in the City of Chicago



1994 study: *Chicago Urban Forest Project*

Chicago's Department of Planning and Development mapped the city's tree coverage and green infrastructure using GIS.

4.1 million trees providing a range of benefits:

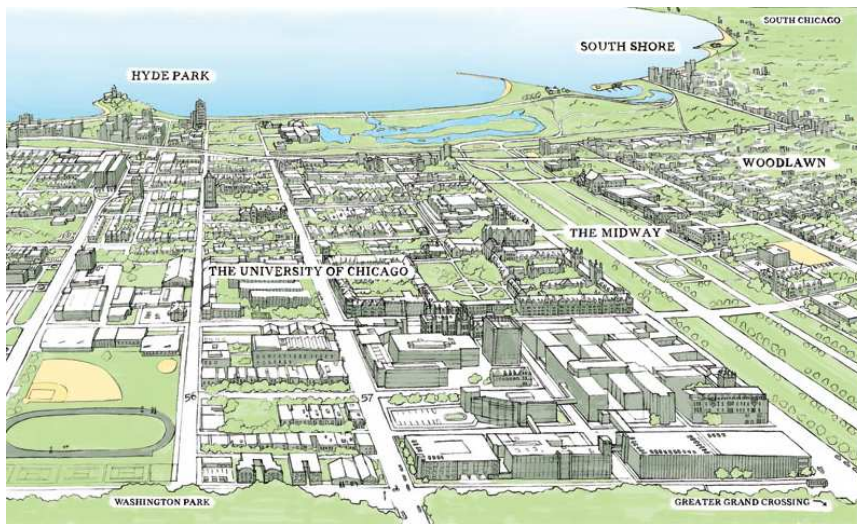
- Pollution removal worth \$1 million (1994 value);
- 855 000 tons of carbon stored;
- Reduction in surface rainwater run-off;
- Interception of solar energy reducing the need for air-conditioning.



An urban forest in the City of Chicago

A heat wave killed 600 Chicago residents in 1995;

GIS data revealed that the worst affected areas had the lowest tree coverage.



An urban forest in the City of Chicago

Urban forest regarded as a vital part of Chicago's infrastructure;

Authorities decided to use trees to mitigate extreme temperatures → identified targets for immediate action (mainly public land including school grounds and parks);

Robust and convincing GIS evidence helped to foster local support for the tree planting;

Communications strategies were employed, and partnerships established in order to outreach and educate unconvinced residents.



An urban forest in the City of Chicago

Gill *et al.* (2007) found that in Manchester on hot summer days, the shade provided by mature trees can keep surfaces as much as 15.6 °C cooler;

Besides temperature regulation, there are also multiple additional benefits of urban forest including:

- **Carbon sequestration;**
- **Flood regulation;**
- **Price enhancement of adjacent properties;**
- **Health benefits;**
- **Purification of air and water;**
- **Enhanced ecological connectivity;**
- **Creation of communal areas;**
- **Etc.**



Image source: www.cabe.org.uk/case-studies/chicago-urban-forest?photos=true&viewing=6771

Augustenborg: the revival of a Swedish neighbourhood



Background

32 ha neighbourhood in the City of Malmö, Sweden;

Built in the 1950s and initially successful but fell into decline in the 1970s;

→ buildings suffered dampness, ventilation problems and poor appearance;

Annual flooding overwhelmed the sewage system;

→ expensive damage to buildings and vehicles;

Social problems arose, including high levels of unemployment, the neighbourhood depopulated and flats remained unoccupied.

Augustenborg: the revival of a Swedish neighbourhood

Regeneration partnership

In the 1990s the city council partnered MKB Housing company, housing landlords and local residents:

- The regeneration project, “Ekostaden Augustenborg” commenced in 1998;
- focus on flooding, waste management, biodiversity and climate change.



Image source: http://farm1.static.flickr.com/68/369931034_87292494de.jpg

Augustenborg: the revival of a Swedish neighbourhood

Storm water management

Urban drainage overwhelmed annually;

The Malmo Department of Water and Wastewater implemented a storm water management system;

→ water collected in gutters from rooftops and other impervious surfaces;

→ channelled through canals, ditches, ponds and wetlands before finally draining into a conventional closed sub-surface storm water system;

→ system retains 70% of all rainwater that falls in the neighbourhood.



Augustenborg: the revival of a Swedish neighbourhood

Green roofs

- All new developments feature green roofs;
- Many existing developments retrofitted;
- Developed in partnership with universities and private companies;
- Local, national and European funding sources;
- The green roofs intercept around ½ of total runoff each year;
- Provide insulation during winter and cooling during summer.



Augustenborg: the revival of a Swedish neighbourhood

Green roofs

A 9500 m² botanical roof garden is the biggest in Scandinavia.



Augustenborg: the revival of a Swedish neighbourhood

Green spaces

- Green spaces improved to accommodate flooding;
- Reconfiguration of public spaces;
- Creation of allotments to allow residents to grow vegetables;
- Planting of flowering perennials and trees, creation of wetlands and improving play areas.



Augustenborg: the revival of a Swedish neighbourhood

Mitigating climate change

- 400 m² of solar thermal panels;
- 100 m² photovoltaic panels to generate electricity;
- Ground source heat pump;
- Improved insulation of buildings and underground water pipes;
- Fitting of low flow showerheads;
- Reduced speed limit to encourage cycling and walking;
- A community car club with electric and ethanol powered cars;
- An electric street train;
- A recycling scheme.



Augustenborg: the revival of a Swedish neighbourhood

Community involvement:

Public consultation, community workshops, etc.

Residents involved in the design process;

→ good local understanding of and support for the project.

Innovative environmental performance:

Compulsory competitive tendering for city services;

→ City tries to promote environmental innovations.

Ongoing maintenance:

Management work jointly funded by the housing company, the water board and the city council's maintenance budget.



Augustenborg: the revival of a Swedish neighbourhood

Wide ranging benefits:

- reduced housing turnover by 20%;
- far fewer empty properties;
- higher employment rates;
- 20% reduction in energy consumption;
- Storm water management system a proven success;
- Now a desirable place to live;
- Augustenborg a role model for others;
- Image of Augustenborg positively enhanced.



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Green living takes root in Sweden

By Laurence Peter
BBC News, Malmo, Sweden

"Western Harbour" is not the most romantic name for a pioneering ecological housing development - but then Sweden is pursuing green goals with more pragmatism than flamboyance.

Sustainability is the motto of the Western Harbour (Vaestra Hamnen) project in the southern city of Malmo.

There are futuristic buildings sporting massive glass windows and glinting solar panels.

But turn a corner and you find a green courtyard with a little pond and some modest timber structures that remind you of Swedish villages.

"I really like the diversity of houses - and they've made it easy here to live in a sustainable way," says Helena Parker, who was among the first to move into the area in 2001.

Western Harbour's vegetation is as diverse as the architecture

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Image source: <http://news.bbc.co.uk/2/hi/europe/5413960.stm>

Designing green roofs as habitats in Basel



Basel's building and construction law was amended in 2002 making it compulsory for all new flat-topped buildings to have green roofs.

- Guidance provided on creation and species assemblages;
- Specific design criteria to benefit biodiversity i.e. vary the substrate thickness and use locally sourced soils.



The United Bank of Switzerland, Basel

Additional benefits of green infrastructure

Carbon sequestration; food supply; pollination; water purification; disease regulation; cultural services; religious fulfilment; maintaining a sense of place; psychological benefits increasing with biological complexity (Fuller *et al.* 2007); enhanced patient recovery (Ulrich 1984); opportunities for social interaction; eased mental fatigue; opportunities for reflection; leisure and recreational opportunities; attraction of high quality professionals; increasing property prices; inspiration for creative thinking (e.g. bio-mimicry); ecotourism potential; etc.

Helping nature to adapt to climate change

Species ranges are moving northwards and to higher altitudes in response to climate change;

However, their movement is often obstructed by human-made barriers including, urban areas, dams, and even agricultural fields;

Ecological connectivity is key to facilitating these range shifts;

Green infrastructure in the form of stepping stones, ecological corridors and buffer zones can provide lifelines for species;

Where gaps exist opportunities should be explored to strengthen ecological connectivity, by establishing functional connections between habitat patches to support local wildlife.

Helping nature to adapt to climate change

‘Ecoducts’ or ‘green bridges’ help species to cross barriers and move between areas. They already exist in Denmark, Belgium, the Netherlands, Austria, UK, Portugal and Greece.



A green bridge for wildlife in Mile End Park



- Mile End Park, London;
- 1st green bridge in the UK;
- 25m wide, traversing 5 motorway lanes uniting two areas of the park;
- Contains birch trees, evergreens, shrubs and grasses;
- Includes a cycle/footpath.



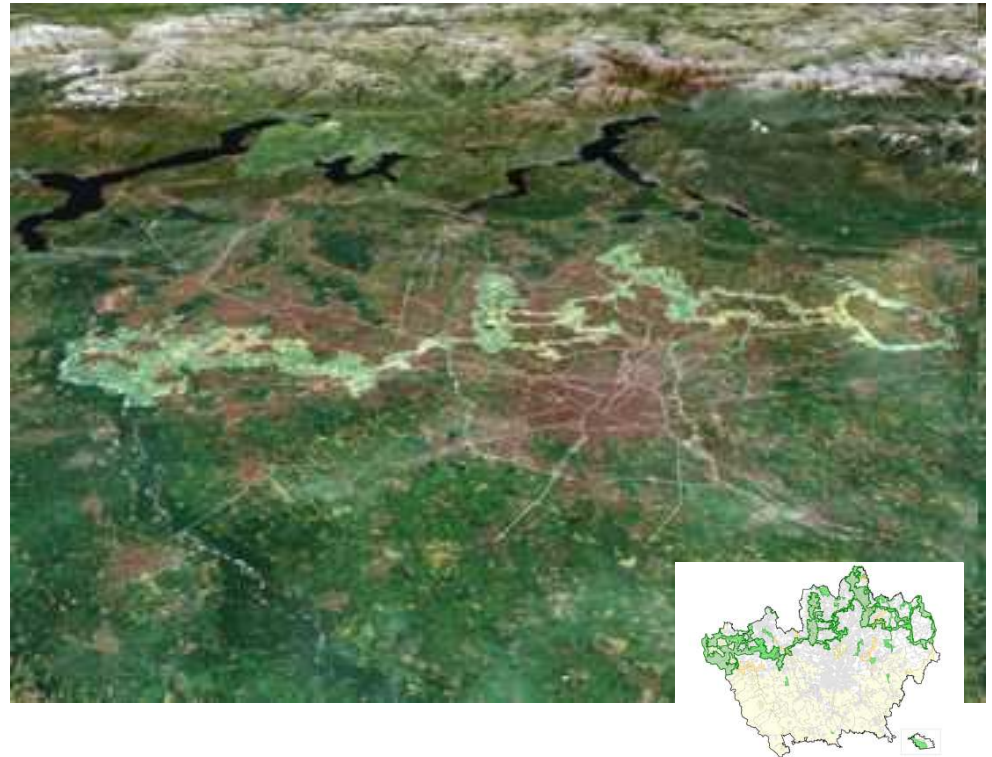
The Dorsale Verde (Green Ridge) in North Milan



A large open space system that extending for more than 65 km between Adda and Ticino;

Thorough preparatory work including a year-long public consultation;

The Province of Milan aims to improve the connectivity of protected areas, which already occupy 80% of non urban land.



Conclusions 1

- **Green infrastructure (GI) is especially important in helping humans meet the challenges of climate change.**

(attenuating flooding and landslide risks, regulating temperatures, sequestering carbon, etc.)

- **GI helps nature to adapt to climate change by enhancing the connectivity of habitat patches;**

-> diversity of life + healthy ecosystems -> the more they can contribute to our well-being, including resilience to climate change

Conclusions 2

- GI also provides multiple additional benefits not directly related to climate change;

How can civil society help?

Consultative approaches that involve local stakeholders from the outset can foster greater understanding, support, and sense of ownership within communities for environmental projects, very little can be achieved without the support and the contribution of civil society.

How can we come to a consensus?

We need to look at the evidence, including economic evidence and focus our actions.

IUCN and our work on cities

- European Capitals of Biodiversity: <http://www.capital-biodiversity.eu/>
- Biodiversity in a changing world, 8-9th September, Ghent, Belgium <http://www.lne.be/en/2010-eu-presidency/events/bio-diversity-post-2010>
- Cities and protected areas task force of the World Commission on Protected Areas <http://www.interenvironment.org/pa/> -> BiodiverCities event on 6-8 September, Paris <http://biodivercities.net/>



Thank you

Merci

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