



Urban forests and climate change


Challenges and opportunities

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Forests and climate change

- **Forests are part of the solution**
- **4th Assessment Report of the United Nations Framework Convention on Climate Change (UNFCCC, 2007):**
 - “sustainable forest management strategy aimed at maintaining or increasing forest carbon stocks, while producing an annual sustained yield of timber, fibre or energy from the forest, will generate the largest sustained mitigation”.
- **How about urban forests??**




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- **Climate change and urban forestry**
- **Impacts of climate change on urban forests**
- **Mitigation of climate change by urban forests**
- **Buffering effects on the results of climate change**
- **Educational and symbolic roles of urban forests in the climate change debate**
- **Conclusions**

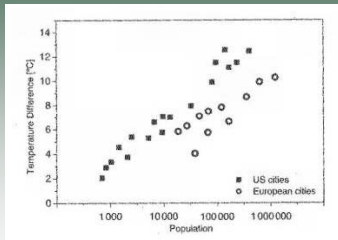


Climate change and urban areas

- **Urban areas are main polluters and have a large carbon footprint**
- **Urban areas are heavily affected by the results of climate change**
 - **Urban heat island effect is worsened**
 - **City centres are often ‘deserts’ in terms of microclimate due to the many hard surfaces**
- **Most people live in cities and towns today**



Urban Heat Island



Source: Oke (1994), in Sieghardt et al. (2005)



“Playing Field” of Urban Forestry

	The Urban Forest		
	Individual trees	Tree groups and small woods (e.g. in parks)	Urban & peri-urban woodlands
Policies, planning, form and design			
Technical activities, including selection and establishment			
Management			

Modified from Konijnendijk & Randrup (2002) Urb. For. & Urb. Green. 1:1-4.

Source: Thomas Randrup



Urban forest are affected by climate change

- Changes in temperatures, humidity, wind, etc.
- Higher levels of smog and air pollution
- Impacts on growing conditions, species choice
- Extreme weather conditions, hurricanes, flooding
- Expected increases in (invasive) pests and diseases
- Urban-wildland interface: more frequent fires

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Urban forests mitigate climate change (1)

- Do urban forests sequester carbon?
- YES, see various studies:
 - United States: 93 kg C/yr for large, healthy trees – 1 kg C/yr for small trees (Nowak 1994, 2006)
 - Beijing urban forest: 0.2 million tons of C stored by 2.4 million trees (Yang et al. 2004)
 - Roots store 17-23% of carbon (Nowak 1994; Johnson & Gerhold 2003)
- BUT, direct contributions are still relatively small:
 - Considering present emission trading etc.: only few, specially designed urban tree projects are cost effective (McHale et al. 2007)



Compensation Forests

- FACE Foundation in The Netherlands
www.stichtingface.nl
- “Help abate enhanced greenhouse effect by planting and protecting forest”
- Funded by Dutch electricity generation board
- Total of 50,000 ha of plantations, mostly abroad
- Very first project: urban forest near Leeuwarden
- 312 ha on local authority land



Urban forests mitigate climate change (2)

- Some of the problems with urban trees and carbon sequestration:
 - Low survival rates of urban trees – many stresses
 - Not many large trees (short life span)
 - Dead/removed trees: within 1 year, up to 80% of carbon is released (McPherson & Simpson 2000)
 - High costs of urban tree planting and management (while carbon credits still have a low value)



Buffering climate change effects (1)

- Reduce flooding
- Reduce air pollution
- Cool temperatures
- Shading
- Buffering of extreme winds





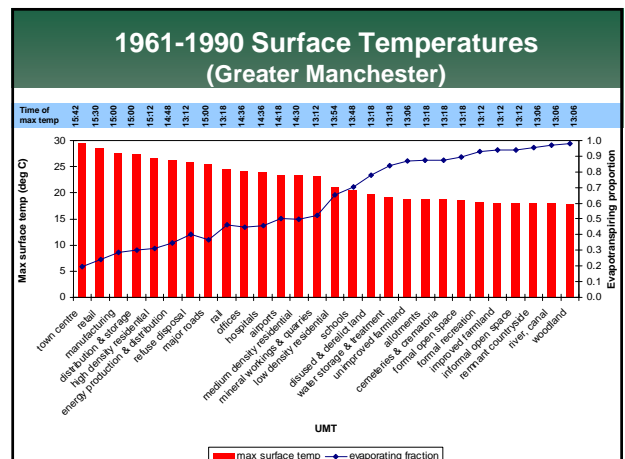
**Adaptation Strategies for Climate Change
in the Urban Environment (ASCCUE)**

Consortium members: CURE (University of Manchester), CRIBE (Cardiff University),
DCEE (University of Southampton), OCSO (Oxford Brookes University)

Building Knowledge for a Changing Climate

Buffering climate change effects (2)

- **Reducing energy needs for cooling and heating** (e.g. Nowak 1993, McPherson 1998)
 - Trees close to buildings: shading, reducing wind
 - Cooling effects and air conditioning
- **Moderation of urban micro-climates**
 - Shading, evapo-transpiration, etc.
 - Microclimatic conditions important for comfort and recreational use (air temperature, wind speed, cloud cover) (e.g. Eliasson et al. 2007)
 - Urban trees and 'climate sensitive planning' (Eliasson et al. 2007)



Some ASCCUE findings (with thanks to S. Pauleit & colleagues)

- Green space can moderate temperatures in residential areas & town centres
- Mature trees critical for shading
- Water surfaces stay cool during drought
- Green space on its own less effective in regulating surface runoff expected with climate change...
- ...but most effective on high infiltration soils



Copenhagen Metropolpark (1)

METROPOLPARKEN



Source: SLA Architects
<http://www.metropolparken.dk/>



Education and symbolic role of urban forests in climate change debate

- Urban forests have important educational functions
 - Raising public awareness
 - Learning how to deal with climate change (e.g. species choice for different conditions)
- Urban forests have important symbolic functions
 - Climate change mitigation at *people's doorstep*
 - Climate change mitigation where most emissions occur
 - Facilitating local action, acting as a 'flagship'
 - Action in the centre of power and the political debate



Copenhagen Metropolpark (2)



Source: Politiken, cartoon by P.M. Otzen

- One of the arguments mentioned by SLA Architects: *"If we plant 3,000 to 4,000 trees, this will result in a significant reduction of CO₂"*



'Klimaatbosjes' - Netherlands

- Campaign hier.nu (here.now) – “The Netherlands climate-neutral”
- Establishment of climate woods with at least three walnut (*Juglans regia*) trees
- High profile locations
- Involvements of schools, companies
- Sequestering CO₂, but mostly symbolic



Source: www.hier.nu

Conclusions (2)

- Urban forests play a very important role in reducing the effects of climate change
 - Keeping cities liveable through cooling, shading etc.
- Urban forests can have important educational and symbolic functions in the climate change debate
 - Mitigation at people's doorstep; making climate change visible
- Importance of selection of the right trees
- Climate change is only one aspect of multifunctional urban forestry!



Conclusions (1)

- Urban forestry and climate change have close links
- Urban forests are affected by climate change in different ways
 - E.g., storms, higher temperatures, drought, pests
- Urban forests help reduce the effects of climate change in urban areas
 - although direct mitigation effects of urban forests are relatively limited
- Urban forestry projects are not yet attractive for investors
 - but carefully designed projects and evolving credit markets will help



Thank you!

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