

Architecture, Urban Planning and Biodiversity: Thoughts about an ecopolis, plea for a lobe-city.

*How blue-green networks within urban areas can improve biodiversity,
city climate conditions and the urban water management.
The public-private gradient as a planning tool to realise ecologically and
socially sound urban planning.
European examples*

Erik P.C. ROMBAUT, Master in Biology.

Hoger Architectuurinstituut Sint-Lucas, Hoogstraat 51, B-9000 Gent /
Paleizenstraat 65-67, B-1030 Brussels.

KaHo Sint-Lieven, Hospitaalstraat 23, B-9100 Sint-Niklaas.

+ 32 (0)3 7707147. erik.rombaut@scarlet.be

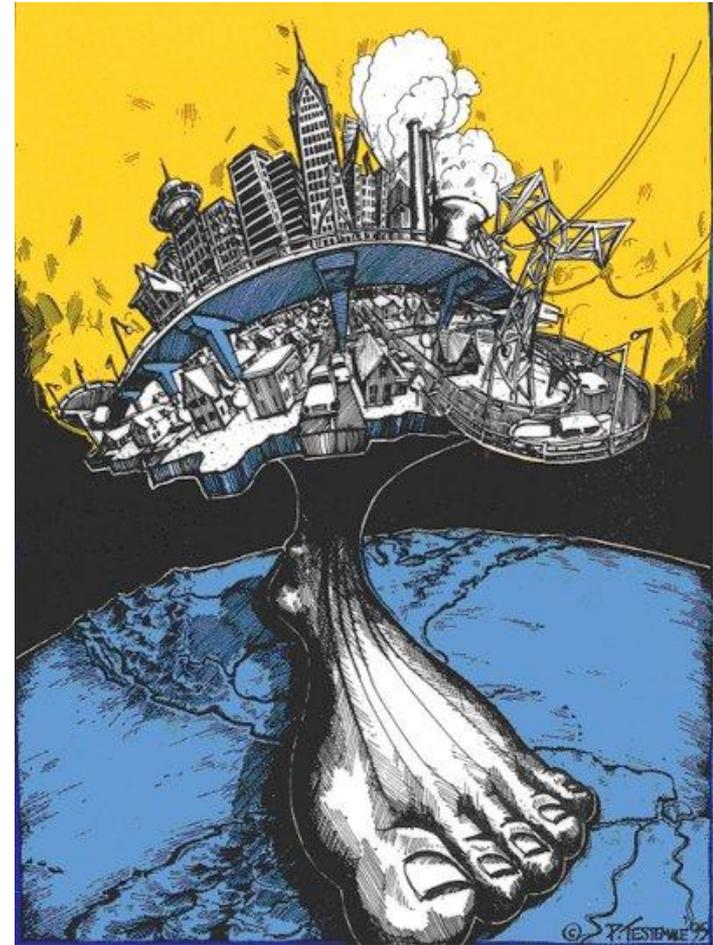
Centre for Alternative technology (CAT)
Canolfan y Dechnoleg Amgen. Machynlleth Wales
Science symposium October 9th 2010.

Centre for
Alternative
Technology

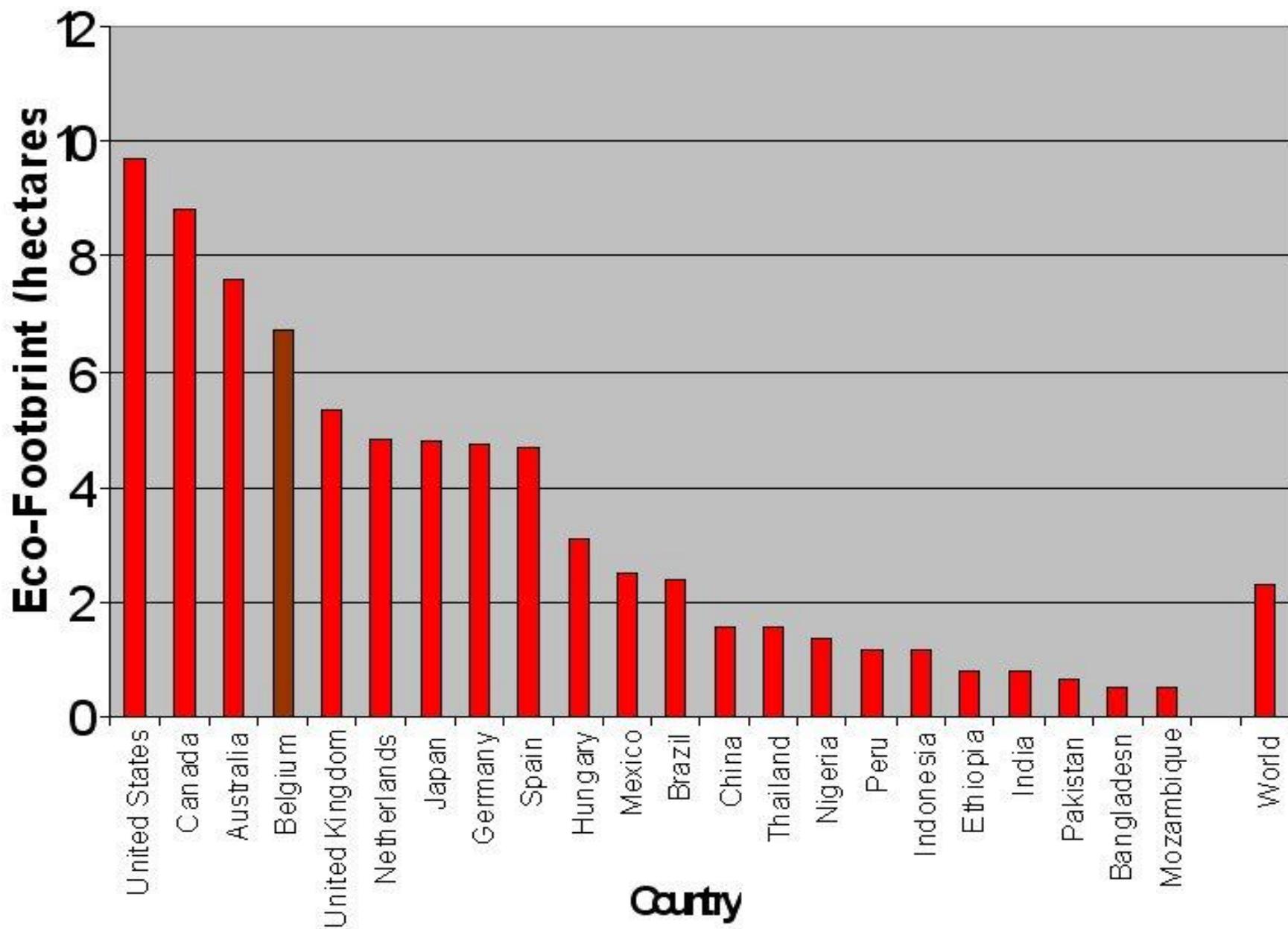


The aim: Searching for climate-proof urban planning tools

- Searching for the most appropriate urban form **to decrease the ecological footprint** of cities.
- Searching for the best urban form **to create attractive conditions** for humans and for restoring biodiversity within cities.



Equivalence Adjusted Per Capita Ecological Footprints of Selected Countries (1999 data)



How urbanised areas depend on rural areas

What flows in?
Where does it come from?
How is it made?

Be sy'n llifo i mewn?
O ble mae'n dod?
Sut mae'n cael ei wneud?

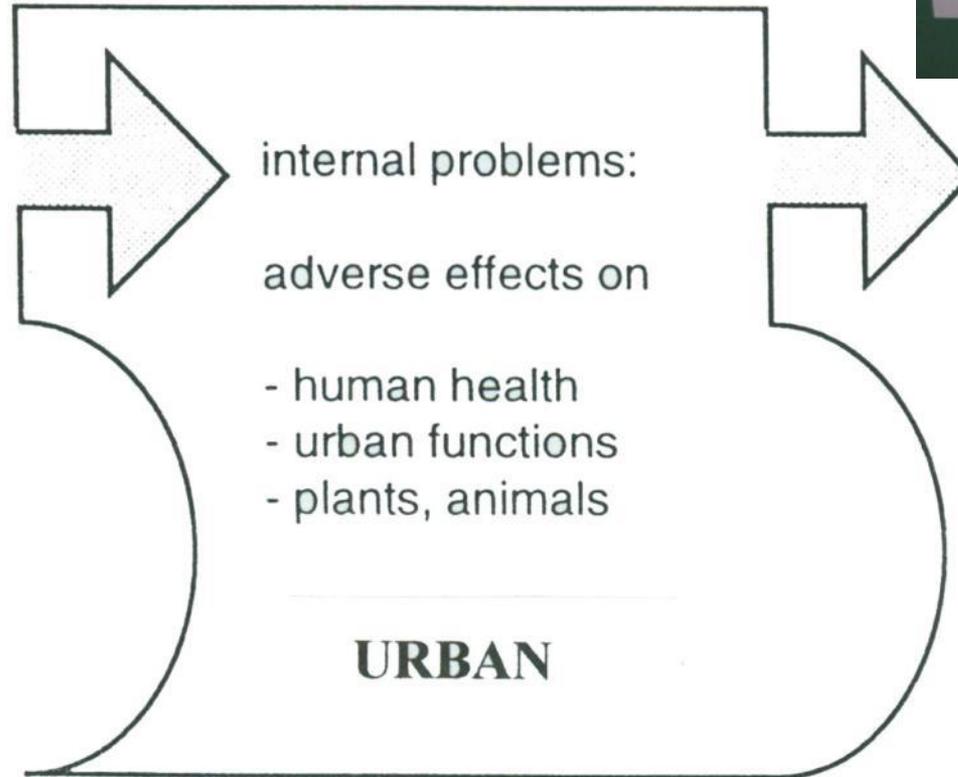
What flows out?
Where does it go?
How does it get there?

Be sy'n llifo allan?
I ble mae'n mynd?
Sut mae'n cyrraedd yno?

source problems:

depletion
pollution
disturbance

RURAL



internal problems:

adverse effects on

- human health
- urban functions
- plants, animals

URBAN

sink problems:

pollution
disturbance

RURAL

The ecocodevice model applied on urban environmental problems
(TJALLINGII, 1996).

Three main strategic decision fields: The ecopolis strategy

- Management of **FLOWS**: *the responsible city*

E.g.: energy, water, traffic, waste,...

- Management of **AREAS**: *the living city*

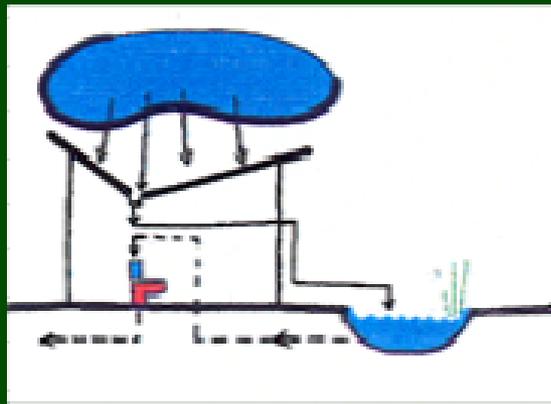
Providing quality to urban (semi-) public areas
Attracting different people and different lifestyles
= social diversity
And a variety of plants and animal
= biodiversity

- Management of **ACTORS**: *the participating city*

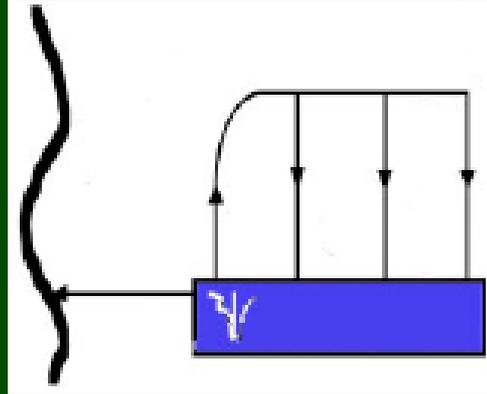
An ecopolis cannot be accomplished without the co-operation of the local residents and the citizens.

These three main decision fields must be treated together and integrated by a multidisciplinary team
All this is the subject of the ECOPOLIS-model
(TJALLINGII 1992,1994,1996)

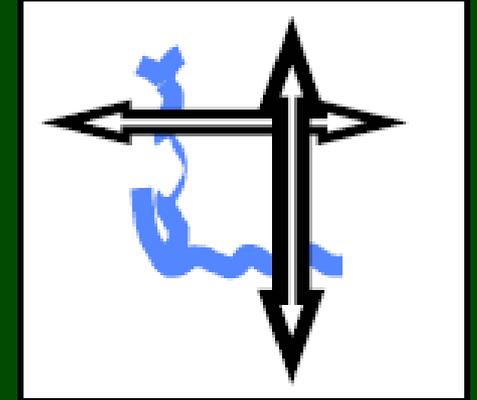
Example : water as an organizing principle at different levels.



Building level



District level



City level

Wise use of water on the building level

Wees wijs met water

**Drinkwater is om te drinken,
niet om de auto mee te wassen!**

Een waterbesparende douchekop en toilet raken steeds meer ingeburgerd, waardoor daadwerkelijk op drinkwater bespaard wordt.

Regenwater is prima te gebruiken voor het begieten van (kamer)planten. De opvang van regenwater in een vijver is een aanwinst voor de tuin.

In de piramide en het bezoekerscentrum wordt het doorspoelen van het toilet gedaan met regenwater. Een composttoilet, ook aanwezig in het bezoekerscentrum, kent zelfs helemaal geen waterspoeling of rioolaansluiting.



Toilets are wasting about 40 % of the drinking water in Belgium. Modern compost toilets don't.

Sealing surfaces with concrete, roofs, pavements, ... causes increasing amounts of rainwater which can not infiltrate any longer and which is drained into mixed sewage systems.

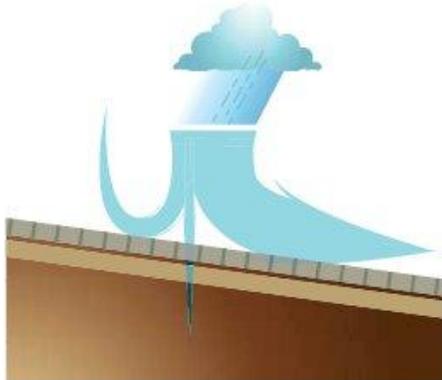


A

FIGUUR 12-1

Afstroming en infiltratie in buitengebied op op verharde oppervlakten.

A
In het onverharde buitengebied stroomt er weinig water oppervlakkig af, veel hemelwater wordt door de vegetatie opgenomen en verdampt weer (naar Karel Michiels).

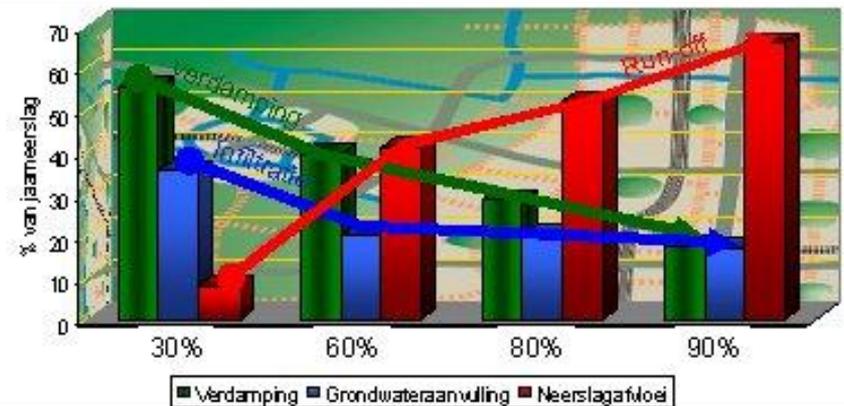


B

B
Door de grote verharde oppervlakten dringt er in de stedelijke omgevingen weinig water door in de ondergrond. Het meeste hemelwater stroomt af naar gemengde rioeringen, een relatief klein deel verdampt (naar Karel Michiels).

Probleemstelling

- Gevolgen: verdamping, infiltratie & neerslagafvoer in relatie tot toenemende verzegeling

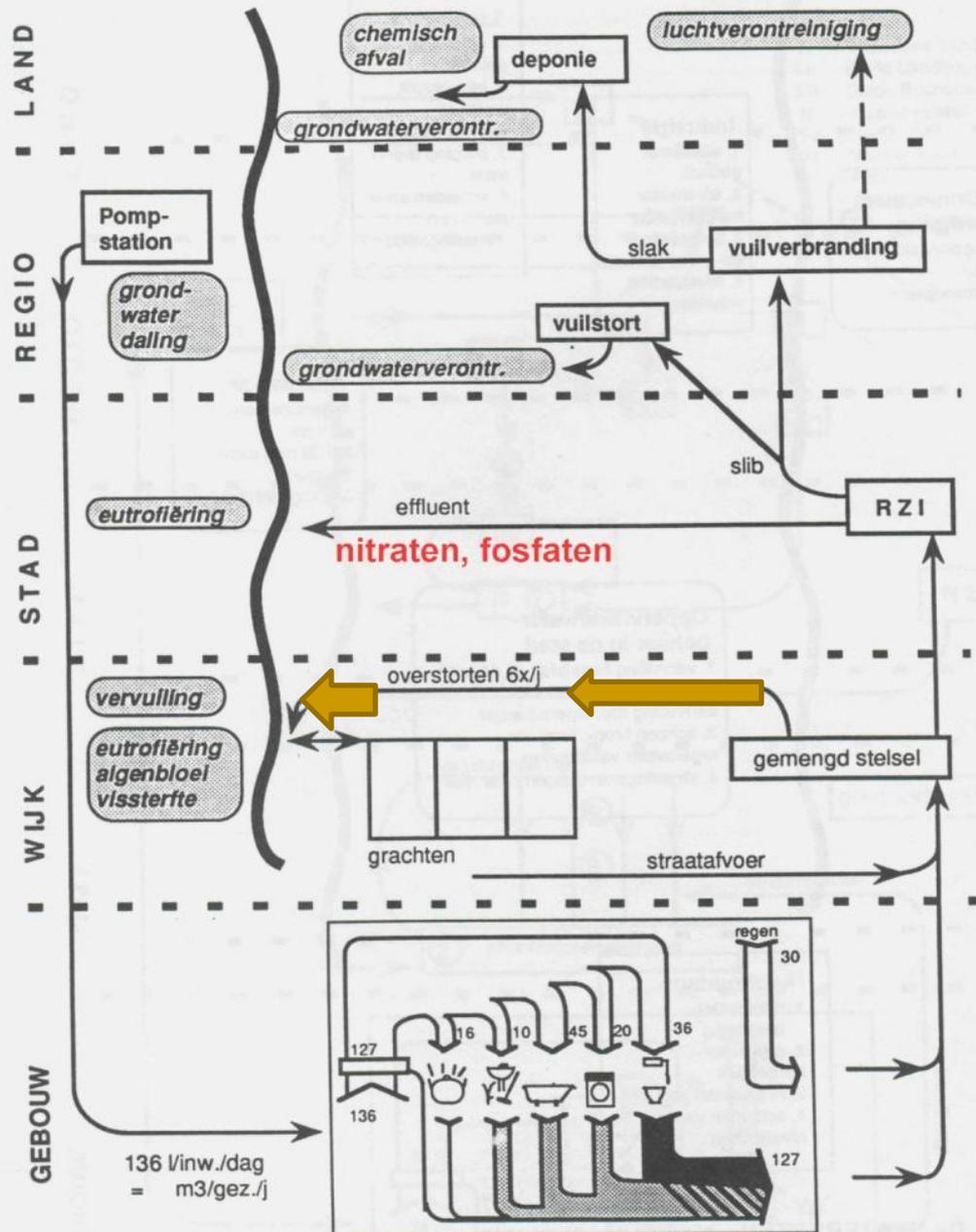


Run-off increases as more city- surface is impermeable.

10-50% (30%) (matig); eengezinswoning en met kleine tuinen, zijwoning en
 45-75% (60%) (gemid); woningblokken in buitenwijken
 70-90% (80%) (steek); stedelijke woonblokken, industriegebouwen
 85-100% (90%) (zeer steek); woonblokken in stadscentra, dichte
 industrieterreinen

Unsustainable use of water causes severe problems.

Mixing black, grey and white water in sewage systems causes capacity problems in the purification plants, in periods of heavy rainfall: **overflows** bring polluted water directly into the river.



Figuur 2.3.1 De WATERKETEN, bestaande systemen en milieuproblemen.

Disconnecting roof rainwater from the sewage system is necessary.



Design water neutral: Green roofs are minimising run-off amounts.

Sweden



Ecolonia (Alphen a/d Rijn NL)





Eidfjord (N). Hardangervidda national park

Use succulent plants (such as Sedum sp.) for green roofs.

Boxtel (NL). De Kleine Aarde



Green roofs are interesting for biodiversity, summer cooling and water management, ...

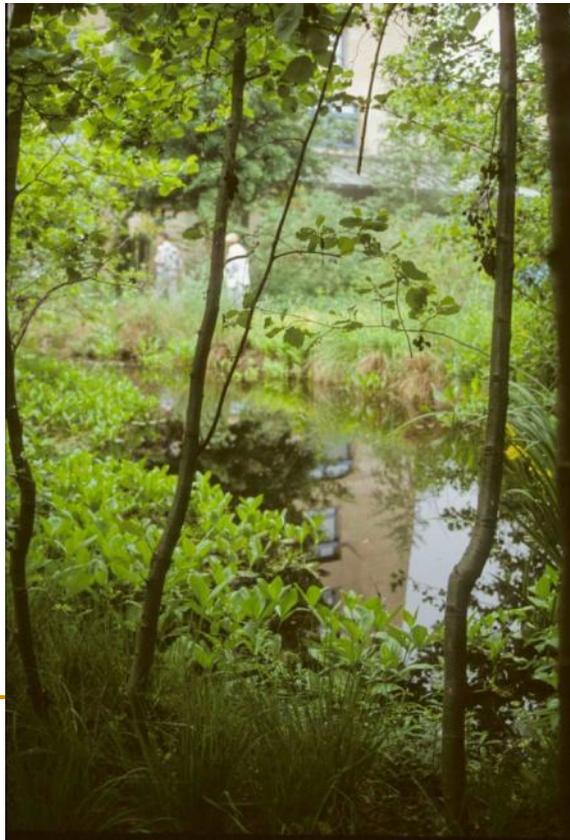


Westerlo (B). Kamp C



Hovden (N): water neutral ecoquarter.

Amsterdam (NL): designing with rainwater on the roof of the ING Bank.



Water management on city quarter level

- Separating sewage systems
 - Disconnecting rainwater from sewage
 - Collecting and re-using rain water
 - Infiltrating superabundant rainwater
- (figure from TJALLINGII, 1996)

Water en ruimtelijke ordening

Waterrijk Nederland kent wateroverlast en waterkorten. Door bebouwing, peilbeheersing en grondwatergebruik dreigen delen van Nederland te verdrogen. Ook vanuit de bouw en ruimtelijke ordening kan dit probleem worden aangepakt.

Verdroging op het eiland van Dordrecht



Een gezonde waterkringloop in het stedelijk gebied zorgt voor minder verdroging en dus voor een verhoging van de ruimtelijke kwaliteit van de leefomgeving.



Vasthouden regenwater en zuiveren water



Verbeterd gescheiden rioolstelsel
Huishoudelijk afvalwater wordt gescheiden van regenwater
Mena Park Dordrecht

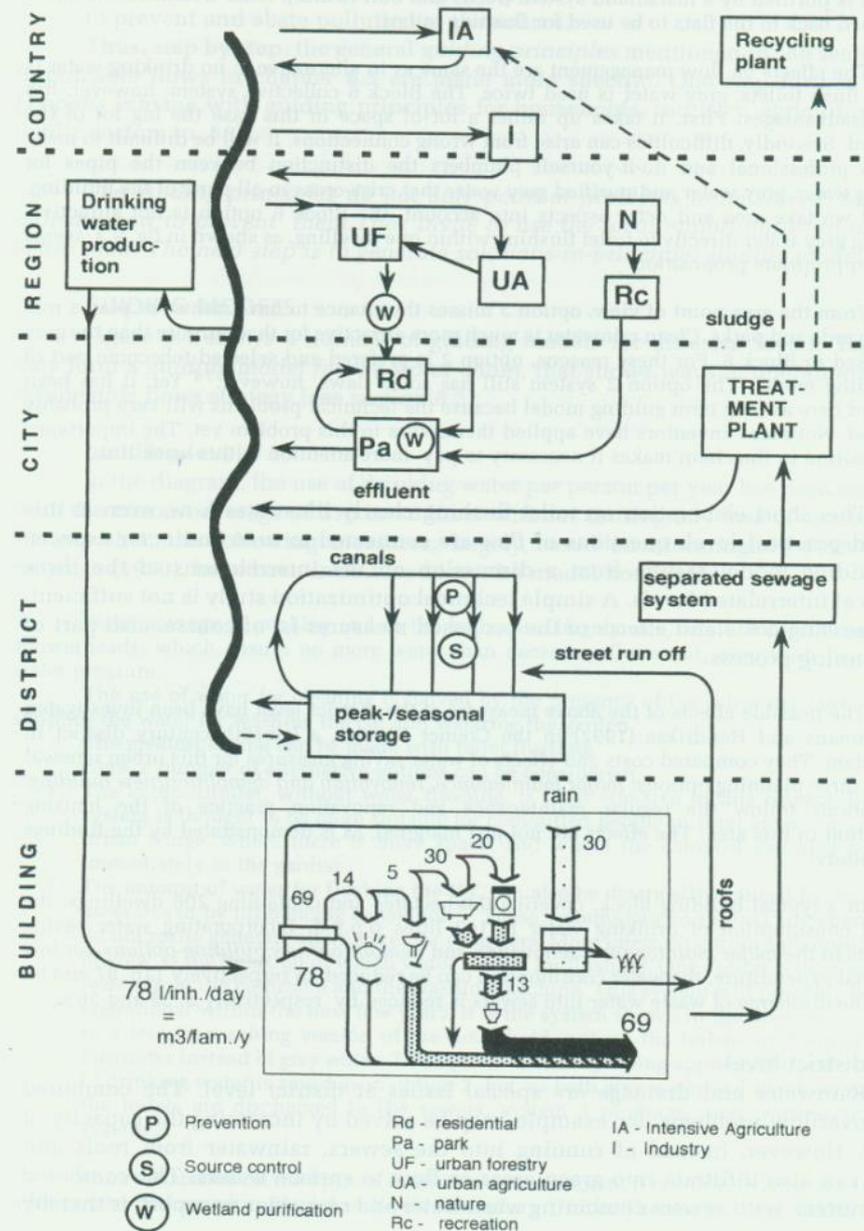


Figure 9.3:
Guiding models for the water chain (lowland situation).
source: Ecopolis.

Separating sewage systems

Culemborg (NL)

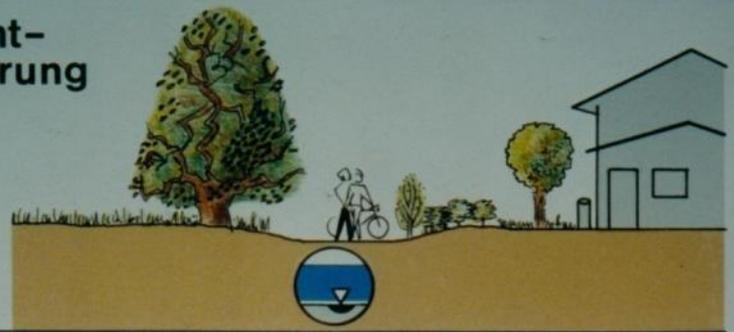


Belfort Bethoncourt (Fr)

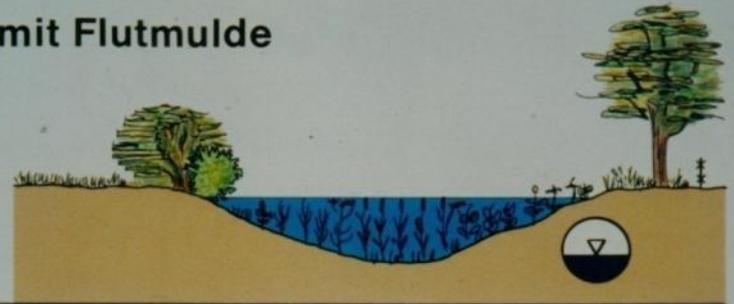
Alphen a/d Rijn (NL): Eco-
quater *Ecolonia*.



Gesamt-
verrohrung



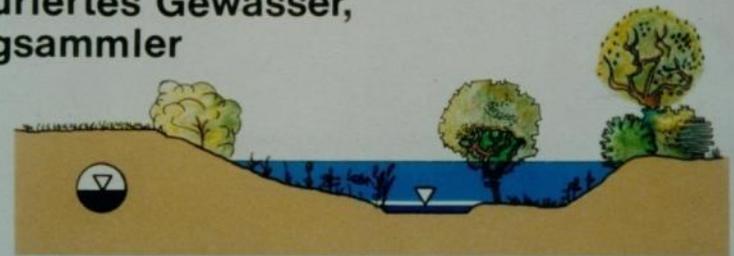
Kanal mit Flutmulde



Stadtgewässer, Abfangsammler



Renaturiertes Gewässer,
Abfangsammler



Möglichkeiten
der Umgestaltung von
Schmutzwasserläufen

1989
229/112

Infiltration zone in Gelsenkirchen (D).

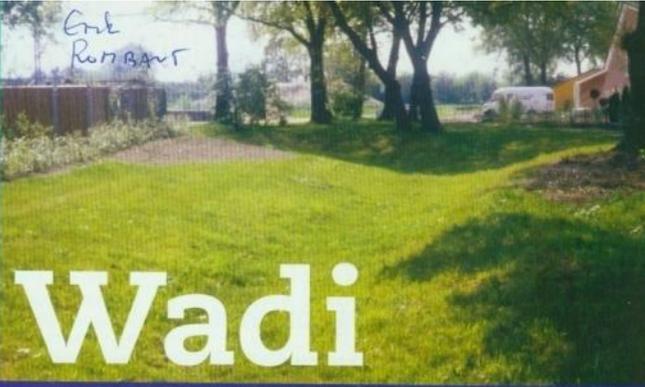




Gelsenkirchen (D.)



WADI technique for infiltrating rain water

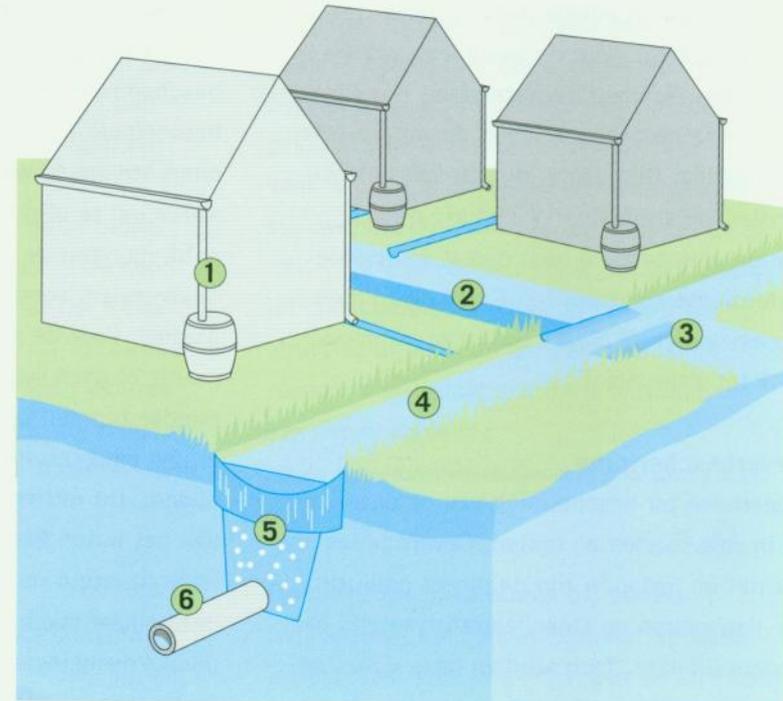


Een natuurlijke regulering van hemelwater



Werking van een wadi

- 1 Afvoer van het regenwater gaat niet onder de grond maar naar de regenot of via gootjes naar de weg of naar de wadi.
- 2 Straat is hol uitgevoerd, zonder straatkolken en loopt af naar de wadi.
- 3 De kruising met de wadi is tevens verkeersremmer.
- 4 Regenwater infiltreert. De bodem zuivert het water.
- 5 Sleuf met kleikorrels om het water te bufferen voordat het verder de grond intrekt.
- 6 Drainagebuis om de stand van het grondwater op peil te houden.



Enschede (NL): eco quarters *Oikos*
en *Ruwenbosch*



Malmö (Sweden): ecoquarter *western harbour*



Ecologically sound urban planning (**city level**).

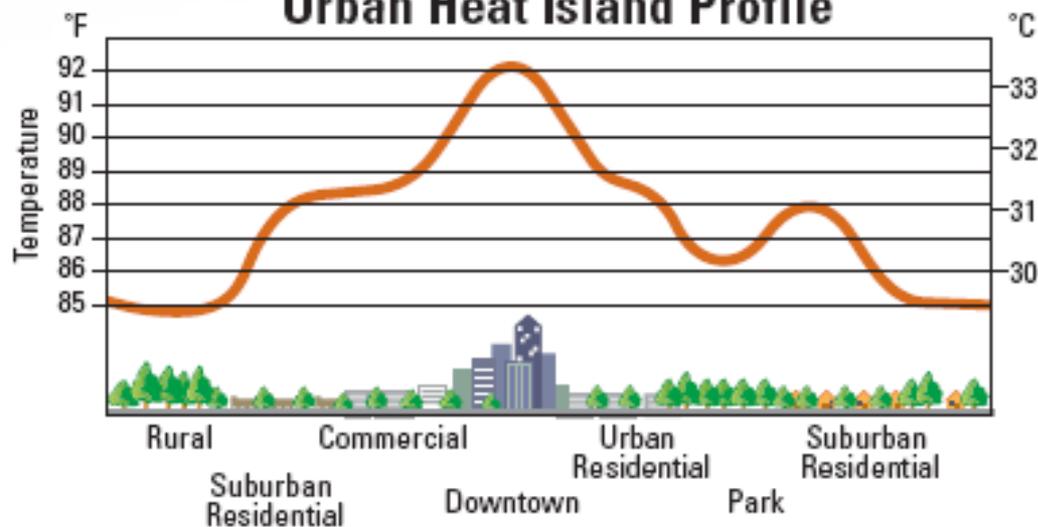
Athens ; Greece
(5,000,000 inh.)



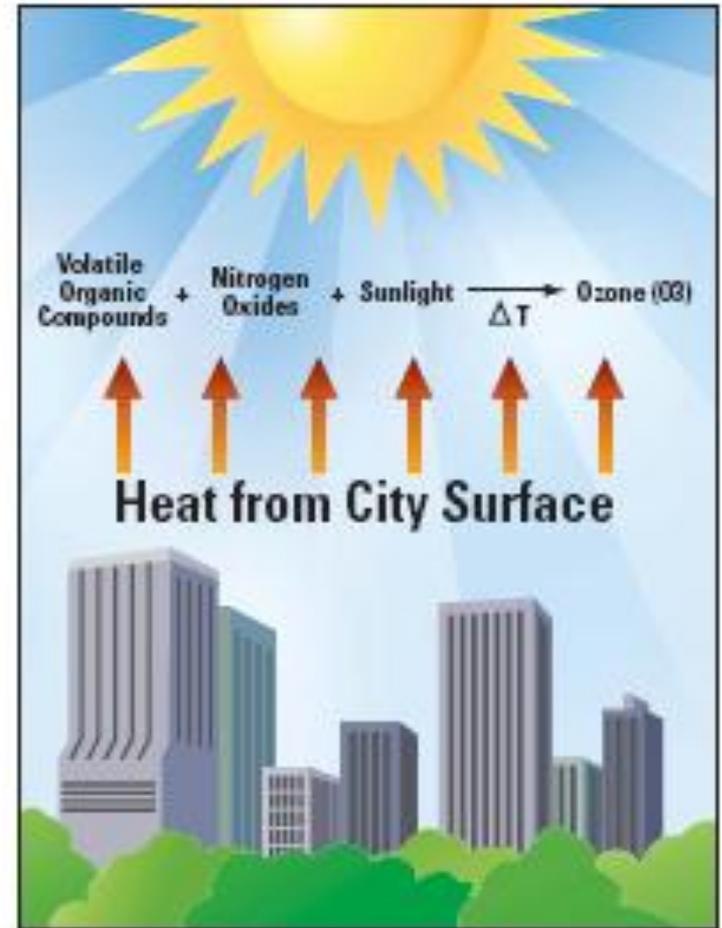
Concentric expansion of cities has a lot of disadvantages:
Lack of ventilation (summer smog) ; Increasing distances to the rural areas.

The urban heat island effect

Urban Heat Island Profile



Heat islands are often largest over dense development but may be broke up by vegetated sections within an urban area.

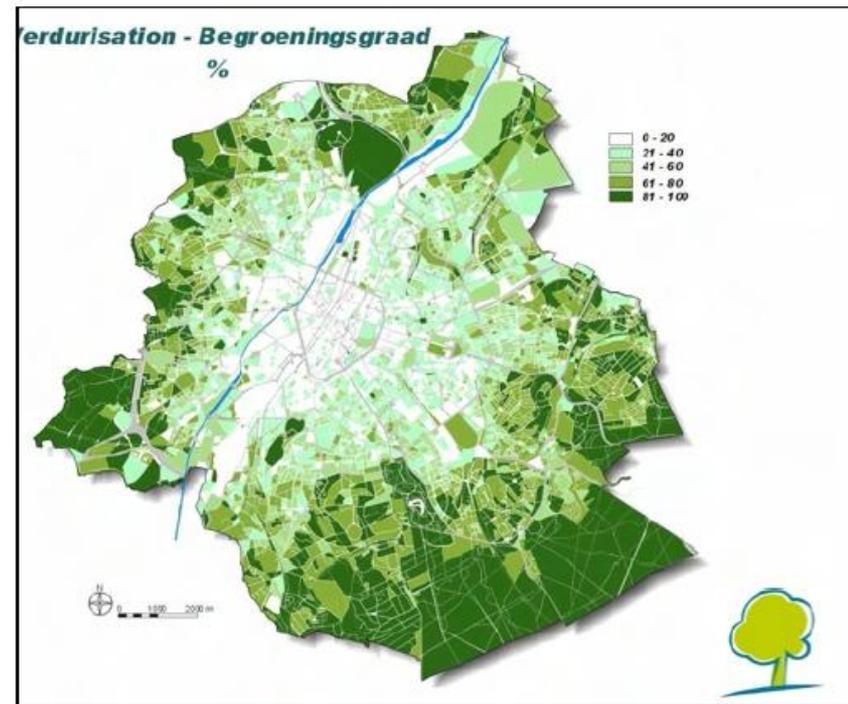
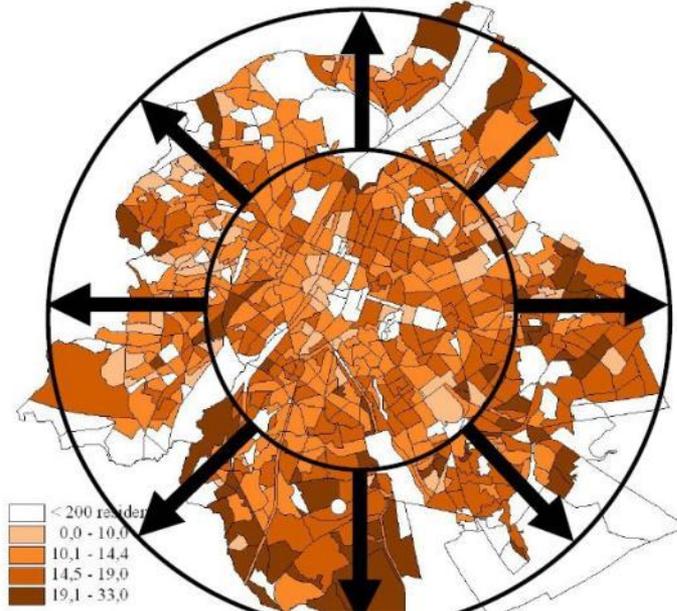


Ozone forms when precursor compounds react in the presence of sunlight and high temperatures.

Brussels (1,000,000 inh. ; Belgium)

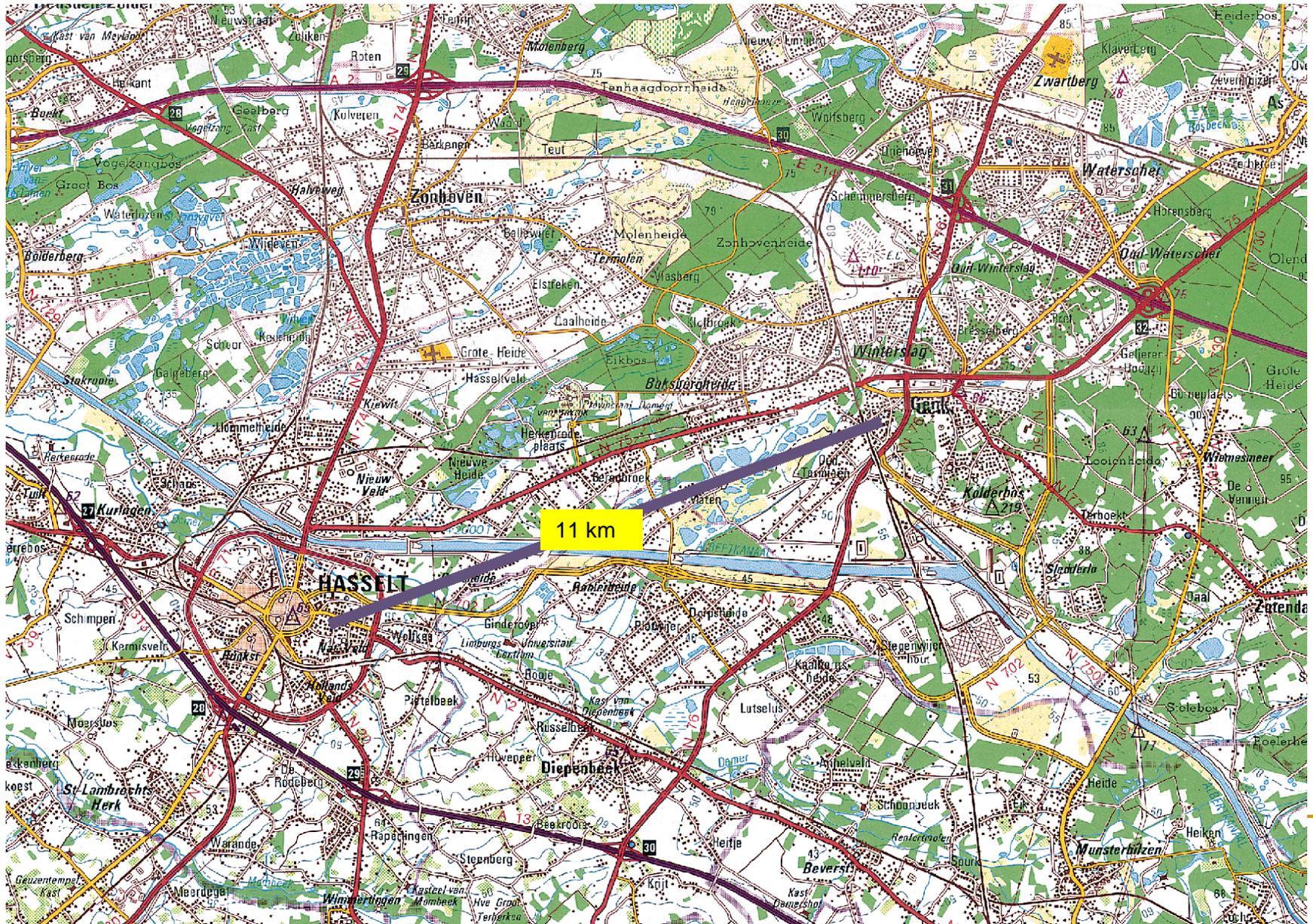
Younger families with children leave the city centre and move to the green city fringe and rural areas.

Married couples with 2 children per 100 households per neighbourhood in Brussels (2000)

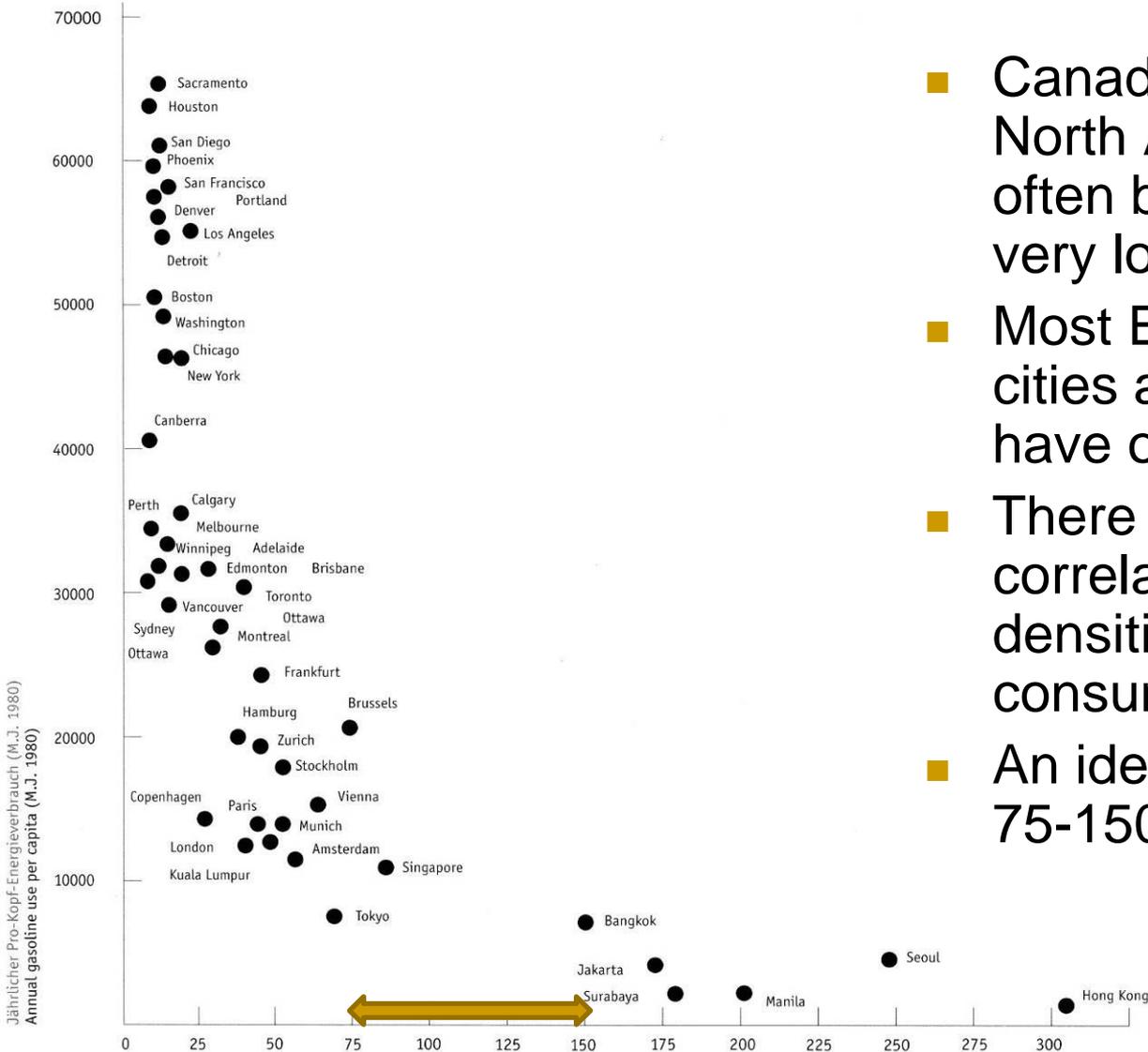


Proportion of green, open spaces in Brussels Capital Region
Source : IBGE-BIM

‘urban sprawl’ (Belgian example), leads to unpayable public services
(public transport, sewage systems, post,...)



Urban densities and energy consumption



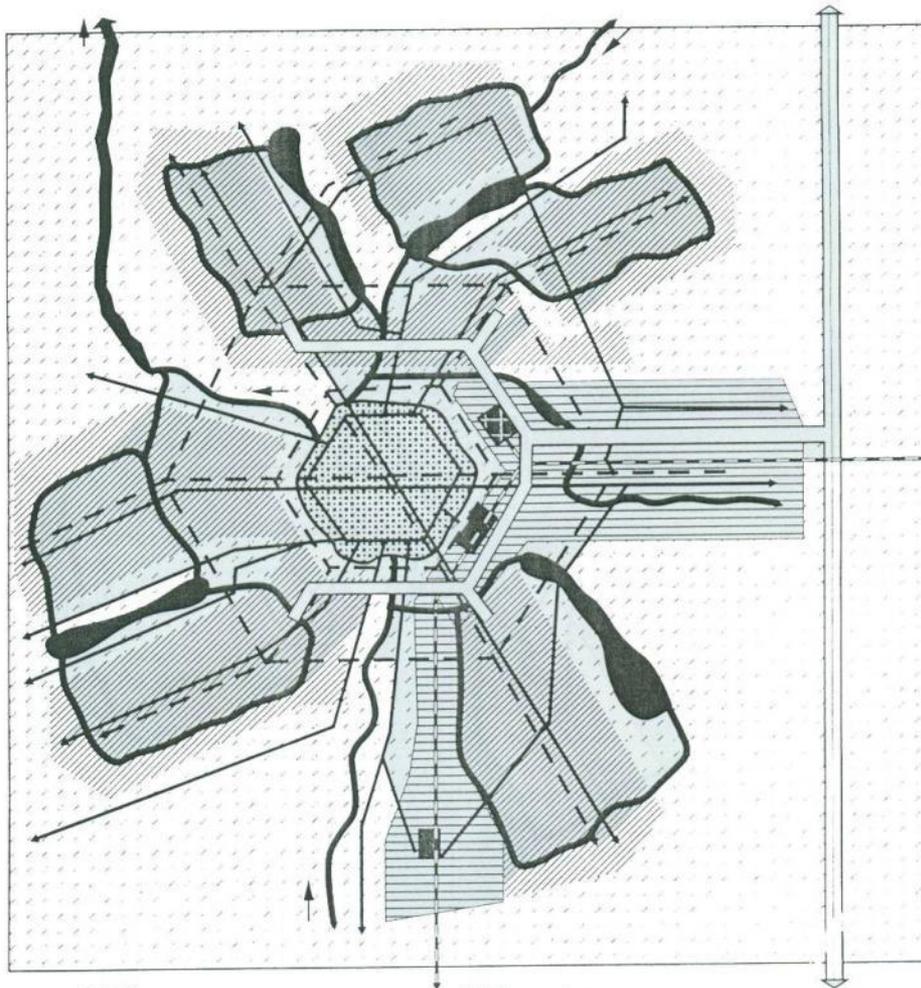
- Canadian, Australian and North American cities are often broad-acres cities with very low densities.
- Most European and Asian cities are medieval and have often higher densities.
- There is an amazing correlation between densities and energy-consumption.
- An ideal density might be 75-150 inh./ha.

Städtebauliche Dichte (Einwohner pro ha)
Urban density (person per ha)

So both city expansion models, the concentric expanding city as well as the garden city, have a lot of ecological disadvantages.

- How to combine rural and urban features together in **another way** than garden cities do ?
 - How to generate enough compactness in **another way** than compact, concentric cities do?
-

Solution: The lobe-city model



Built-up city-lobes
separated by
Blue-green fingers
(wedges)

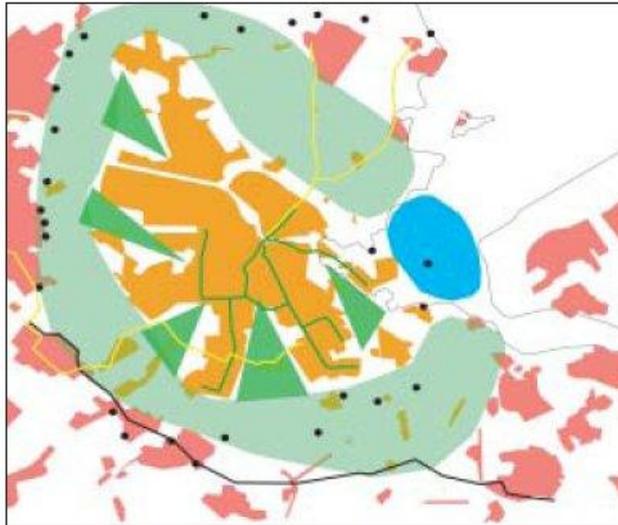
from Tjallingii, 1996



The lobe-city model

- The lobe-city model was developed in the first half of the 20th century.
 - To varying degrees, this model was used in Denmark for the “fingerplan” in Copenhagen (1948), the general plan to extend Amsterdam (1935) and in cities such as Hamburg, Köln (1927), Berlin (Germany) and Stockholm (Sweden).
 - Also the planners developing Shanghai Dongtan (China) as an eco-city, use the concept of blue-green fingers.
-

In lobe-cities the blue-green fingers are penetrating deep into the centre.

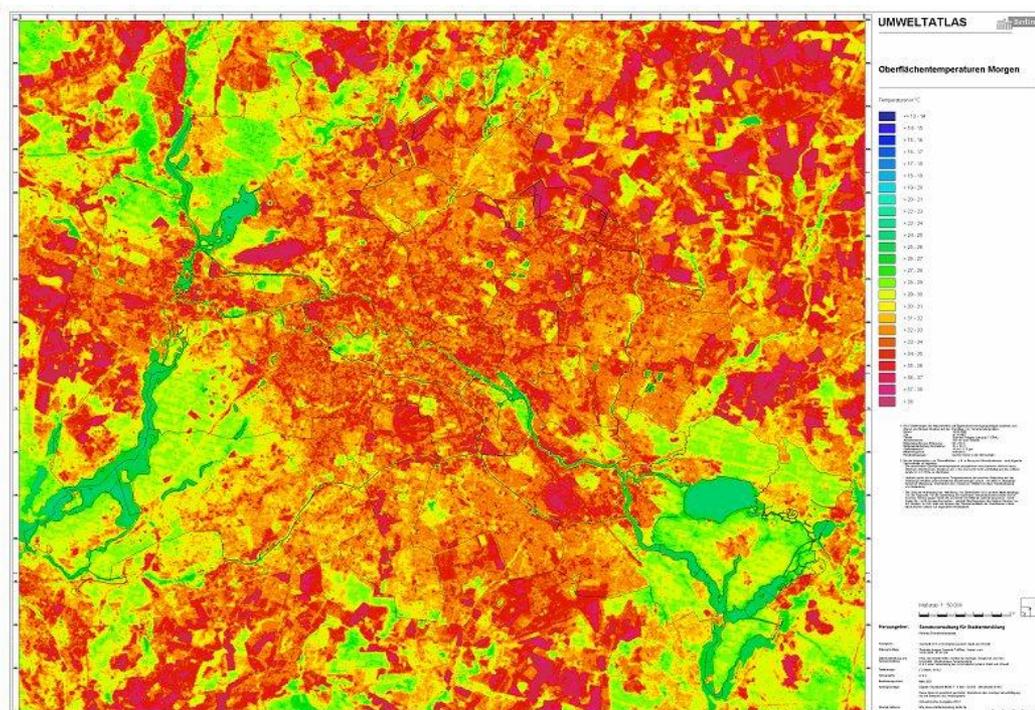
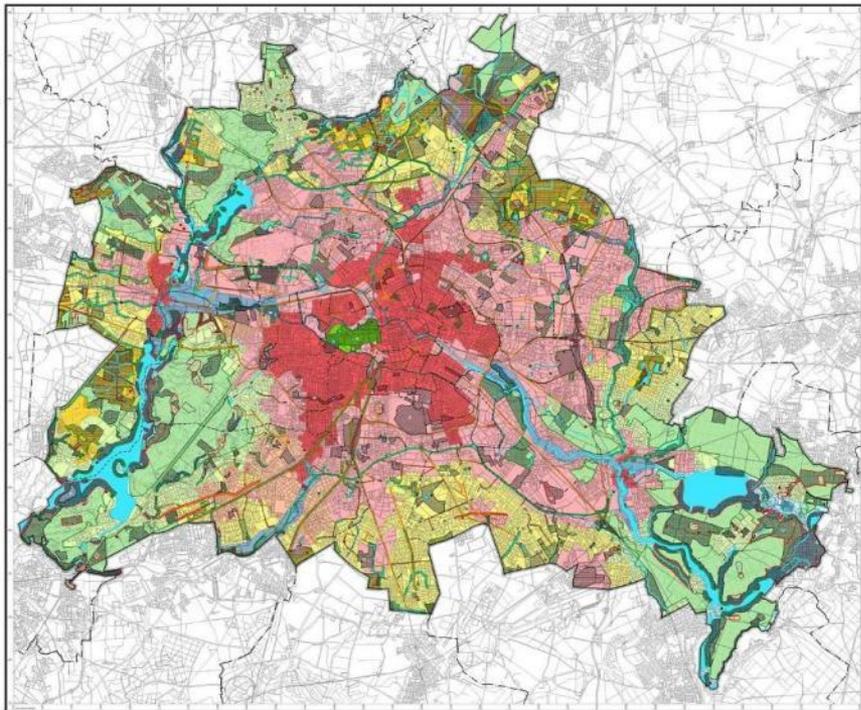


De Amsterdamse lobbenstad ligt een
zone. Daaromheen ontstaat langzamer-
en krans met bebouwing, een
amde kranstad.
Amsterdam 'finger city' is surrounded by
belt. A garland of construction is
ly appearing around it, a so-called
city.

Amsterdam (750,000 inhabitants ;
The Netherlands). From Gieling, 2006



The blue-green fingers are tempering the heat island effect in Berlin (3,400,000 inh. ; Germany)



Infrared picture of hot city-lobes and cooler blue-green fingers of Berlin.
(Cloos, 2006)

- Calculated for the city of Valencia (Spain):

Decreasing temperature by	1°C: need for 10 ha green
	2°C: 50 ha green
	3°C: 200 ha green

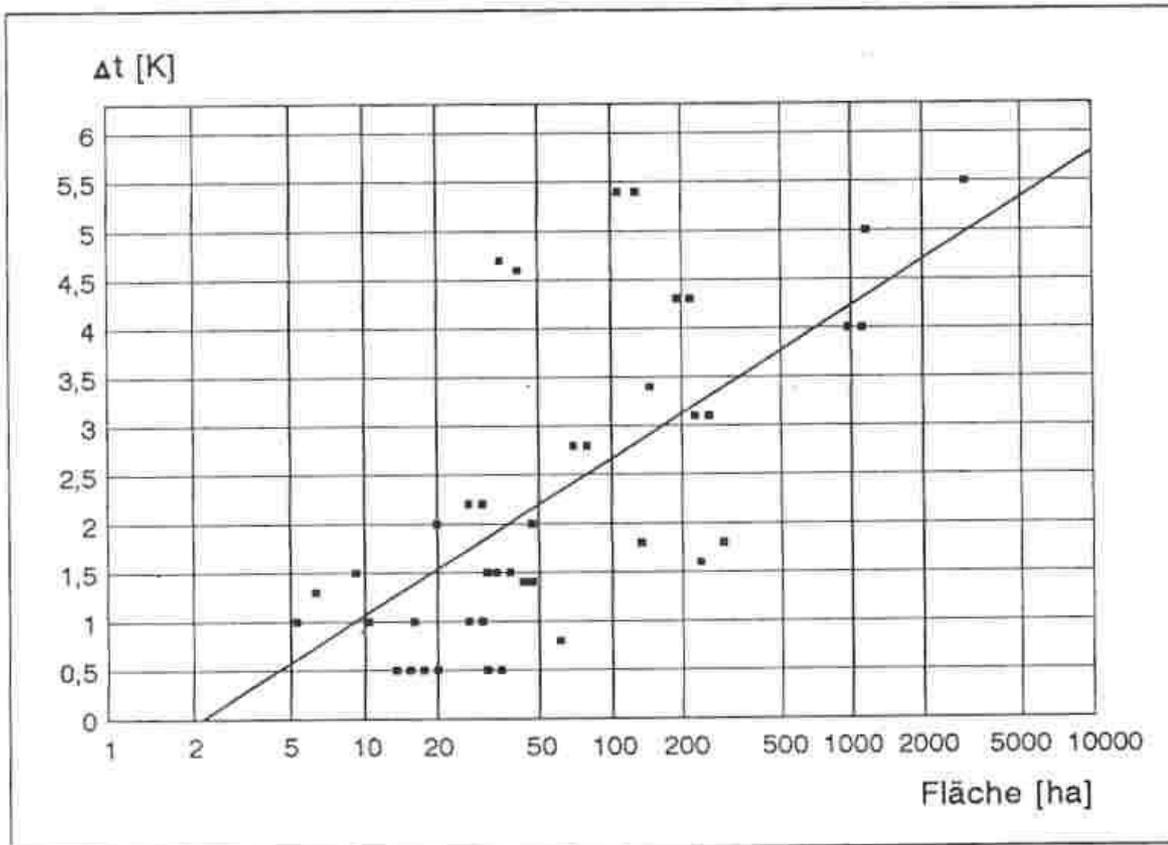
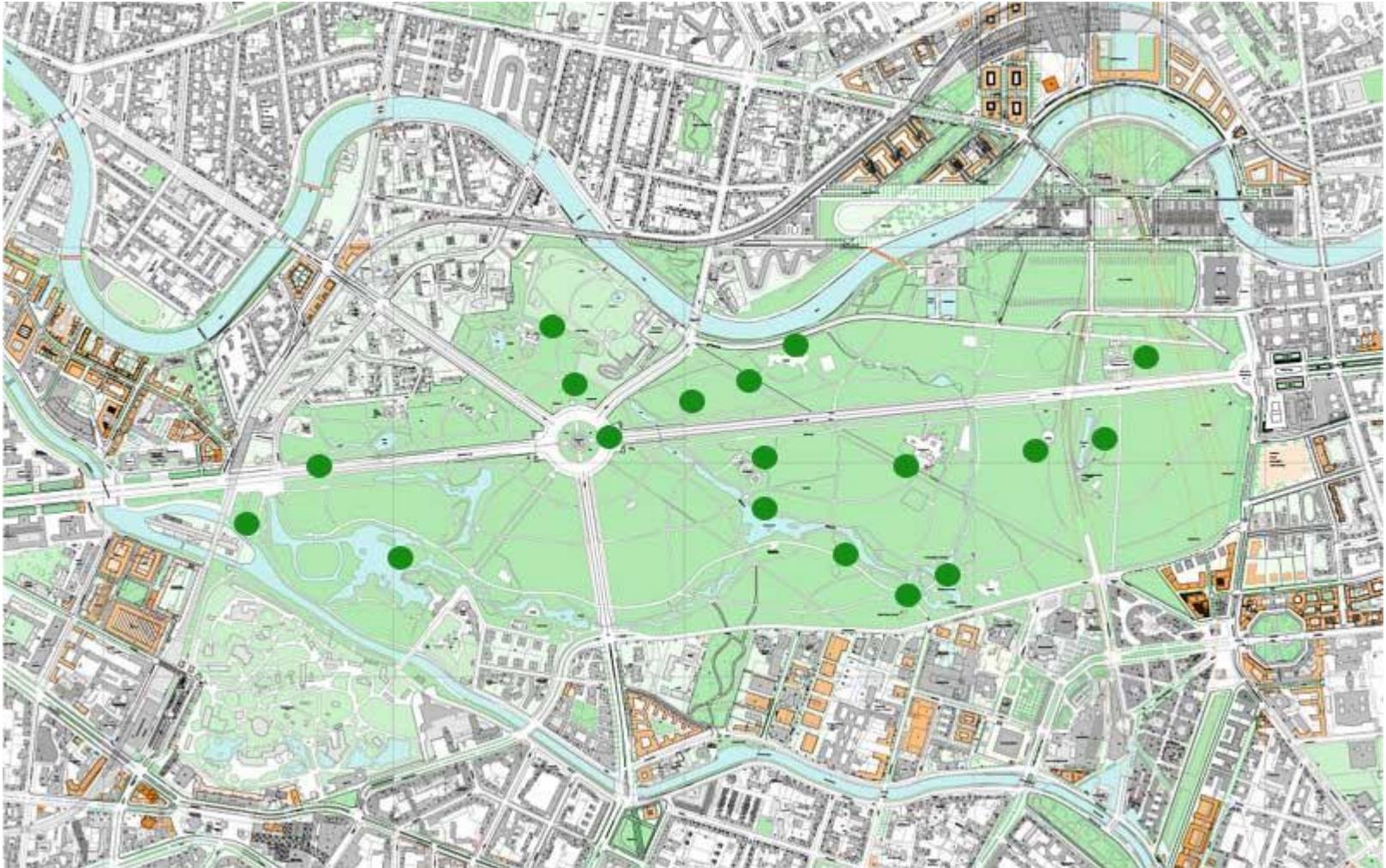
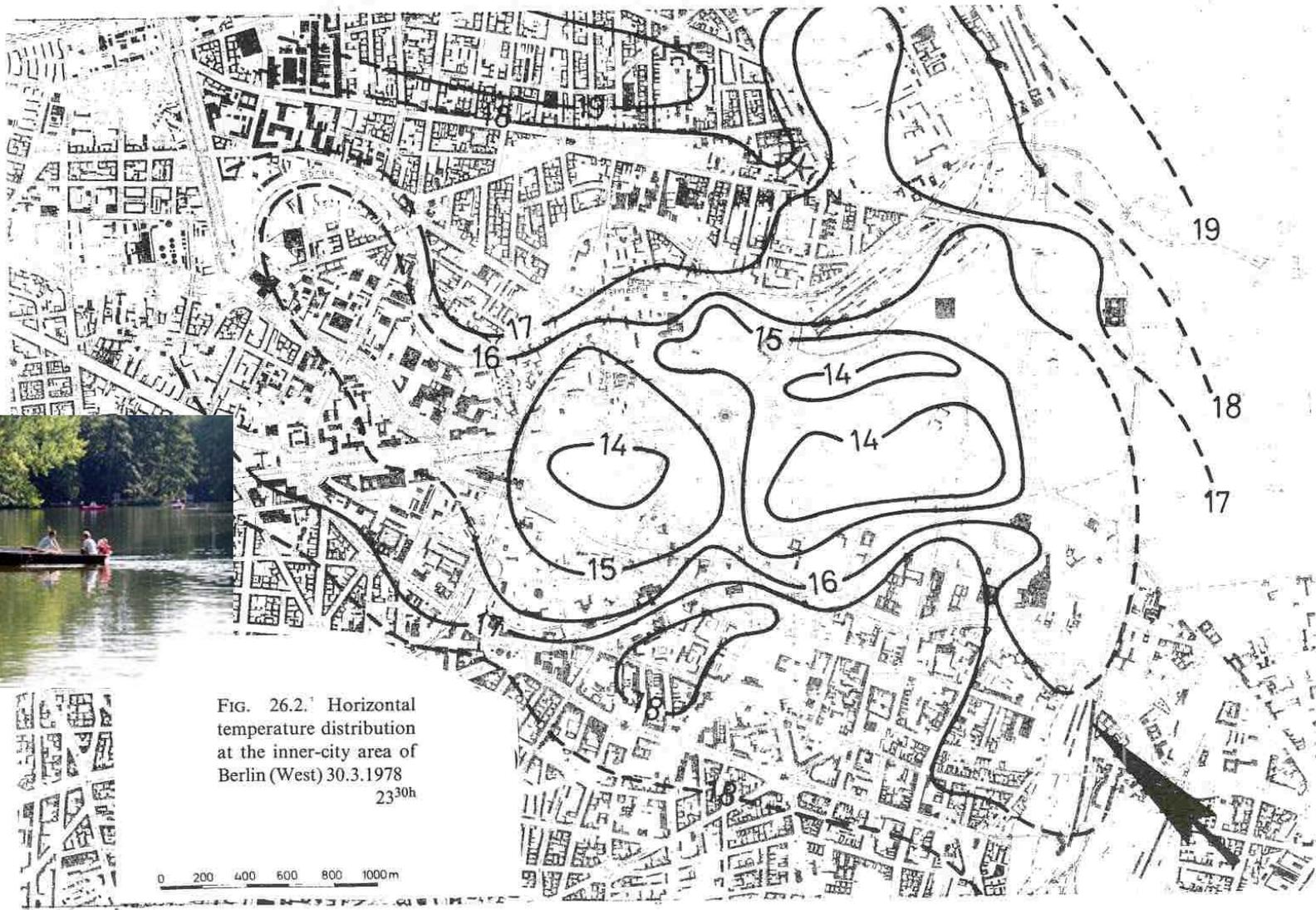


Abb. 6-21: Temperaturdifferenzen (Δt) verschiedener Berliner Grünanlagen zu ihrer Umgebung in Abhängigkeit von ihrer Größe in einer mäßig austauscharmen Strahlungsnacht (9. 07. 1982, 23.00 h MEZ) bei NE- bis E-Wind (nach v. Stülpnagel 1987).

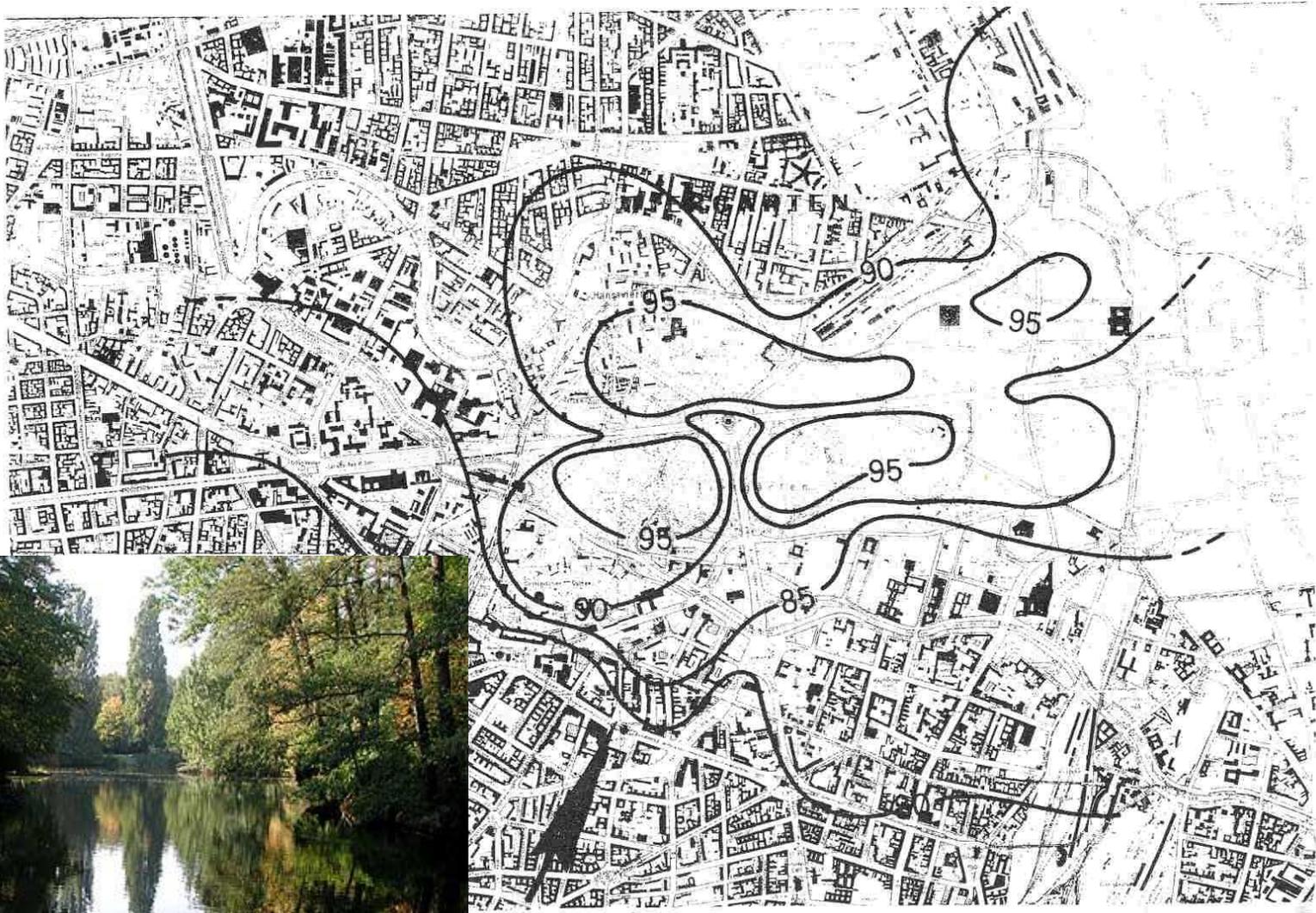
Tiergartenpark (Berlin), surface 210 ha. <http://www.stadtentwicklung.berlin.de/umwelt/stadtgruen>



Influence of the Tiergartenpark (Berlin) on temperature

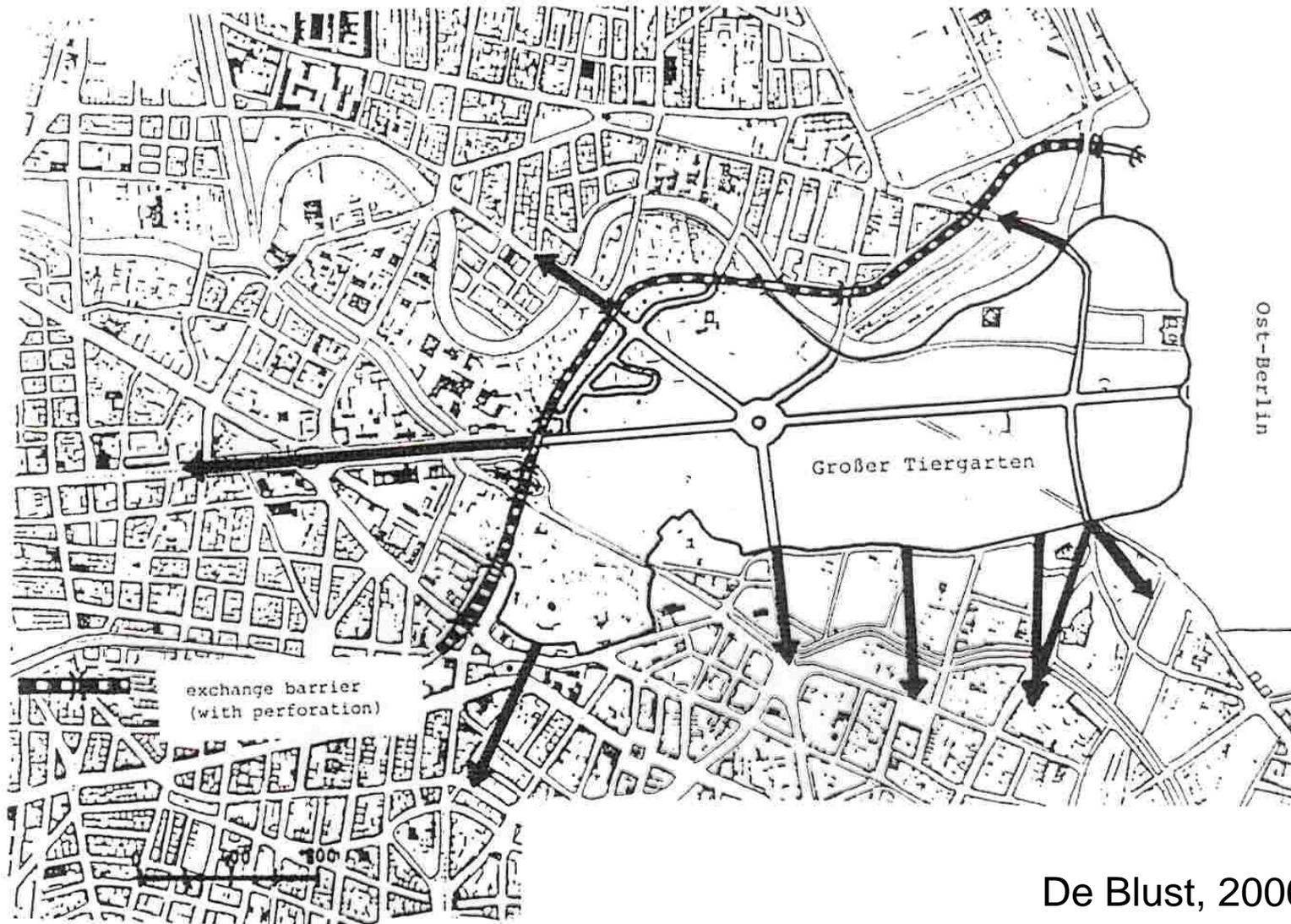


Influence of the Tiergartenpark (Berlin) on humidity



De Blust, 2006.

City climatic influence of the Tiergartenpark (Berlin)



De Blust, 2006.

Fig. 7. Maximum ranges of climatic influence (length of arrow) from the 'Tiergarten Park', measured for air temperature at 2 m (from von Stülpnagel, 1987).

Densely built-up city-lobes, separated from each other by vast blue-green fingers (City of Tübingen ; 85,000 inh. ; Germany)

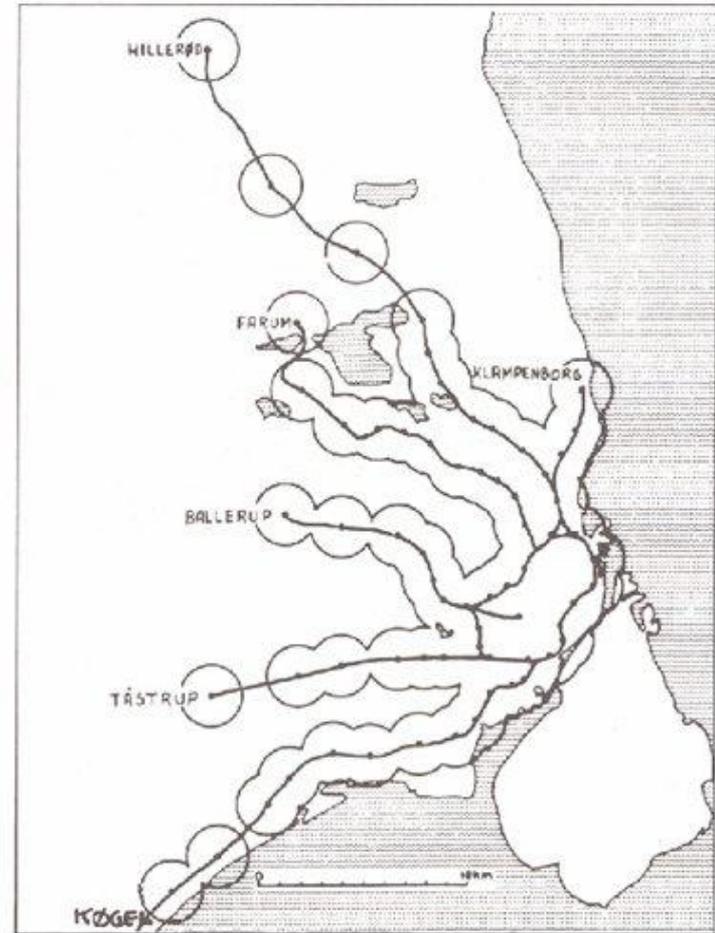


In the city-lobe *French Quarter* live
240 inhabitants/ha and 50 à 60
labour places / ha are created.

Within the blue-green fingers, a lot of functions can be combined: city-farms and children-farms, cemeteries, outdoor sports infrastructure, historic fortifications, city parks, etc.



The cities of Köln (1,000,000 inh. ; Germany) and Copenhagen (1,400,000 inh. ; Denmark) applied the lobe-city concept.



The fingerplan of Copenhagen

High densities in the eco quarter *Vauban* (Freiburg, D)



The formation of 'citizen building groups' is a first key to establish the higher densities. Future neighbours learn to know each other during this process.



Examples of citizen building groups in Freiburg im Breisgau (D)

How do private citizen building groups work ?

- Private families or private persons agree together to realize their ideas of building, living and working within the city, in common. They work together with one architect.
 - The municipality of Tübingen stimulated the formation of such building groups by organising so called **building markets**. These are meetings of interested partners, finding each other: Families, singles, elderly, small entrepreneurs ... gathered to develop a project together.
 - When their project was accepted, an appropriate allotment was awarded to the building group.
-

Some advantages of the building group formula.

- An important advantage of this building group formula was the fact that the prices were **up to 20 % cheaper** than they would have been without cooperation.
 - Moreover, the traditional aversion of citizens against living in densely occupied city quarters, does not exist (or is not so obvious) amongst members of a private building community. **Social cohesion** grows during the process between the future neighbours.
 - The **diversity** of the building groups (different social groups and generations) is reflected in the different scale and typology of the projects. So a virtually organically grown city quarter arose, not stereotyped as often when built up by private promoters.
 - Success story: a lot of German cities, Switzerland, the Netherlands, and Belgium...
-

Designing a well thought **public-private gradient** in the green areas is the second key towards higher densities.



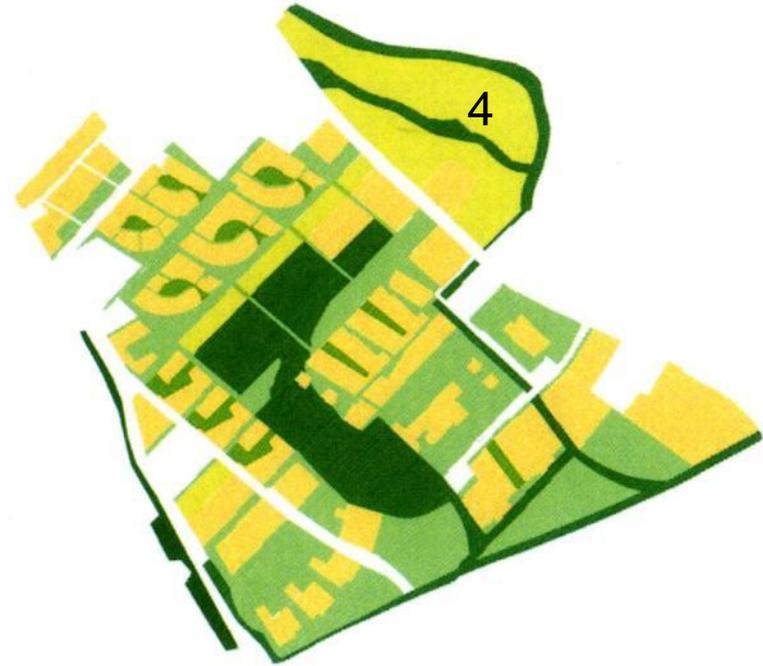
Culemborg (NL). Ecoquarter *EVA-Lanxmeer*

Ontwerp Vasalishof





public-private gradient



-  Zone 1: Private gardens and terraces (PRIVATE)
-  Zone 2: gentle gradient from private to public
(SEMI-PUBLIC / SEMI PRIVATE)
-  Zone 3: intensively used public area, parks, 'edible' landscape
(PUBLIC)
-  Zone 4: city farm (PUBLIC)
-  Zone 5: Watershed area , natural river banks (PUBLIC)

Public-private gradient in detail



Zones in EVA-Lanxmeer:

1. Private gardens
2. Semi-public 'hof' is collectively owned
3. Public park
4. Public city farm.
5. Public green along the river.

Semi-public 'hofjes' ,as connecting zones, are very attractive for children.





Gentle gradient between private and public in blue-green fingers.





Common orchard



View from the living through the private garden towards the public green area.

Or how a small garden becomes large for the kids

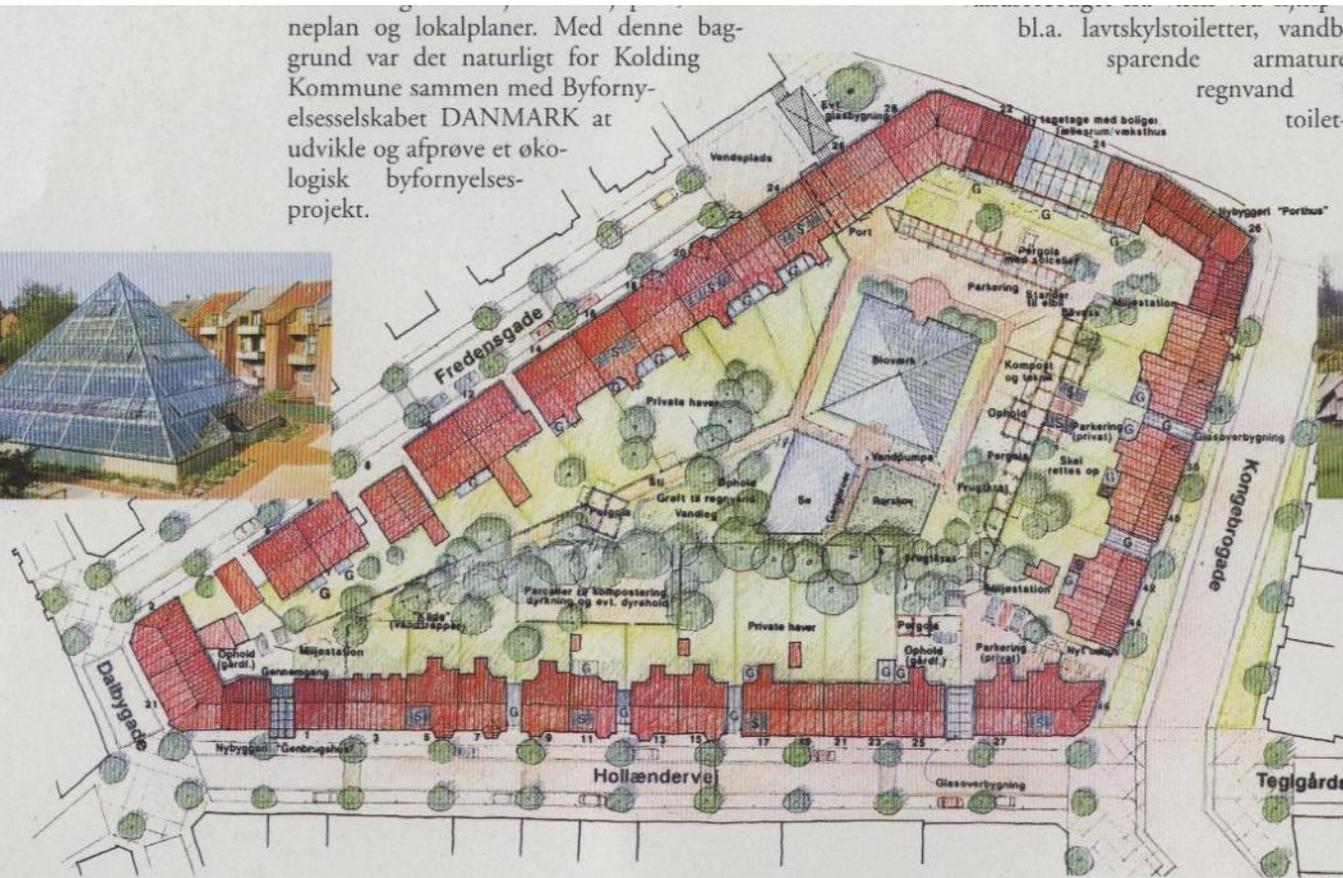
Is a well thought public-private gradient also possible in the inner cities ? Case study from the centre of Kolding (DK).



Casestudy Kolding (DK).

neplan og lokalplaner. Med denne baggrund var det naturligt for Kolding Kommune sammen med Byfornylselsesselskabet DANMARK at udvikle og afprøve et økologisk byfornyelsesprojekt.

bl.a. lavtskylstoiletter, vandbesparende armaturer, regnvand til toilet-







Wadi for infiltration of white water



Black and grey water are purified in a plant purification system.

Plant purification system in Kolding (DK), in a glass pyramid in the middle of the semi-public garden.



The municipality is maintaining the inner garden, in exchange for limited access for the public.

Kolding (DK)



Utrecht (NL)



Risk: privatising gardens to
an ecoghetto for the 'happy few'.

Malmö (S)



Culemborg (NL)



Copenhagen (DK)

Design a well thought **public-private gradient** between the buildings on the city-quarter level.



Freiburg (D).

Quartier Vauban

*Common bicycle
storage.*



Design car parking areas just at the edge of the eco-quarter.



Solargarage Vauban	
	fotovoltaik
Bau und Betrieb	S.A.G. Solarstrom AG, Freiburg
Module	776 Module SF115
Modulfläche	ca. 900 m ²
Installation	Solar-Energie-Systeme GmbH, Freiburg
Leistung	90 kWp
> Stromertrag/Jahr	ca. 80.000 kWh
> CO ₂ -Ersparnis/Jahr	ca. 38 Tonnen



Freiburg (D). Eco quarter *Quartier Vauban*

collective parking areas (permeable for rain water).



Ecowijk *Dyssekilde* (Torup, DK).

Eco quarter Viikki (Helsinki, Fin.)



Give car-sharing the best places in the eco-quarter

CAR-SHARING
STADT • TEIL • AUTO
Nachbarn teilen sich Autos
Info Telefon 63 77 777

Stellplätze:
NEUPERLACH (2)
Neuperlach Zentrum
Hauptstraße Platz
10 (Naher-Neuperlach)

Warum wir wollen, daß Sie Ihren **Privatwagen/ Zweitwagen** aufgeben oder die Anschaffung Ihres **Neuwagens** verschieben sind **STADT • TEIL • AUTO**

Warum STADT • TEIL • AUTO?
1. Sie sparen 2000,- € bei der Wagenanschaffung
2. 23 Stunden am Tag nutzbar und kostet jede Menge Geld mindestens 6.000,- € im Jahr. Dieses Geld können wir Ihnen ersparen. Und uns das Ärger mit dem Stadt...

STADT • TEIL • AUTO Mitglieder bringen Vorteile mit sich: kein Kauf, Wartung und Verwaltung des Wagens zu kümmern. Dabei fahren Sie immer ein neuwertiges, sicheres Fahrzeug.



cambio

ROZEMARIJN

AUTODELEN
Meer info:
070 222 292
www.cambio.be
inlichtingen@cambio.be

Ein initiatief van:
STAD GENT

teilAuto
www.teilauto-tuebingen.de

**CAR-SHARING
STELLPLATZ**

3 Stellplätze

Design also a well-thought **public-private gradient** within the buildings.



Zürich (CH). *Werdwies*; common laundry on the ground floor in a social housing project.
Social cohesion guaranteed.

Bike-friendly design in the car-free quarter *Stellwerk 60* (City of Köln, Germany). Common entrance and bike parking.



Design also a well-thought public-private gradient within the buildings.



(Culemborg, NL). Senior house 'Het Kwartel' in the ecoquarter *EVALanxmeer* with some common facilities in the dark round part of te building (bar, spare rooms, bike parking, ...)

Ecovillage *Sieben Linden*. (Municipality of Poppau, D).



Central building with common kitchen, library, guest rooms and seminar rooms. In the front a common swimming pond.



Common energy supplies.

Ecovillage *Keuruu* (Fin.)



Common facilities in the 'community house'.

Ecovillage *Keuruu* (Fin.)



View on the common square





Findhorn Ecovillage (Scotland, UK).



Common meditation room (Findhorn ecovillage, Scotland (UK))



Common vegetable gardens.



Keuruu (Fin.)



Findhorn (Scotl., UK)



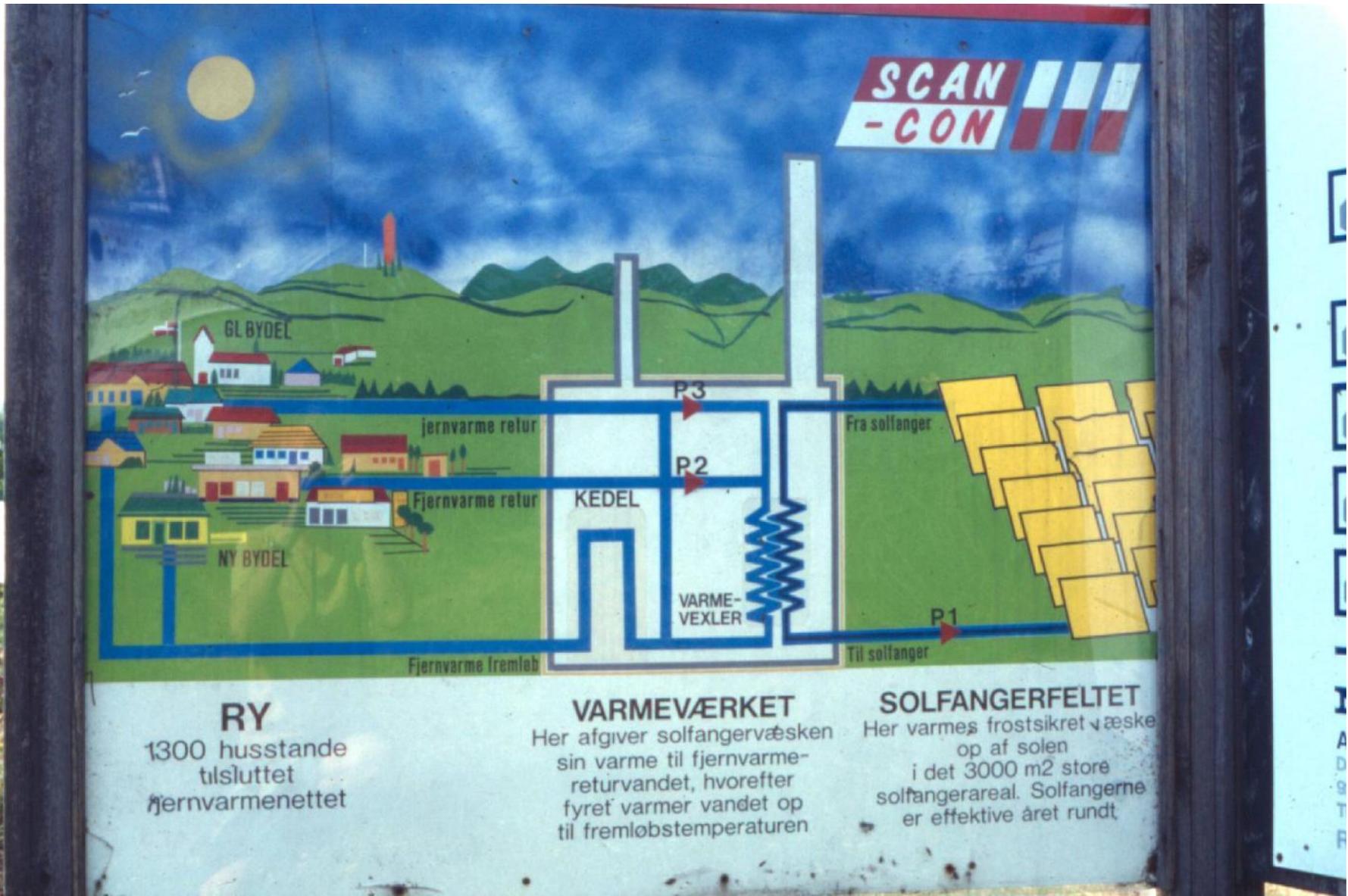
Poppau (D.)

Densely built-up city-lobes can be heated by small plants for cogeneration of heat and power (CHP).



In the city of Tübingen (Germany) the whole city-lobe *Loretto-areal* is heated by a district heating system, connected with a CHP plant.

District heating based on the CHP principle.
Municipality of Ry (Denmark)





In the city of Freiburg (Germany) the *ecoquarter Vauban* is heated by a CHP on wood (biomass)

Holz-BHKW Vauban
Die neue Qualität im Energiehaushalt

regiostrom produzieren
Bisher wurden
7 1080 MWh
Megawattstunden Regiostrom aus Biomasse erzeugt

wärme liefern
600 Haushalte im Vauban wurden mit
4 402 600 MWh
Megawattstunden Wärme aus Holz versorgt

klima schützen
Der Umwelt bleiben
132 70 t
Tonnen des Treibhausgases Kohlendioxid (CO₂) erspart

ressourcen schonen
Jährlich werden
26000 m³
Kubikmeter Holz nachschneitzel aus heimischer Produktion verarbeitet

badenova
Holzwerk Day for Day



Holz-BHKW Vauban
Die neue Qualität im Energiehaushalt

regiostrom produzieren
Bisher wurden
7 1080 MWh
Megawattstunden Regiostrom aus Biomasse erzeugt

wärme liefern
Die Haushalte im Vauban wurden mit

Freiburg im Breisgau (Germany)

Plus-energy houses in the eco-quarter *Am Schlierberg*)



CONCLUSION (1):

- In ecovillages, a lot of experience is gathered with the public-private gradient as well in the green areas as in and between the buildings, most of them in rural context.

<http://www.gen-europe.org>

<http://www.oekosiedlungen.de>

- These experiences deserve to be translated and adapted to be used within cities and villages in order to create and build ecoquarters and to provide good ideas for the transition of traditional towns and city quarters..
-

CONCLUSION (2): Towards climate-proof urban development .
Lobe-cities can **buffer** climate change (global warming and changes in precipitation) because they

- Offer **blue-green fingers** with possibilities to buffer and to infiltrate rainwater, avoiding flooding downstream of the city. An ecologically sound green management of those blue-green wedges can improve and restore urban biodiversity.
 - Temper the urban heat island effect, because the **blue-green fingers** stimulate urban ventilation, based on convection.
-

CONCLUSION (3): Towards climate-proof urban development .
Lobe-cities can help to **avoid** further climate changes because they:

- Show enough compactness within the built-up **city-lobes**, which therefore can be carried easily by central public (lightrail) transport axes.
 - Provide densely built-up **city-lobes** which can be heated easily with small and local CHP plants, connected to a district heating system, so carbon emissions can be decreased strongly.
-

Thank you for your attention.

Any questions ?

erik.rombaut@scarlet.be

