Some guidelines for Applying ecosystem-services in urban and rural planning.
Plea for a lobe city.

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International Master in Architecture.

Course Ecological Sustainability.

Structure of this presentation.

- 0. The 17 sustainable development goals of the United Nations.
- 1. Ecosystem services
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- 3. The **concentric city** and the urban heat island effect
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The 17 UN -global goals for sustainable development (SDG)

In September 2015, 193 governments have agreed on 17 Global Goals For Sustainable Development (SDG's). This is a UN-17-point plan to end poverty, to halt climate change and to fight injustice and inequality by 2030.

This lecture wants to present a contribution to SDG 11: ideas for *inclusive*, *safe*, *resilient* en *sustainable* cities and settlements.

THE GLOBAL GOALS
For Sustainable Development

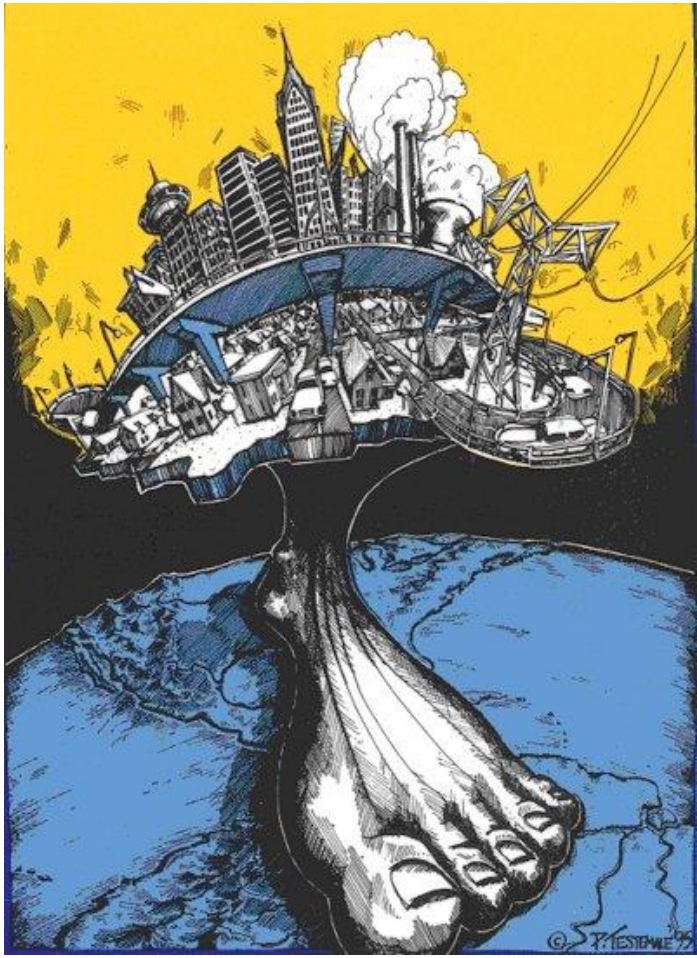
11. INCLUSIEVE, VEILIGE, WEERBARE EN DUURZAME STEDEN EN DORPEN

Urban SDG-11: Making cities and human settlements inclusive, safe, resilient and sustainable

http://www.globalgoals.org ;
http://cifal-flanders.org/leadership-for-sustainability/sustainable-development-goals ; http://cifal-flanders.org/wp-content/uploads/2015/10/Dossier-Belgische-NGOs-Beleidsaanbevelingen-implementatie-SDGs-in-Belgi%C3%AB-oktober-2015.pdf

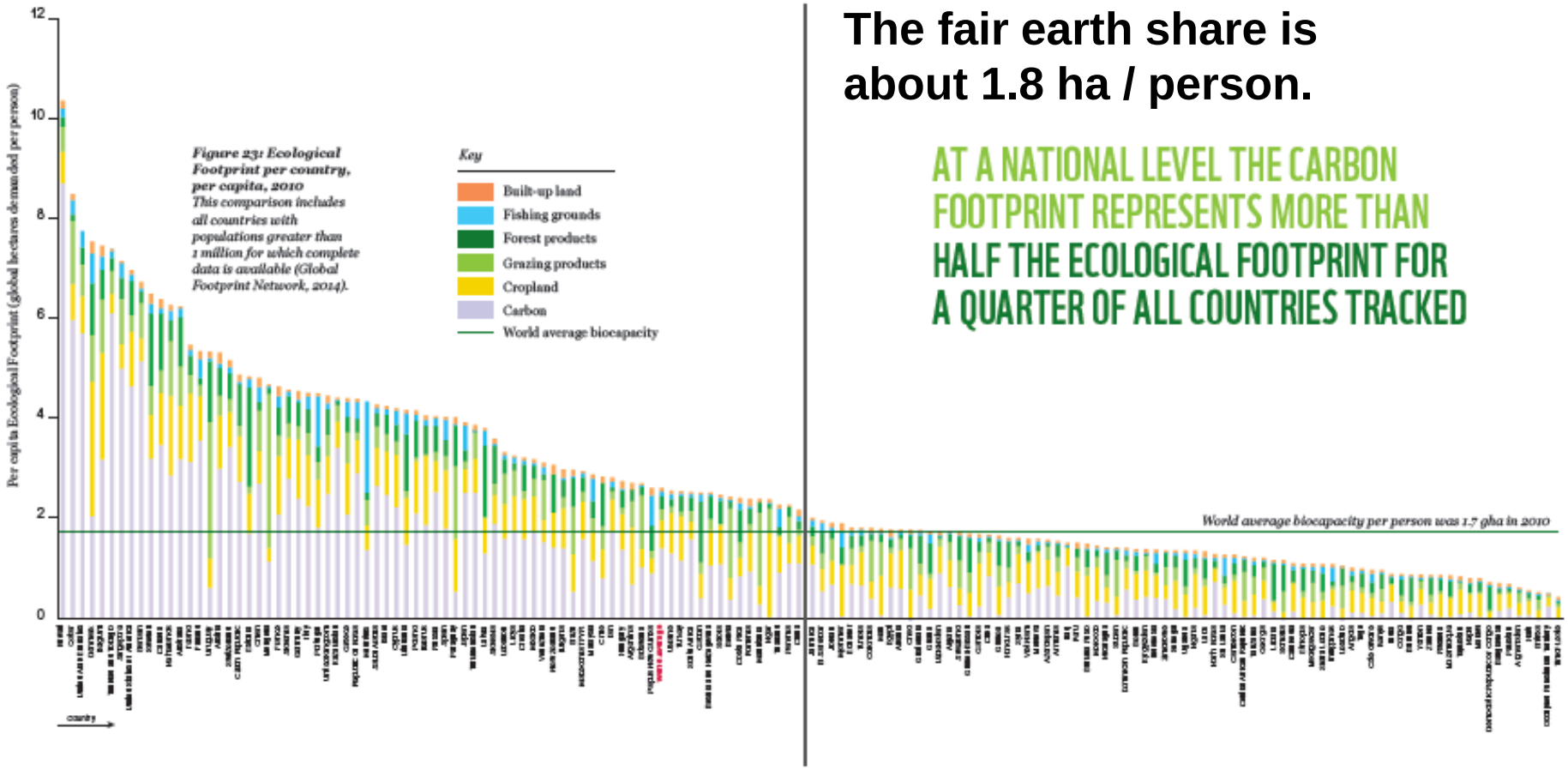
The aim: Searching for climate-proof urban and rural planning tools

- What is **climate-proof urban and rural planning** ?
- Which socio-ecological *patterns and processes* are able to decrease **the ecological footprint** ?
- What are **attractive socio-ecological conditions** for an inclusive human society?
- And are those consistent with **vulnerable abiotic conditions** for the restoration of urban and rural biodiversity ?



From Rees, 2004

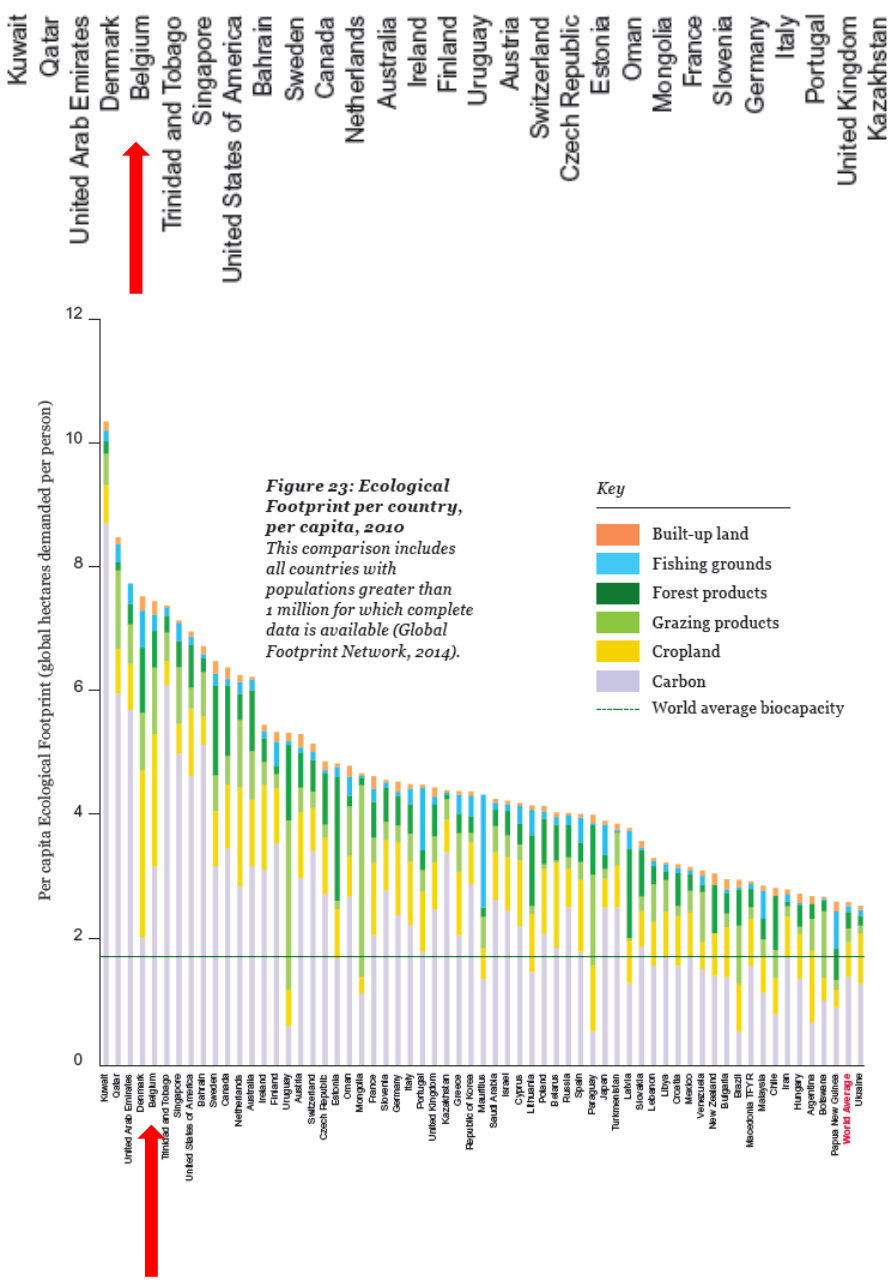
Ecological footprints per country per person in 2010 (WWF, 2014)



The fair earth share is about 1.8 ha / person.

AT A NATIONAL LEVEL THE CARBON FOOTPRINT REPRESENTS MORE THAN HALF THE ECOLOGICAL FOOTPRINT FOR A QUARTER OF ALL COUNTRIES TRACKED

http://wwf.panda.org/about_our_earth/all_publications/living_planet_report/



Belgium has (together with the USA) with about 8 ha (!!) per person, the 5th largest ecological footprint in the world, after Kuwait, Qatar, United Arab Emirates, en Denmark, (WWF, 2014).

Overview of EU-27

Number of Earths needed if all people on the planet had the Footprint of an average resident of the countries below:

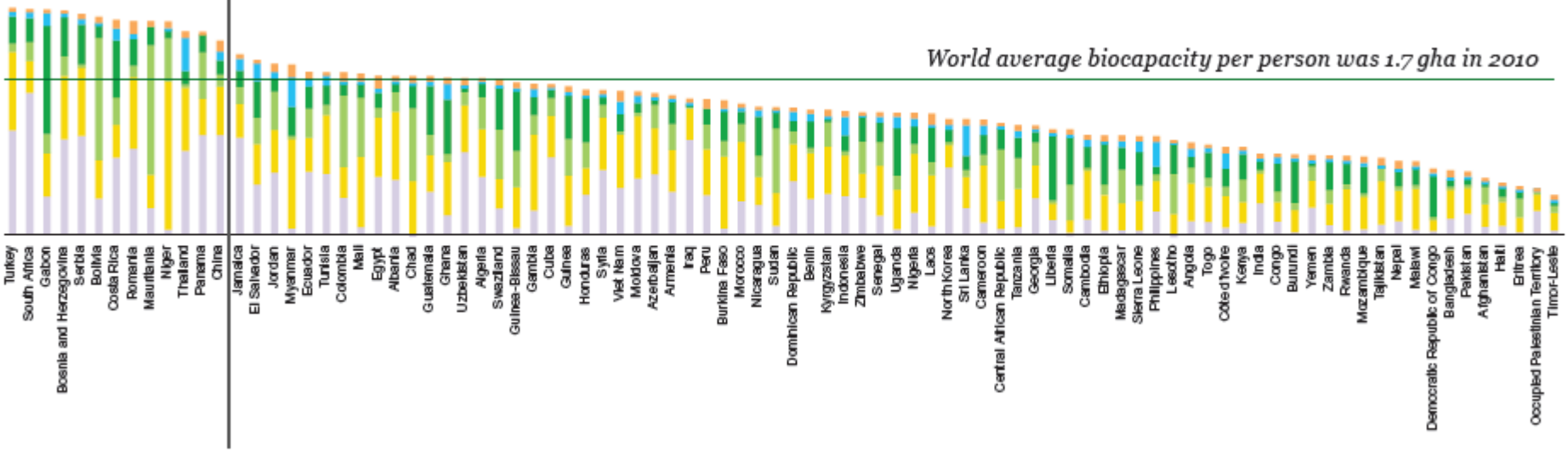
Country	Earths
Austria	3.1
Belgium	**4.3**
Bulgaria	1.7
Croatia	1.9
Cyprus	2.4
Czech Republic	2.8
Denmark	4.3
Estonia	2.8
Finland	3.1
France	2.7
Germany	2.6
Greece	2.5
Hungary	1.6
Ireland	3.2
Italy	2.6
Latvia	2.2
Lithuania	2.4
Malta	2.5
Netherlands	3.6
Poland	2.4
Portugal	2.6
Romania	**1.4**
Slovakia	2.1
Slovenia	2.6
Spain	2.3
Sweden	3.7
United Kingdom	2.6

When all humans would live like an average Belgian citizen, humanity would need 4,3 planets
WWF, 2014

In 2010, the most recent year for which data is available, per capita Ecological Footprint exceeded global per capita biocapacity (1.7 gha) in 91 of the 152 countries (Figure 23). At a national level the carbon component represents more than half the Ecological Footprint for a quarter of all countries tracked. In fact the carbon Footprint is the largest single component for approximately half of all countries tracked.

Contributions to the global ecological overshoot vary across nations. For example, if all people on the planet had the Footprint of the average resident of Qatar, we would need 4.8 planets. If we lived the lifestyle of a typical resident of the USA, we would need 3.9 planets. The figure for a typical resident of Slovakia, or South Korea would be 2, or 2.5 planets respectively, while a typical resident of South Africa or Argentina would need 1.4 or 1.5 planets respectively.

China



And what when these poor countries will enlarge their ecological footprints in the future ? …..

And they do so: Shanghai (China) 1987

Bron:Wollaert. 30/11/2015. Lecture Uantwerpen

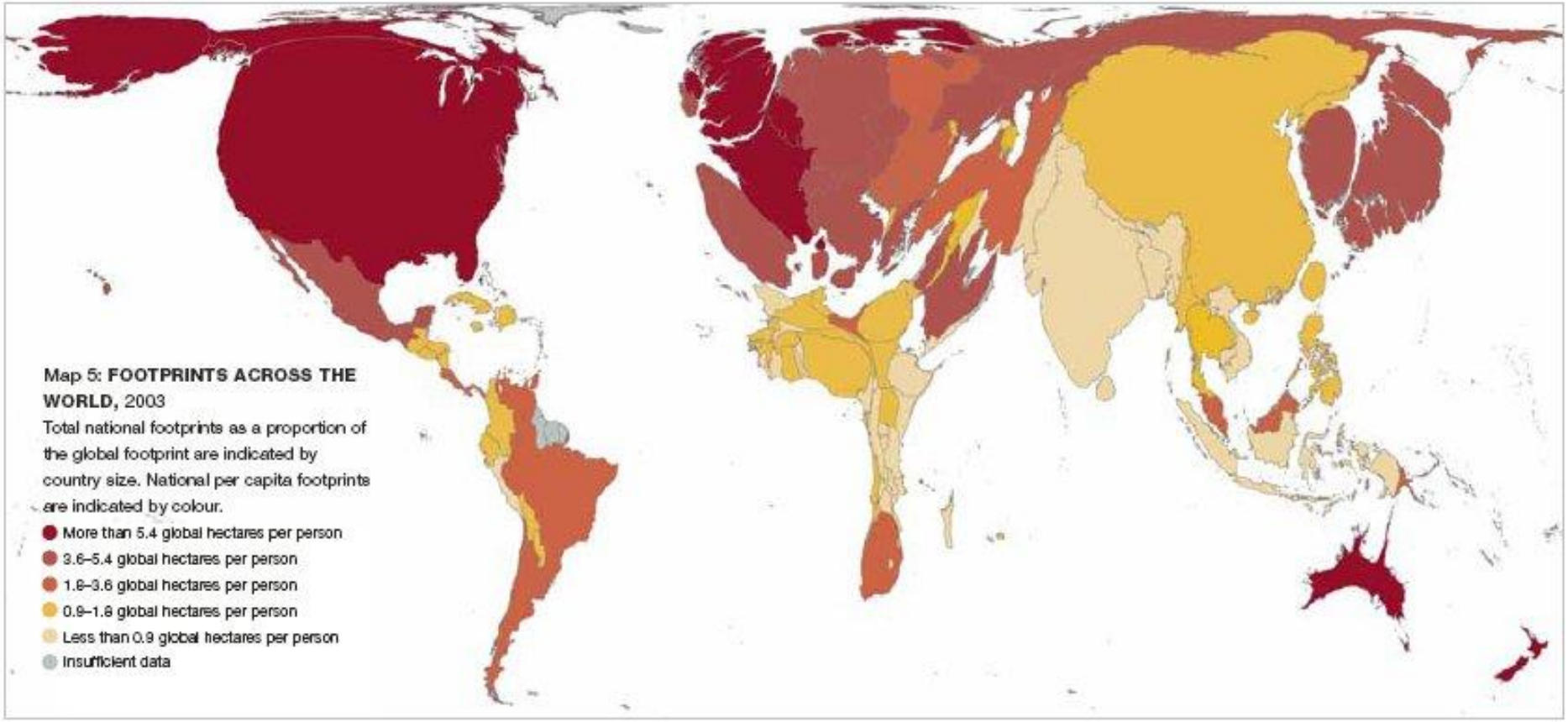
http://cifal-flanders.org/wp-content/uploads/2015/12/CIFAL-Flanders-Intro-Smart-Sustainable-Cities-Peter-Wollaert-30-11-2015.pdf

Shanghai (China) 2012

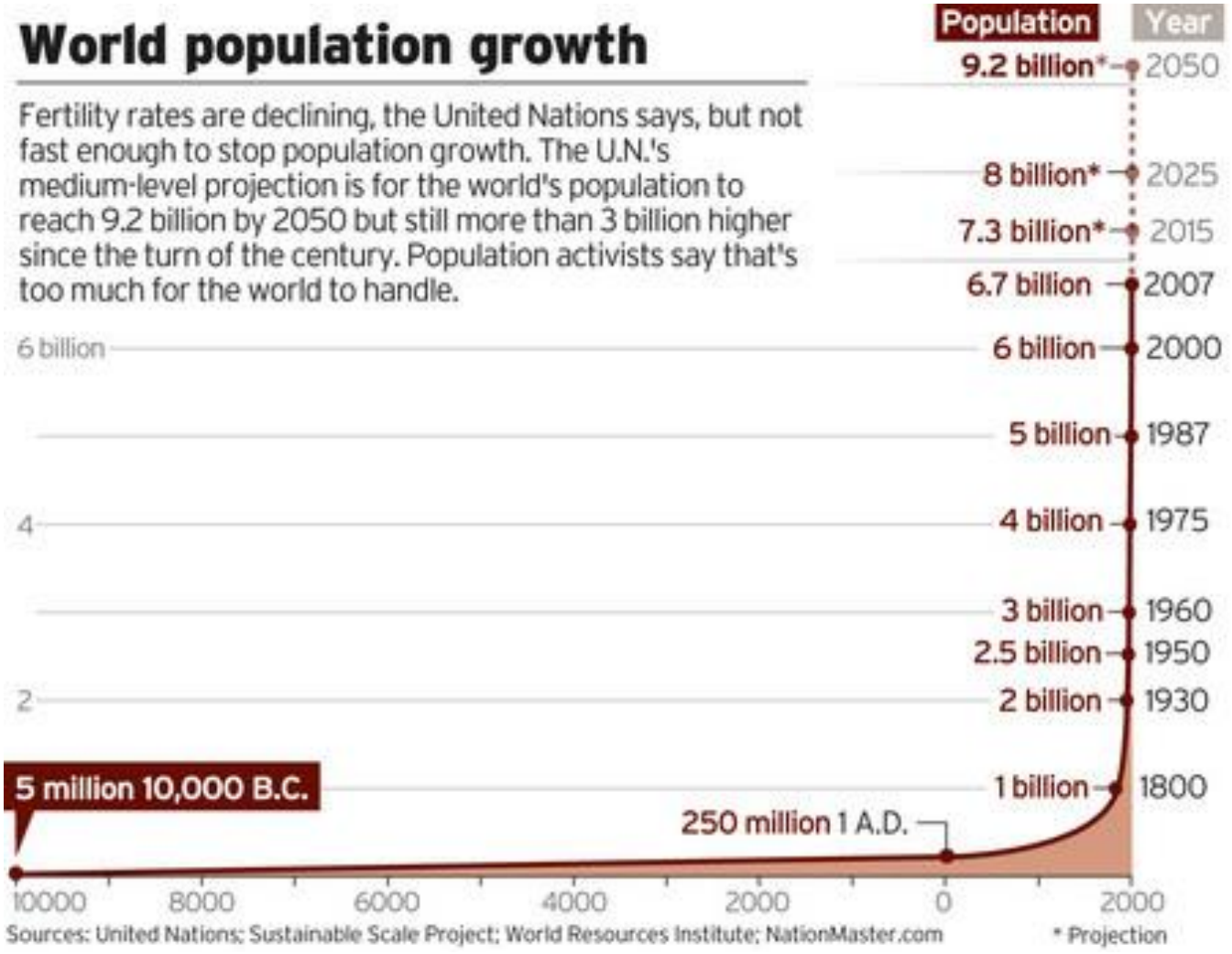
Bron:Wollaert. 30/11/2015. Lecture Uantwerpen

http://cifal-flanders.org/wp-content/uploads/2015/12/CIFAL-Flanders-Intro-Smart-Sustainable-Cities-Peter-Wollaert-30-11-2015.pdf

A world map with ecological footprints makes the gap between North and South very visible



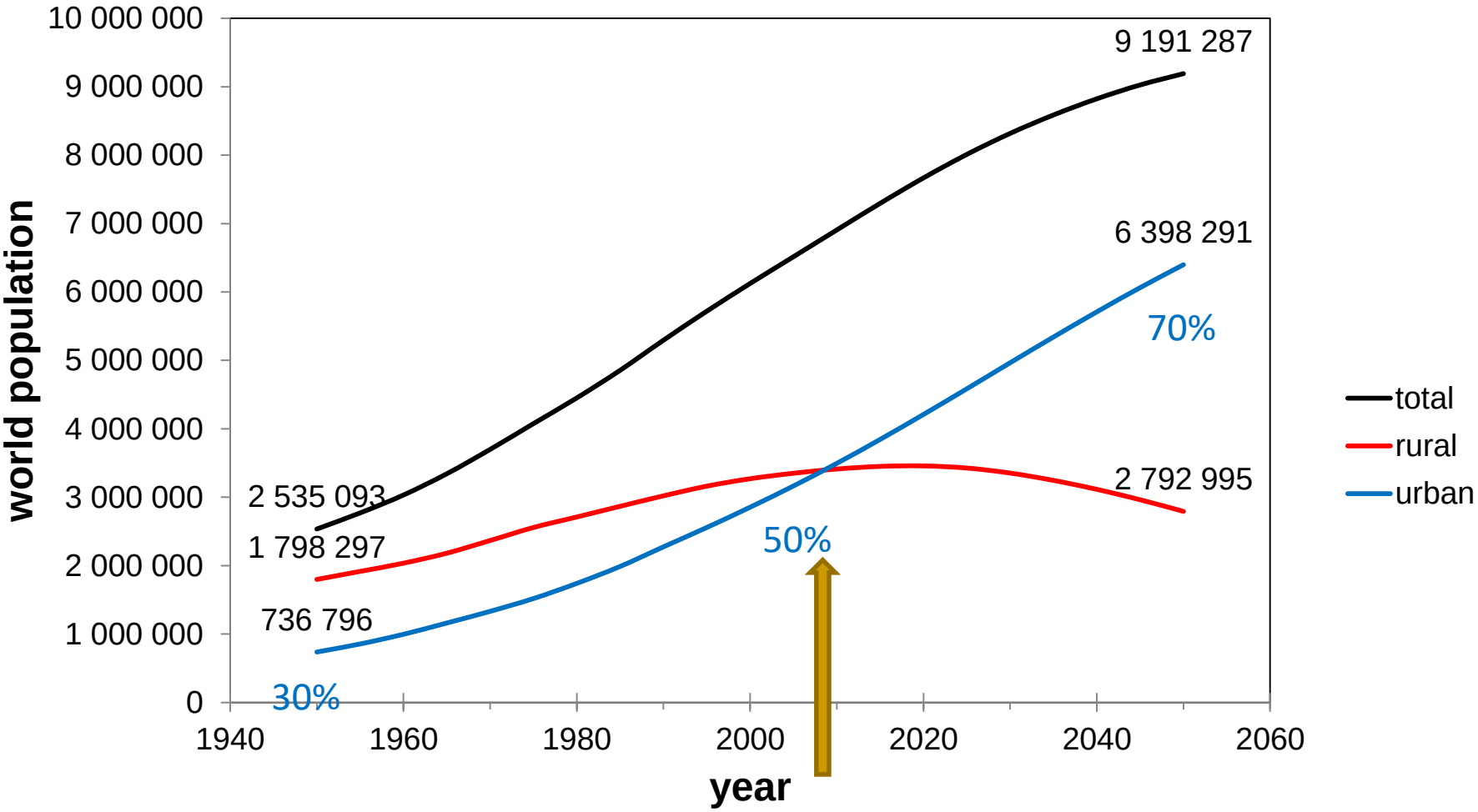
(Disturbing) human population growth curve.



http://albertideation.com/2009/12/21/world-population-growth-chart

World population: urban and rural.

http://esa.un.org/unup



More than 50 % of the world population is living within urban areas, since 2008. So solutions for ecological and sociological problems must be found within urban areas.

How can we design cities as part of a solution ?

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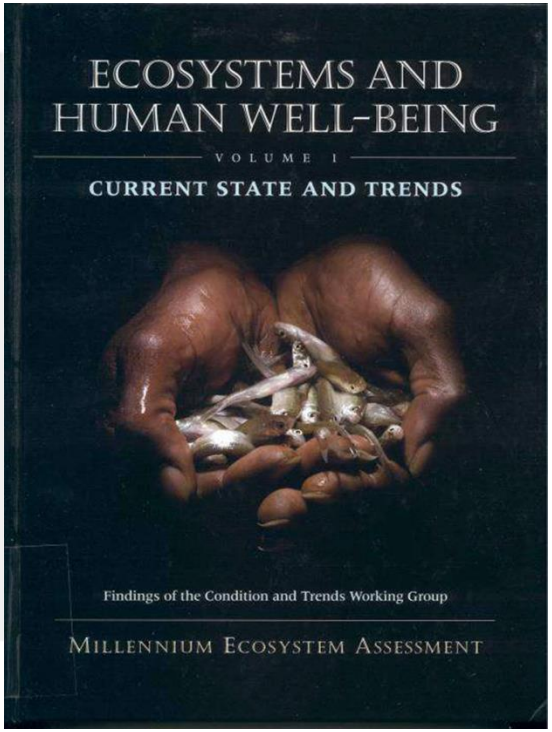
Ecosystem services.

'The benefits people obtain from ecosystems'
Millennium Ecosystem Assessment (2005)

'The contributions that ecosystems make to human well-being'
Common International Classification of Ecosystem Services (CICES) (2013)



De voordelen die mensen verkrijgen van ecosystemen
(MEA, 2005)

De bijdragen van ecosystemen tot menselijk wel-bevinden
(CICES, 2013)

Ecosystem Services:

The set of services that ' nature ' is offering to our society, for free :

Producing and providing services:

Food and fibres,
Fuel,
(Building)materials,
Fresh water, ….

Regulating services:

Carbon sequestration,
Climate regulation,
Erosion- and flood-control,
Water regulation and -purification,
Disease control ,
Pollination, ...

Cultural services:

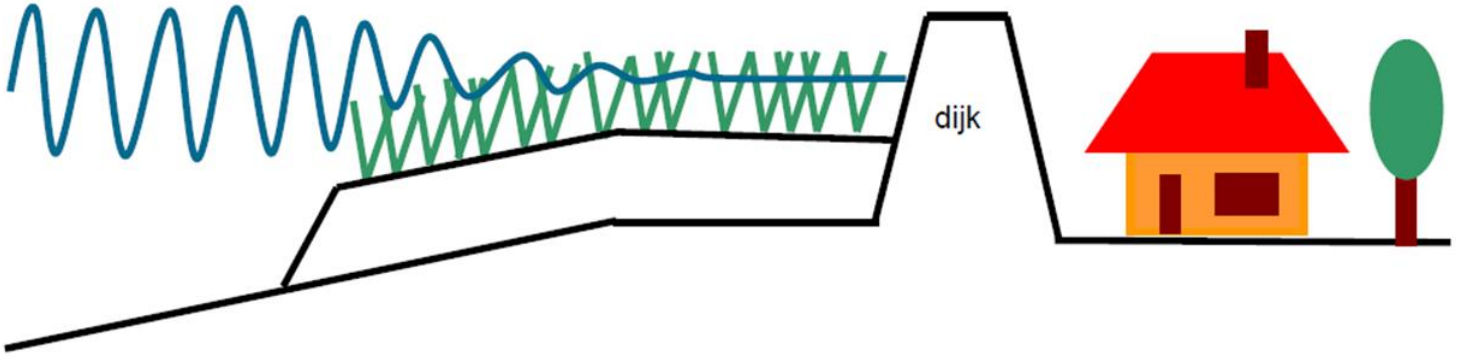
Inspiration,
Aesthetic, Spiritual, Educational,
Recreation,
Health ,...

Supporting services (necessary for services above)

Photosynthesis (C-cycling), Nutrient cycling (N, P, K, …)
Water cycling, Biodiversity, Soil formation,….

Naar HASSAN, 2005 ; MEIRE en VAN DYCK, 2014, etc. …

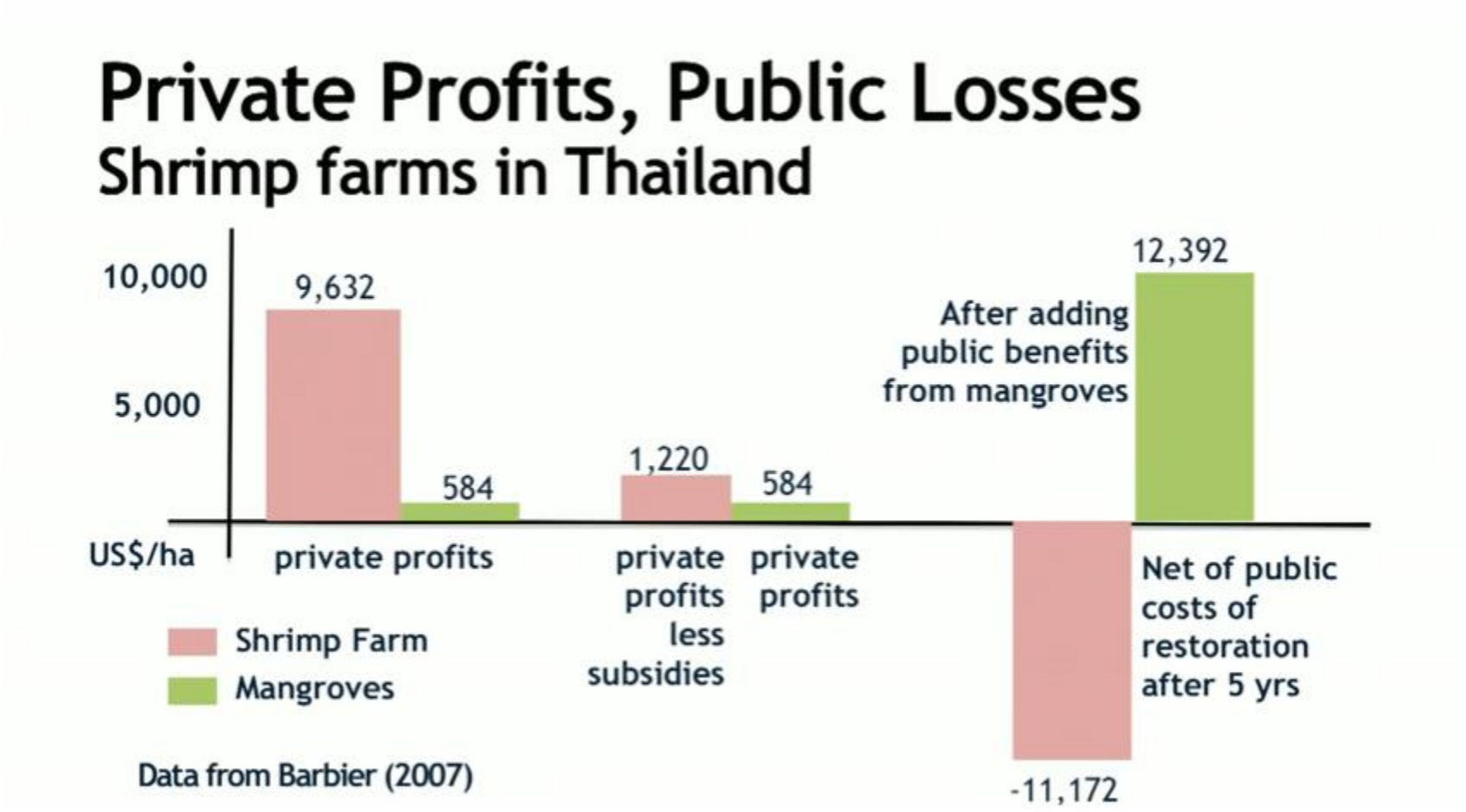
An *ecosystem service* such as coastal protection by mangroves is important for (sub)tropical regions against tsunami's and cyclones, as salt marshes are in Europe against flooding.



Mangroves and salt marshes temper wave power energy

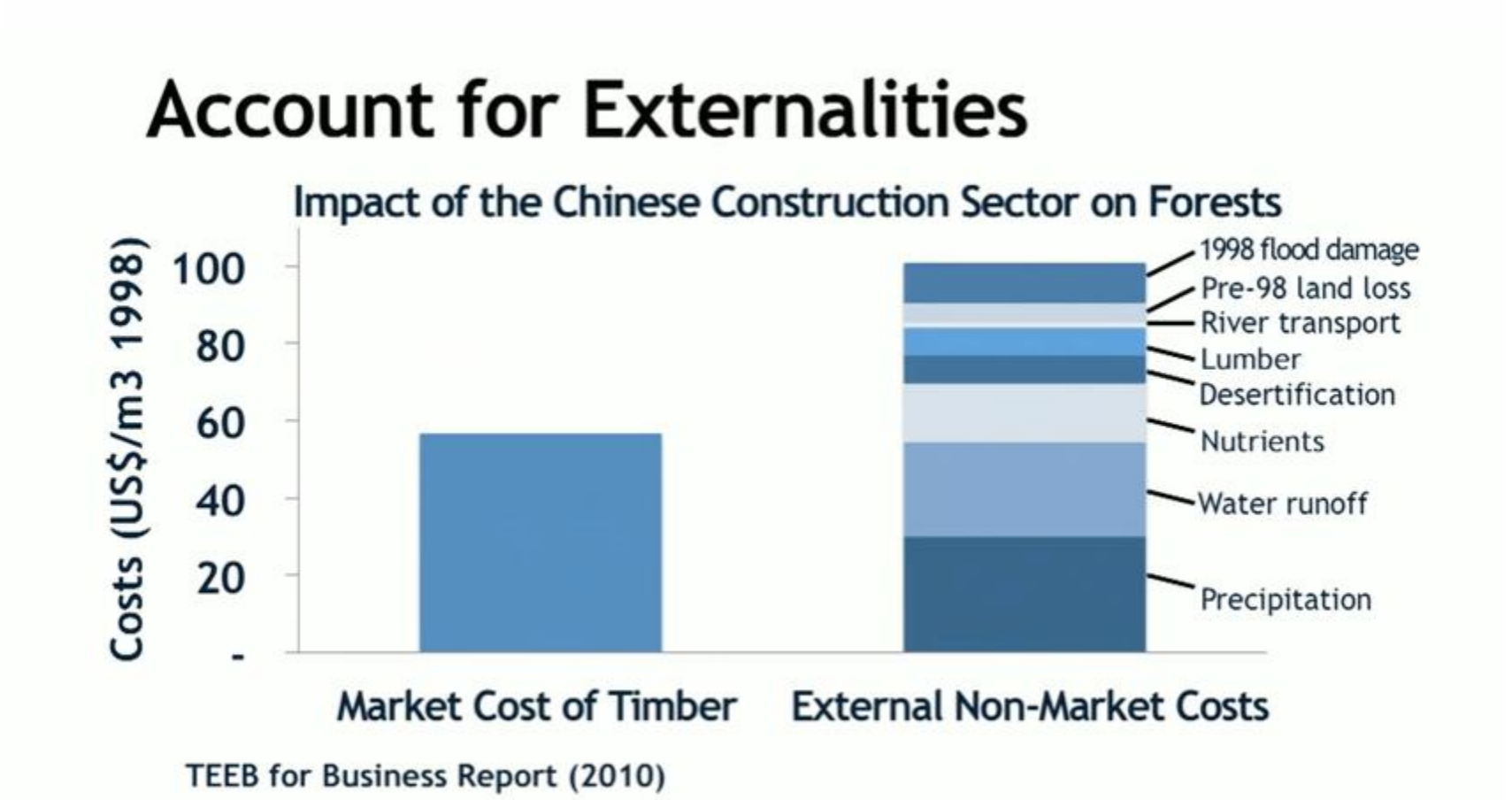
(after MEIRE 2013 ; MEIRE & VAN DYCK, 2014)

Replacing mangroves by shrimp farms: Poor profits linked with huge losses of public benefits (**Thailand**)



https://www.ted.com/talks/pavan_sukhdev_what_s_the_price_of_nature#t-952648

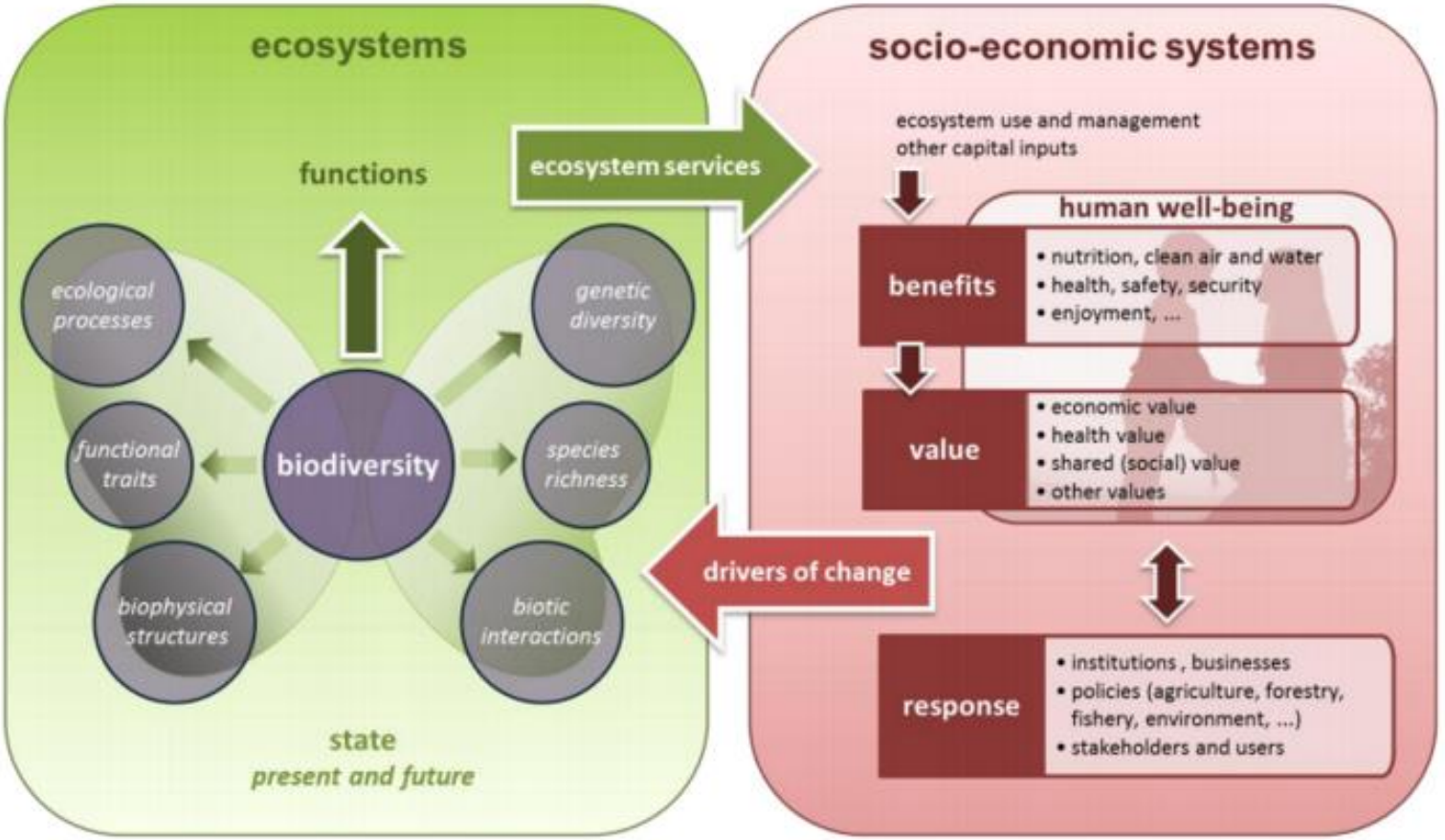
The benefits of selling timber (wood) meet merely half of the external costs in **China** caused by deforestation,



https://www.ted.com/talks/pavan_sukhdev_what_s_the_price_of_nature#t-952648

- Pavan Sukhdev, the Deutsche Bank economist leading a European study on ecosystems, reported that we are losing natural capital worth between US$ 2 trillion and US$ 4 trillion every year as a result of **deforestation** alone (https://www.ted.com/talks/pavan_sukhdev_what_s_the_price_of_nature#t-952648)
- The losses incurred so far by the financial sector amount to between US$ 1 trillion and US$ 1.5 trillion. Sukhdev arrived at his figure by estimating the value of the services — such as locking up carbon and providing fresh water — that forests perform, and **calculating the cost of either replacing them technically, or living without them**.
- So the credit crunch (financial crises 2008) is petty when compared to the nature crunch (biodiversity crises, extinctions).

Concept '*Ecosystem services*' seems on its way to enable a serious debate on 'monetary value' of functions that are difficult to quantify.



http://biodiversity.europa.eu/maes

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One ecosystem service in detail:

The cooling effect of vegetation.

Infrared spectrum

Visible spectrum

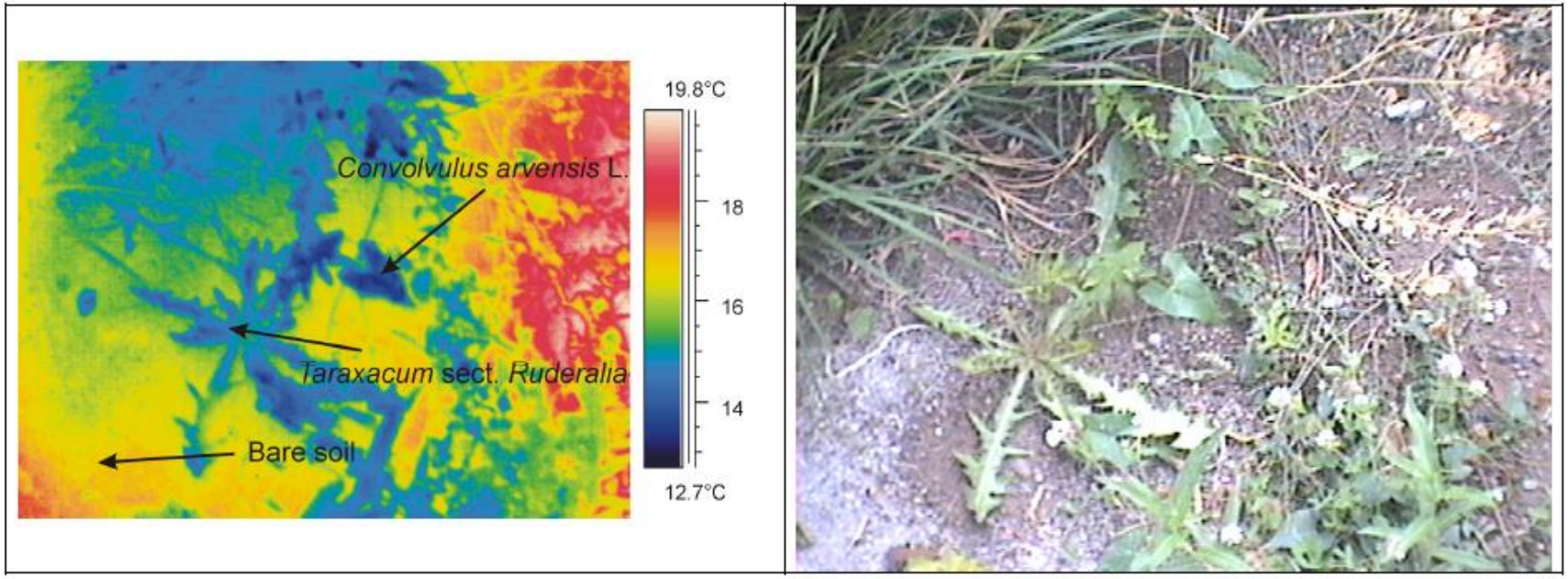


***Fig. 7* Photographs of thin vegetation in the infrared spectrum and in the visible spectrum**. The bare surface of the ground is visibly warmer than the surface of the leaves cooled by transpiration. (Třeboň, Czech Republic, 12 July 2002, 10:00 hrs).

Kravčík, M. et al., 2008. Water for the recovery of the climate. A new water paradigm. Košice (Slowakia), Typopress-publishing house, ISBN 978-80-89089-71-0. 122 pp. Ill

The cooling effects of water evaporation and of transpiration through **vegetation**.

- 80-90 % of the plant biomass is water, water is also needed for photosynthesis.
- **Evaporation** (1) includes *physical* vaporization from the soil and from plant surfaces.
- **Transpiration** (2) (*biological*) is the water taken by the roots, transported through the plant and leaving through the stomata of the leaves (which can be opened and closed, regulating the amount of transpiration). The total amount of involved water is **evapotranspiration** (1+2)
- Because the vaporization of water needs a lot of latent heat, this system cools the local area down. The evaporation of 3 litres/m^2 of water needs 7,5 MJ /m^2. This is far more than the solar energy needed for photosynthesis: the production by photosynthesis of 10 grams plant material requires only 170 kJ.

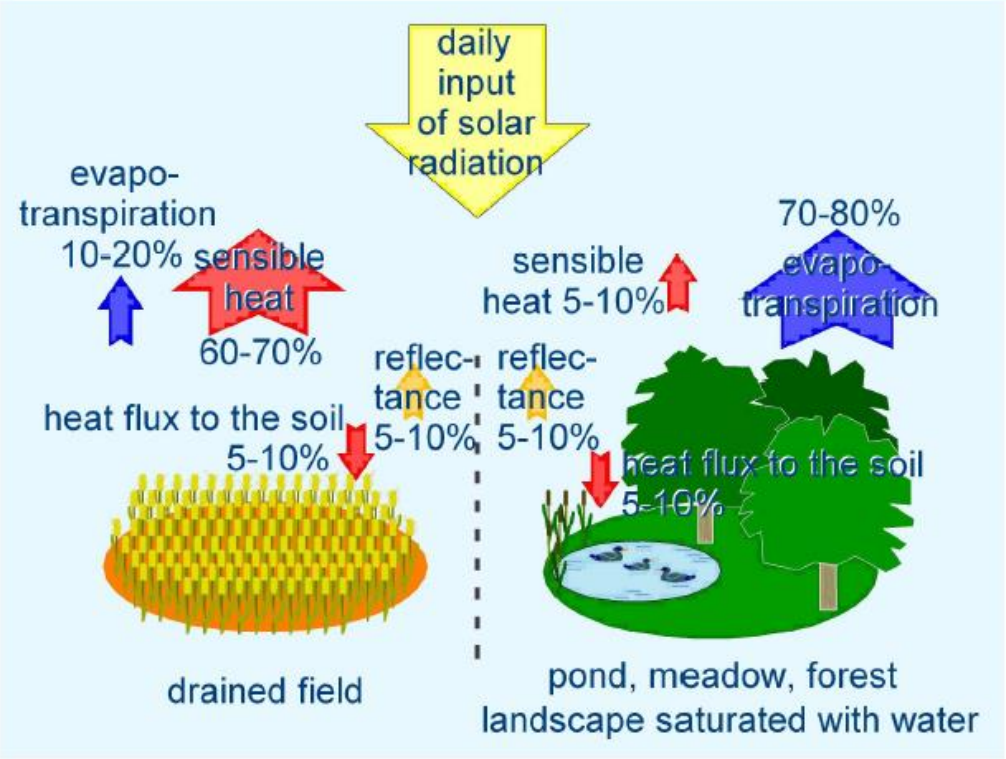


Fig. 4 **The distribution of solar energy on drained land and on a landscape saturated with water**

The input of solar energy is turned into sensible heat, in **drained landscapes** (left), which is leading to **higher local temperature**.

Wetlands (right) turn solar energy into latent heat, taken away by evapotranspiration, and thus **lowering local temperature**.

The concept of the **large** and small **watercycle**.

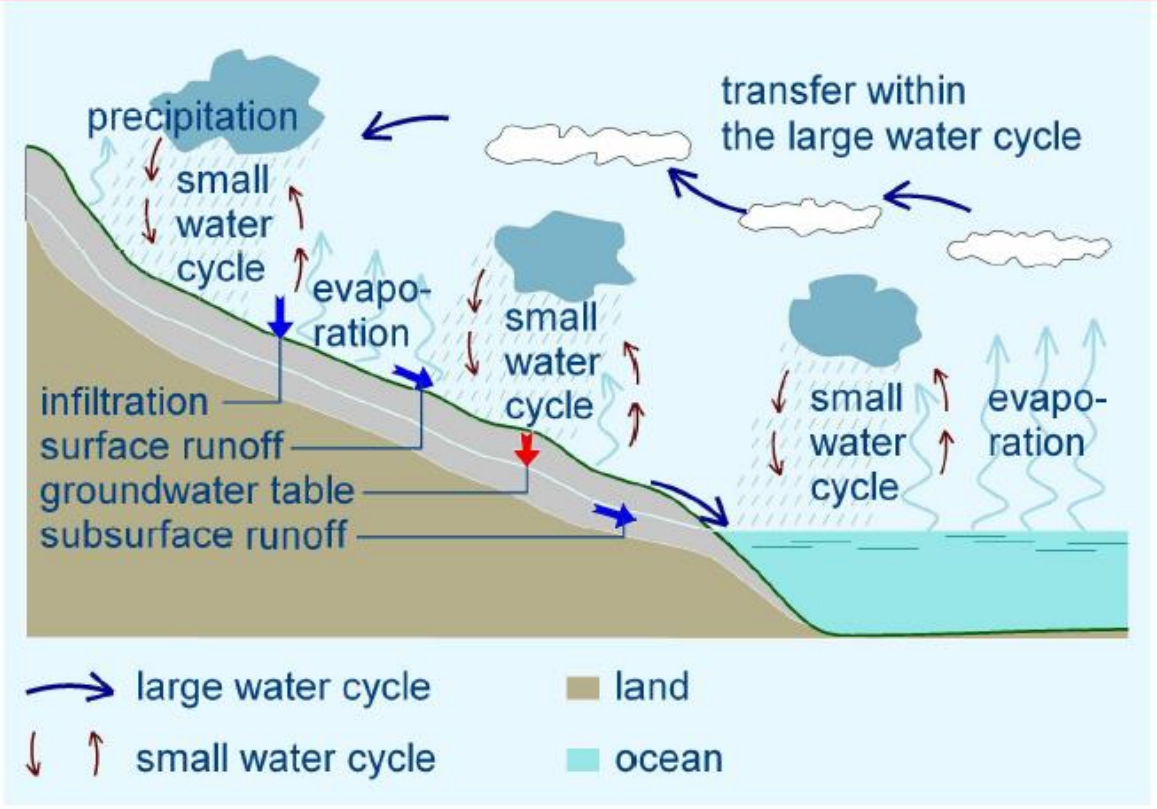


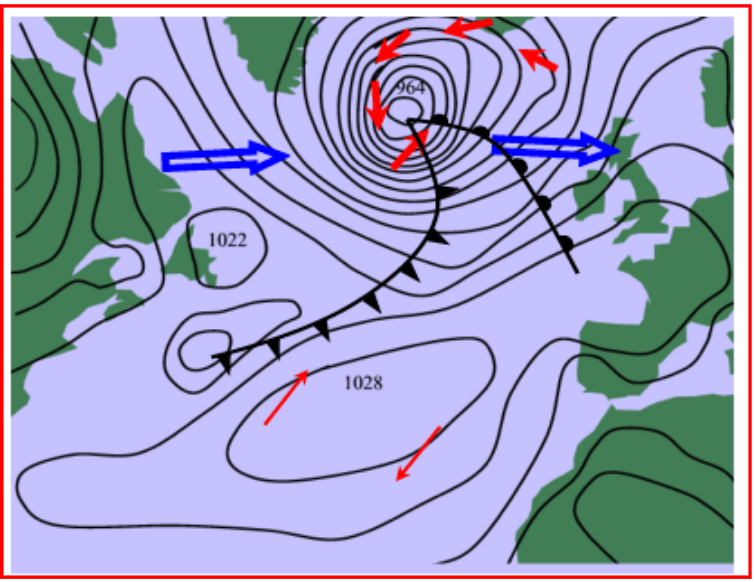
Fig. 1 **The large and small water cycles on land**

The **large water cycle**: exchange of water between oceans and land.

- 550.000 km³ of water evaporates / year into the atmosphere, 86 % from seas and oceans, 14 % from land.
- Atmospheric precipitation falls 74 % over the seas and 26 % over land.
- So there is a contribution from oceans, endowing the land with 12 % (86 % - 74 %) more water than is locally evaporated. This surplus is transported over a great distance above the land by clouds.

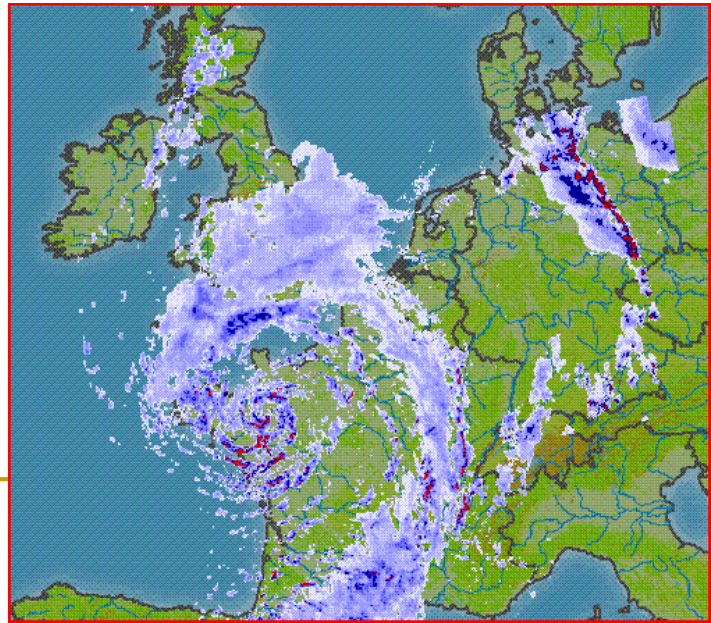
Source: Kravčík, M. et al., 2008.

Depressions on the Atlantic ocean and North sea bring precipitation towards Europe (the large water cycle).



www.kayarchy.co.uk

Scotland: rain showers are coming on land, from the Atlantic ocean and the North Sea, carried by depressions.



The concept of the large and **small watercycles**.

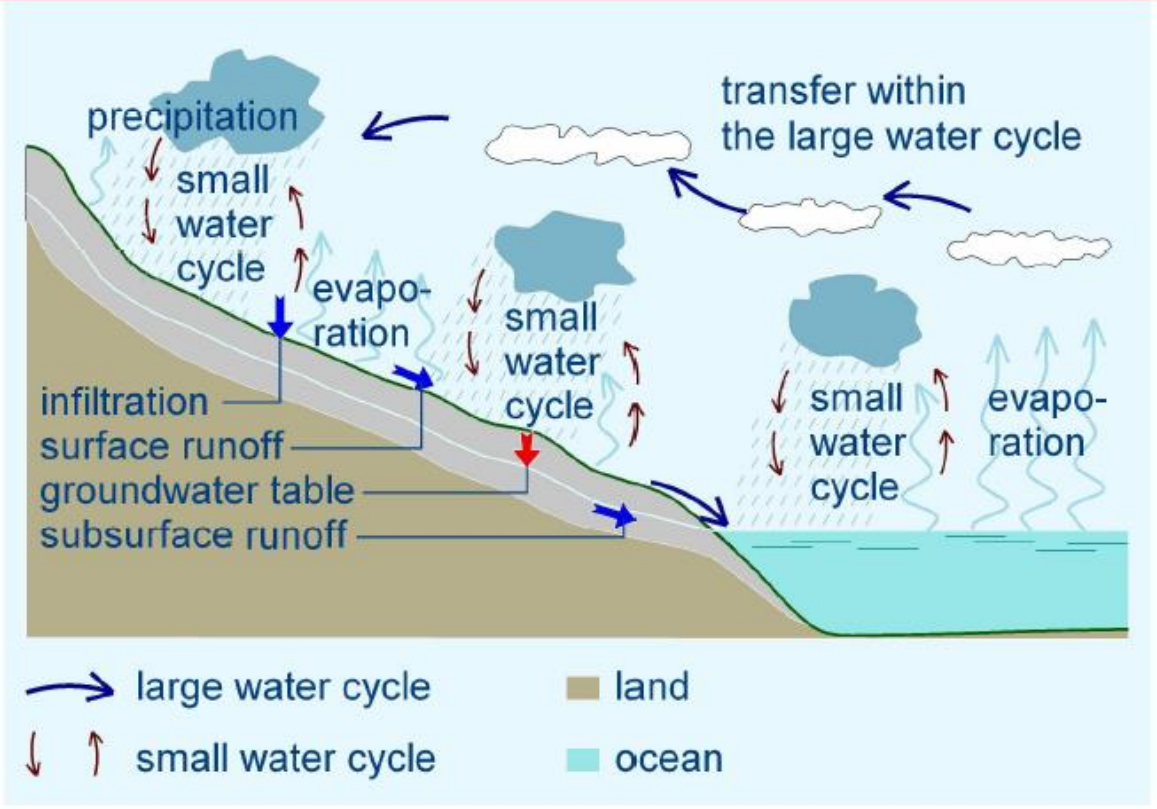


Fig. 1 **The large and small water cycles on land**

Forests, wetlands, especially moorland, are contributing very much to local evapotranspiration, and to local small water cycles, cooling down local temperatures, increasing local air humidity (fog).

www.natuurrondleidingen.nl

Moorlands in Finland.

The **small water cycle**: a closed circulation of *locally* evaporated and transpirated water, which falls again as precipitation in the same region.

- Average rainfall in **Slovakia** is 720 mm/year. Input from oceans is 310 mm/year. Locally produced precipitation through small water cycles is 410 mm/year (!!). So the regional precipitation comes for more than 50 % from locally evapotranspirated water.

- So mankind cannot transform and drain the land limitlessly, without having a serious impact on its local precipitation: the volume of the small water cycle will gradually decrease. So a self-reinforcing phenomenon of further drying-out of the local environment is started: *more urbanisation and run-off, less evapotranspiration, less local rainfall, more drought and sensible heat, higher temperatures because the cooling effect of the evapotranspiration is decreasing....*

A stable water cycle, over time.

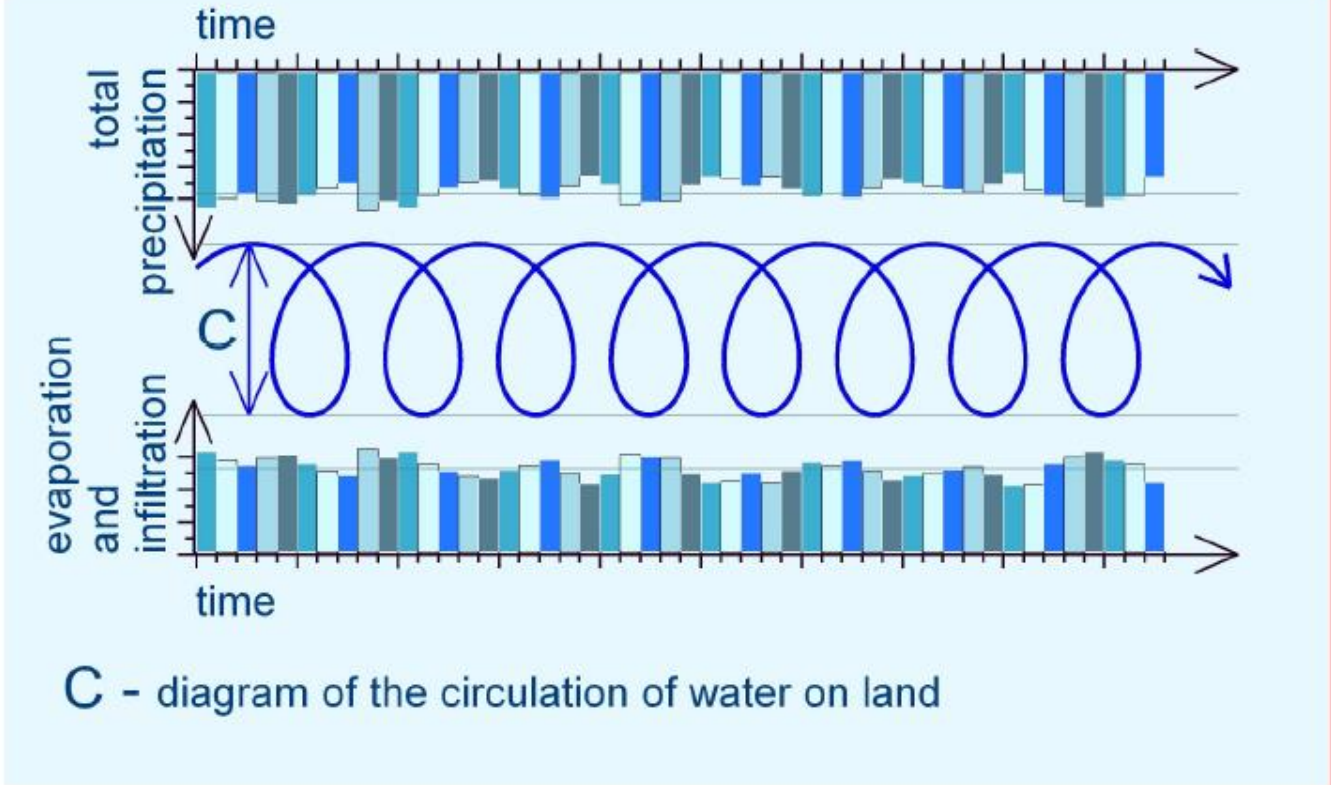
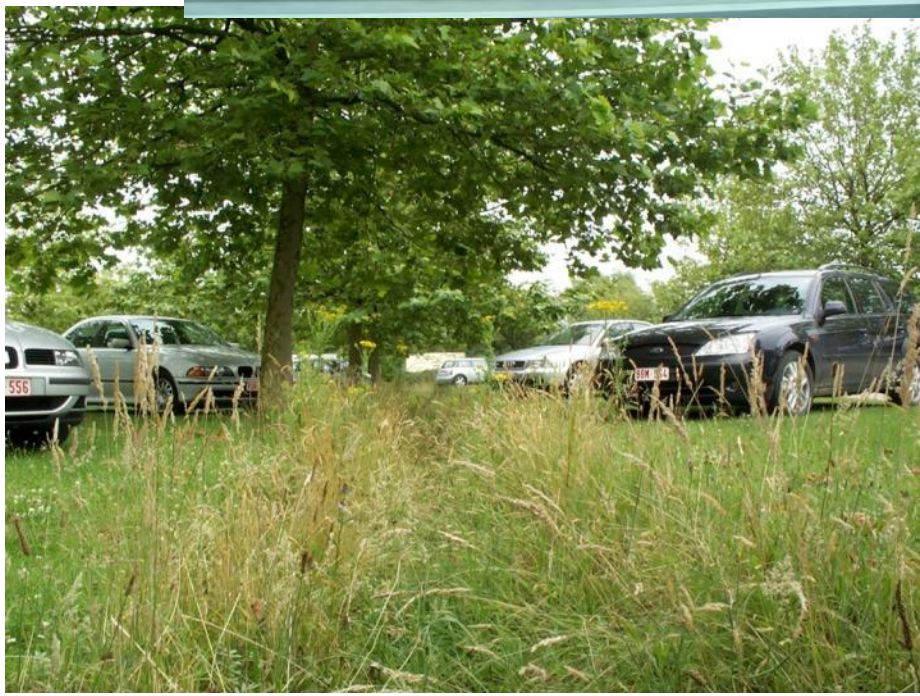


Fig. 2 **Diagram of the long-term stable water cycle on land**

Stable local evapotranspiration over time, leads to stable small water cycles providing stable local precipitation.

Good examples: permeable parkings.

Mechelen (B). Parking
Planckendael (Muizen)



Sint-Niklaas (B). Parking
Recreation area ‘De Ster’.

Contribution to the local water cycle, through the evaporation of a swimming pond.

Especially in dry urbanised regions it is important to restore the local contribution to the small water cycles, as is shown by this swimming pond example in which the local rain water is harvested from adjacent roofs, evaporating into the air.

Bad examples: non-permeable seal, disturbing local small water cycles, huge RUN-OFF.

Sint-Gillis Waas (B).
New parking areas for super markets Carrefour/GB en Aldi.

Additionally, these parking areas significantly contribute to the **urban heat island effect,**

Consequences of decreasing the small water cycle.

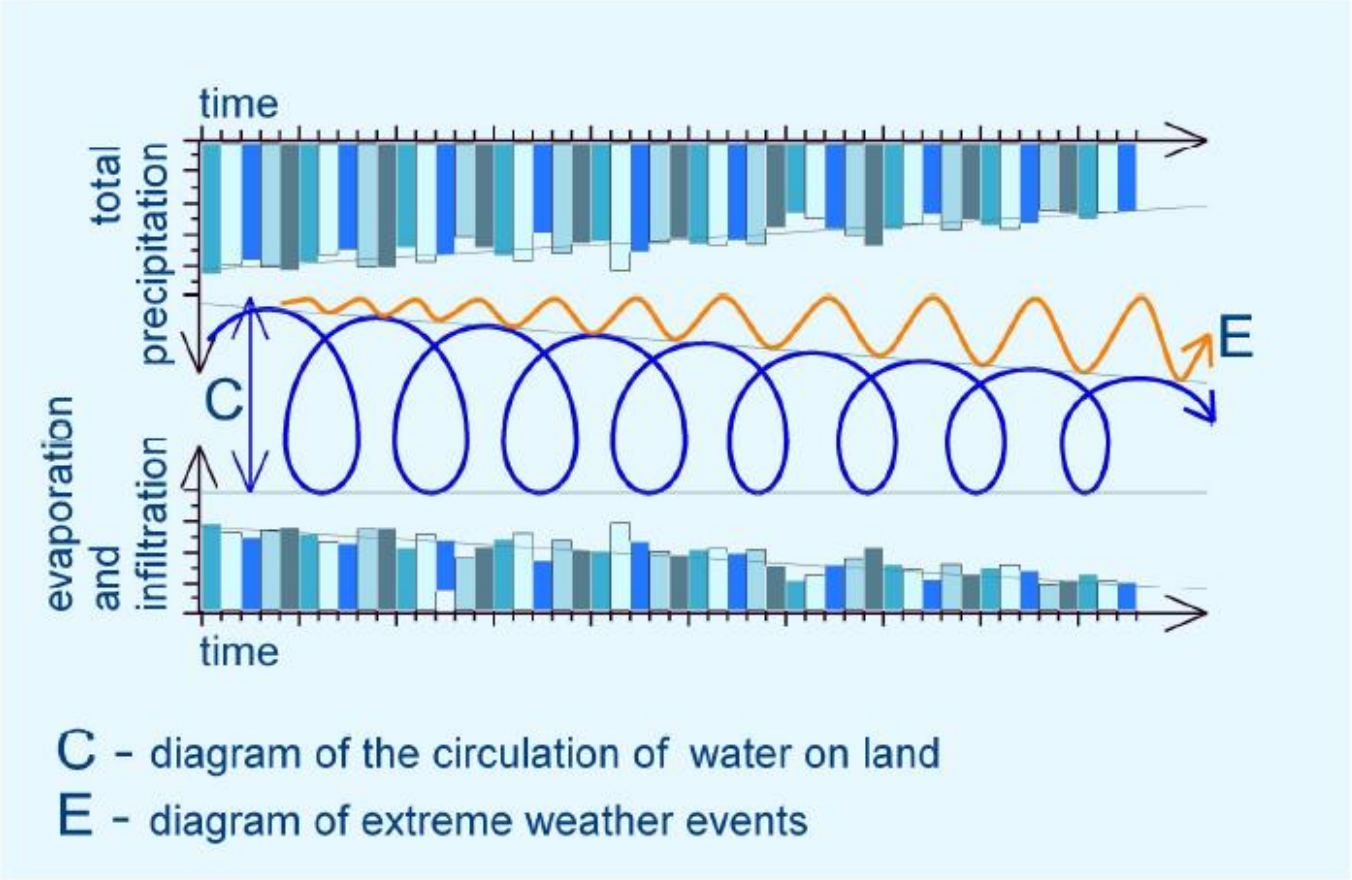


Fig. 17 **The growth of extreme weather with the decrease of water in the small water cycle**

Less evapotranspiration leads to decreasing locally generated rainfall and increasing risks **<u>for extreme weather events,</u>**

Slovakia, Tatra mountains. Situation 1800.

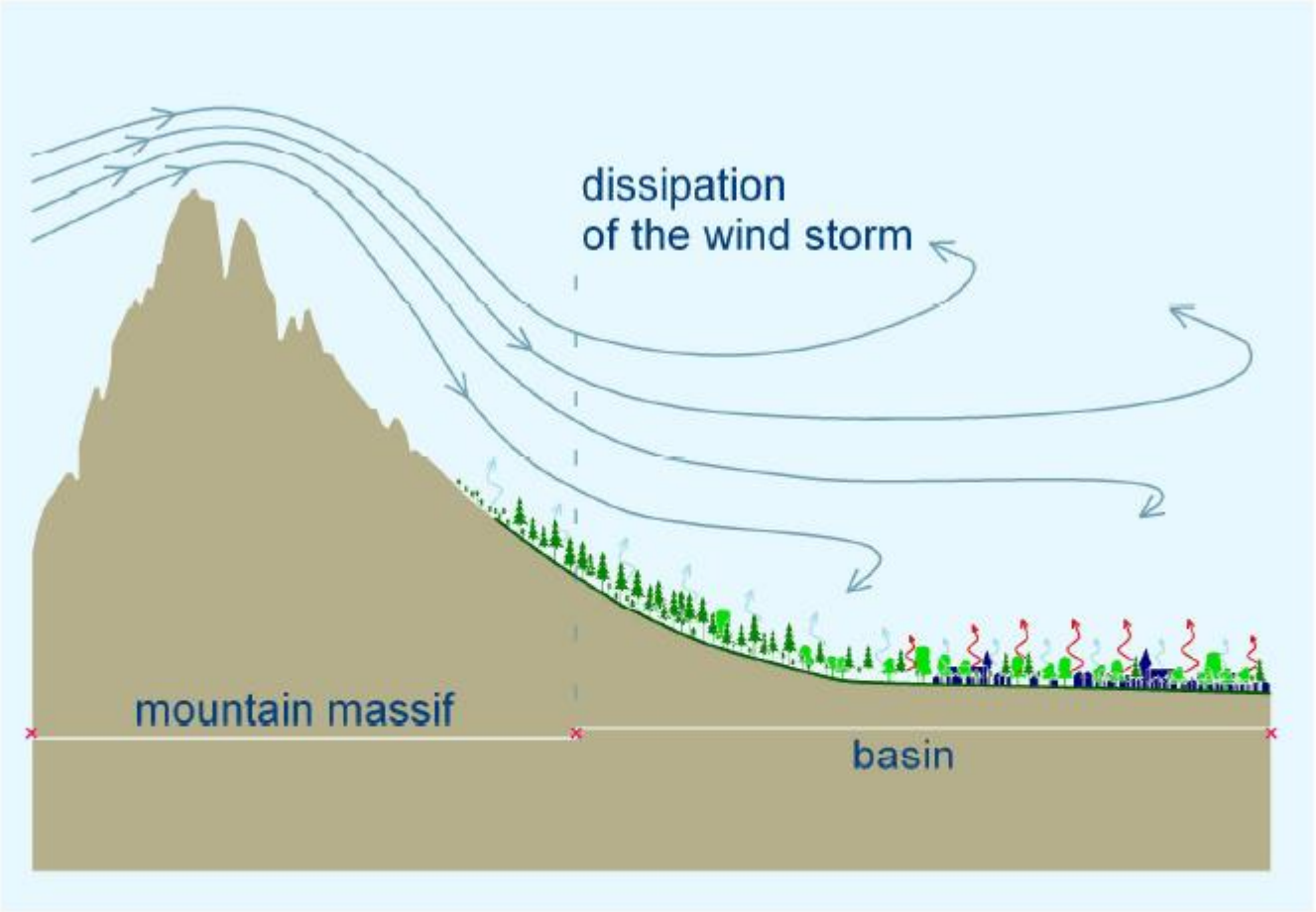


Fig. 24 **The incursion of cold air to the High Tatras regions (the Tatra bora) - the assumed state around the year 1800**

The conditions of the land under the mountains allowed for the gentle dissipation of the currents.

The destruction of the small water cycles by urbanisation and by draining for agricultural and forestry purposes.

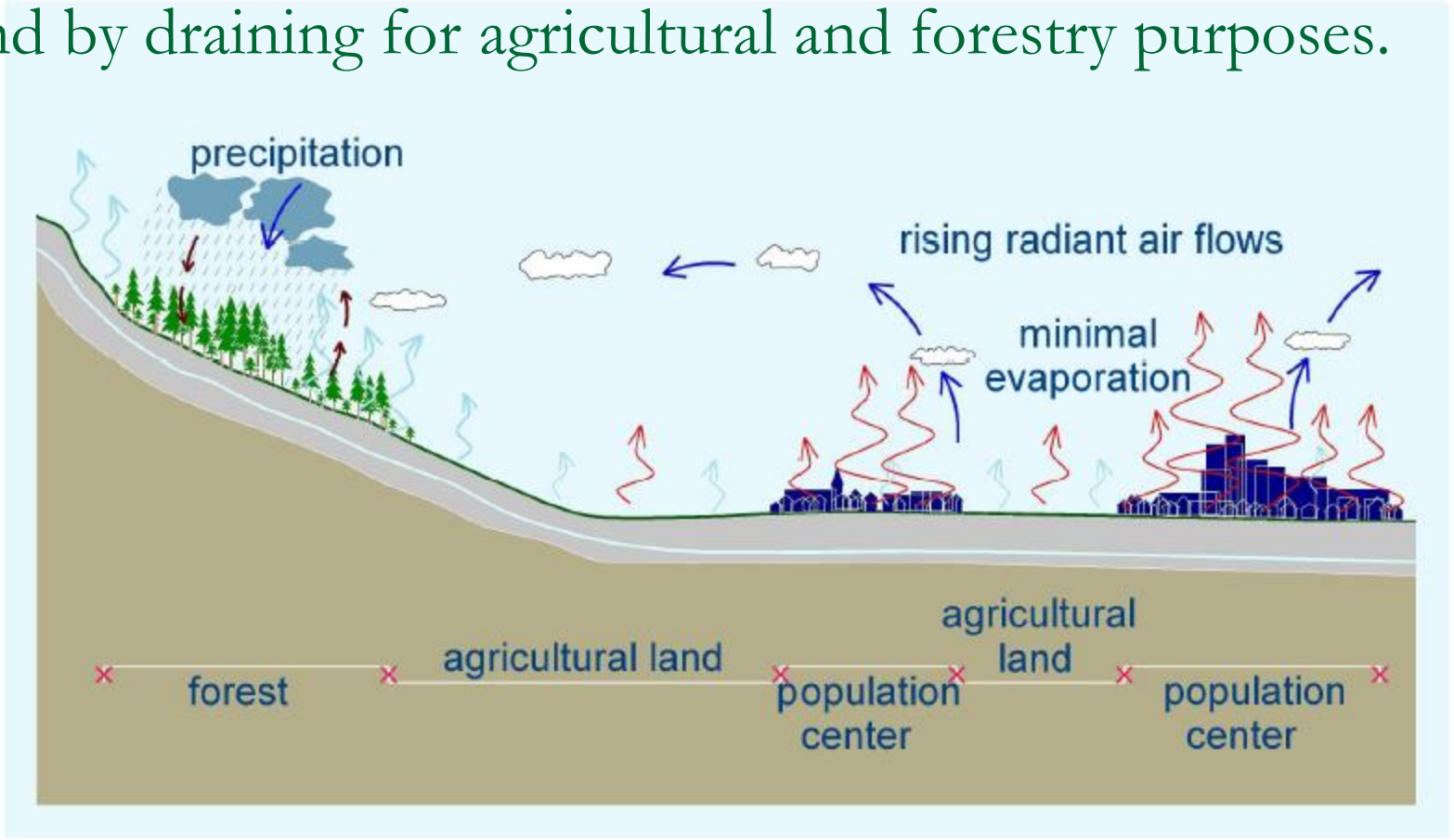


Fig. 18 **The impact of the transformation of land on the destruction of small water cycles**

Rising radiant flows push clouds to cooler environments.

Slovakia, Tatra mountains. Situation 2004.
Growing and increasing temperature contrasts thus:
Increasing risks for extreme weather events
See also flooding in **Balkan countries**
Spring 2014

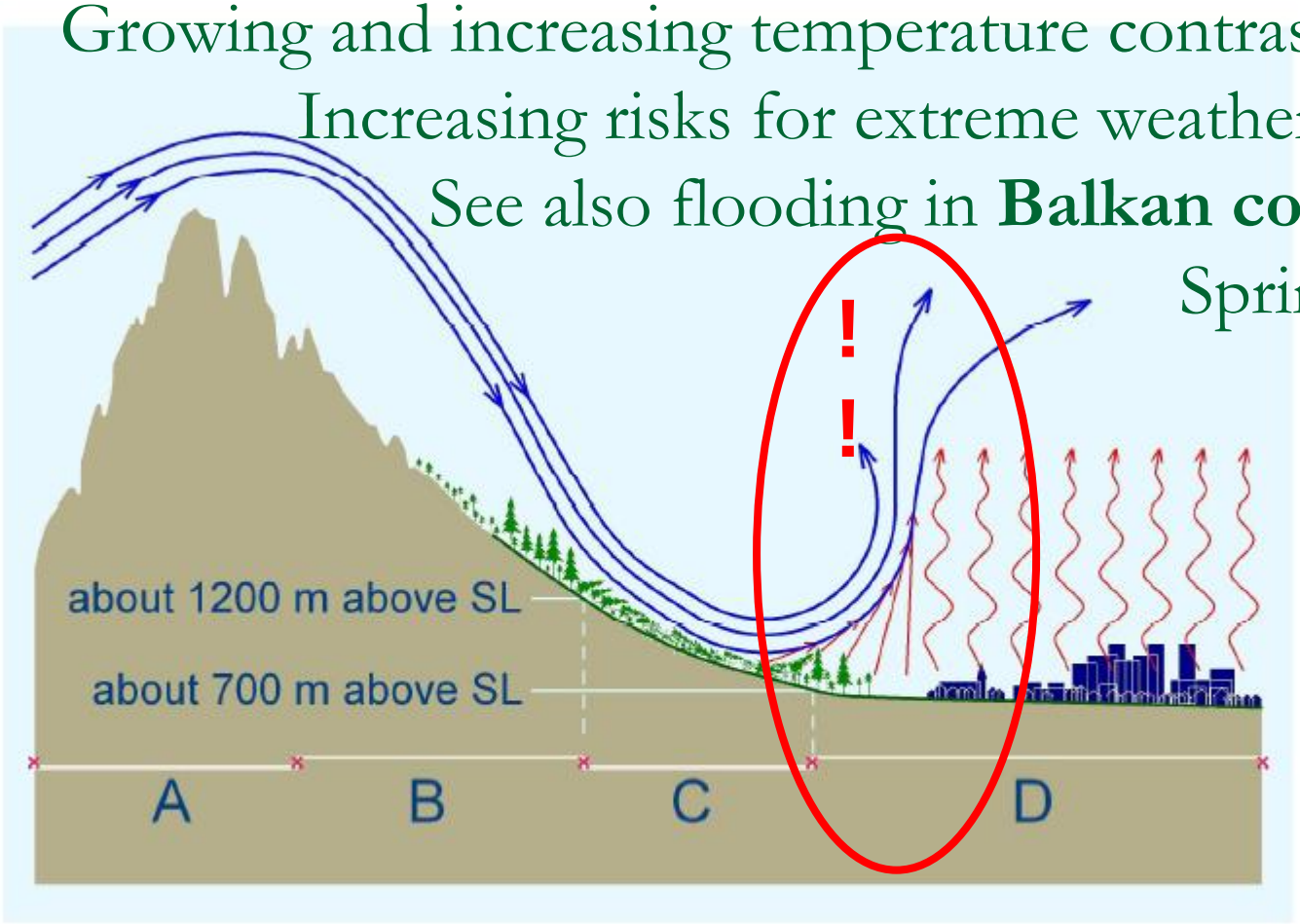


***Fig. 25* Wind storm in the High Tatra mountains, Slovakia, November 19, 2004**
Radiant flows of warmed currents from agricultural-urban areas (zone D) accelerated air currents with the rapidly falling cold front through the ridge of the High Tatra mountains: v(A) 150 – 200 km/h, v(B) < 100 km/h; v(C) 200 – 250 km/h, v(D) < 150 km/h.

Small water cycle restoration measurements, such as here in the Tatra mountains (Slovakia) do matter, for *local climate* but are also *preventing flooding* downstream and *preventing erosion*

***Fig. 35* A Water Forest in the High Tatras – building water conservation measures on territory destroyed by a natural disaster**
An example of the renewal of vegetation and hydrological stabilization of a territory through the conservation of water on land.

Restoring the *small urban and rural water cycles* leads to local climate recovery and decreases risks for extreme weather events.

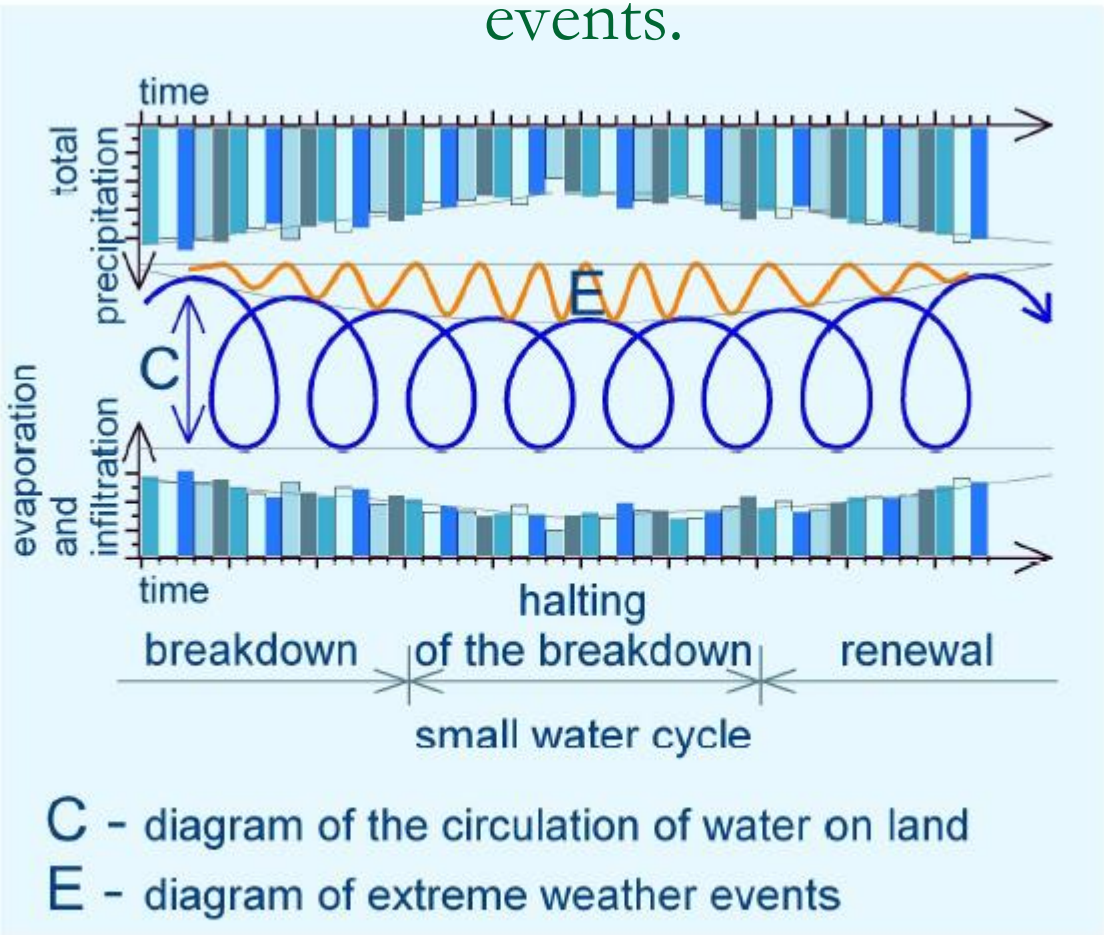


Fig. 27 **The course of destruction of the small water cycle over land until it is halted and then renewed to its original state**

Wetland landscapes remain cooler than dry landscapes

The presence of water as a local temperature regulator, in both urban and rural areas, is a very important ecosystem service.

As long as there is local water and moisture available (in rural but also in urban areas) the (summer) temperatures remain moderate and constant and do not exceed 30-35 °C (as in *(sub)tropical rainforests*). That is because locally evapotranspirated water volumes do evacuate a lot of latent heat, which therefore is not turned into local sensible heat.

From the moment on water disappeared, temperatures will increase dramatically up to 50 °C and even more. This explains *desertification* as a consequence of drought, but it explains also the existence of the **urban heat island effect**.

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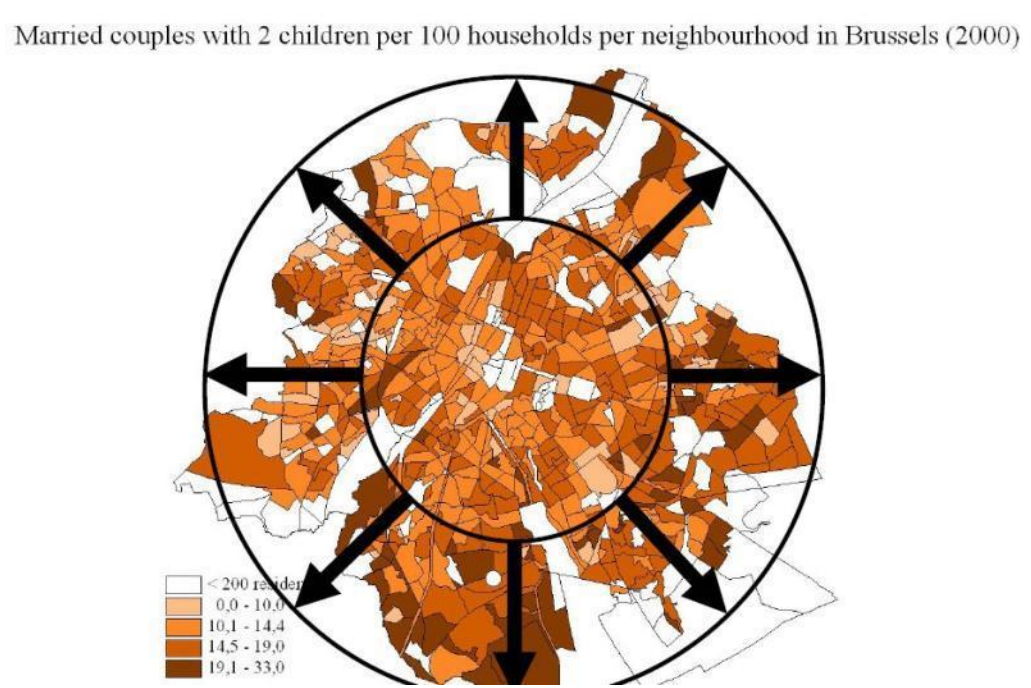
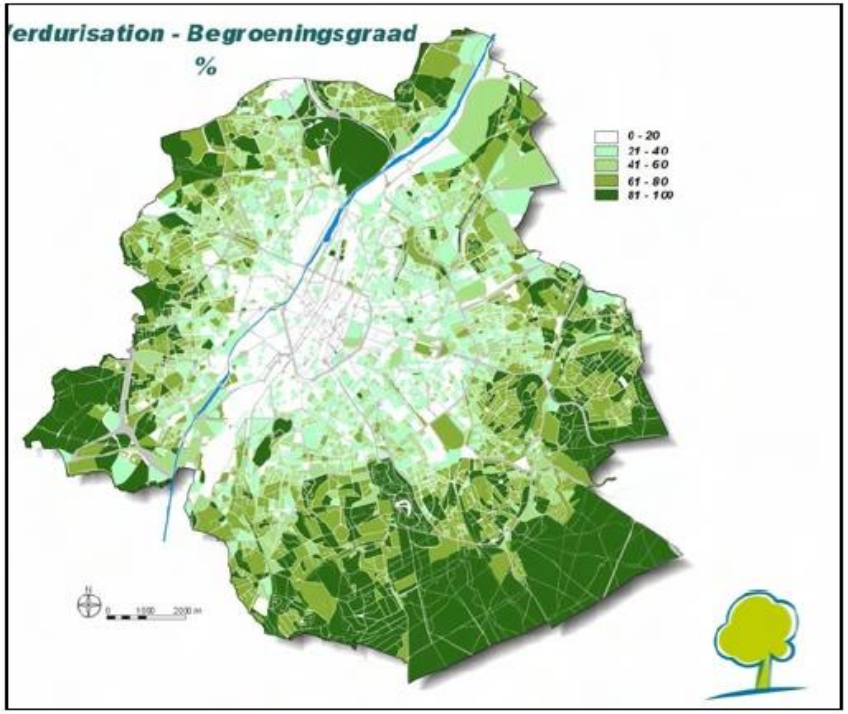
Brussels (1,100,000 inh. ; Belgium, European capital)
Younger families with children leave (flee from) the city centre and move to the green city fringe and rural areas.

traffic insecurity

lack of adventurous public green



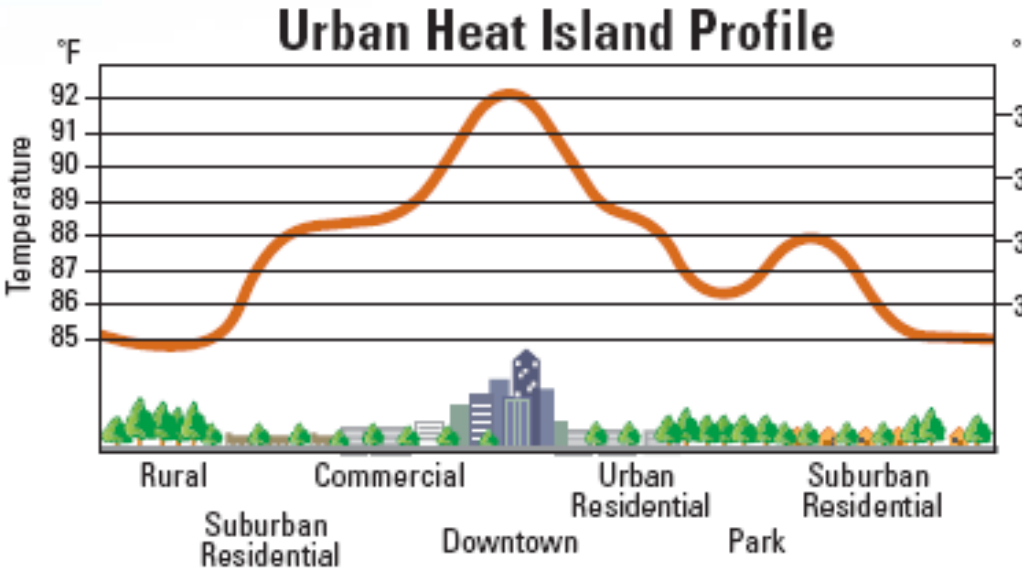
From De Corte, 2005



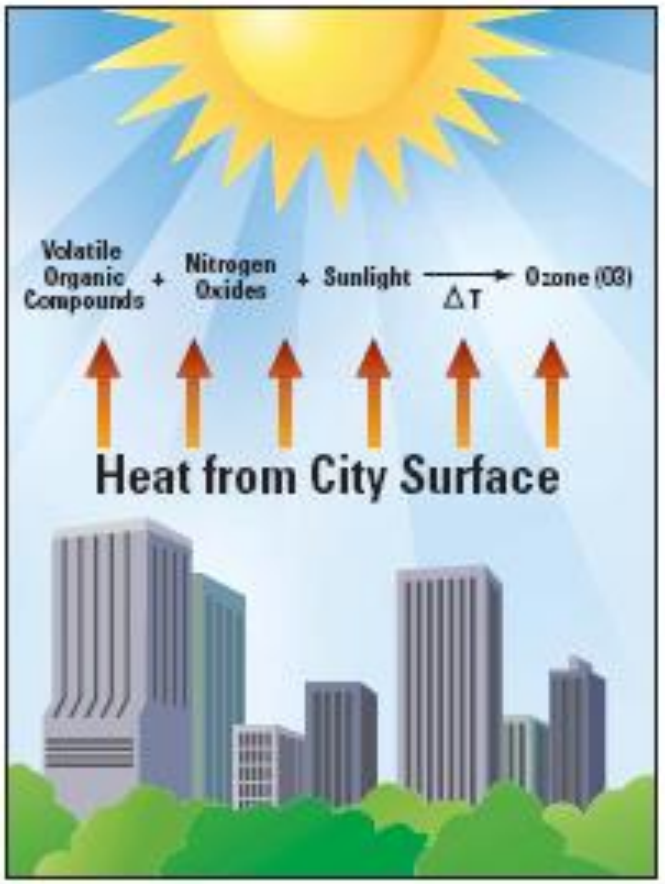
Proportion of green, open spaces in Brussels Capital Region
Source : IBGE-BIM

Concentric expansion of cities has a lot of disadvantages:
Lack of ventilation with fresh and humid air (summer smog)
Increasing distances to the rural areas
Athens (5,000,000 inhabitants ; Greece.)

The urban heat island effect.



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

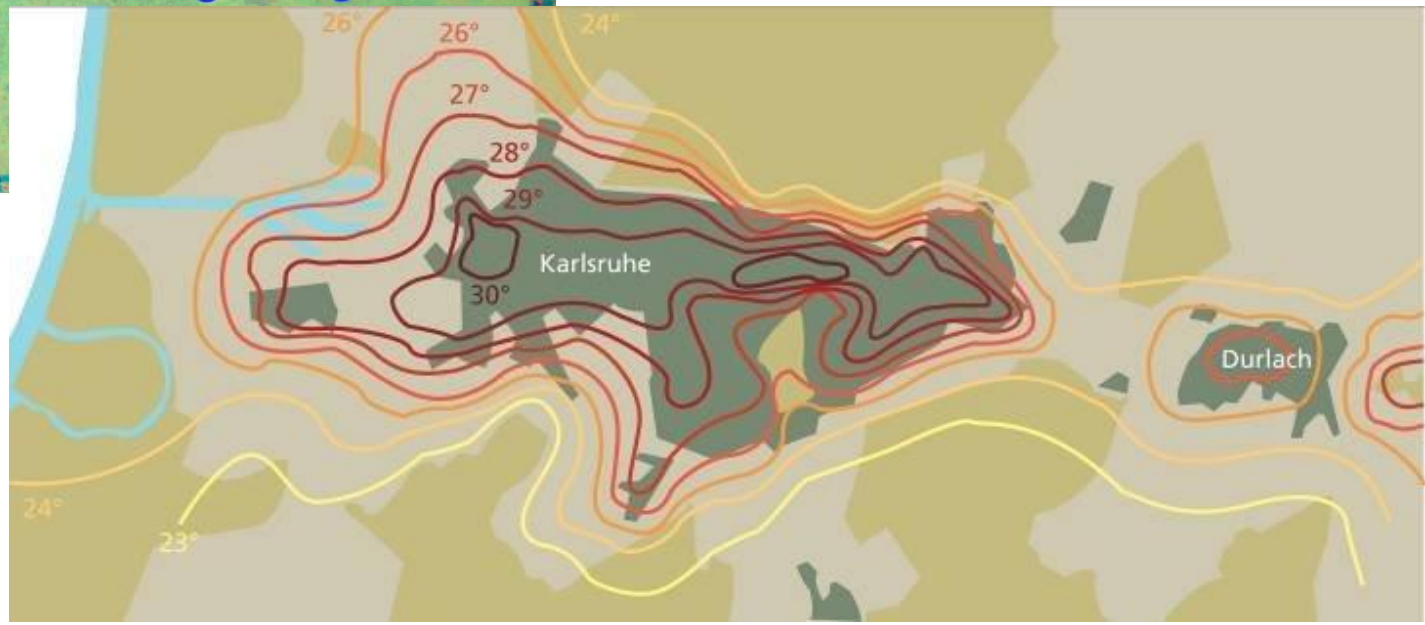


Ozone forms when precursor compounds react in the presence of sunlight and high temperatures.

http://www.epa.gov/heatislands/resources/pdf/HIRIbrochure.pdf

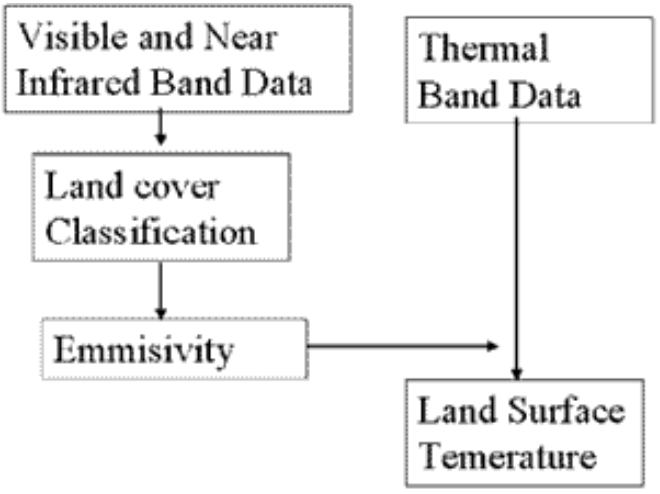
Gartland, Lisa. 2008 . Heat Islands. London, Earthscan,

ISBN 978-1-84407-250-7



The urban heat island effect in Karlsruhe (290.000 inh. ; Germany). Source:Hermy, 2005.

Some Asian examples



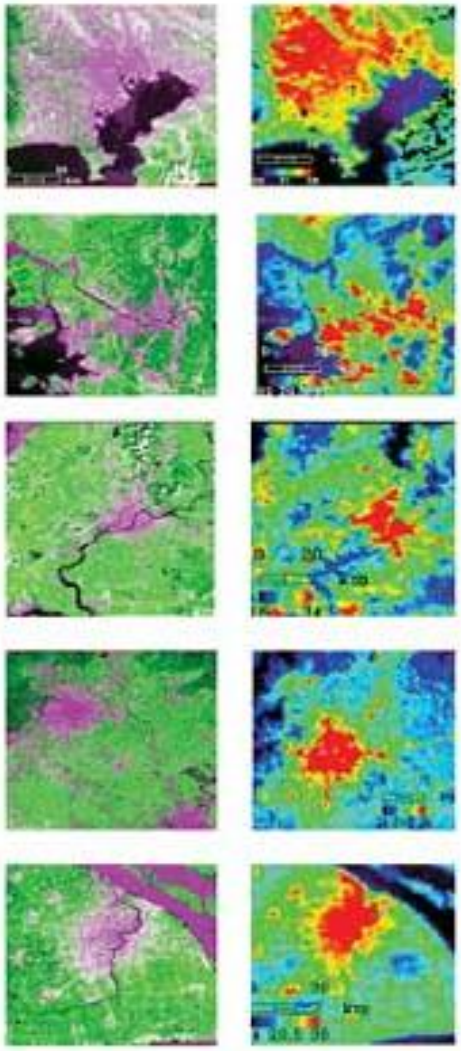
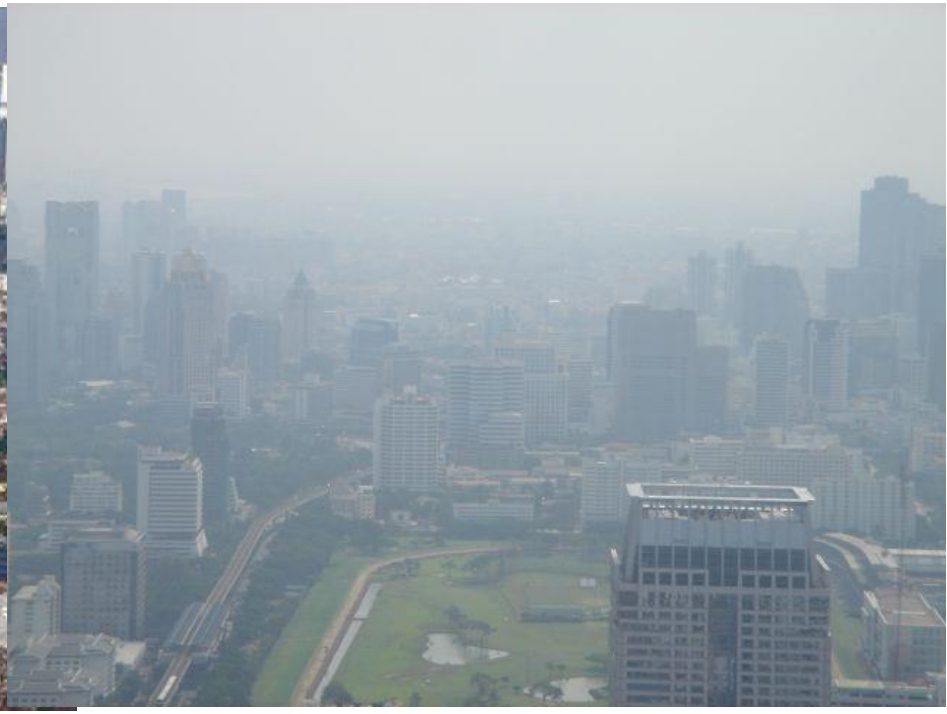


Fig-3 Visible band and thermal band for the study sites (Tokyo, Seoul, Pyongyang, Beijing and Shanghai, from top)

Monitoring Urban Heat Environment in East Asia, Shiro Ochi et al, Institute of Industrial Science, University of Tokyo
Source: http://www.gisdevelopment.net/application/urban/overview/urbano044pf.htm

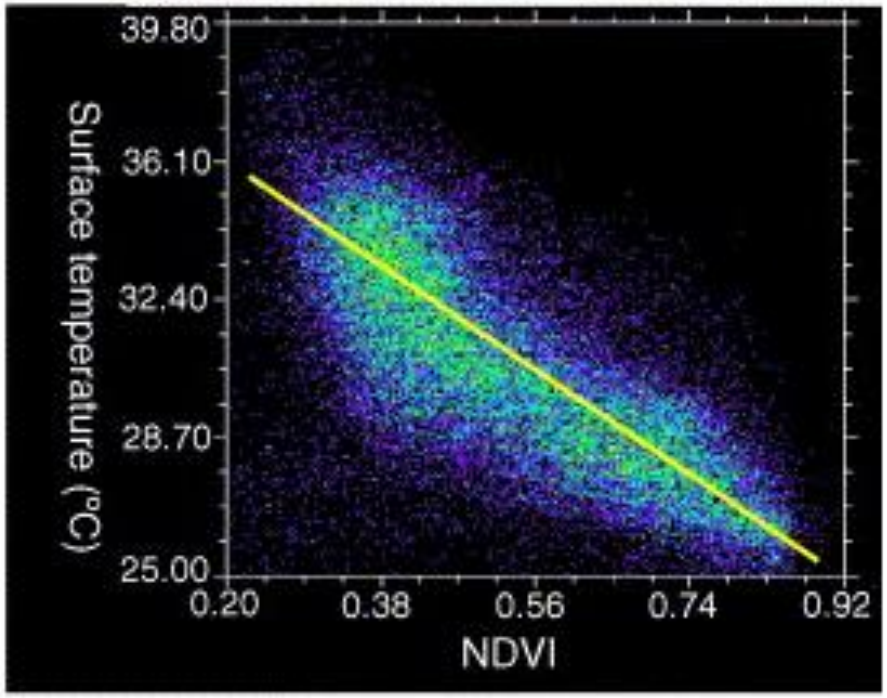
As in so many other concentric growing unplanned cities, also **Bangkok** suffers from the urban heat island effect and summer smog, raising see level, sinking city in the muddy soil because of extracting groundwater under the heavy built-up area.



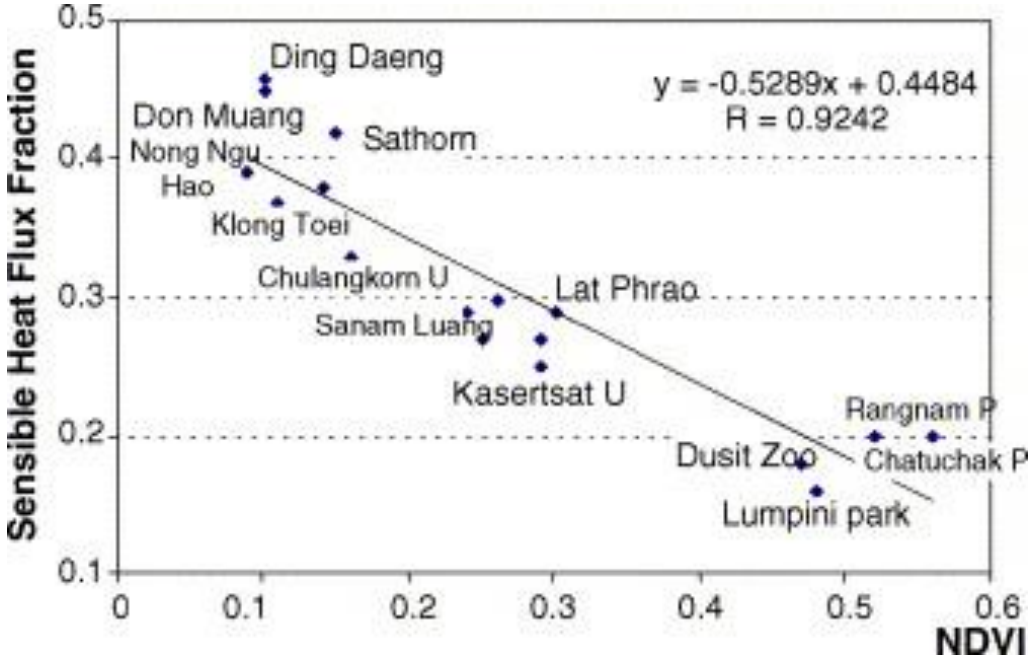
http://www.zoover.be/thailand/thailand/bangkok

http://www.tkolar.com/travel/Asia/Thailand/Bangkok/Bangkok.html

Effects of vegetation on UHI-effect: The example of Bangkok (International Journal of Applied Earth Observation and Geoinformation Volume 8, Issue 1, January 2006, Pages 34–48)

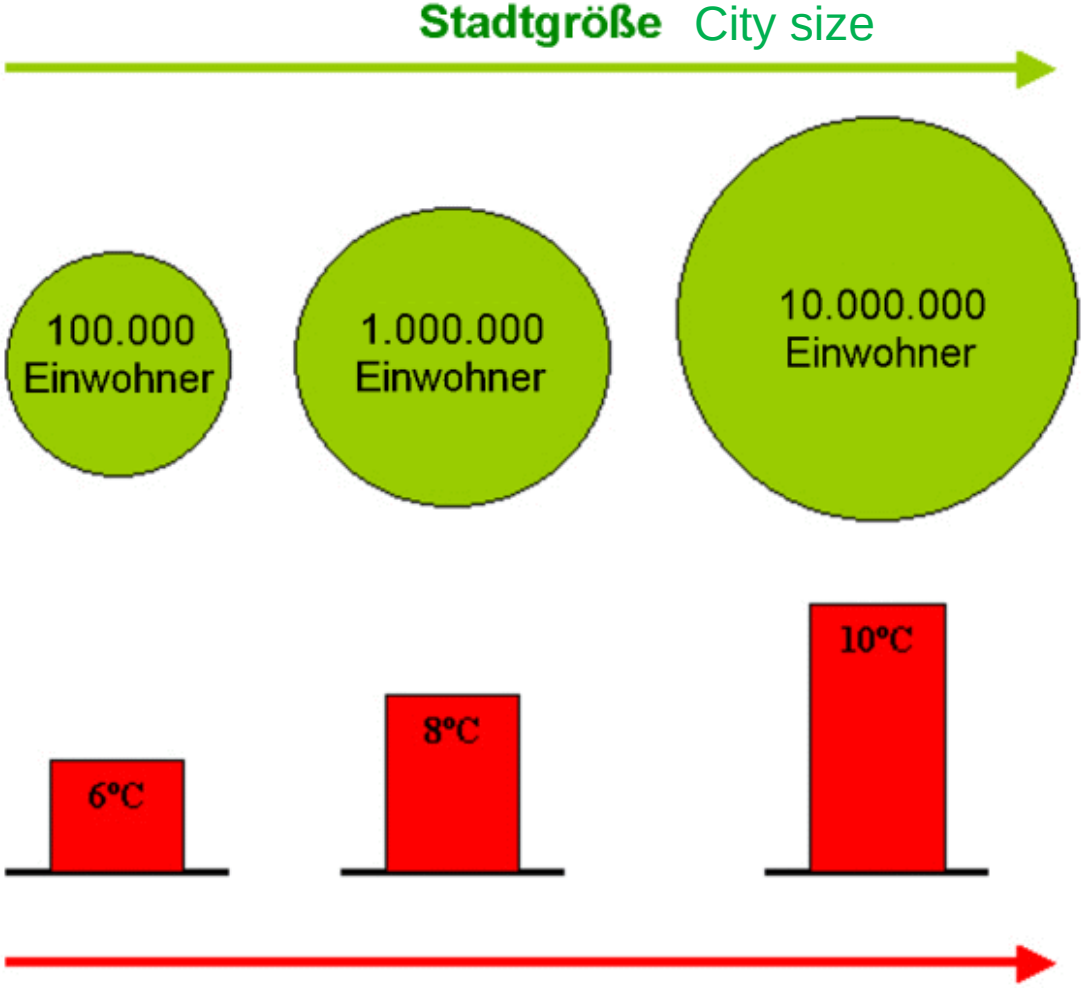


Scatterplots of day-time surface temperature vs. vegetation index for Bangkok in February 2002.



Effects of vegetation cover on the sensible heat fluxes in 18 sampled Bangkok's neighborhoods.

Source: Assessment with satellite data of the urban heat island effects in Asian mega cities, by Hung Trana, et al, Daisuke Uchihamab, Shiro Ochib, Yoshifumi Yasuokab



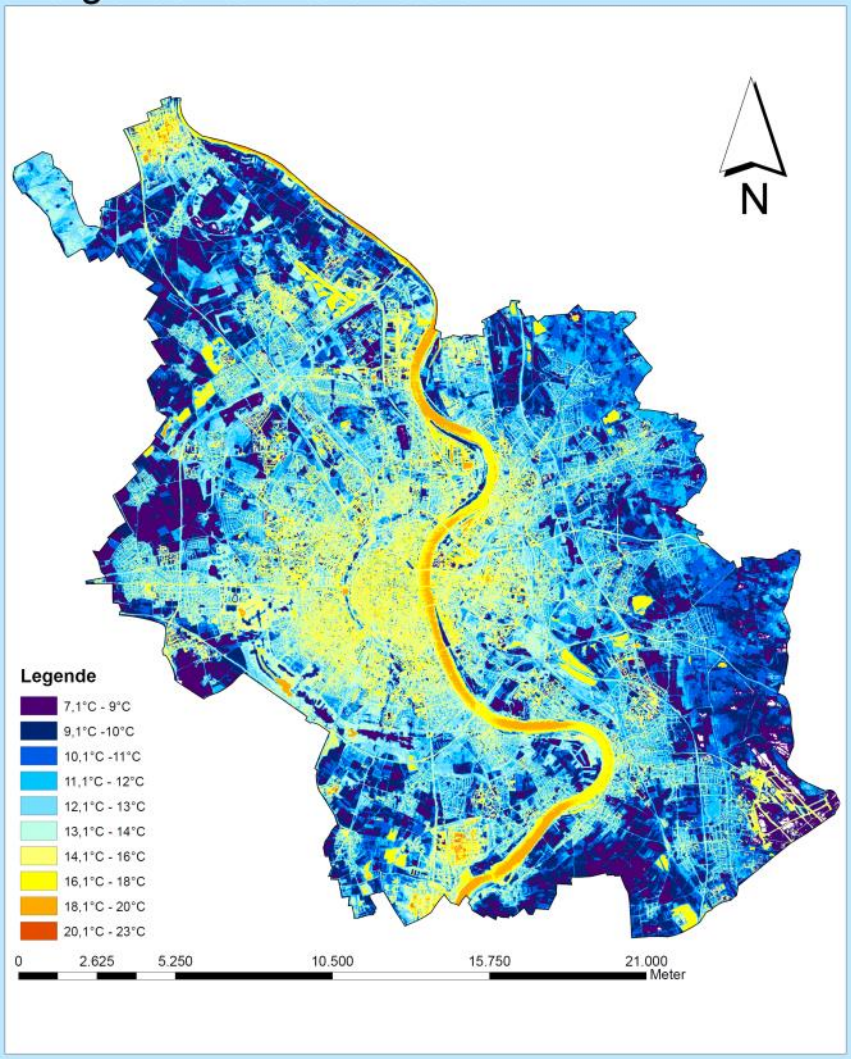
The amount of the urban heat island effect is depending on the number of citizens, on the size of the city.
Attention: This has little to do with temperature *averages* but deals with increasing *extremes*.
Grafik: Anita Bokwa, Pawel Jezioro
(From S. Lippke, 2010)

Wärmeinsel Köln
-Thermalbild-

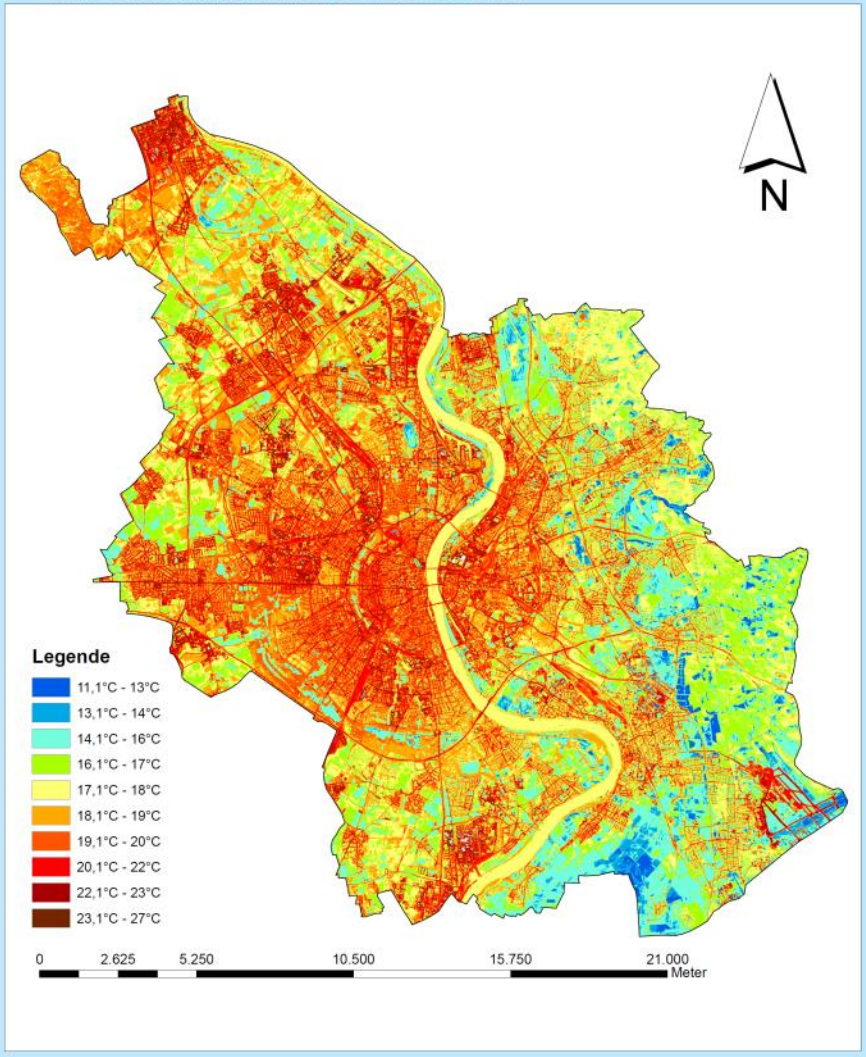
Lippke, 2010

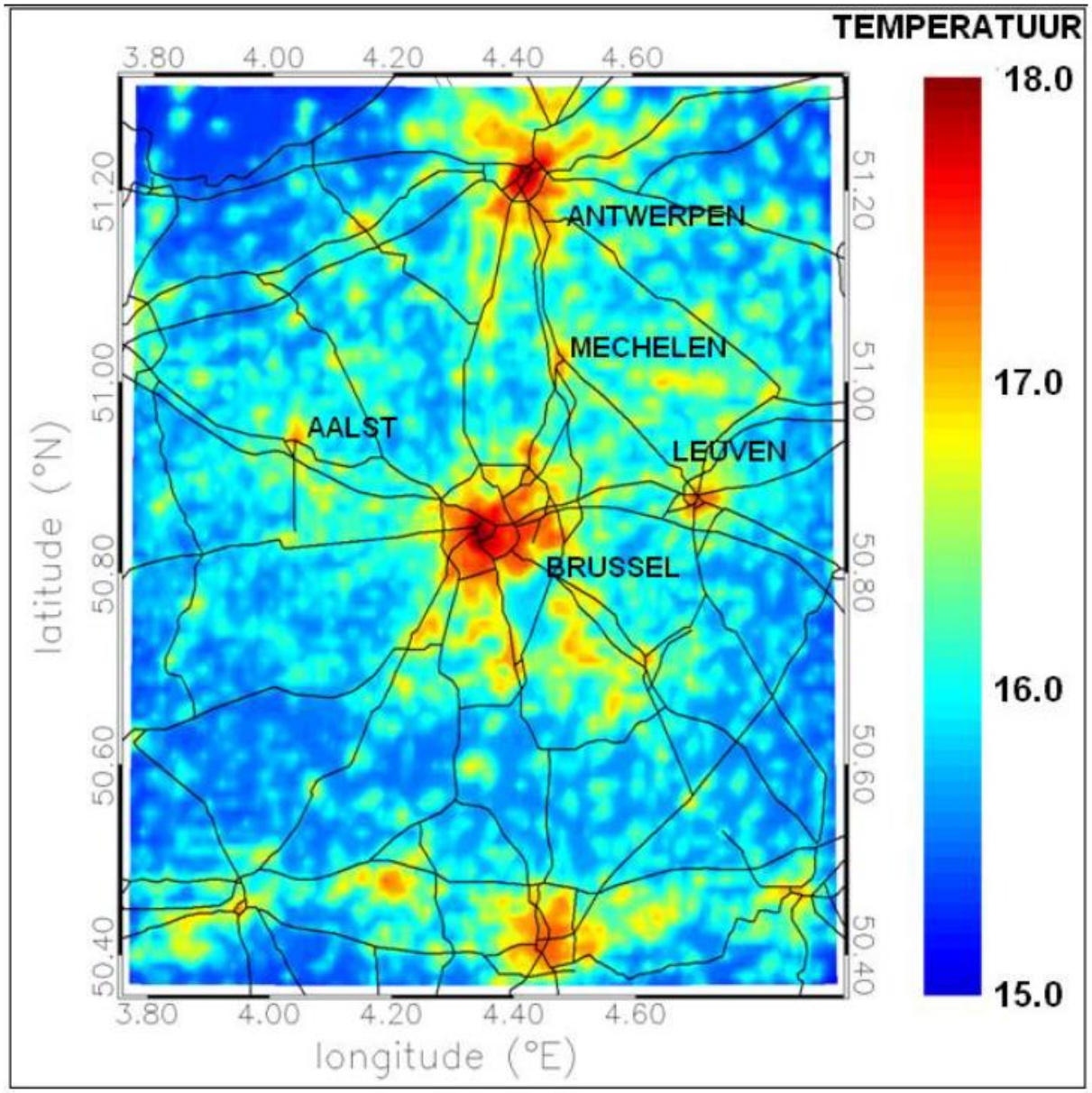
Stadt Köln
Der Oberbürgermeister
Umweltamt / UVP-Geschäftsstelle

Morgenaufnahme 04.00 Uhr



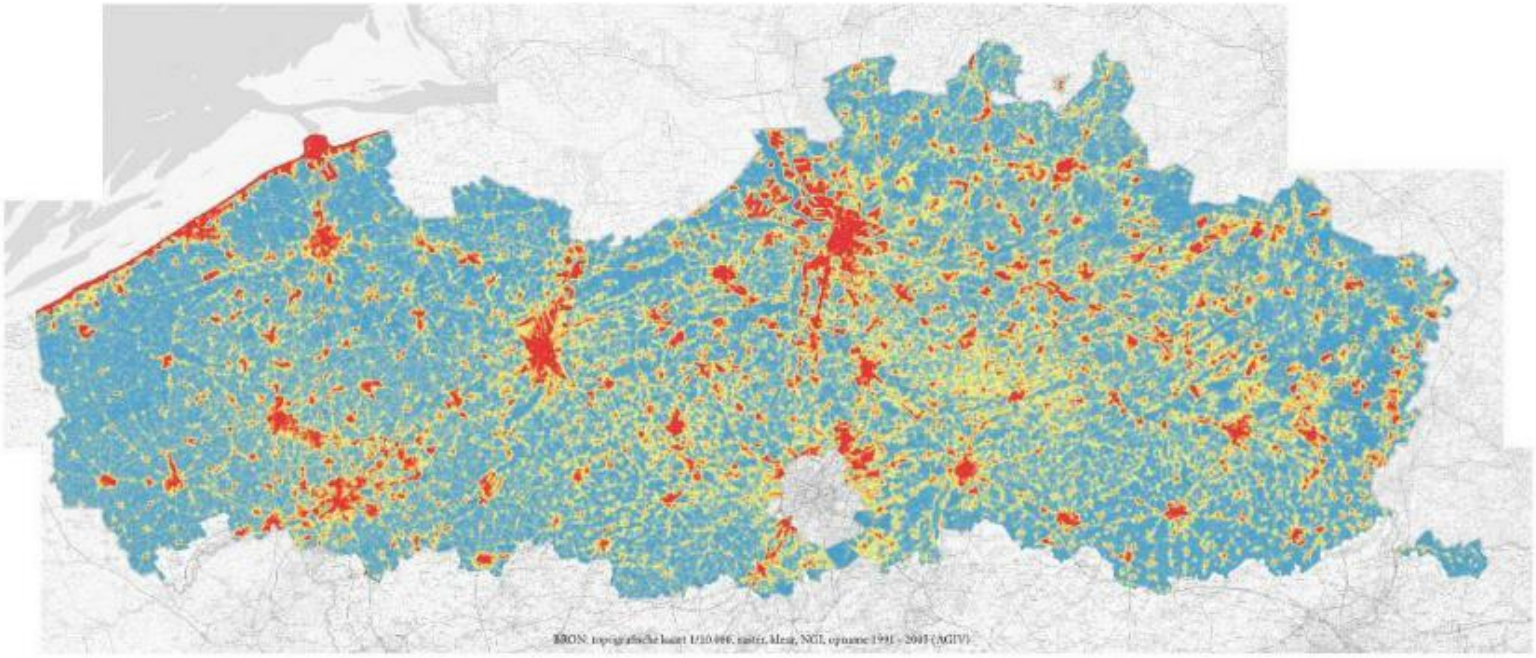
Abendaufnahme 21:00Uhr





Figuur 3: Stedelijk hitte eiland effect in Vlaamse steden op basis van de gemiddelde tempeartuur middernacht (00h00) in de periode mei-september 2008 (Bron: De Ridder et al., in prep.)

Vulnerable zones for increasing UHI-effect in Flanders (2015)



UHI Vlaanderen
High : 4.3208
Low : 2.0753

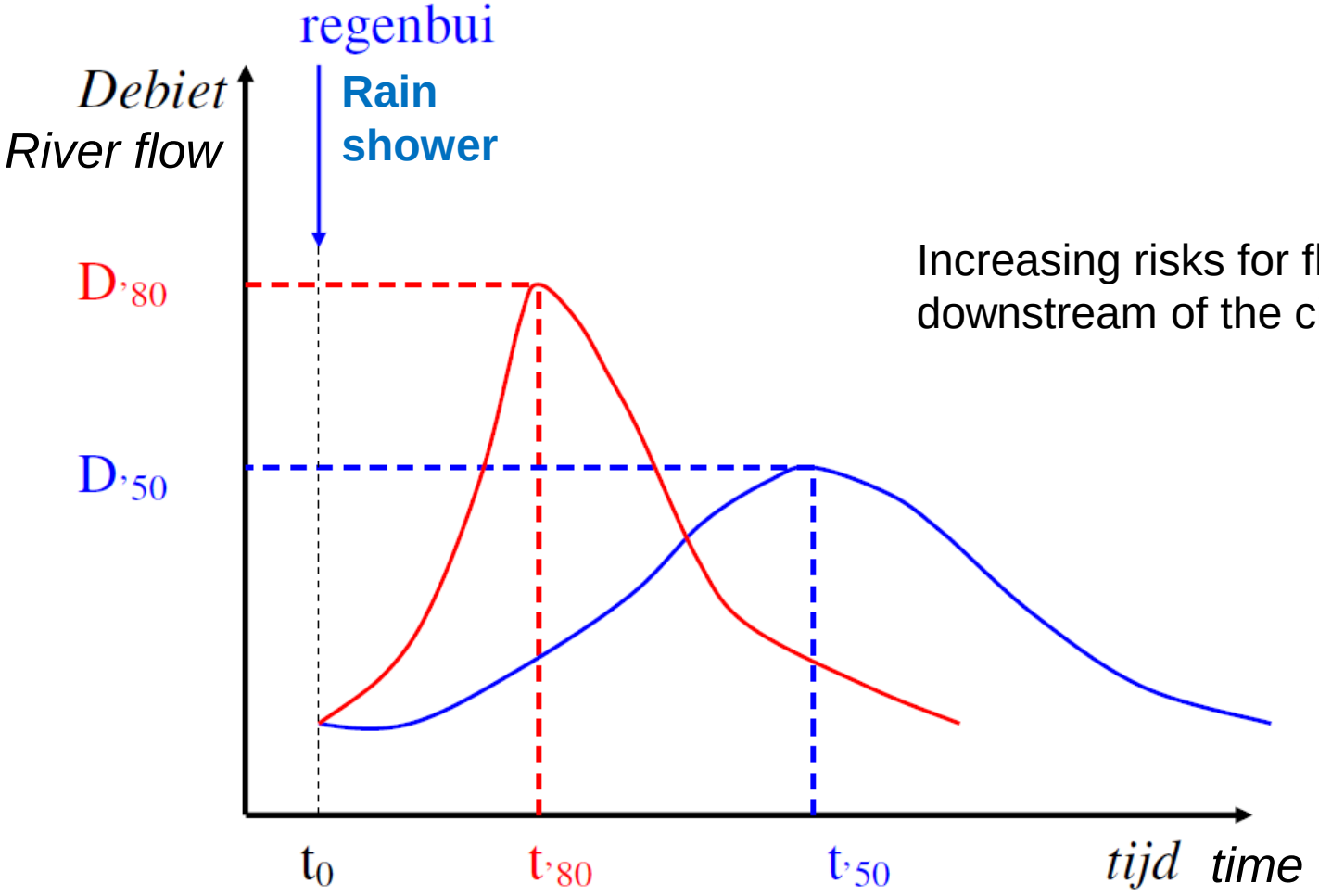
KANS OP VOORKOMEN VAN EEN STEDELIJK HITTEËILAND

Deze kaart geeft een indicatie van de mate waarin bepaalde gebieden in Vlaanderen meer of minder gevoelig zijn voor het ontstaan van een stedelijk hitteëiland (Urban Heat Island (UHI)). Met UHI wordt het fenomeen geduid waarbij steden 's nachts (met name tijdens de zomer) gevoelig warmer zijn dan het omringende platteland. De kaart is gebaseerd op een

http://issuu.com/ruimtevlaanderen/docs/klimaatadaptatie_finaal_rapport_201 ; technum-tractebel, 2015.

Increasing urban storm water run-off is raising flooding risks in rural areas downstream of the city

Consequences: Hydrological research of the **Bellebeek** (Belgian inland brook), (Van der Beken, 1984, University Brussels)

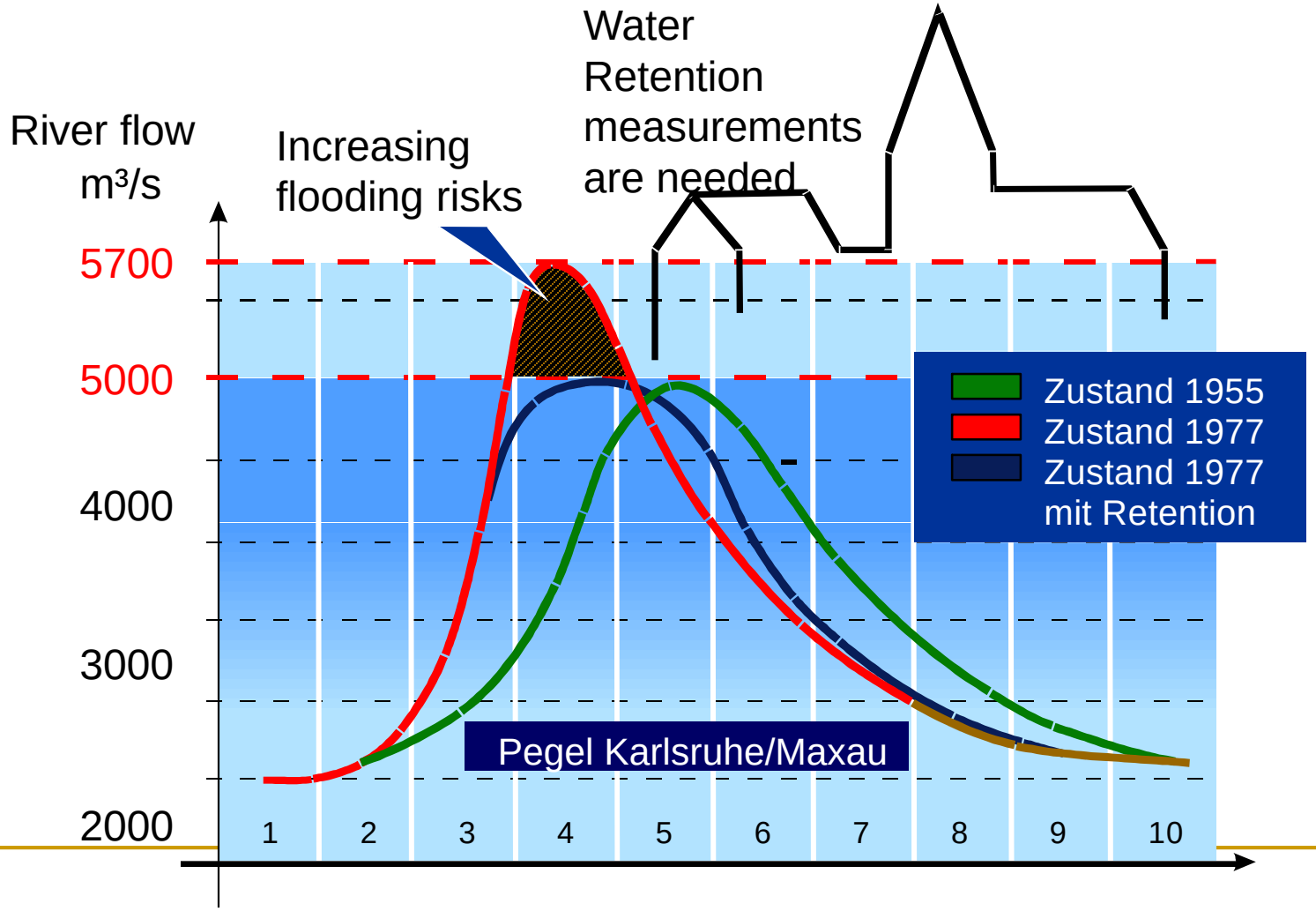


Increasing risks for flooding, downstream of the cities

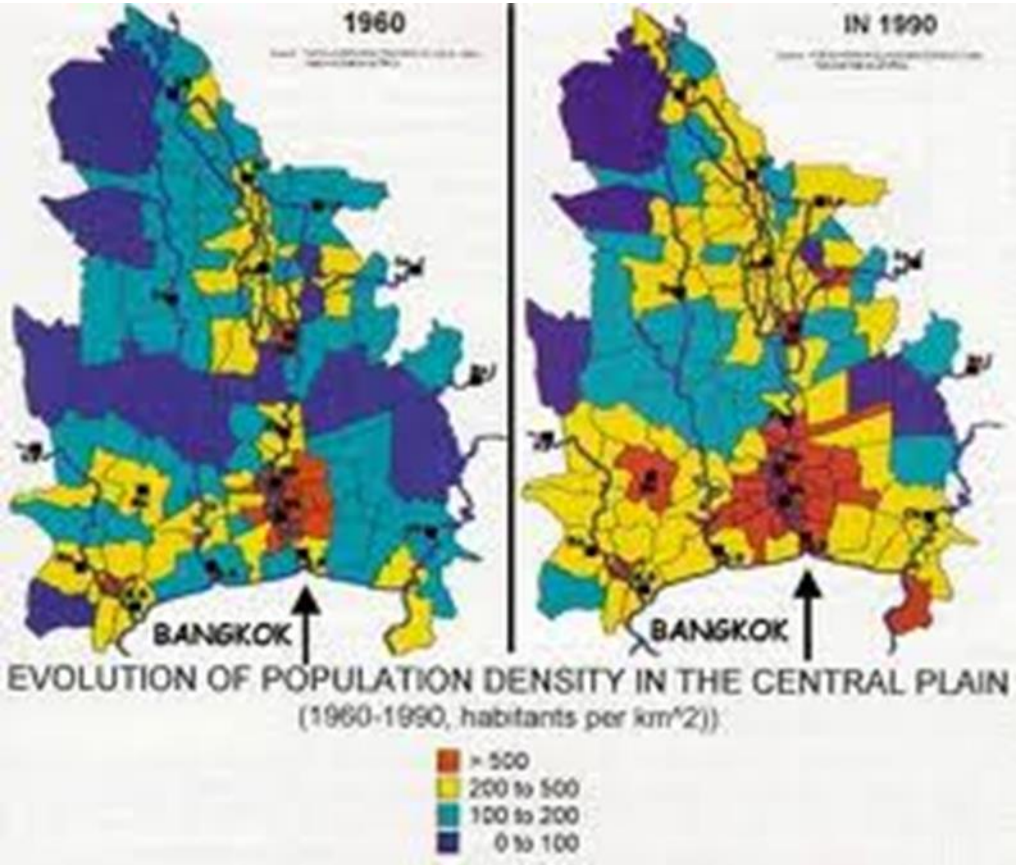
Current peak river flow rates from inland to the North Sea are **higher** and come **earlier** in the time after a rain shower, compared with the years 1950.

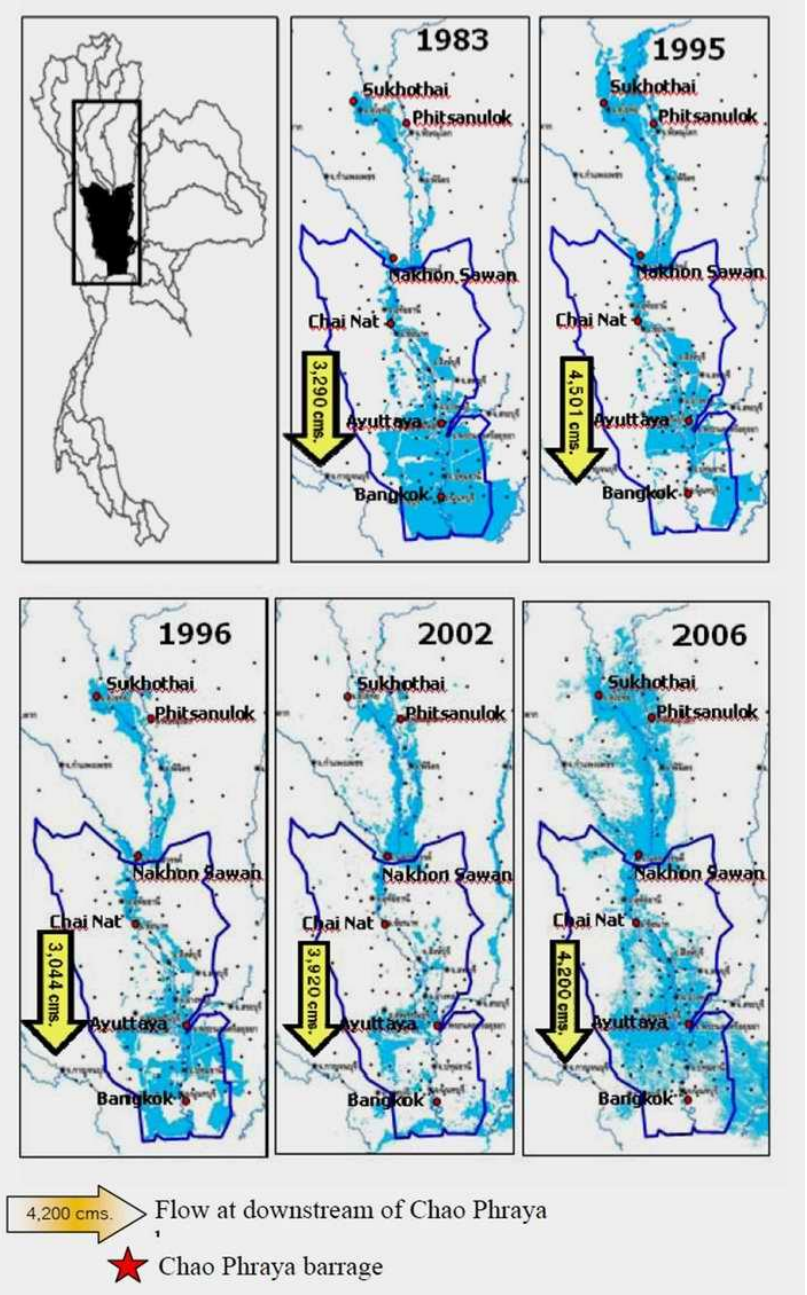
The same is the case all over Europe: example of the river **Rhine**, in the border region between France and Germany.

Source: Das Integrierte Rheinprogramm des Landes Baden-Württemberg (Hochwasserverschärfung)



Bangkok and surroundings 1960's – 1990's





http://www,goodstuff4u.multiply.com

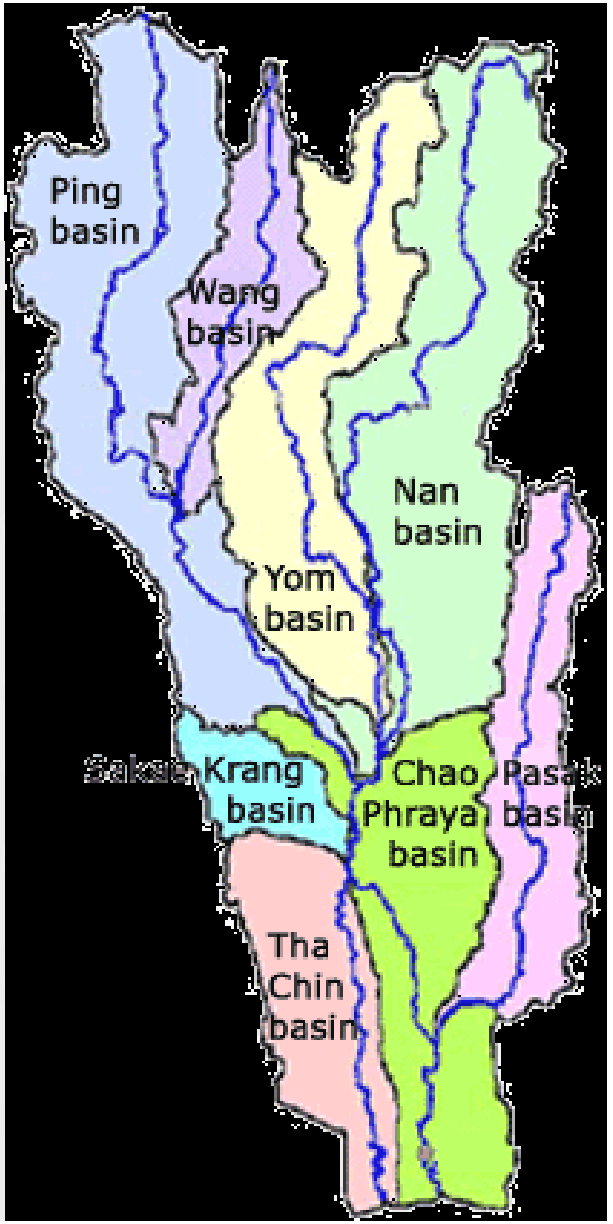
http://bebasbanjir2025.wordpress.com/pengendalian-banjir-mancanegara/thailand/

Example:Chao Praya River basin , Thailand. Table to be supplemented with the 2011 floods

Main features of the major floods in the lower Chao Phraya River basin

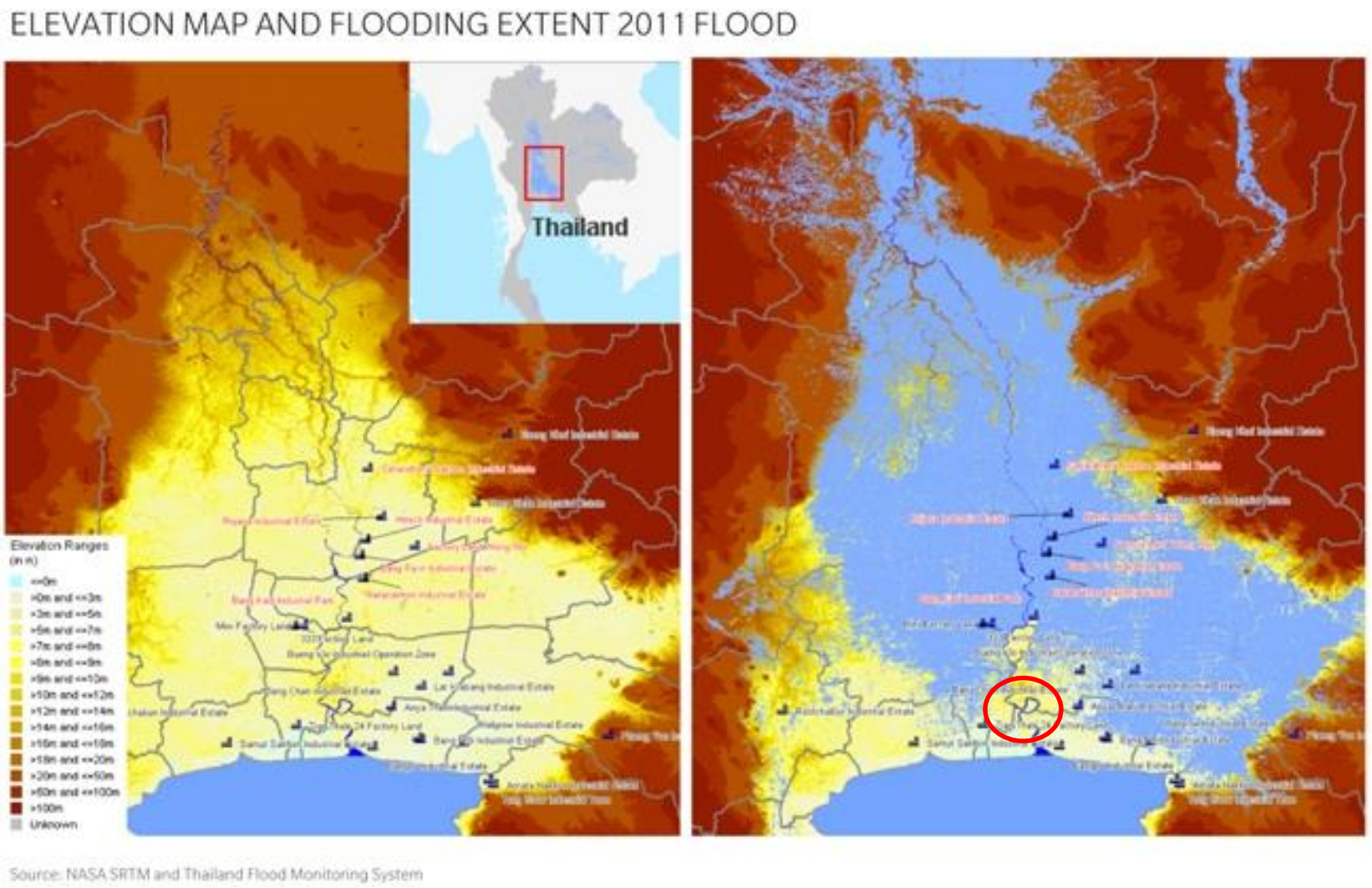
		1942	1983	1995
Human Intervention	Forest cover[a]	166,000 km^2	106,000 km^2	92,000 km^2
	Area denuded	--	60,000 km^2	74,000 km^2
	Reservoir capacity	Nil	23,000 million m^3	24,000 million m^3
	Flood protection	2,230 km^2	12,900 km^2	14,400 km^2
	Urban area[b]	51 km^2	389 km^2	528 km^2
Natural Causes	Rainfall upstream	Exceptionally Heavy	Unusually heavy (Sep.to Nov.)	Unusually heavy to Exceptionally heavy
	Rainfall in Bangkok	Normal	Unusually heavy (Aug.to Nov.)	Normal to unusually Heavy
	Tides	Normal spring tide with additional seasonal effects	Normal spring tide with additional seasonal effects	Normal spring tide with additional seasonal effects

[a] Northern and central regions of Thailand.
[b] Bangkok area only.



source http://webworld.unesco.org/water/wwap/case_studies/chao_phraya/detailed_view.shtml
http://bebasbanjir2025.wordpress.com/pengendalian-banjir-mancanegara/thailand

Thailand flooding 2011.



Bangkok

Luke Browne | *February 20, 2012 10:12*

Thailand economy shrinks 9% on flood impact

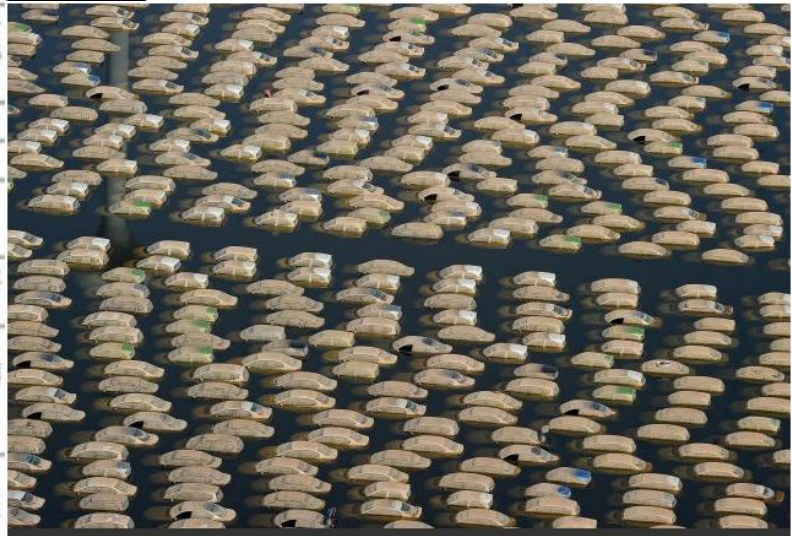
Thailand's economy contracted sharply in the fourth quarter of last year after the kingdom's worst floods in half a century pummelled manufacturing and tourism in south-east Asia's second largest economy, official figures released on Monday showed.

Thailand. Flooding nov 2011

http://www.nationmultimedia.com/business/Global-fallout-of-Thai-floods-30167951.html
http://www.globalpost.com/dispatch/news/regions/asia-pacific/thailand/120220/thailand-economy-shrinks-9-flood-impact

Effect of Thai floods on Japanese companies

		Status	Effects	
Automobiles	Honda	Factory submerged	No prospect of recovery	
	Toyota	Parts not supplied by flood-damaged manufacturer	Production suspended	Until Saturday. Considering air shipment of parts and other measures
	Nissan			Until Wednesday
	Isuzu			Until Friday
Electronics	Nikon	Digital camera factory submerged	No prospect of recovery	
	Sony			
	Canon	Printer-related factory submerged	Considering production at a different factory in Thailand and other areas	
	Nidec	Two electronic parts factories submerged and employees at four factories evacuated	Considering production in China and other countries	
	TDK	Electronic parts factory submerged	Considering production at a different factory in Thailand	
Food	Ajinomoto/ Calpis	Jointly established beverage plant submerged		

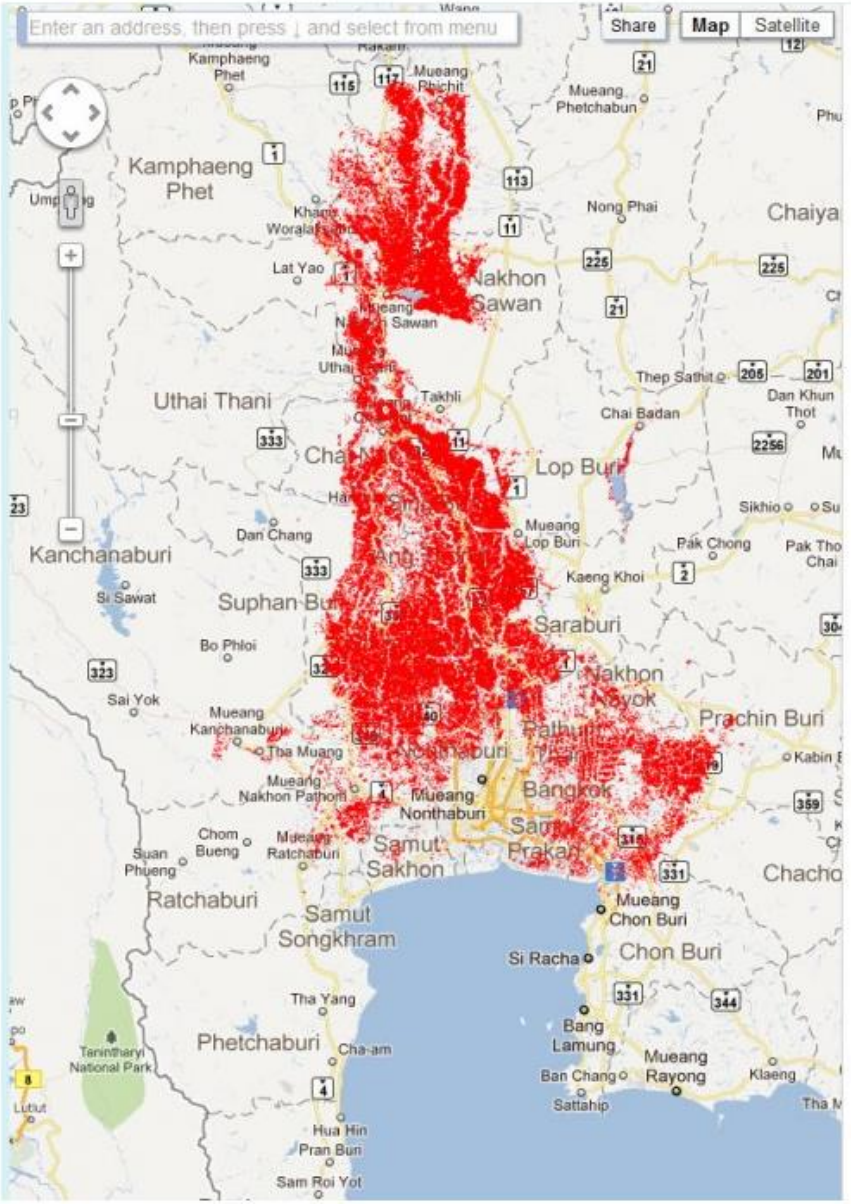


Honda vehicles are seen submerged at the flooded Honda factory in the Rojuna Industrial district in Ayutthaya, Thailand on November 14, 2011.

Thailand's the worst flooding in half a century has forced a number of parts makers and Japanese manufacturers to halt production in Thailand, raising fears the flooding may affect manufacturing worldwide.

Flooding Thailand nov 2011.

Thailand Flooding Area November 2011



Design not only carbon-neutral but also water-neutral: restore urban small water cycles

Boxtel (NL). De Kleine Aarde

Use succulent plants (such as *Sedum sp*.) for green roofs.
Green roofs are interesting for biodiversity, summer cooling and water management, …

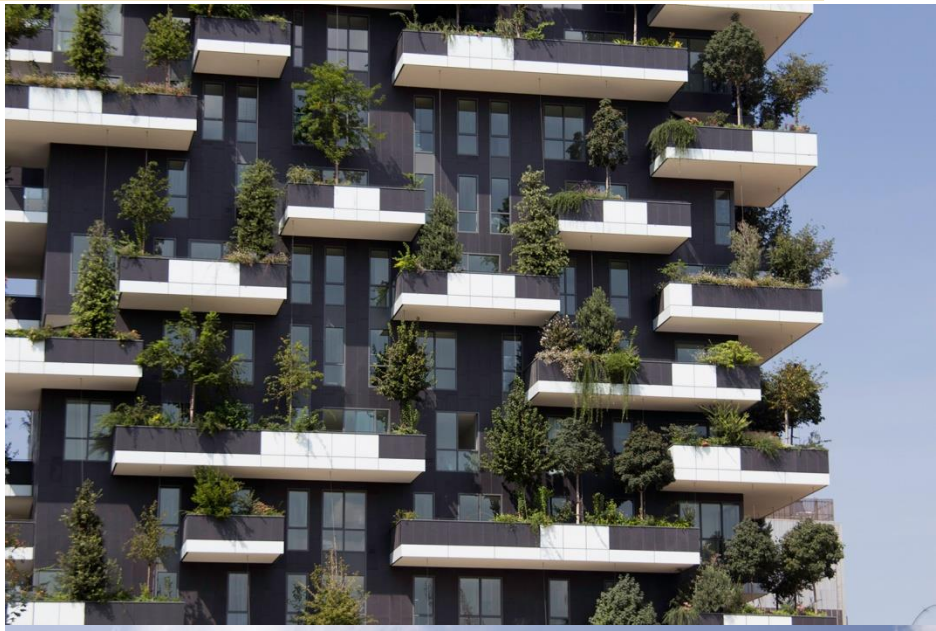
Westerlo (B). Kamp C

Green facades and green roofs to support urban biodiversity and small urban water cycles.

Paris (F): Quai Branly

Paris (F) is planning minimum 100 ha green roofs and facades by 2020: http://www.paris.fr/duvertpresdechezmoi

Bosco Verticale, Milano (It)



Bron: http://thelandscape.org/2014/09/01/bosco-verticale-milan-the-next-step
The landscape architects Emanuela Borio and Laura Gatti working with Stefano Boeri.

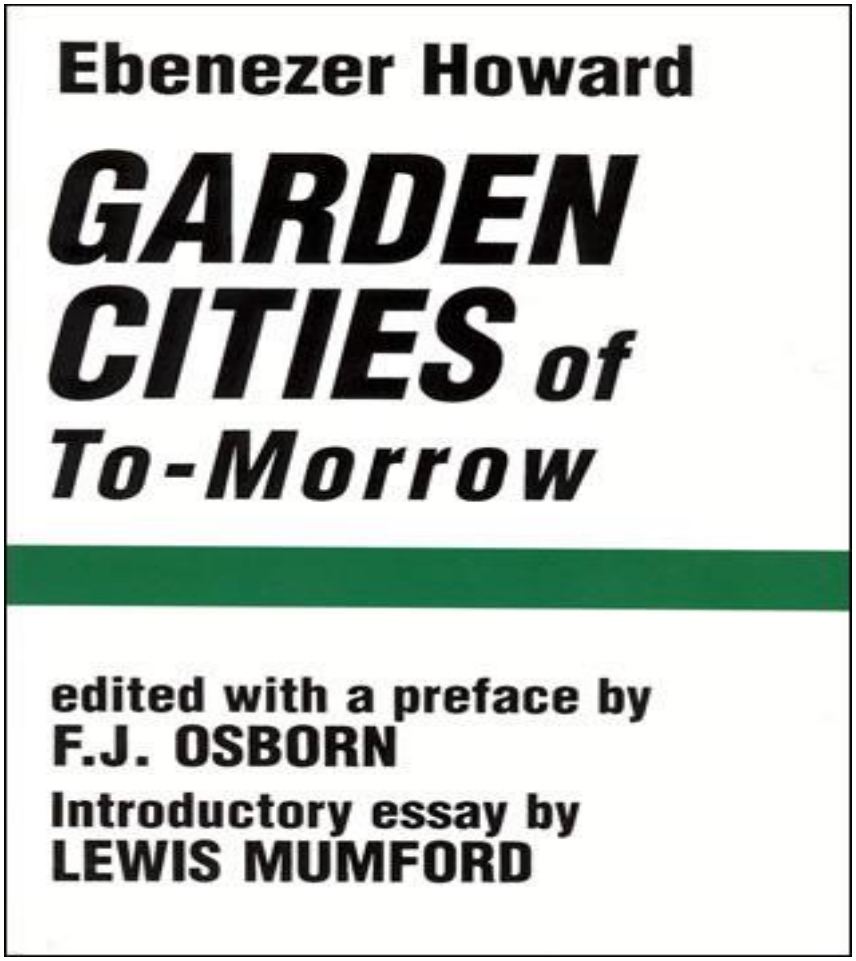
Eidfjord (N). Hardangervidda national park

Hovden (N): water neutral ecoquarter.

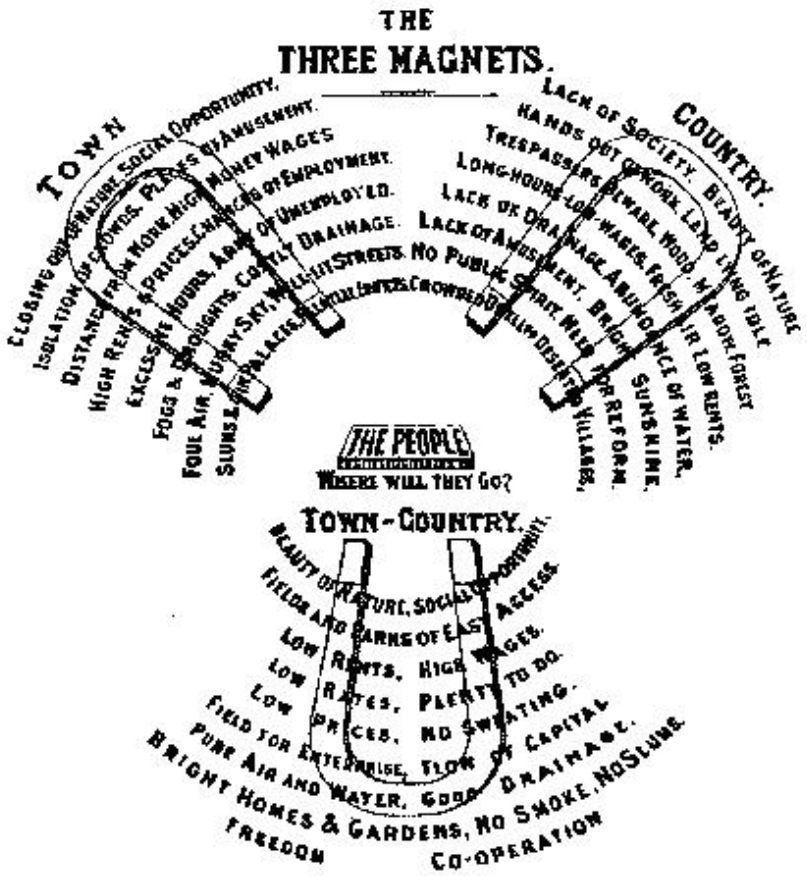
Structure of this presentation.

- 0. The 17 sustainable development goals of the United Nations.
- 1. Ecosystem services
- 2. Cooling by vegetation and blue-green structures as an ecosystem service
- 3. The concentric city and the urban heat island effect
- 4. The ecological, social and financial problems of the **garden city**
- 5. Dominant and vulnerable ecological conditions. High and Low-dynamic conditions versus biodiversity
- 6. the **lobe city** as a solution ?
- 7. How to raise densities without losing residential qualities: restoring the urban advantage
- 8. Higher densities versus district heating and cooling
- 9. conclusions

New-towns ; garden-cities ; broad-acres cities (Frank Lloyd Wright) ; suburbs are synonyms in terms of **a lack of citizens' densities.**



HOWARD, E. (1902)



HOWARD, E. (1898) Tomorrow: A Peaceful Path to Real Reform

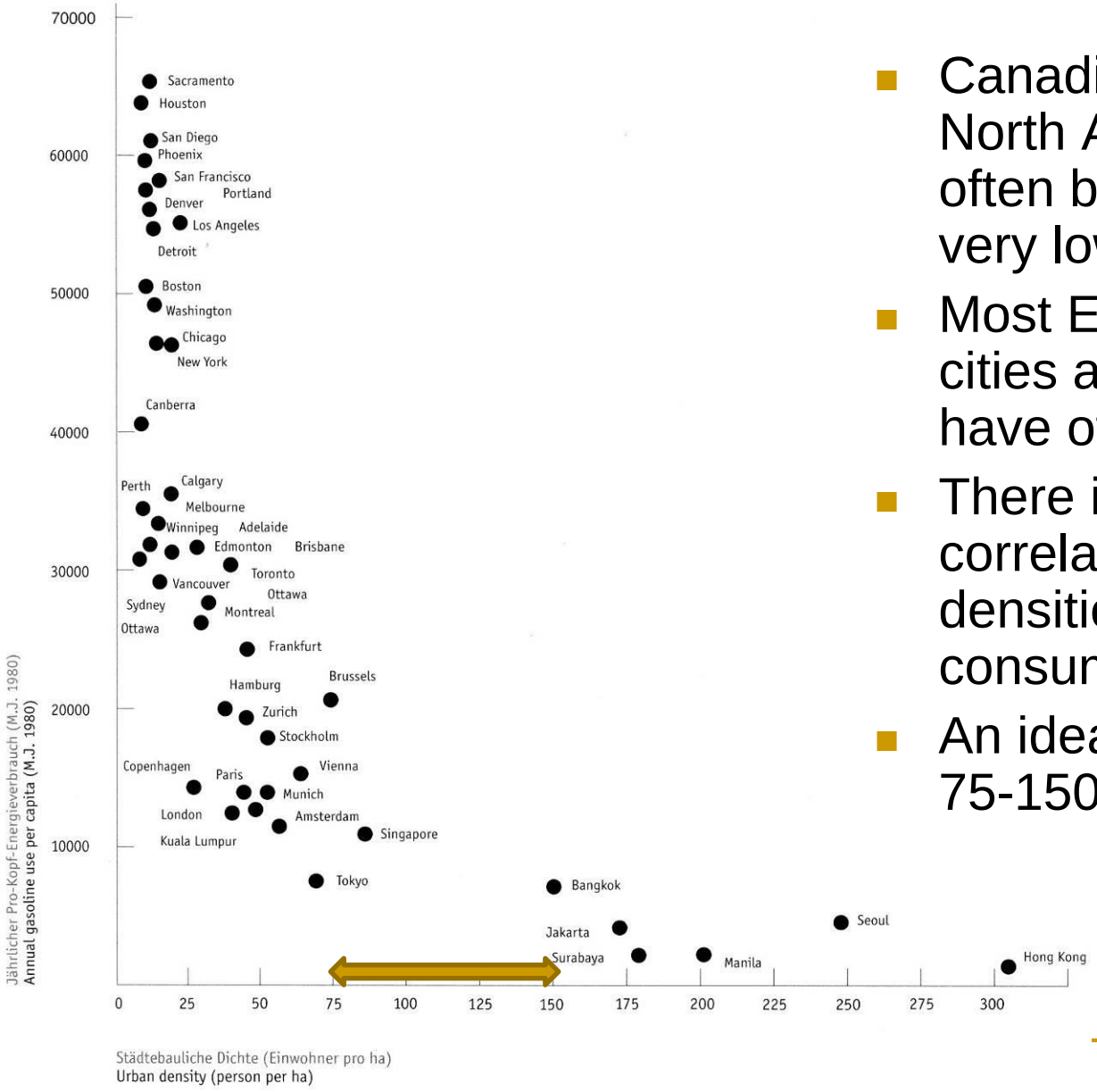
SUBURBIA =
the broad acre city (sensu Frank Lloyd Wright)

http://tvtropes.org/pmwiki/pmwiki.php/Main/Suburbia

http://abcdunlimited.com/ideas/suburbia.html

http://www.boublog.nl/category/zoek-documentaires/grondstoffen/page/5

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.

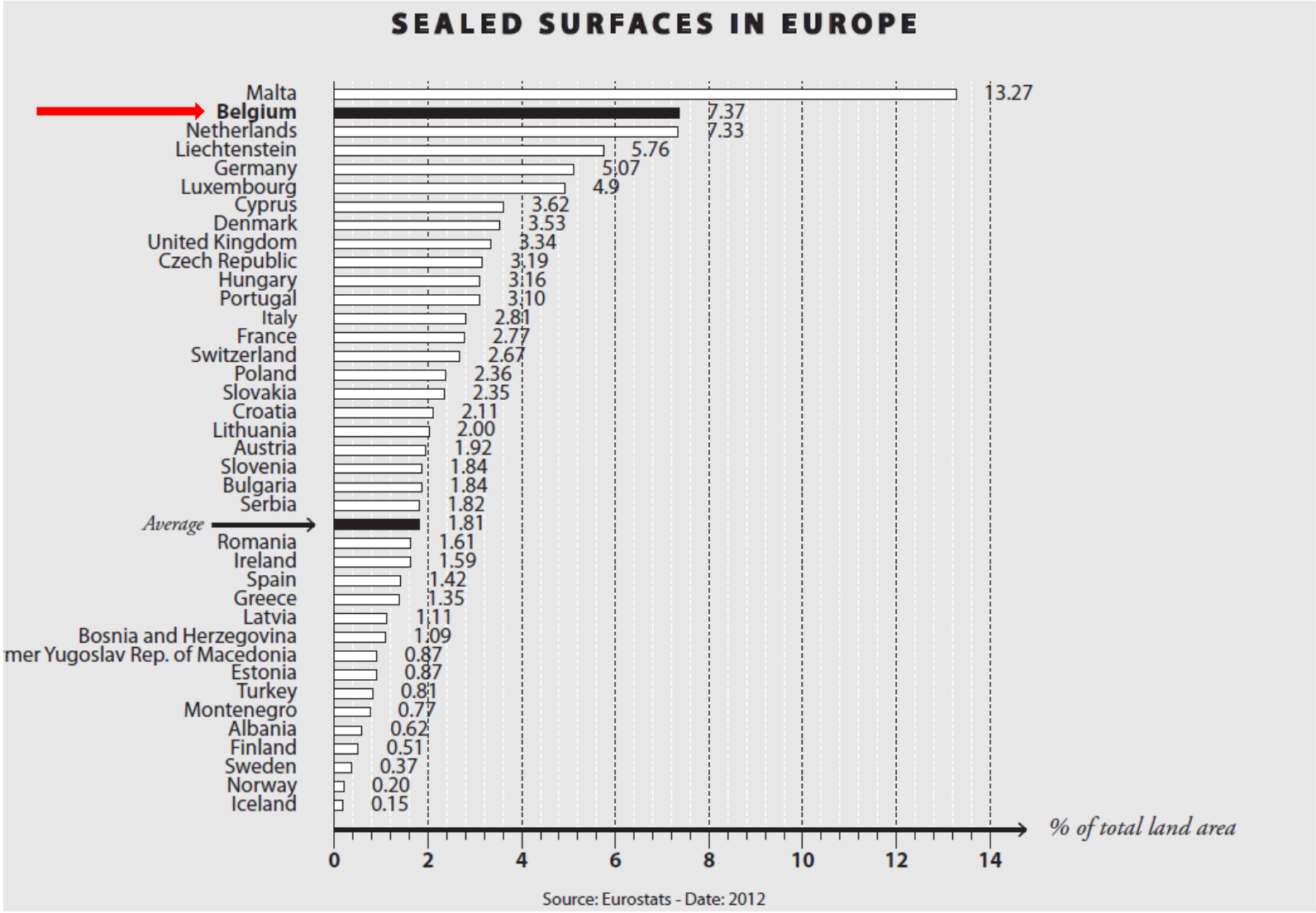
Newman, Peter; Kenworthy, Jeffrey, *Cities and Automobile Dependence: A Sourcebook*, Avebury Technical, Aldershot, Brookfield, Hong Kong, Singapore, Sydney 1992

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

Flanders (Belgium): ‘detached houses with a view….’

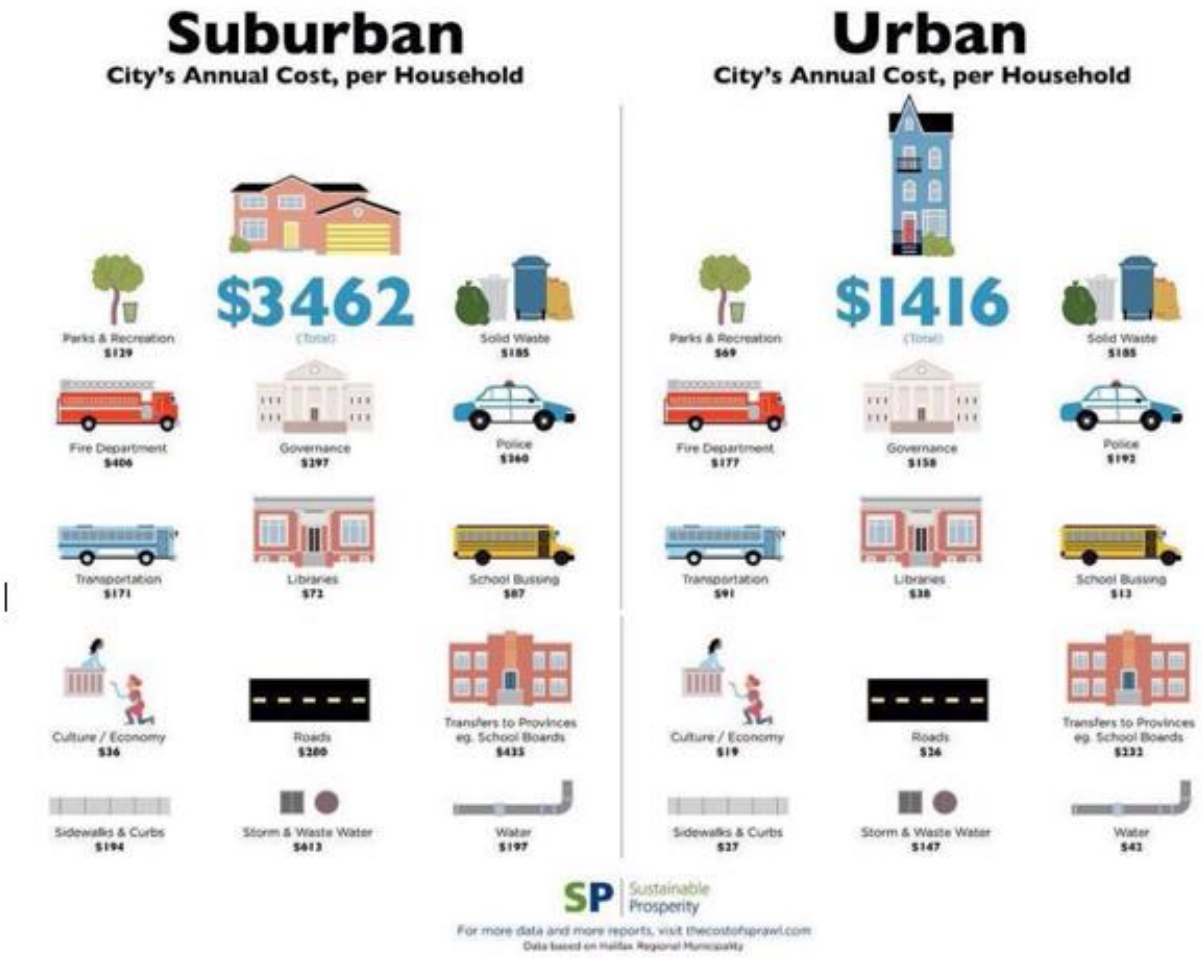
…Leads to extremely low citizens’ densities: thus unaffordable public services and utilities, based on cheap energy sources

Sealed surfaces in Europe (% per country , 2012)



Bron: BOGDAN & VAN BROECK | DuWoBo Transitie-arena 2015

Comparison annual cost/household **suburban** versus **urban** area's



With his *broadacre-city* **Frank Lloyd Wright** introduces this suburban way of life in the US.

The 'urban advantage' disappeared:

- **Proximity (walkable, public transport)**
- **Mixed functions**
- **Social mix**

How Much Sprawl Costs America

More than $1 trillion, according to a new report.

TANVI MISRA | @Tanvim | Mar 24, 2015 | 115 Comments

4.5k Shares | Share on Facebook | Tweet

Flickr/lindenbaum

More and more young people are moving to urban centers because they prefer to live in walkable areas with lots of public transportation options. Still, developers are reluctant to build compact housing using this smart growth approach. But perhaps a new economic case against sprawl can convince these developers to think twice.

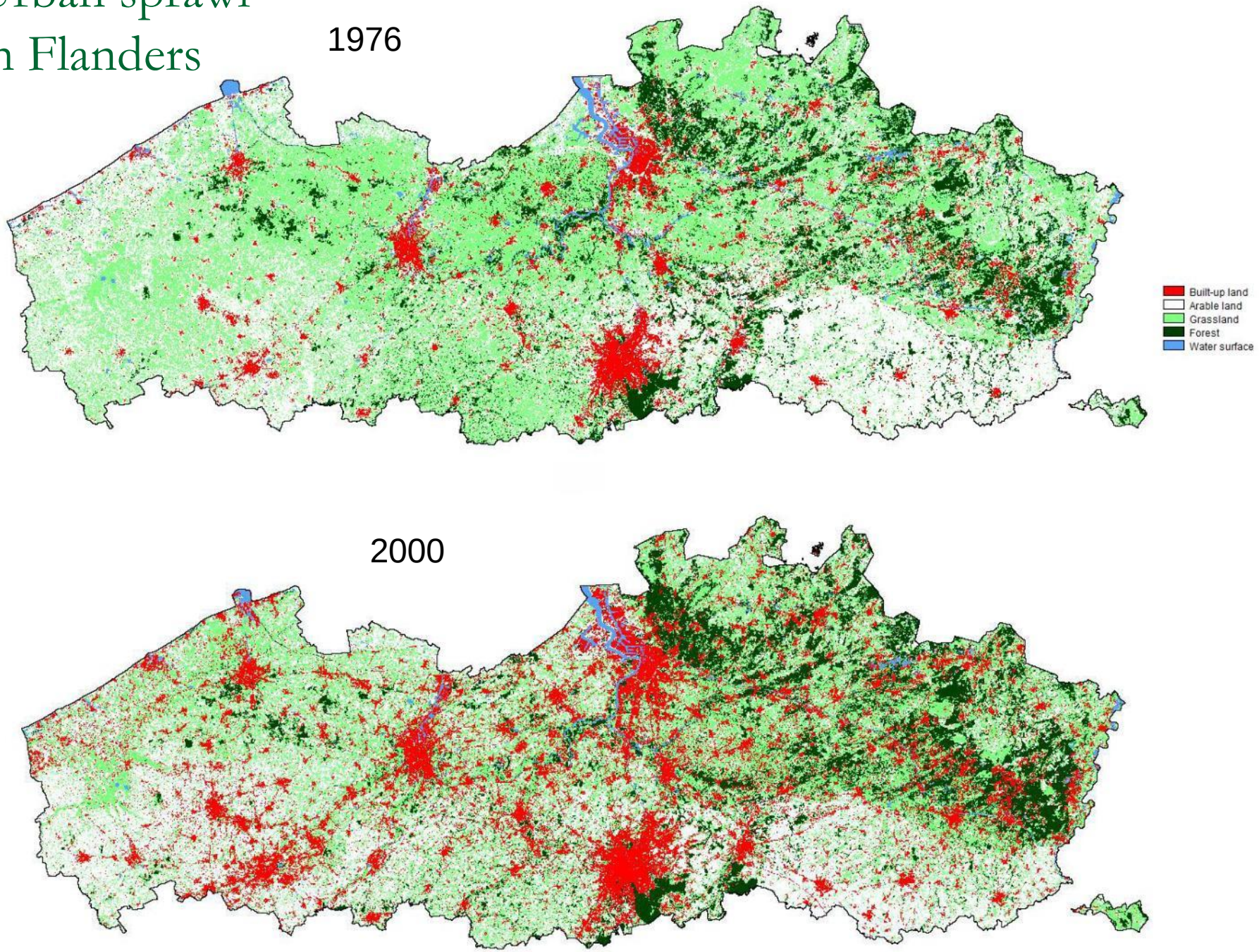
Bron: BOGDAN & VAN BROECK | DuWoBo Transitie-arena 2015

‘Business as Usual’ Urbanization

Tuts, 30/11/2015. Lecture UAntwerpen

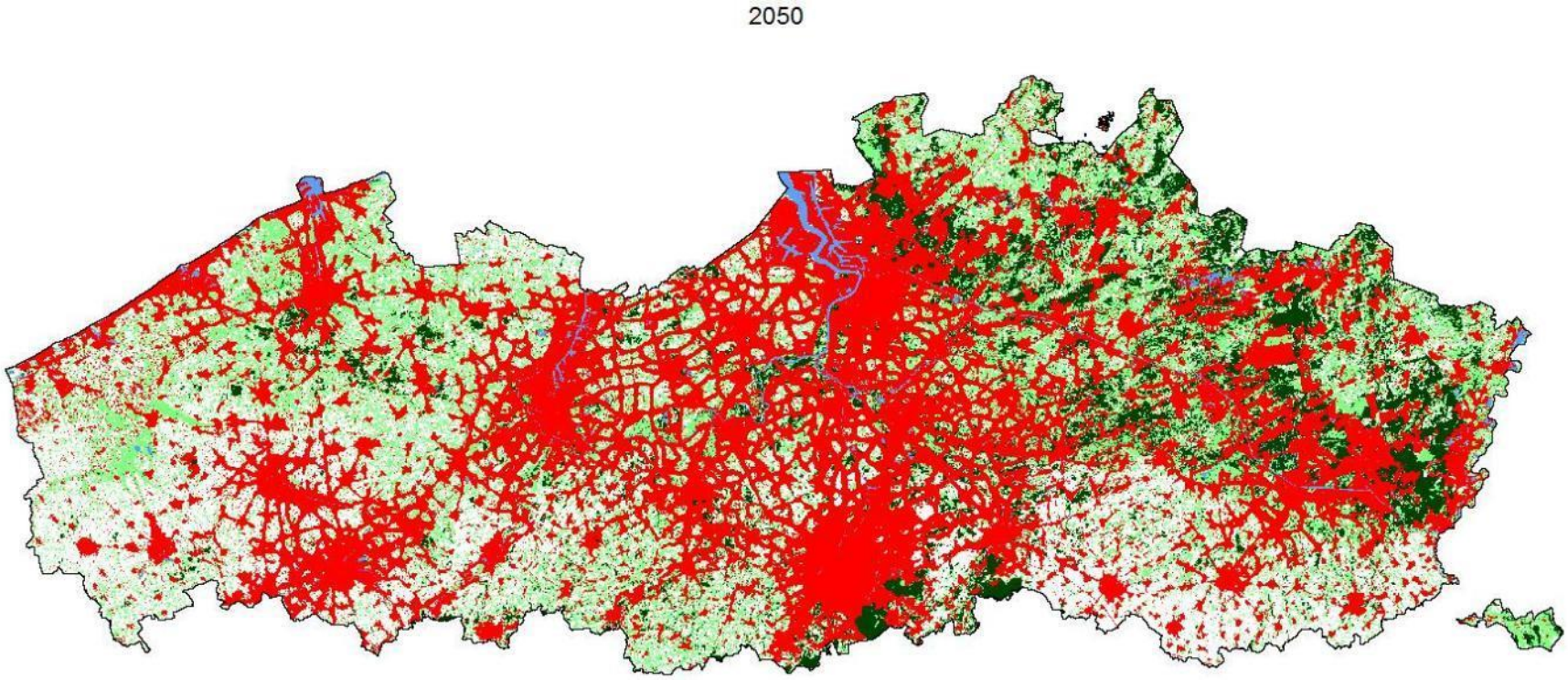
UN HABITAT
FOR A BETTER URBAN FUTURE

Urban sprawl in Flanders



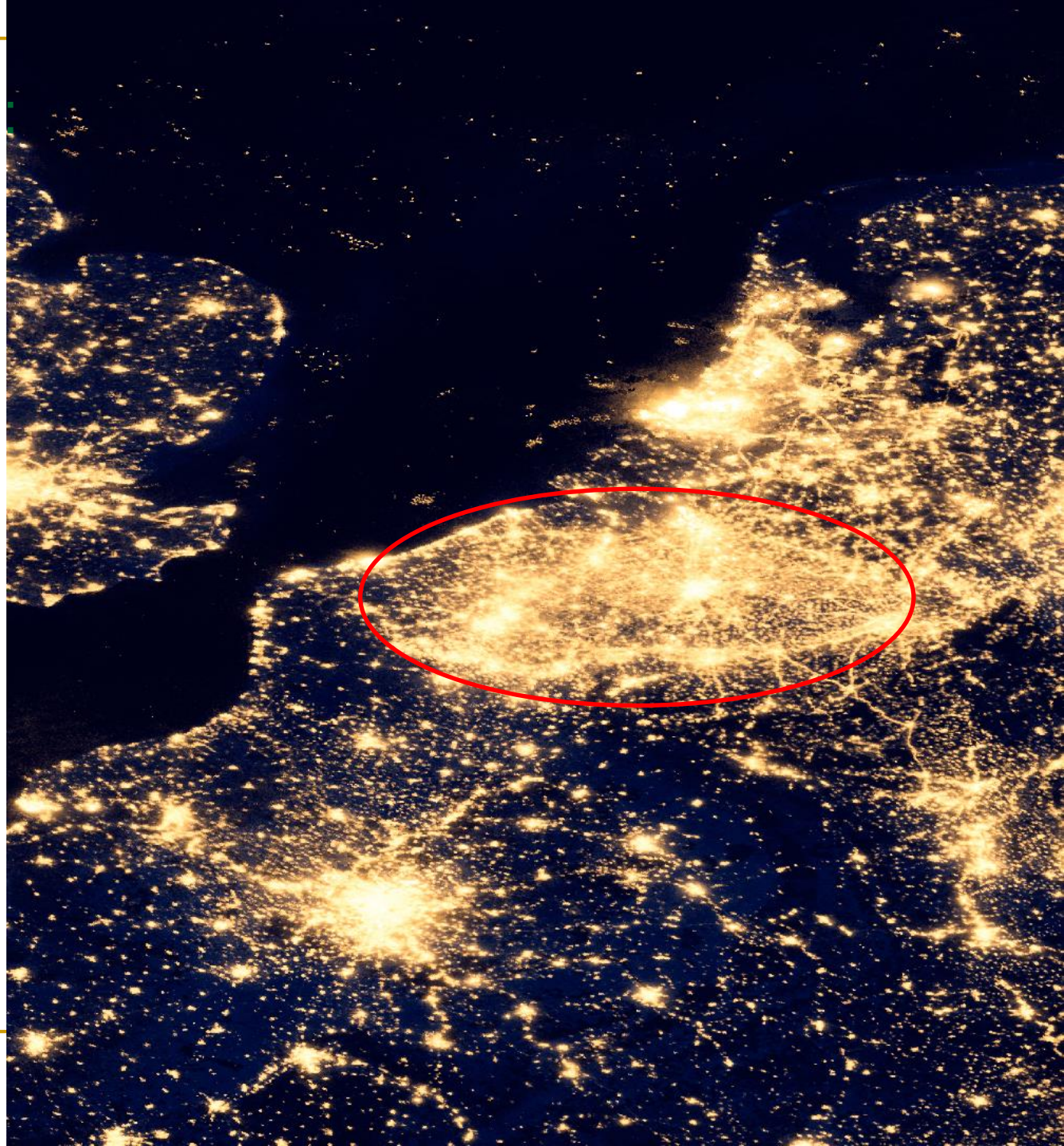
Prognosis 2050 (KUL, Poelmans, 2010)

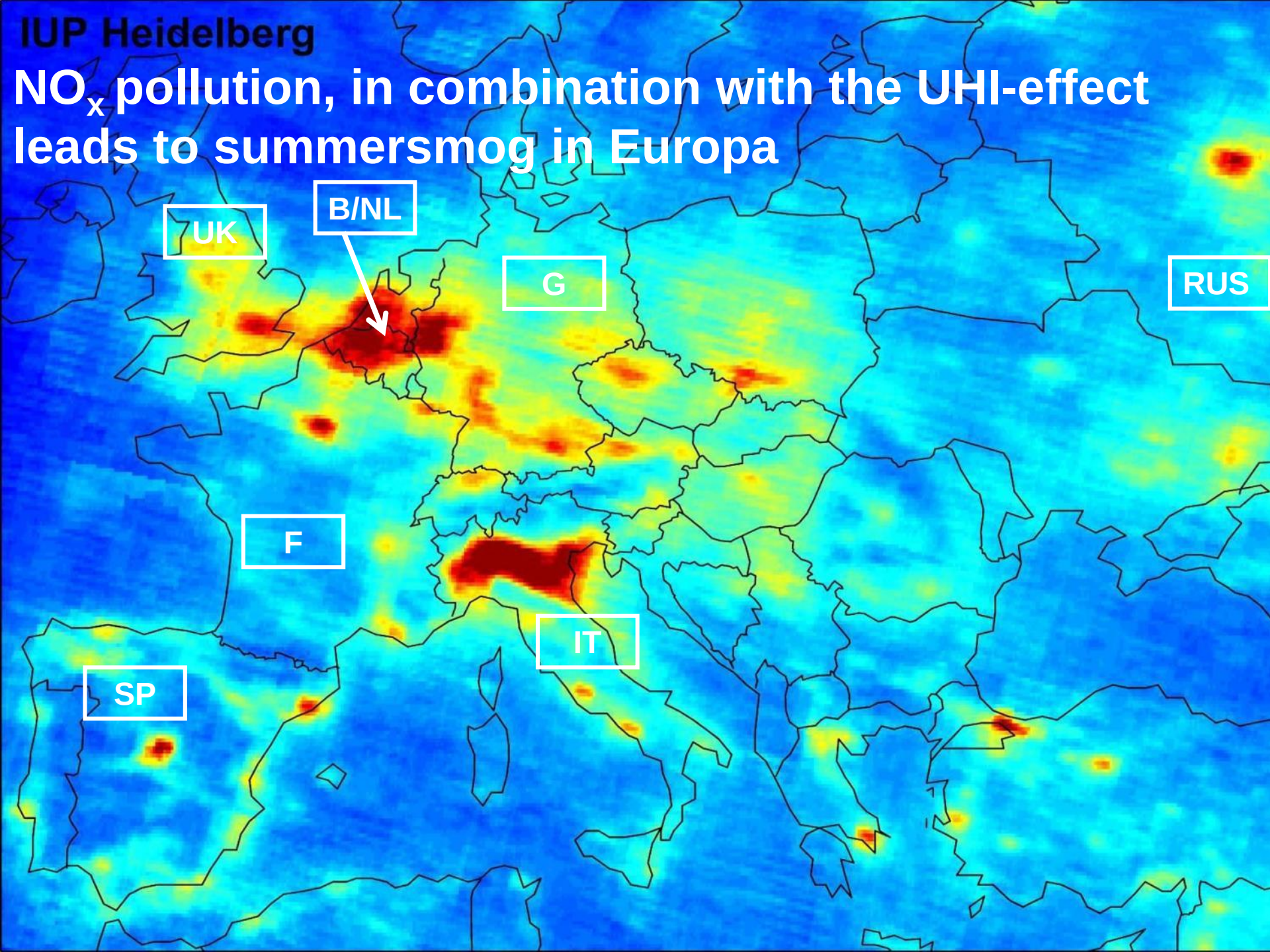
In 1976 7,2% of Flanders' surface was built-up area. End of the1980 it was 12 %, begin 2000 it was 18 %. If occupation continuous at this rate, then 41,5 % of Flanders will be built-up by 2050 (KUL, Poelmans, 2010)



Consequences: Flanders at night.

+/- 300 km




IUP Heidelberg
NOx pollution, in combination with the UHI-effect leads to summersmog in Europa
UK
B/NL
G
RUS
F
IT
SP

'The end of Suburbia' versus the peak oil (see and study dvd: http://www.youtube.com/watch?v=Q3uvzcY2Xug)

- Of course the urban sprawl, which started in North America (with the broad-acres city expansion model from Frank Lloyd Wright) will end in a catastrophe, while *cheap fossil energy is ending*.
- Both the transport in this car-based urban planning model (the urban grid) and heating and cooling of the dwellings will become extremely expensive and contributing to climate change.
- Unfortunately, this '*American way of life*' is being copied all around Europe and the world.

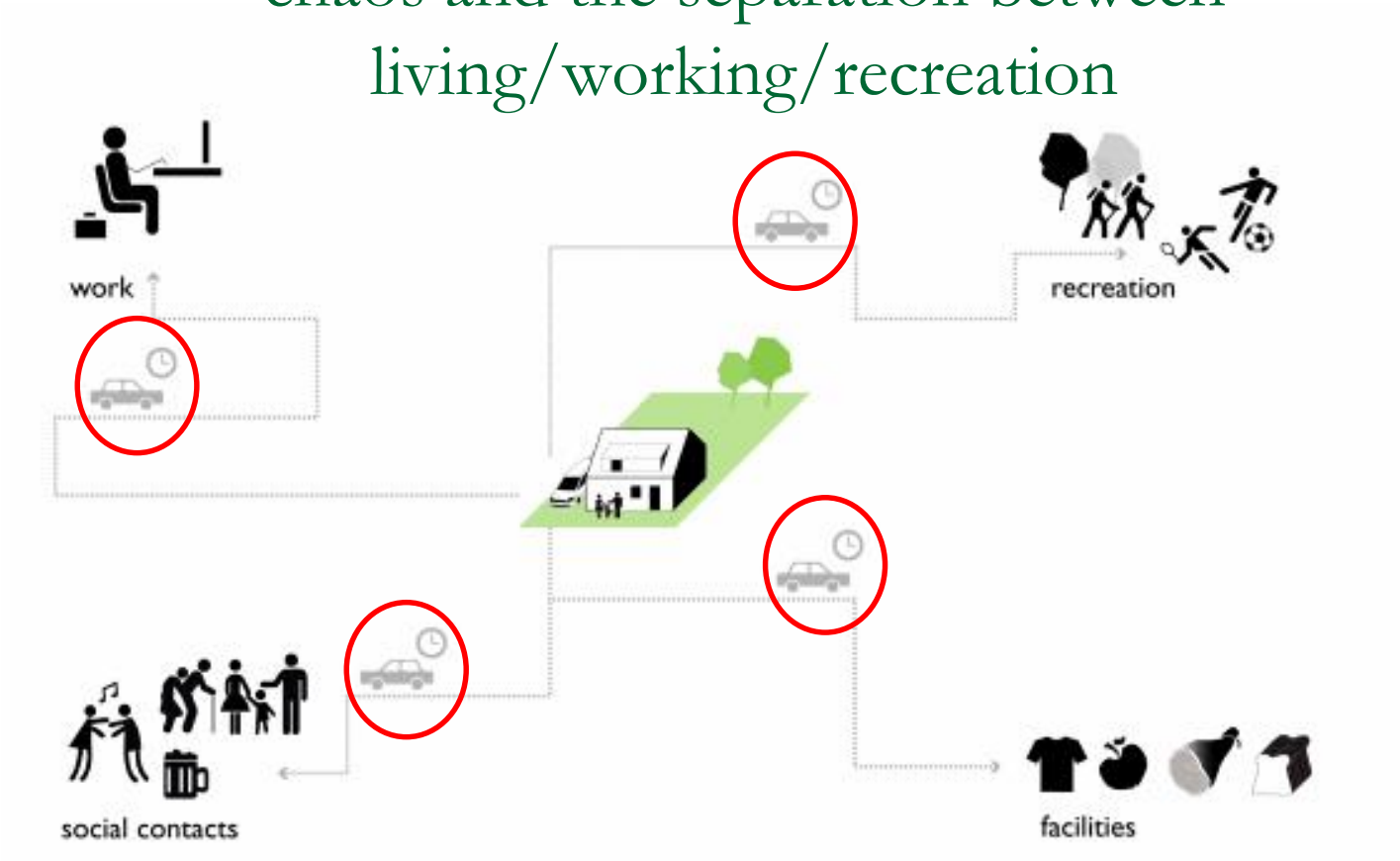
For the same unit Gross Domestic product (GDP), Belgium needs 25 % more energy (85) than Germany (60). Also the EU-27 (64) is doing far better (21%) than Belgium.

Energy Intensity per unit GDP at constant purchasing power parities

ktoe$05p	2006	2007	2008	2009	2010	2011	2012	comparison % 2012
world	0,20	0,20	0,19	0,19	0,19	0,19	0,18	100
Europe	0,13	0,12	0,12	0,12	0,12	0,12	0,12	64
EU-27	0,13	0,13	0,12	0,12	0,12	0,12	0,12	64
Belgium	0,17	0,16	0,16	0,16	0,17	0,16	0,16	85
France	0,14	0,14	0,14	0,13	0,14	0,13	0,13	70
Germany	0,13	0,12	0,12	0,12	0,12	0,11	0,11	60
The Netherlands	0,13	0,13	0,13	0,13	0,14	0,13	0,13	70
United Kingdom	0,11	0,10	0,10	0,10	0,10	0,09	0,10	52

Bron : "World Energy Intensity Data". *Enerdata Statiscal Energy Review 2012*. Enerdata. http://yearbook.enerdata.net/#/energy-intensity-GDP-by-region.html.

An important part of the explanation is the Belgian spatial chaos and the separation between living/working/recreation



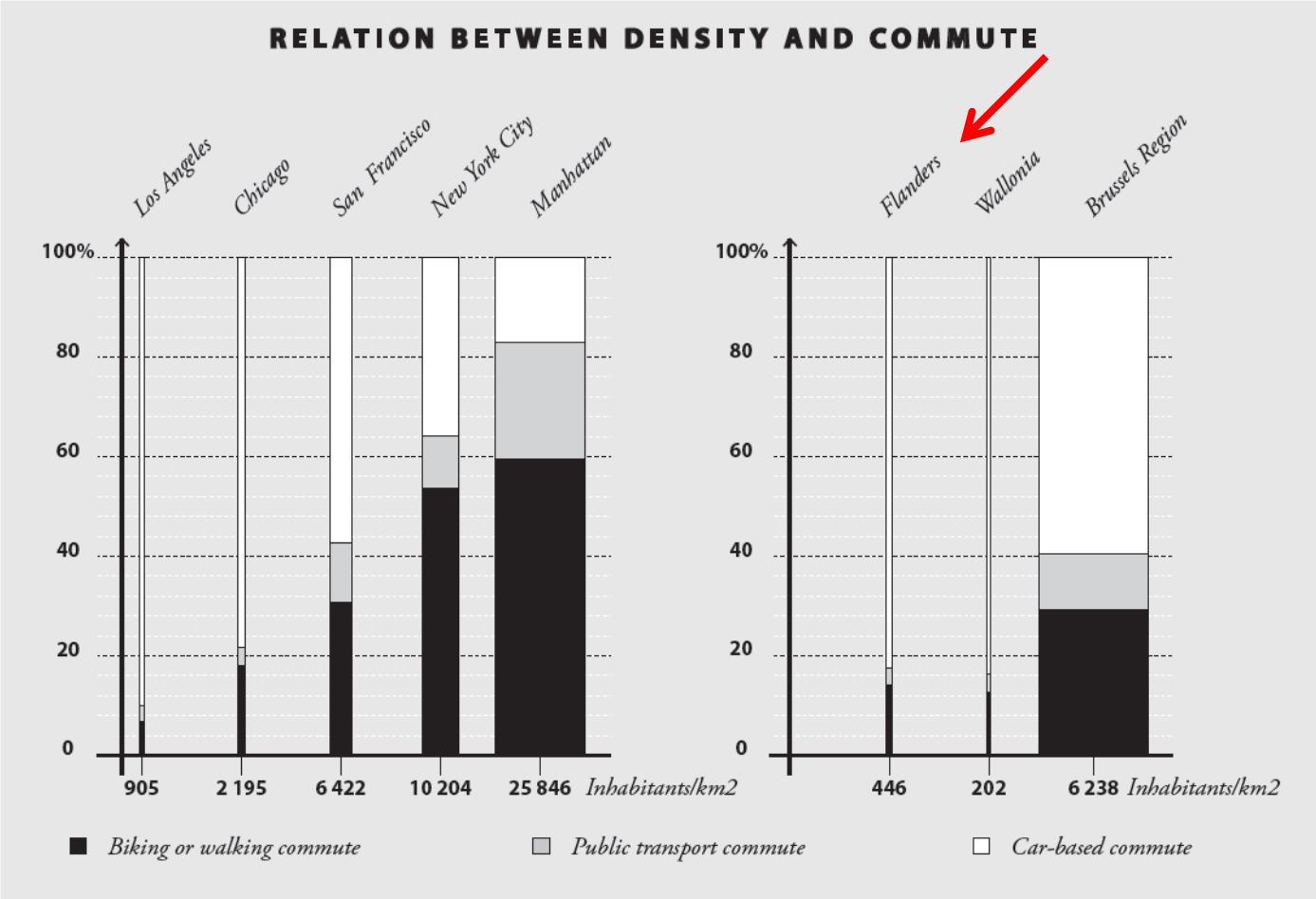
In this ‘car-based’ suburbia model, both transport (by car) and heating/cooling of the single detached dwellings, are demanding a lot of energy.
More-over, the spatial chaos is the cause of traffic congestion.

http://www.posadlabs.com/flemish-metropolitan-dream/

The traffic congestion as a consequence of spatial chaos in *suburban Vlaanderen'* and the separation of liwing/working/recreation.

http://www.posadlabs.com/flemish-metropolitan-dream/

Relation between density (inh/km²) and commuting:



The lower residential density is, the more people using cars to commute.

Bron: BOGDAN & VAN BROECK | DuWoBo Transitie-arena 2015

Structure of this presentation.

- 0. The 17 sustainable development goals of the United Nations.
- 1. Ecosystem services
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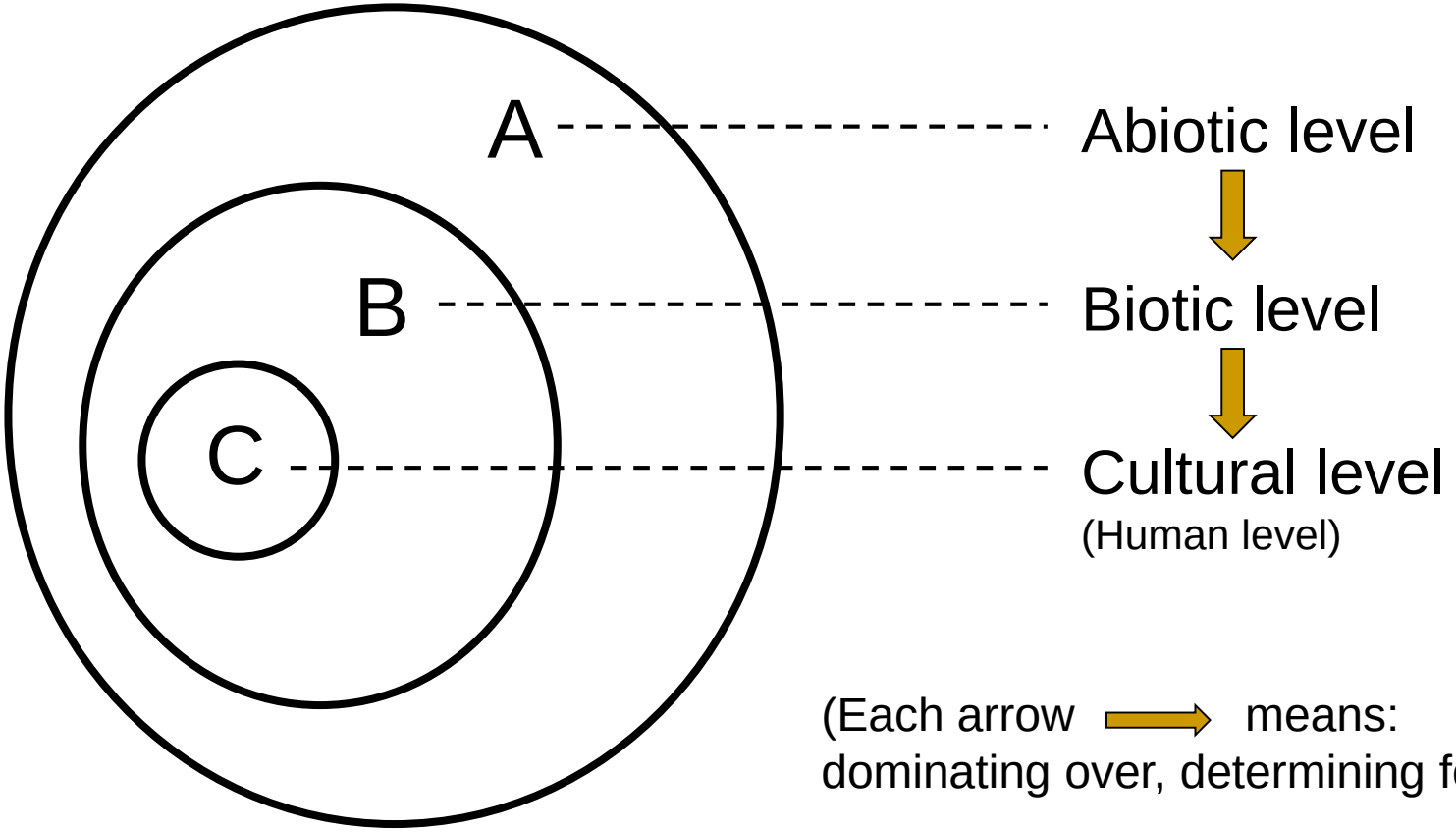
HUMAN ACTIVITIES DEPEND ON AN INTACT BIOTIC AND ABIOTIC LEVEL.

VAN LEEUWEN (1979) EN SCHROEVERS (1982)



(Each arrow ⟶ means: dominating over, determining for)

Cosmosphere (A) ⟶ *atmosphere (A)* ⟶ *hydrosphere(A)* ⟶ *lithosphere (A)* ⟶ *biosphere (B)* ⟶ *noosphere (C)*

Ecological conditions: dominant or weak ?

- Some abiotic conditions are **strong, dominant, aggressive.** Other abiotic environmental conditions are **weak.**

  silence < noise

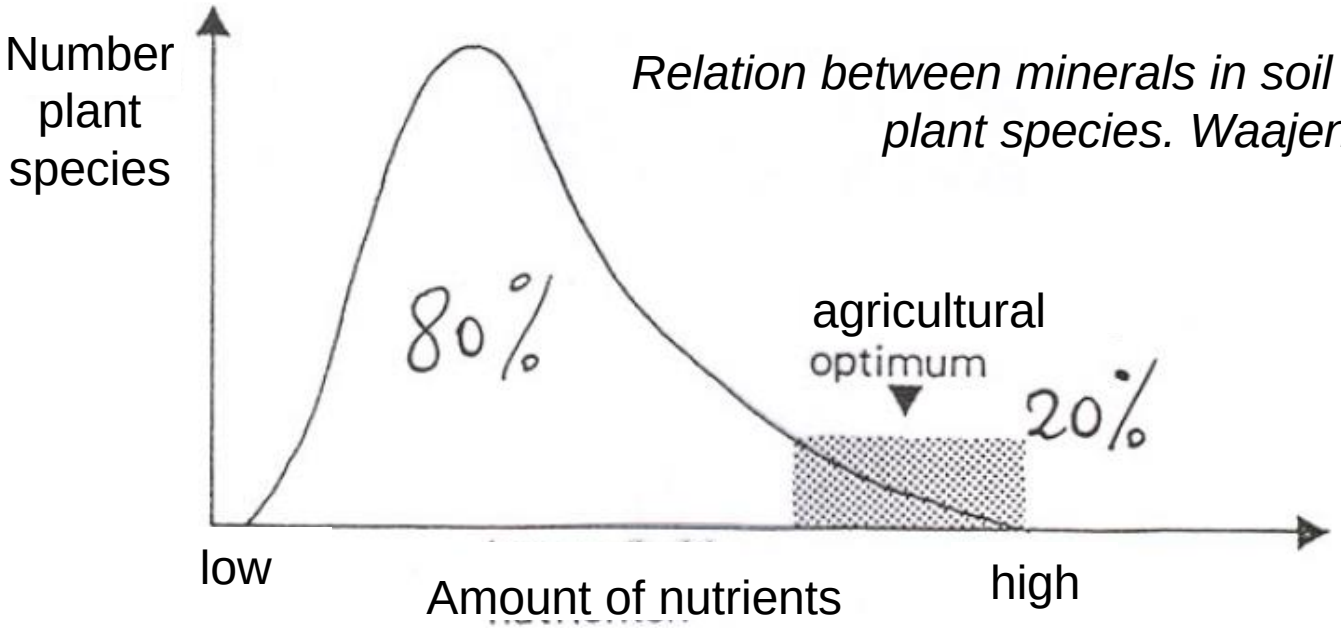
  clean < dirty

  quiet < dynamic

  fresh water < salt water

  …

  low dynamic < high dynamic



Relation between minerals in soil and the number of plant species. Waajen, 1985

Verband tussen het voedselaanbod en het aantal plantensoorten, Bron: Waajen, 1985

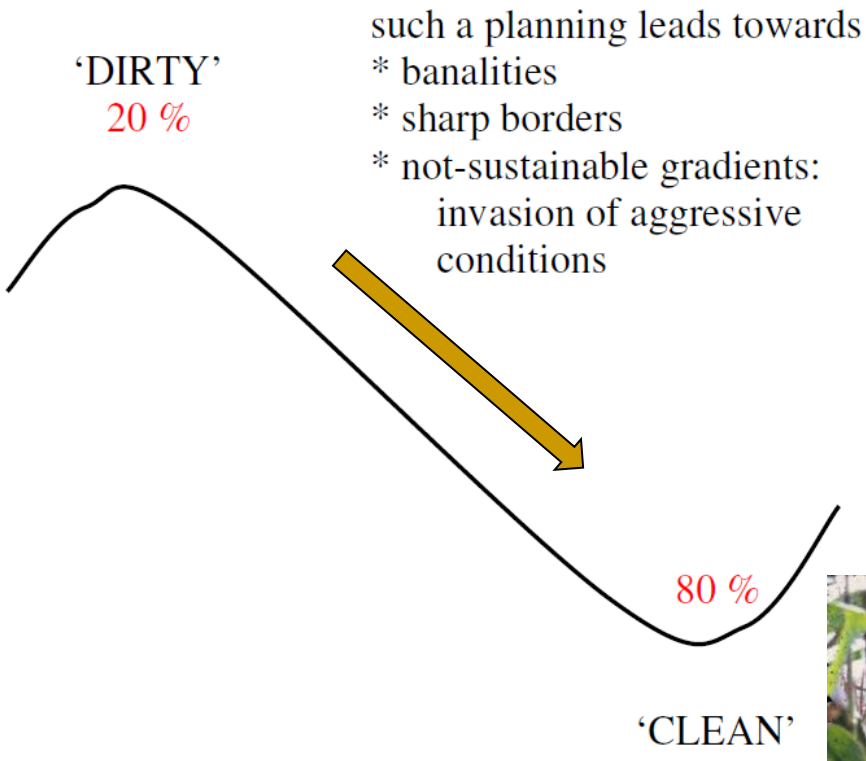
- In habitats characterised by **weak abiotic conditions** (clean, silent, fresh water, few nutrients (= oligotrophic), …), a lot of different species can grow : 80 % of the indigenous plant species. Biodiversity is high.

- In habitats characterized by a lot of **dominant, aggressive abiotic conditions** (dirty, salt, high dynamic, a lot of nutrients (eutrophic),….), very few species can grow: 20 %. Biodiversity is low. Those species will occur in very large populations with a big biomass: very few species but very high densities and a lot of individuals will occur.

- Examples: coastal ecosystems salt mud flats and marshes (Zwin, Saeftinghe, ...)
- but also cities.

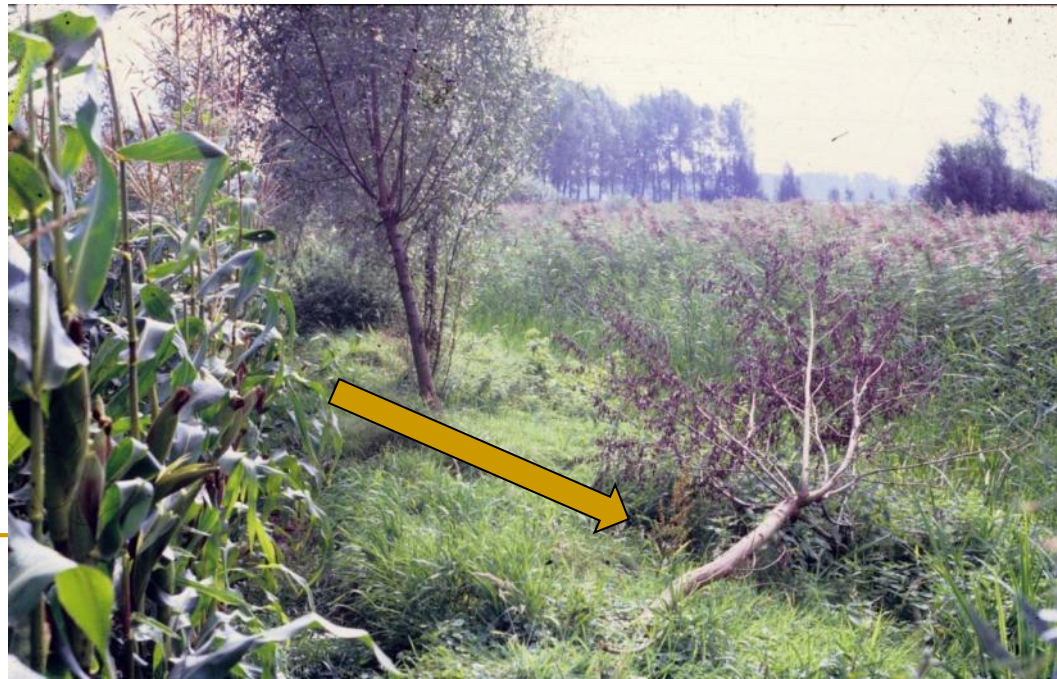
  e.g.: Rats, doves, Stinging Nettle (*Urtica dioica*), English Daisy (*Bellis perennis*), Canada thistle (*Cirsium arvense*), Dandelion (*Taraxacum officinale*), …

Anthropogenic dynamics. Situation to avoid by design.

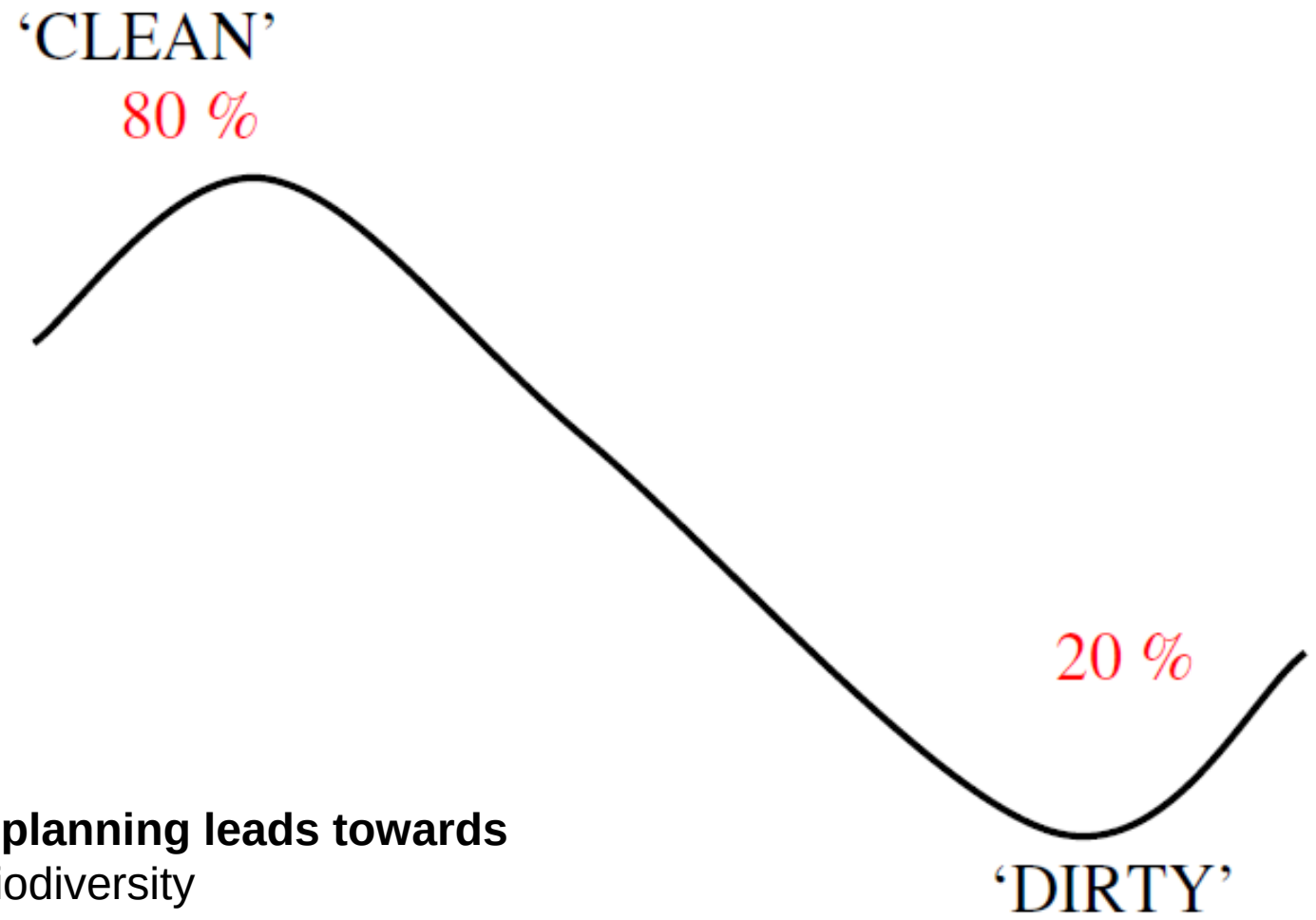


Avoid the situation of aggressive ecological conditions on a higher place (such as slopes, river springs, …) in landscapes.
Those aggressive conditions will spread and overrule lower situated weaker conditions. Biodiversity will decrease for sure.

Saeleghemkreek Meerdonk (O-Vl, B.)



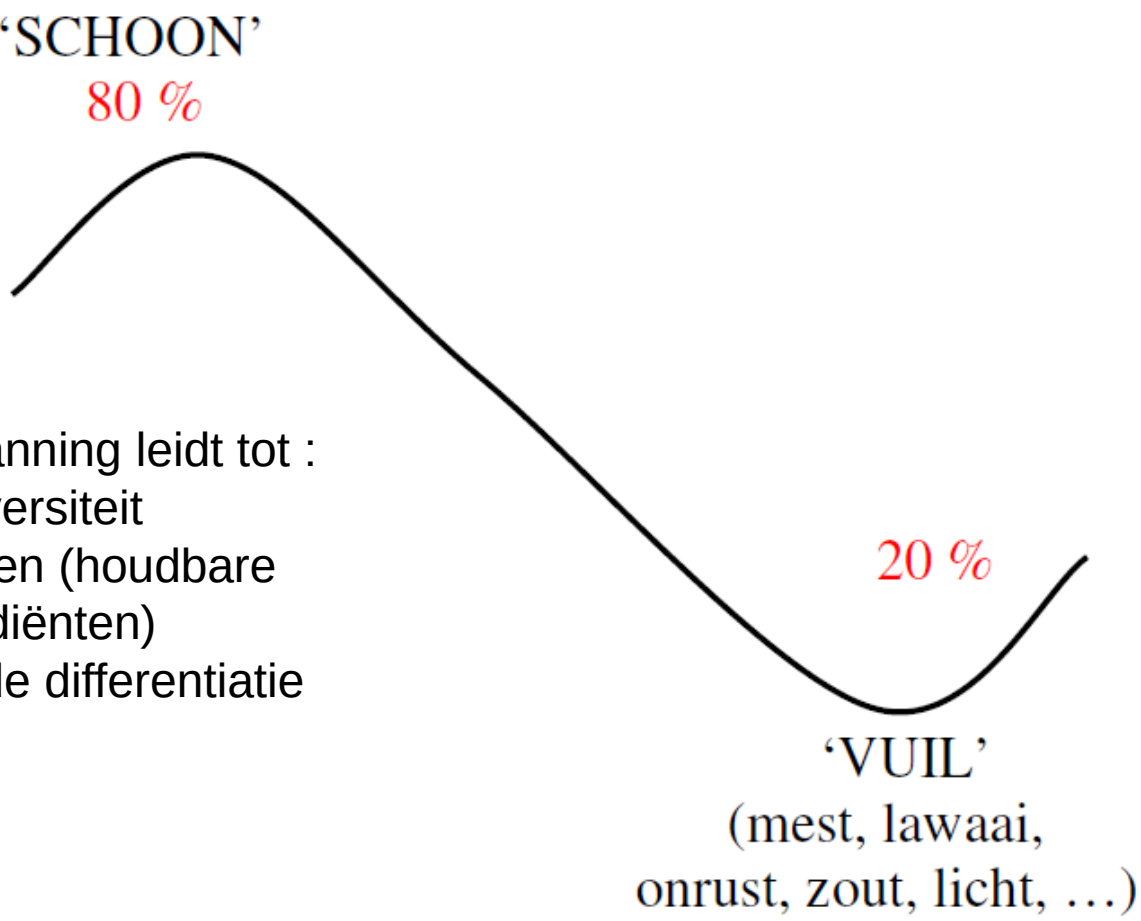
Anthropogenic dynamics. Situation to create by design.



Such a planning leads towards

* high biodiversity
* sustainable gradients
* increasing differentiation

In '(plan)ontwerpen' na te streven situatie.

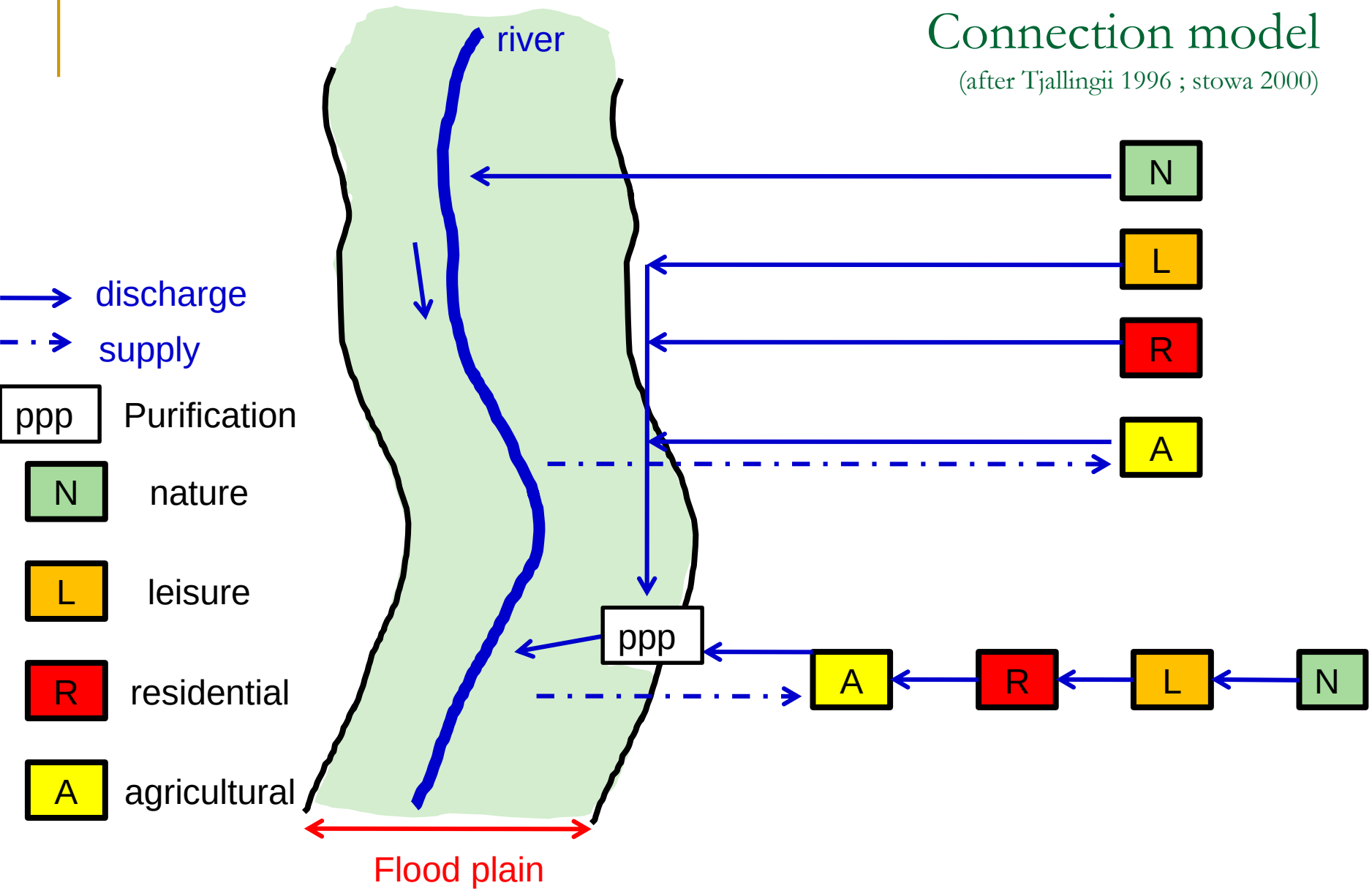


dergelijke planning leidt tot :
* grote biodiversiteit
* vage grenzen (houdbare gradiënten)
* Toenemende differentiatie

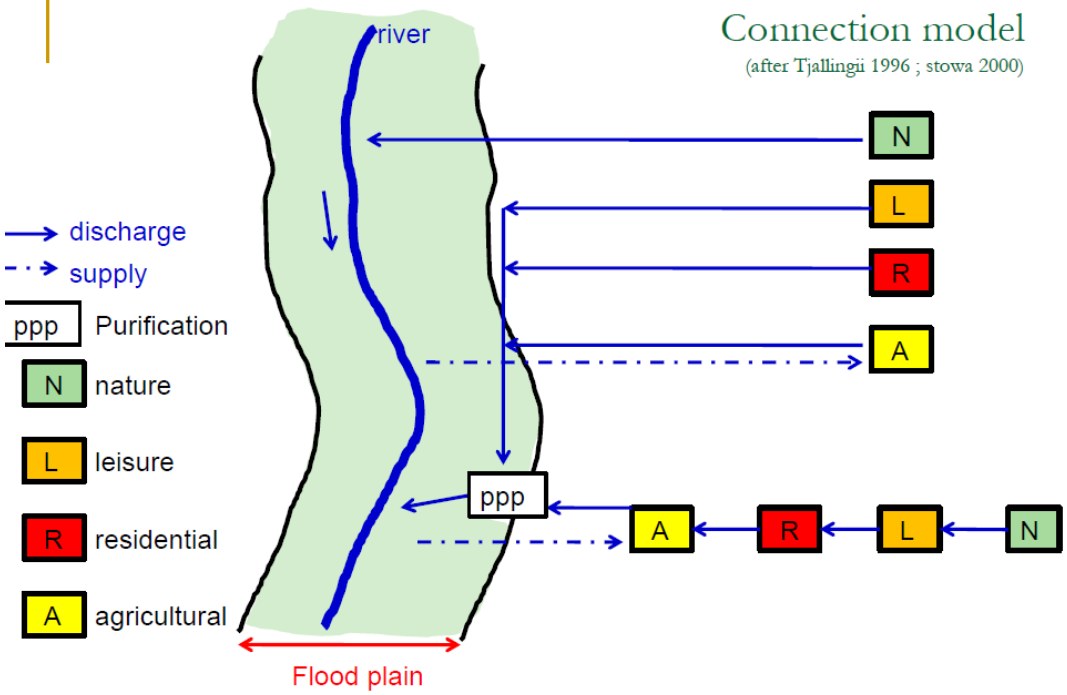
There is no time today to zoom in on the Relation theory (VAN LEEUWEN ,1966).
This theory explains that also the green management over time is very important:
Time is dominant over space, processes are determining patterns.
Processes are the cause, (bio)diverse patterns are the consequence .

Connection model

(after Tjallingii 1996 ; stowa 2000)



The connection model suggests an ecologically sound water-chain between rural and urban regions.



This connection model can be used to design a sustainable regional water system. In this connection model the underlying ecological principle is to create a stable gradient by allowing water to **flow from clean (in low-dynamic surroundings) to polluted (in high-dynamic surroundings)**, from nutrient-poor to nutrient-rich conditions. There are two possibilities: a series connection and a parallel connection (because 'dirty' dominates over 'clean'). See lesson for examples.

STOWA. STICHTING TOEGEPAST ONDERZOEK WATERBEHEER. 2001. Levende stadswateren: werken aan water in de stad. STOWA, ill. ISBN 90 5773 096 3. www.stowa.nl

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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 and citizens' densities in **another way** than *compact, concentric cities* do?
- Is there a third way for a new urban agenda as UN-SDG 11 is aiming for ?

From Business as Usual Towards a New Urban Agenda
Naar een nieuwe stedelijke agenda

Urban Sprawl → Compactness

Verkaveling ⟶ compactheid

Segregation → Integration

Scheiding ⟶ mengen

Congestion → Connectivity

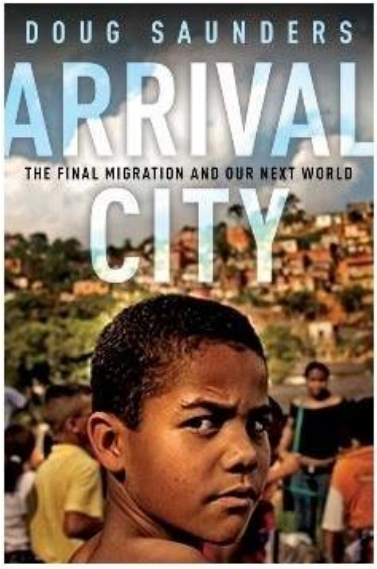
Verstopping ⟶ verbinding

Bron: Tuts, 30/11/2015. Lecture UAntwerpen

UN HABITAT
FOR A BETTER URBAN FUTURE

Congruent findings from ecology and sociology about desirable citizens' densities and of mixing functions.

- Doug Saunders in his bestseller book ' arrival city ' comes to similar conclusions. His ideal arrival neighborhood is densely built-up, situated in or near the city-centre, has a wide variety of functions (with many and cheap buildings for homes, shops, small businesses, etc.).



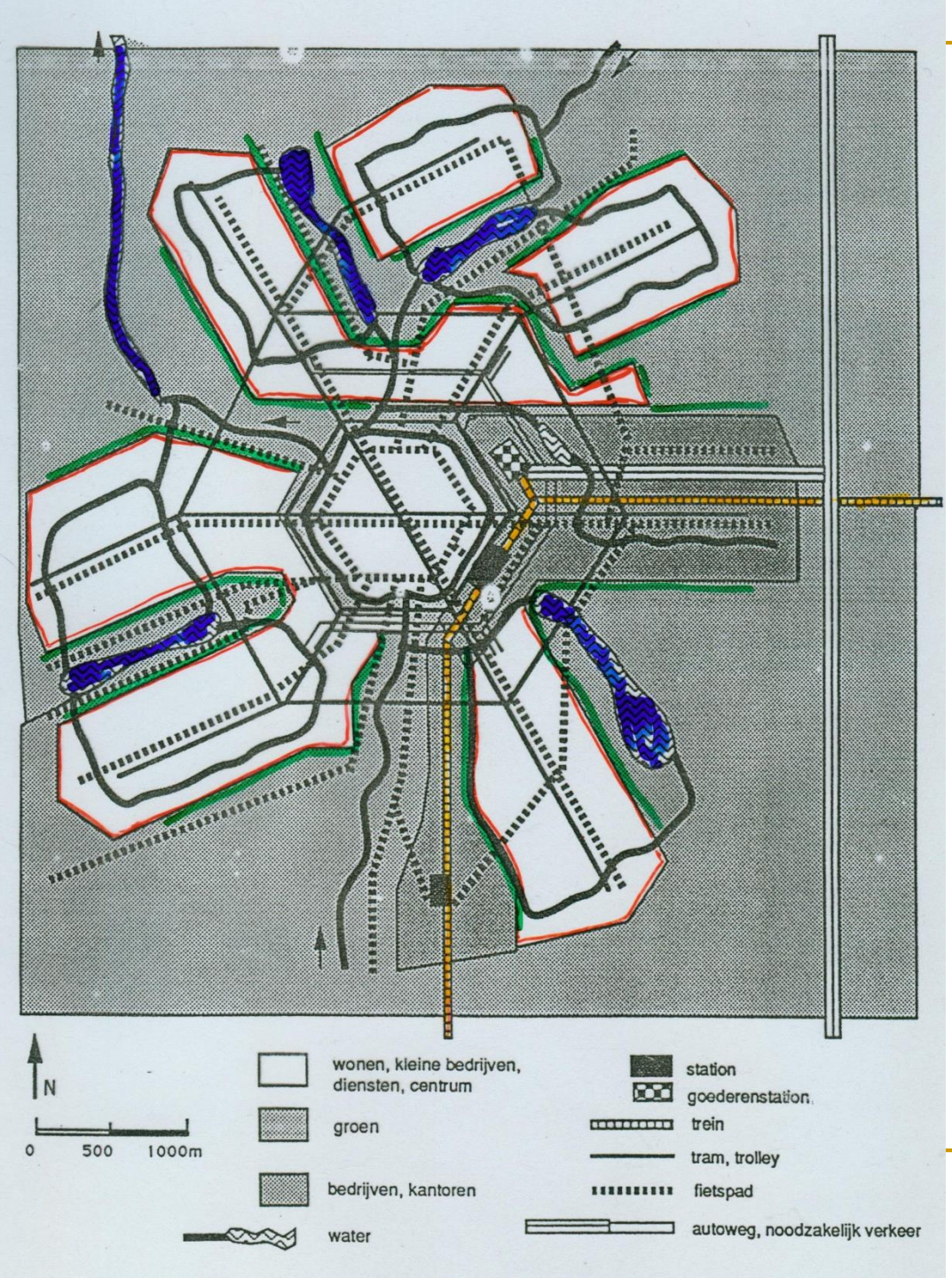
- Such ‘arrival areas’ can then function as an emancipation machine, as locations for transition, integration and social rising. If not, such neighbourhoods might fail and degenerate into resorts of alienation, extreme poverty, social unrest and (religious) extremism,

- Saunders says explicitly, that the ideas of the famous French architect Le Corbusier and of the ‘Congrès international d'Architecture Moderne (CIAM)’, which pleaded for a strict separation of areas for working, for living and for recreation (ideas on which in so many countries, planning was based on) are not compatible at all with the ideal urban arrival neighbourhoods…..

Hope & Peril in Europe’s Landing Pads: The Euro Crisis Hits an Arrival City

By DOUG SAUNDERS | *Published:* DECEMBER 19, 2011

Antwerp



There is a Solution: Building cities following the lobe-city model.

Compact high-dynamic city lobes

(fast lane)

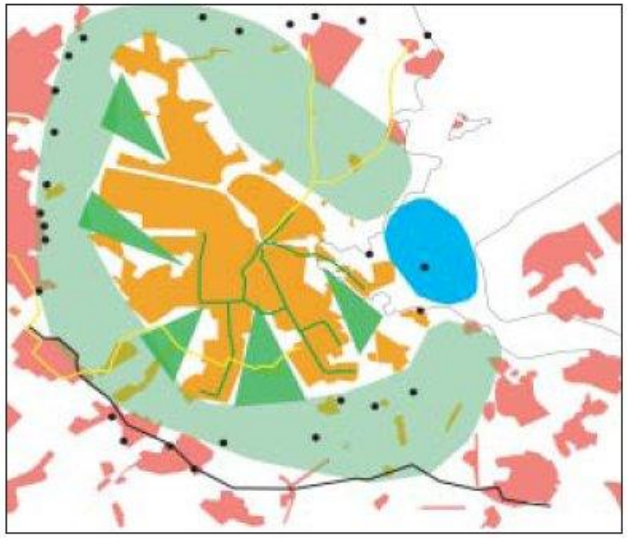
Separated from each other by

Low–dynamic blue-green fingers

(slow lane)

From Tjallingii, 1996

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



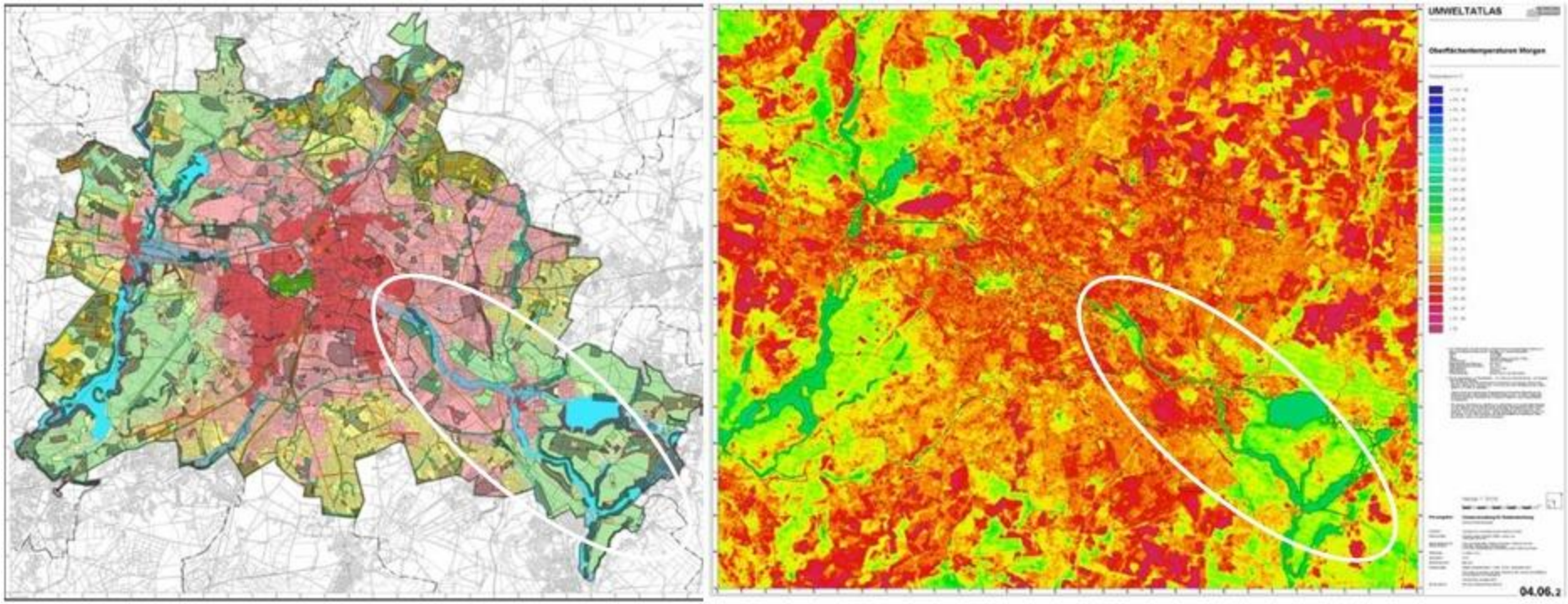
e Amsterdamse lobbenstad ligt een
one. Daaromheen ontstaat langzamer-
en krans met bebouwing, een
amde kransstad.
sterdam 'finger city' is surrounded by
belt. A garland of construction is
ly appearing around it, a so-called
city.

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

The lobe-city model

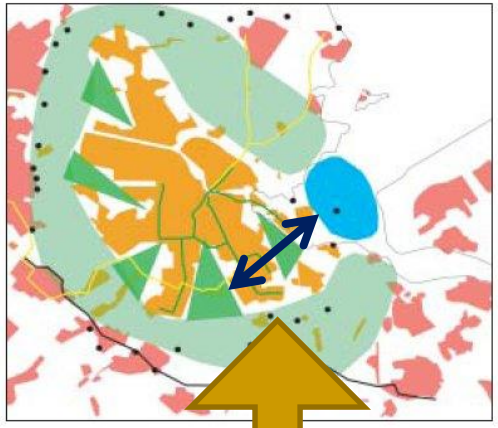
- The lobe-city model was developed in the first half of the 20th century.
- To varying degrees, this model was used in Denmark for the “fingerplan” in Copenhagen (Denmark) (1948), the general plan to extend Amsterdam (The Netherlands) (1935) and in cities such as Hamburg, Köln (1927), Berlin, Stuttgart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

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

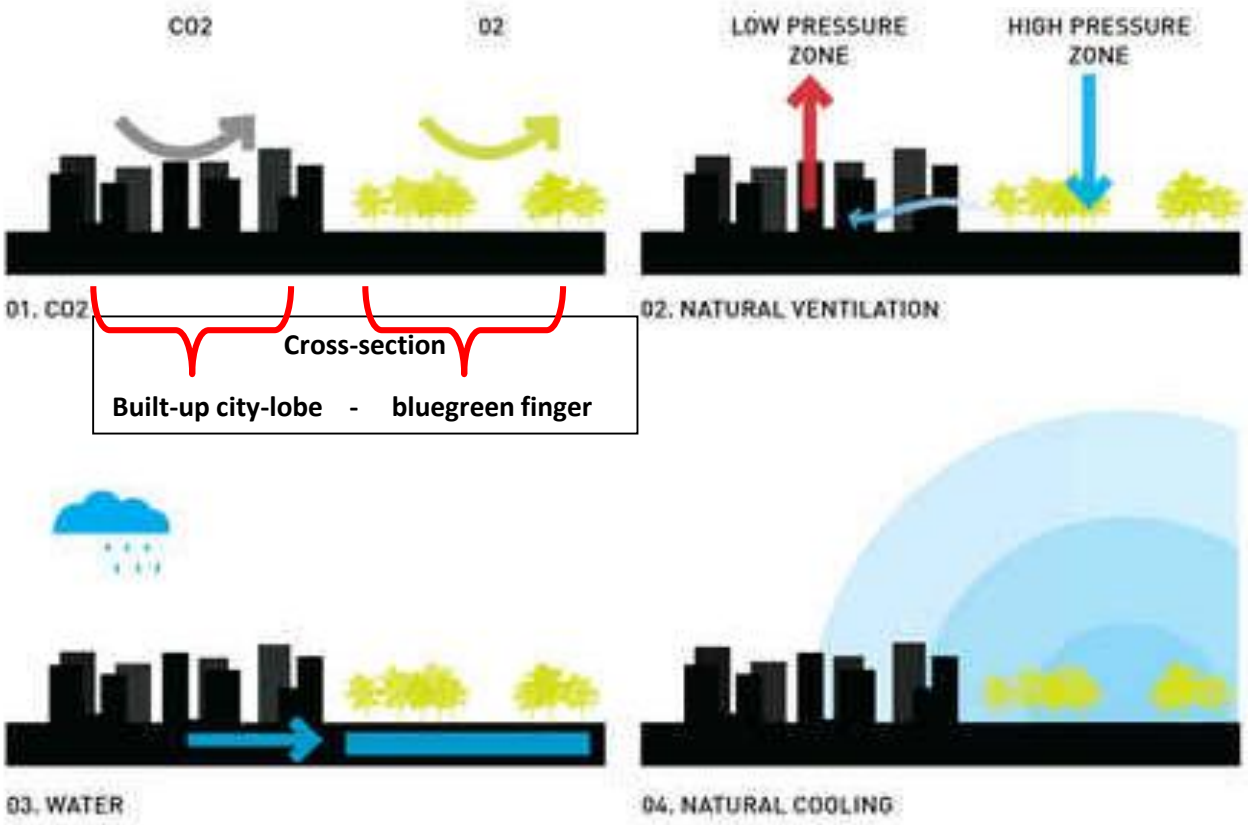


Infrared picture of hot city-lobes and cooler blue-green fingers of Berlin. (Cloos, 2006)

Urban blue-green fingers as a cooling infrastructure.



► Rond de Amsterdamse lobbenstad ligt een groenzone. Daaromheen ontstaat langzamerhand een krans met bebouwing, een zogenaamde kransstad.
The Amsterdam 'finger city' is surrounded by a green belt. A garland of construction is gradually appearing around it, a so-called garland city.



Cross-section of a lobe-city

http://www10.aeccafe.com/blogs/arch-showcase/2011/06/18/masterplan-%E2%80%9Cjuzne-centrum%E2%80%9D-in-brno-czech-republic-by-chybikkristof-associated-architects/

- 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

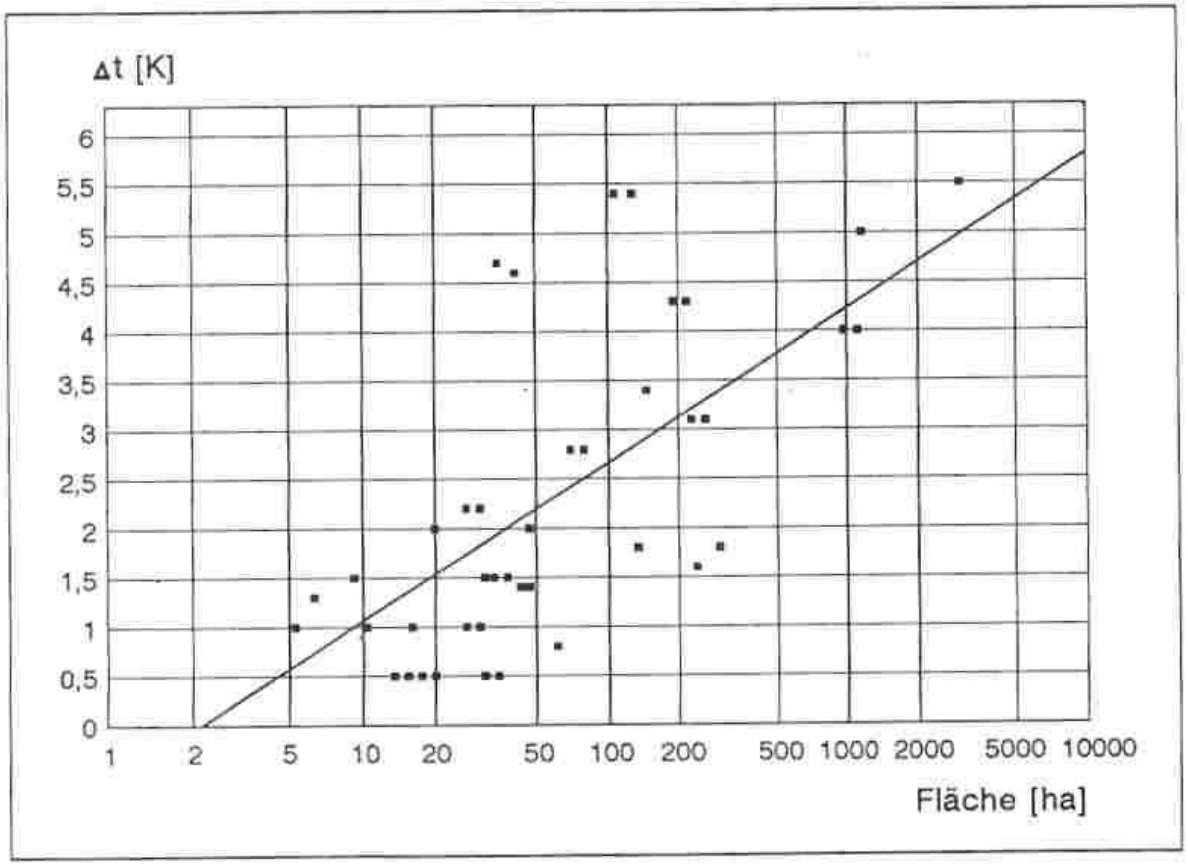
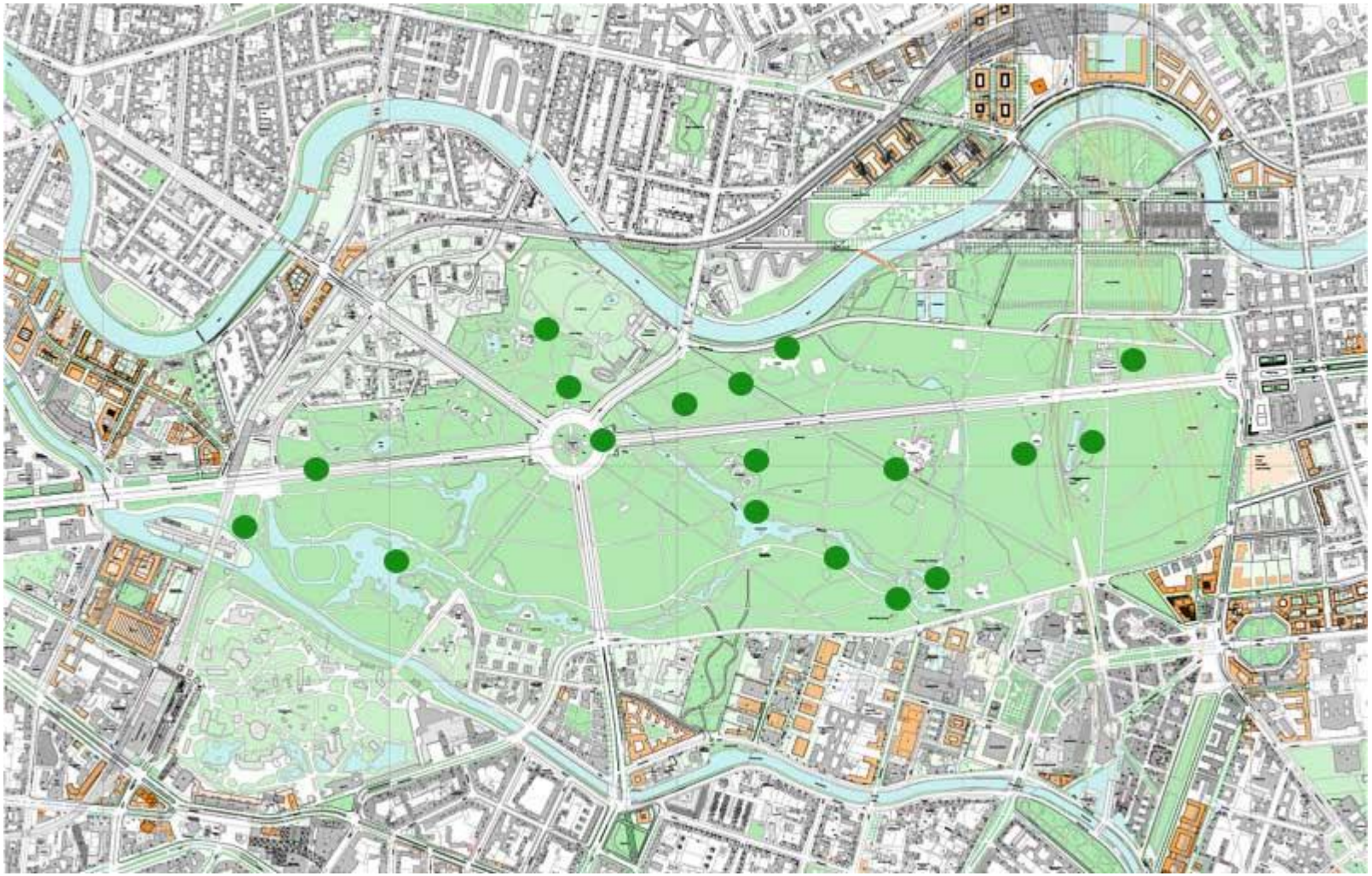


Abb. 6-21: Temperaturdifferenzen (Δt) verschiedener Berliner Grünanlagen zu ihrer Umgebung in Abhängigkeit von ihrer Größe in einer mäßig austauscharmen Strahlungsnacht (9. 07. 1982, 23.00 h MEZ) bei NE- bis E-Wind (nach v. Stülpnagel 1987).

Tiergartenpark (Berlin), surface 210 ha.

http://www.stadtentwicklung.berlin.de/umwelt/stadtgruen



Influence of the Tiergartenpark (Berlin) on temperature

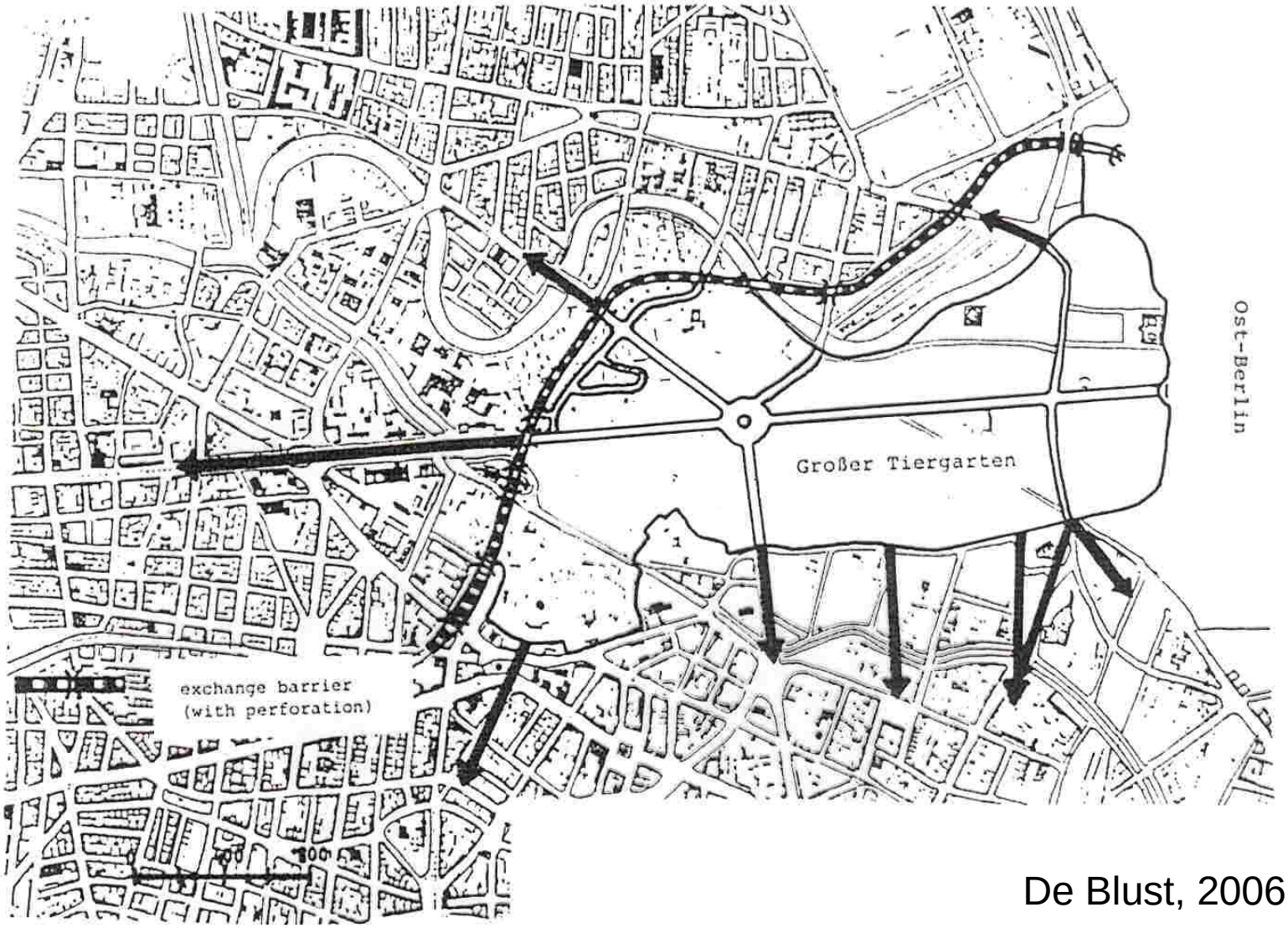
FIG. 26.2. Horizontal temperature distribution at the inner-city area of Berlin (West) 30.3.1978 23^{30h}

from De Blust, 2006.

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.

Mixing of functions was required !

The lobe-city of Houten (NL)

- This municipality is world known for the sake of **bicycle -based city building**, in the context of a lobe-city.
- Each residential district is accessible via a loop by car from city ring. If you want to drive by car from one district to another, you have to drive back to the city ring.
- For cyclists and walkers, all districts are interlinked strongly.
- More details during our compulsory study trip

Residential city quarters of the municipality Houten (NL) are quite well interlinked for bikers and pedestrians.

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

The finger plan of Copenhagen (DK)

Finger Plan (Local Plan Office for Greater Copenhagen, 1947)
http://www.pashmina-project.eu/doc/PASHMINA_D2.3.pdf

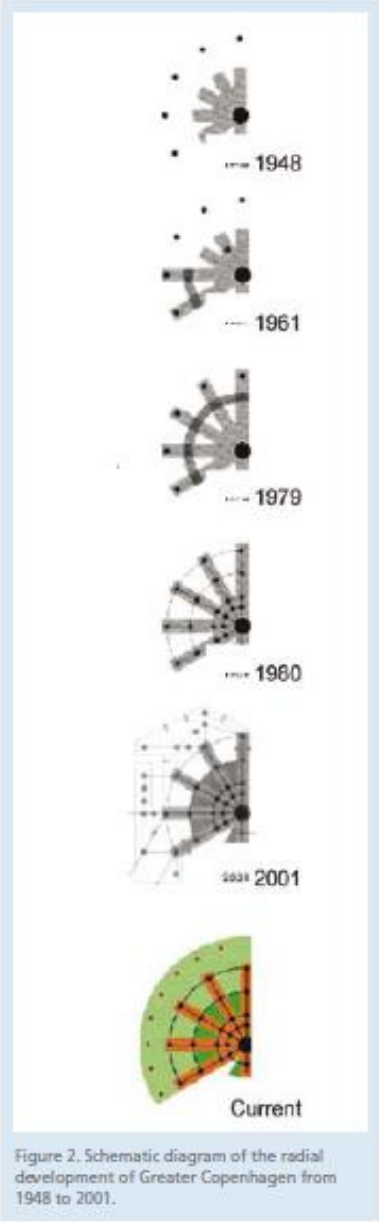


Figure 2. Schematic diagram of the radial development of Greater Copenhagen from 1948 to 2001.

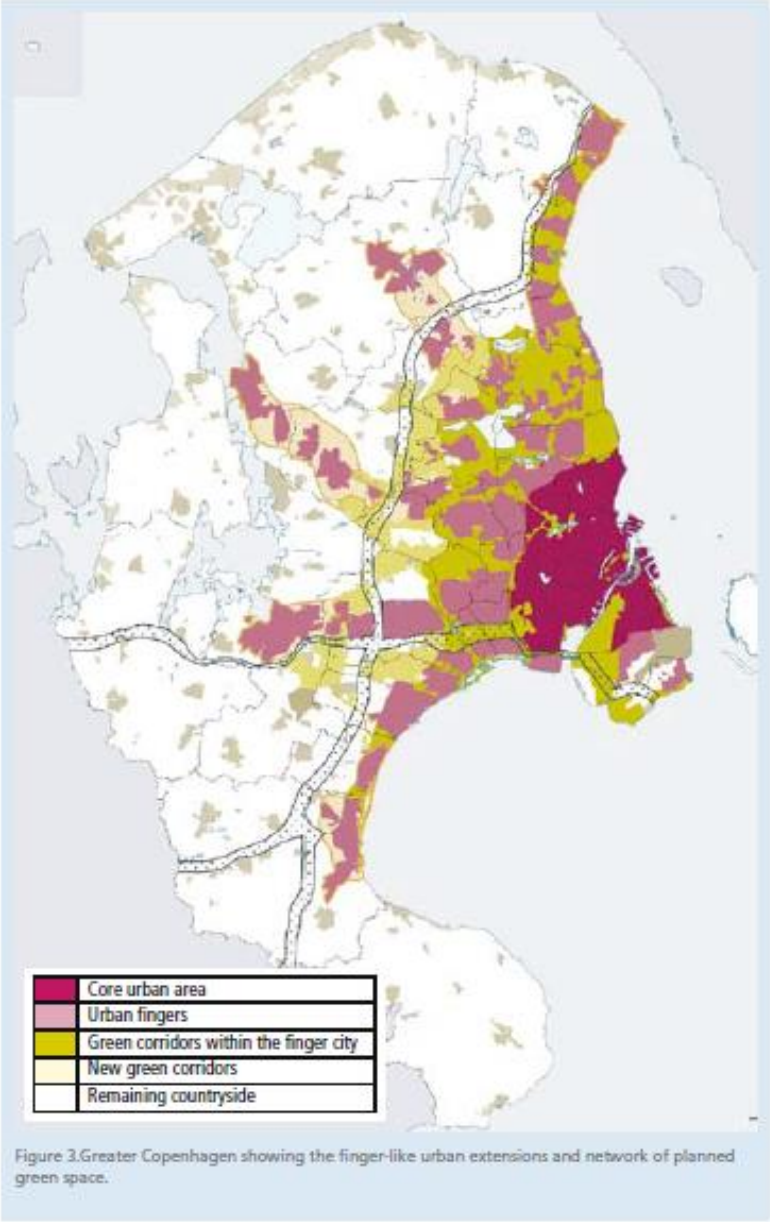


Figure 3.Greater Copenhagen showing the finger-like urban extensions and network of planned green space.

The Finger Plan includes not only the relatively small Municipality of Copenhagen covering the centre part of the city with app. 0.5 mill citizens but in addition take in the Greater Copenhagen Area, and thus also covers 34 adjacent municipalities.

source: UCD, 2008.

Copenhagen (DK)

1947 and 2007 Finger Plans

Historically, the Copenhagen suburbs have been developed according to the **Finger Plan** from 1947 which intends for the suburbs to develop as fingers along commuter rail lines separated by green wedges.

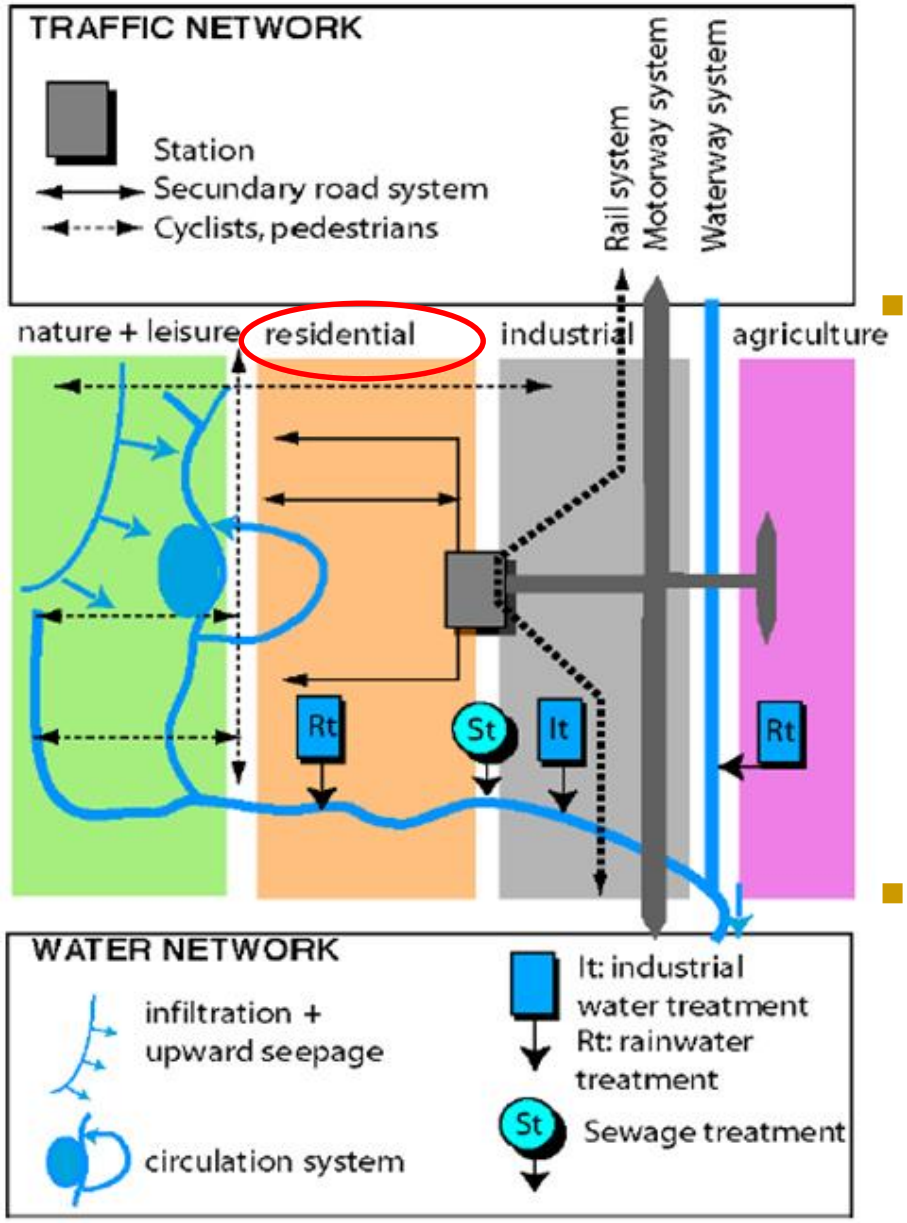
Designing a lobe-city means the designing of **contrasts**: TWO NETWORK STRATEGY (S2N) .

- This is a spatial planning strategy in which the water network is carrying the blue-green fingers

  while the traffic network is carrying the built-up lobes.

- So there is a need to design CONTRAST, very close to each other, because people need both: high dynamic building/industry/agriculture zones very close to low dynamic blue-water/green-nature/leisure zones.

Two network strategy S2N



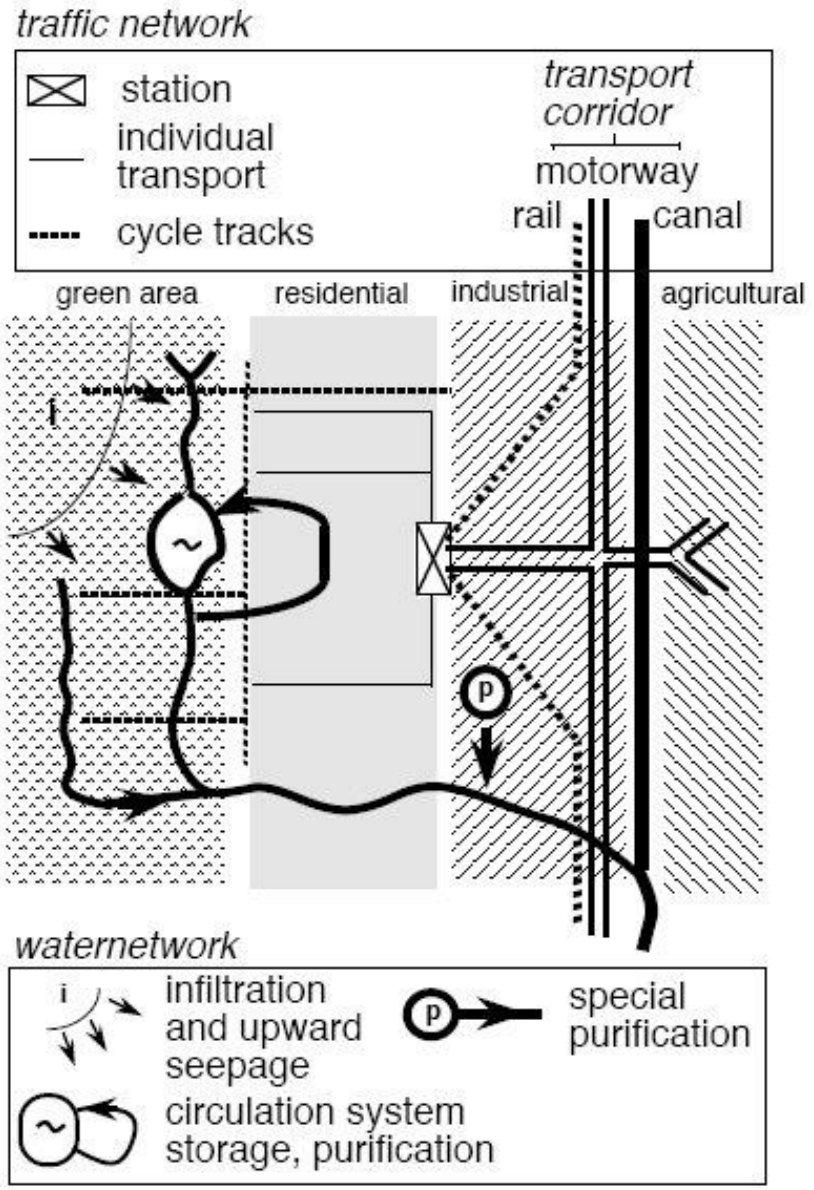
- The residential areas are situated in-between the low dynamic and the high dynamic zone. The **two networks create a good position** for residential land-use in the middle, with free access to both the slow lane and the fast lane.
- Notice that conventional agriculture is regarded as a highly dynamic activity, which is better linked to the industrial area rather than to the blue-green zone.

Low- → High-dynamic

Two Network Strategy (S2N) .

- This model combines the guiding models for water and traffic flows with an ecological zoning principle : the gradient between quiet low dynamic green zones to the high-dynamic traffic zone, has to coincide with the transition between upstream clean water and more polluted water downstream.
- Within the blue-green fingers (SLOW LANE) all the low dynamic activities are concentrated such as foot paths and cycle lanes, city farming, soft recreational forms, nature, ponds for the infiltration and retention of rain water, controlled flooding areas, cemeteries, some sports infrastructure, ….
- Within the built-up city lobes (FAST LANE) all the high dynamic activities are planned, such as industrial activities, trade services, mass recreation, …

S2N



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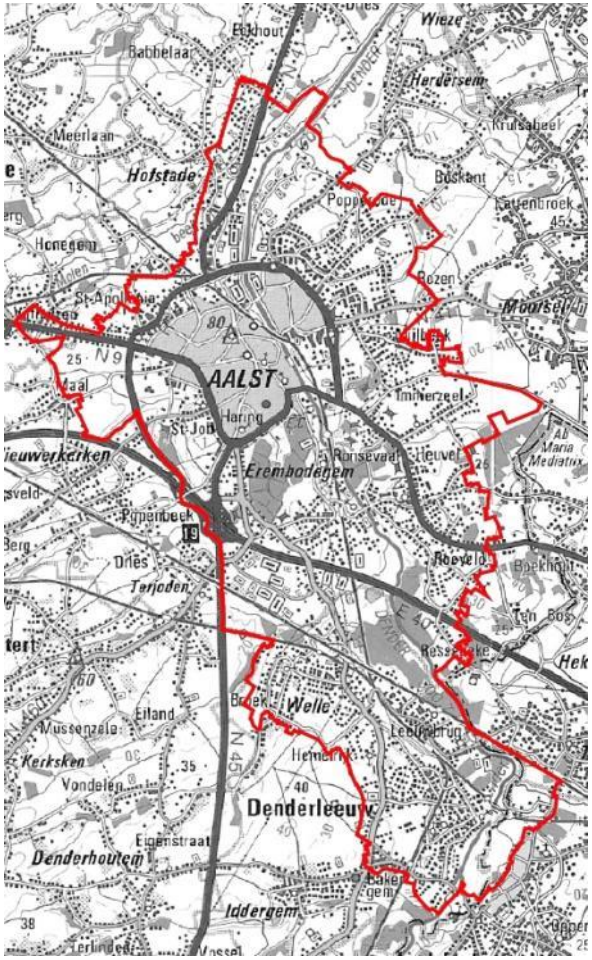
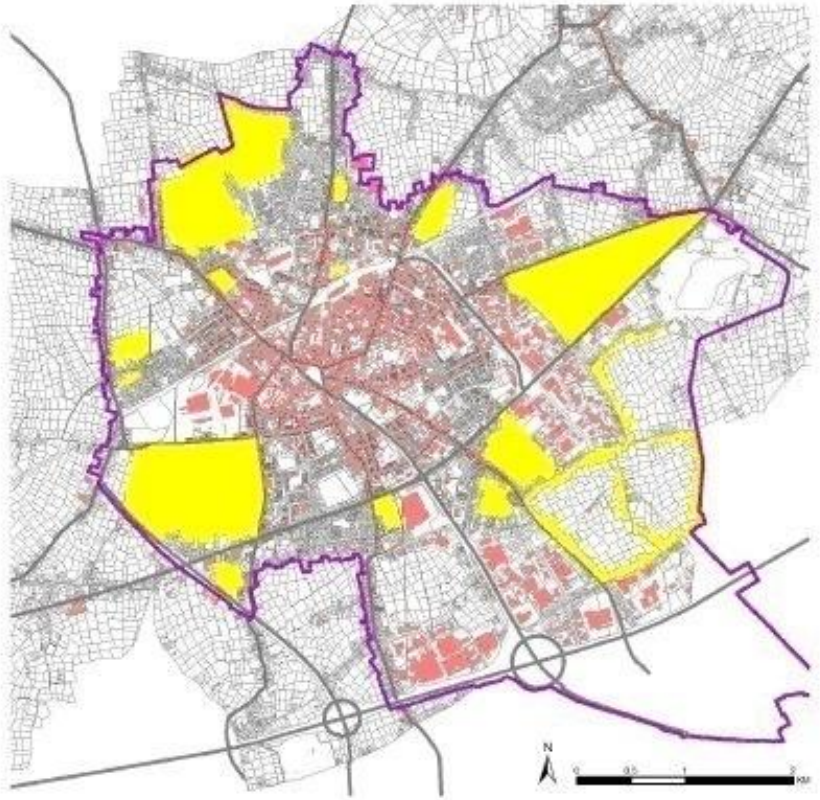
Case study of the Belgian cities *Sint-Niklaas* (68,000 inh.) and *Aalst* (78,000 inh.) Official plans for *concentric expansion* of both cities.

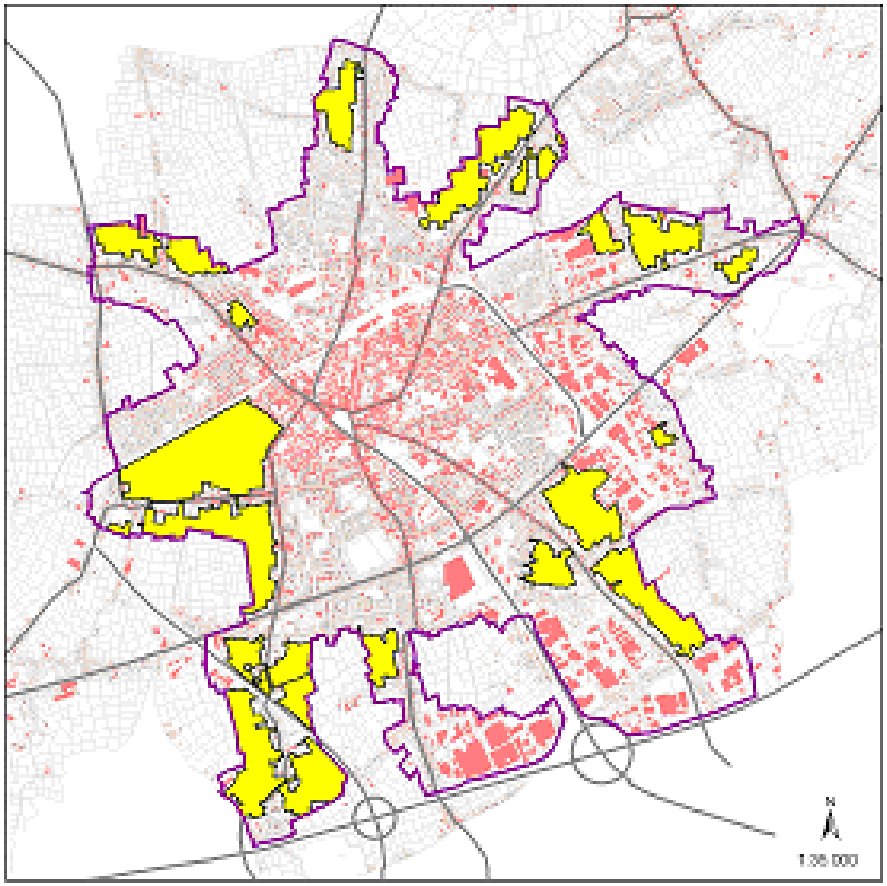


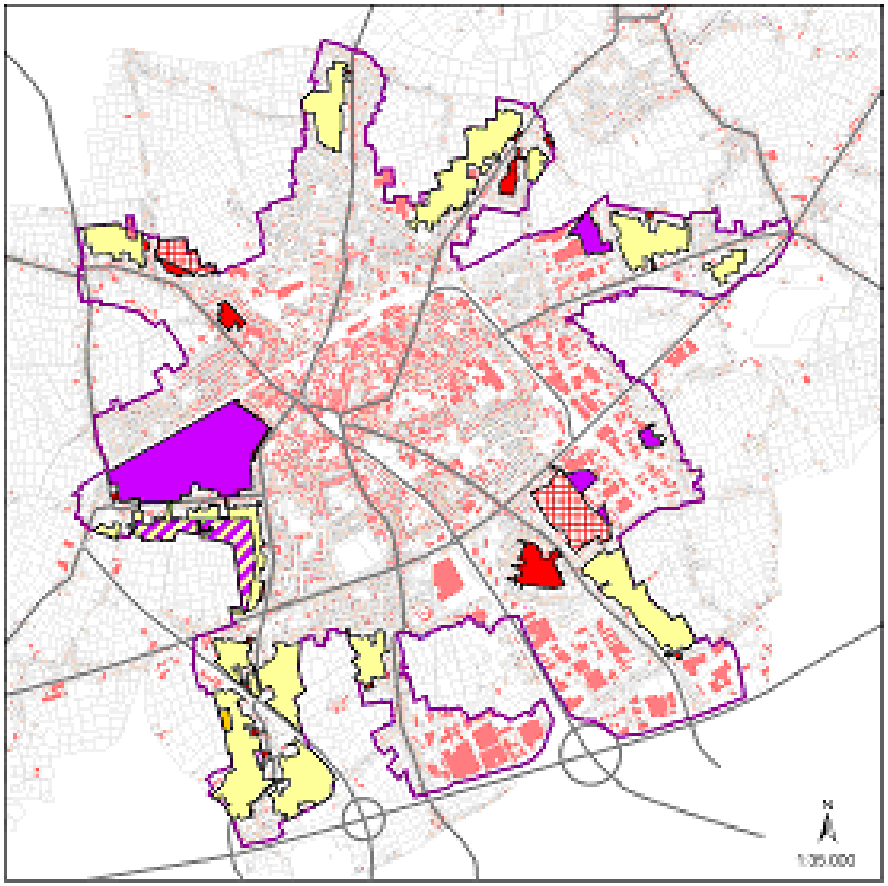


City of Aalst

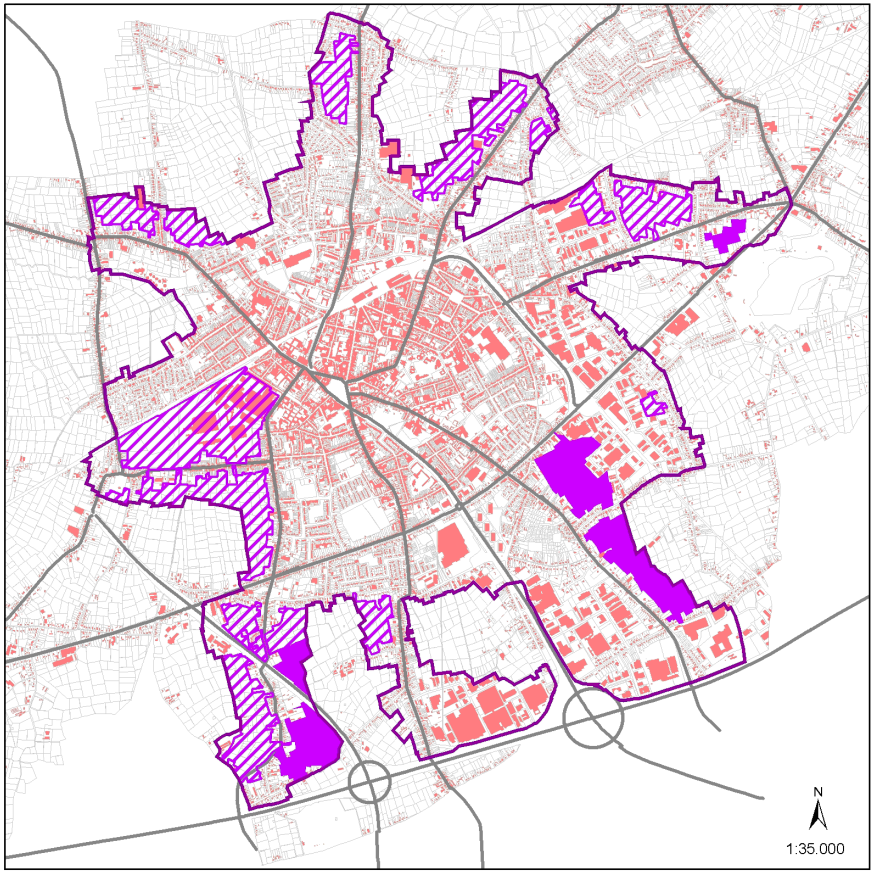
City of Sint-Niklaas

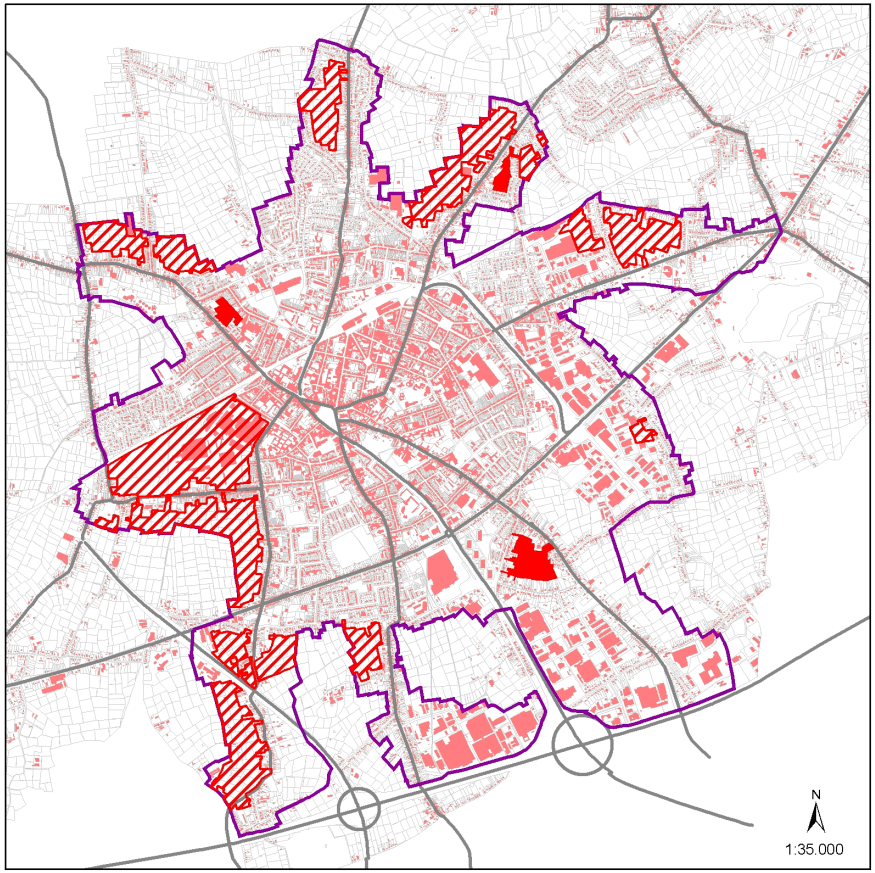
The proposed alternative lobe-city extension for *Sint-Niklaas*, following the lobe-city guidelines.





In the proposed lobe-city *Sint-Niklaas*, 113 ha of industrial area and 214 ha of residential area can be found.

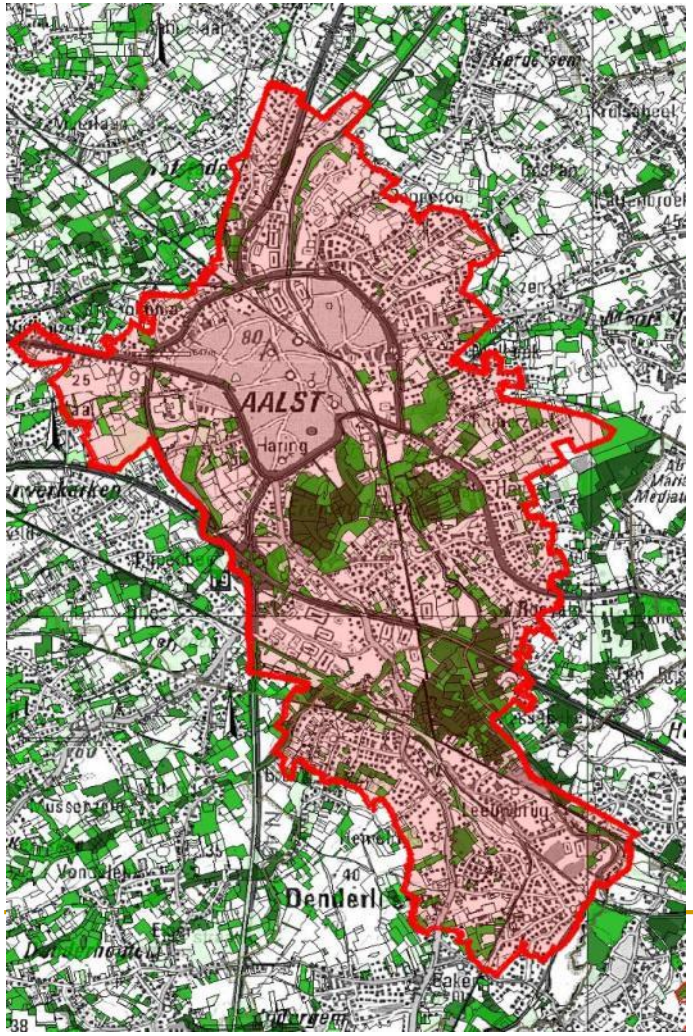


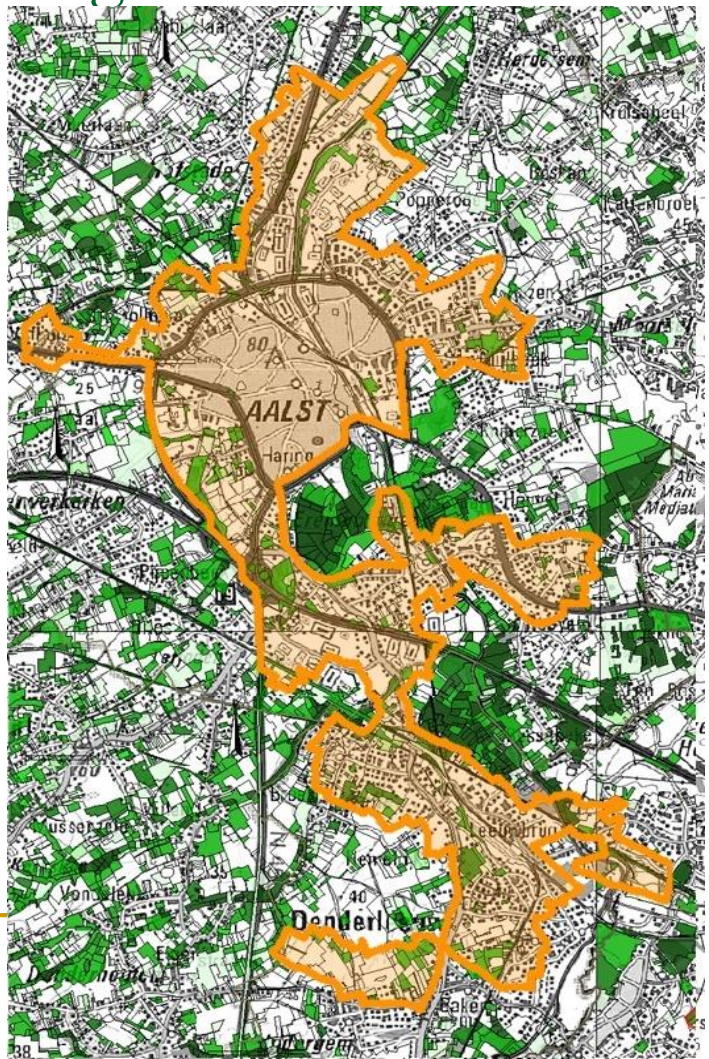


Industrie: 113,0 ha
(77,9 + 233,8 * 15%)

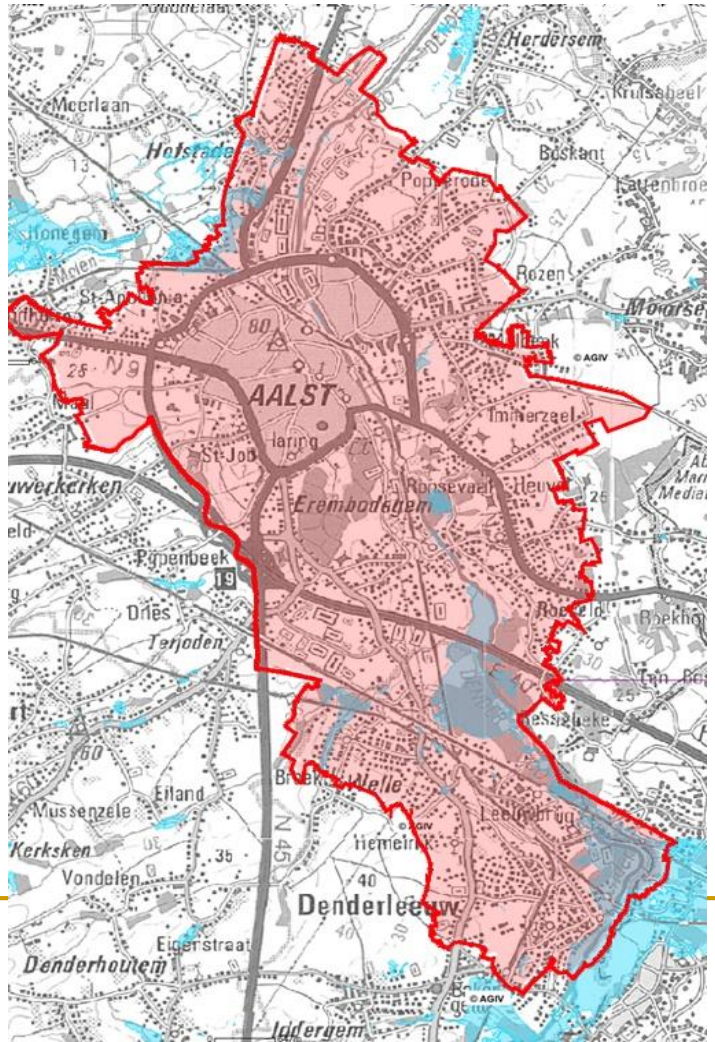
Wonen: 214,1 ha
(15,4 + 233,8 * 85%)

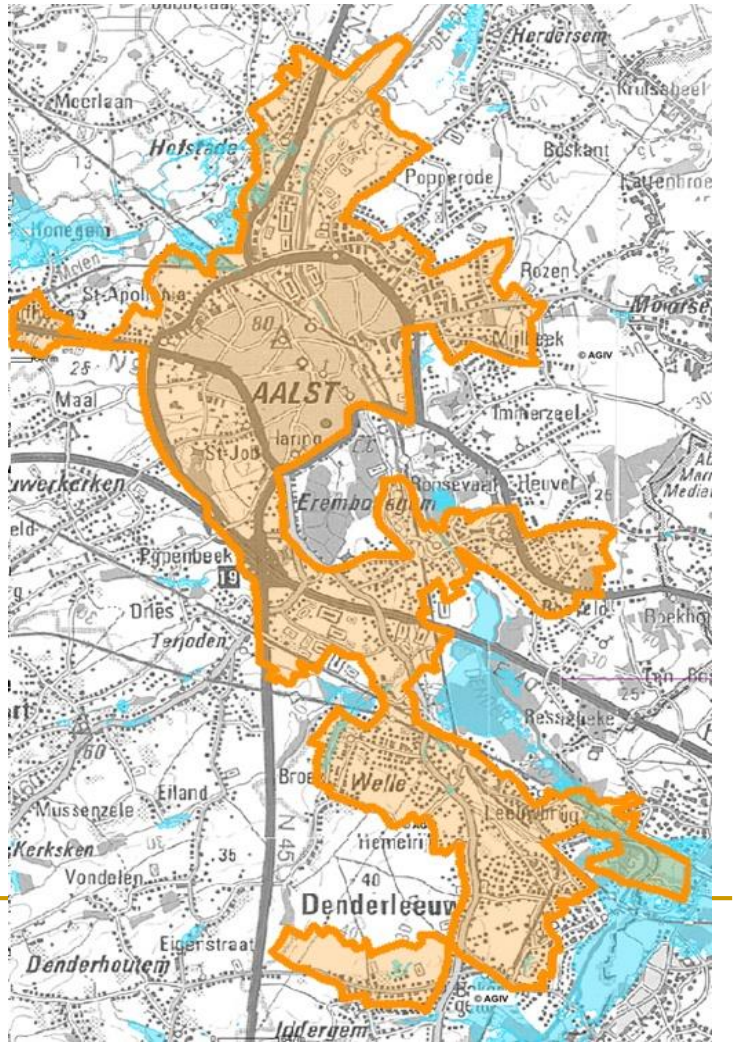
The lobe-city extension of *Aalst* (right), compared with the concentric extension plans (left), excludes green areas with high nature values from city expansion, integrating them into the blue-green fingers.





The proposal to expand Aalst in a concentric way (left) is occupying a lot of recently flooded areas (blue zones). The lobe-city (right) excludes those wet areas along the river Dender from city expansion, integrating them into the blue-green fingers





Lobe-cities have a longer city fringe and use less surface than the concentric expanding model does .

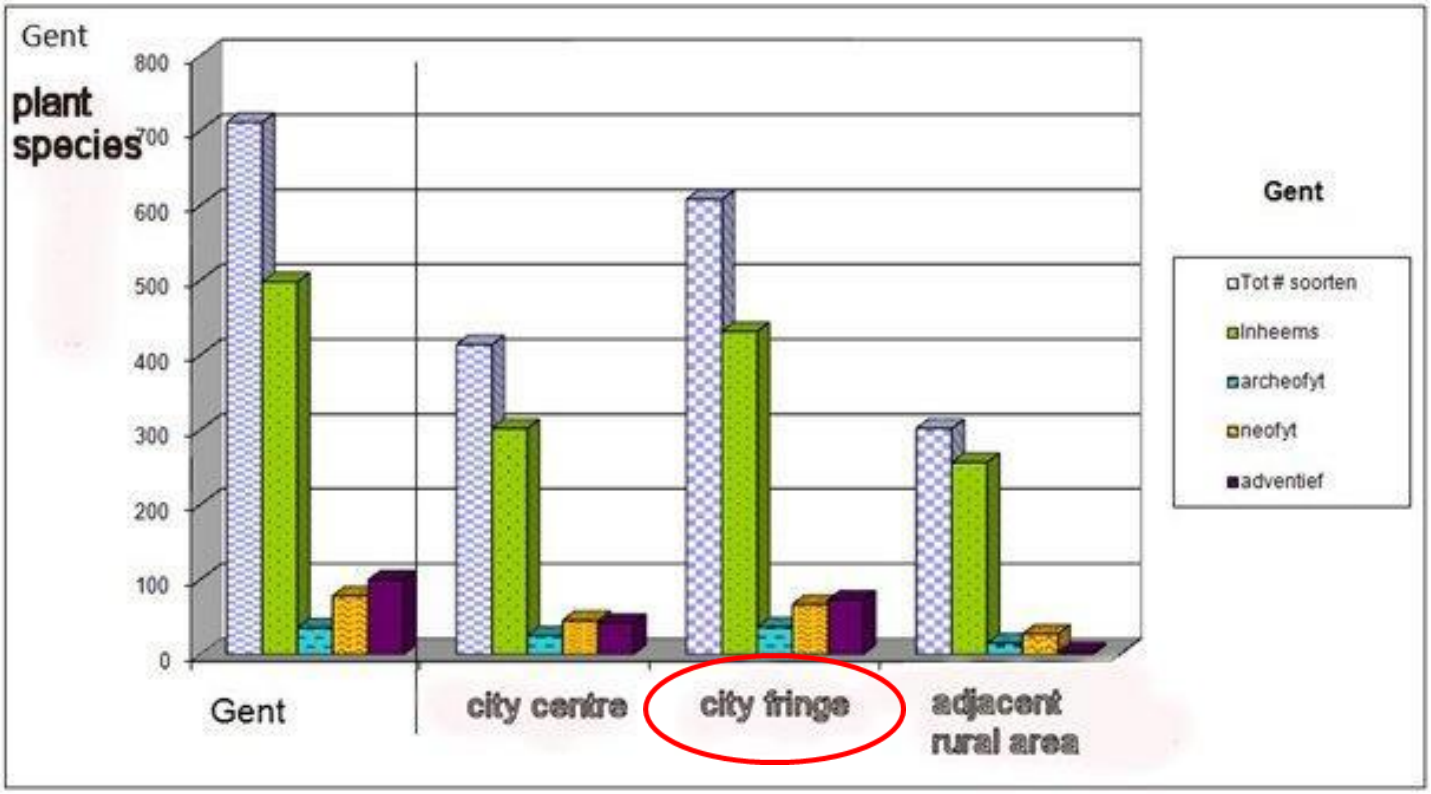
Table 1. An expansion of the city of Sint-Niklaas applying the lobe-city model results in a longer city fringe and needs less city surface

Sint-Niklaas	Concentric model	Lobe-city model
City circumference (fringe)	+/- 28,6 km	+/- 44,0 km
City surface	+/- 2 537 ha	+/- 1 813 ha

Table 2. An expansion of the city of Sint-Niklaas applying the lobe-city model results in a longer city fringe and needs less city surface

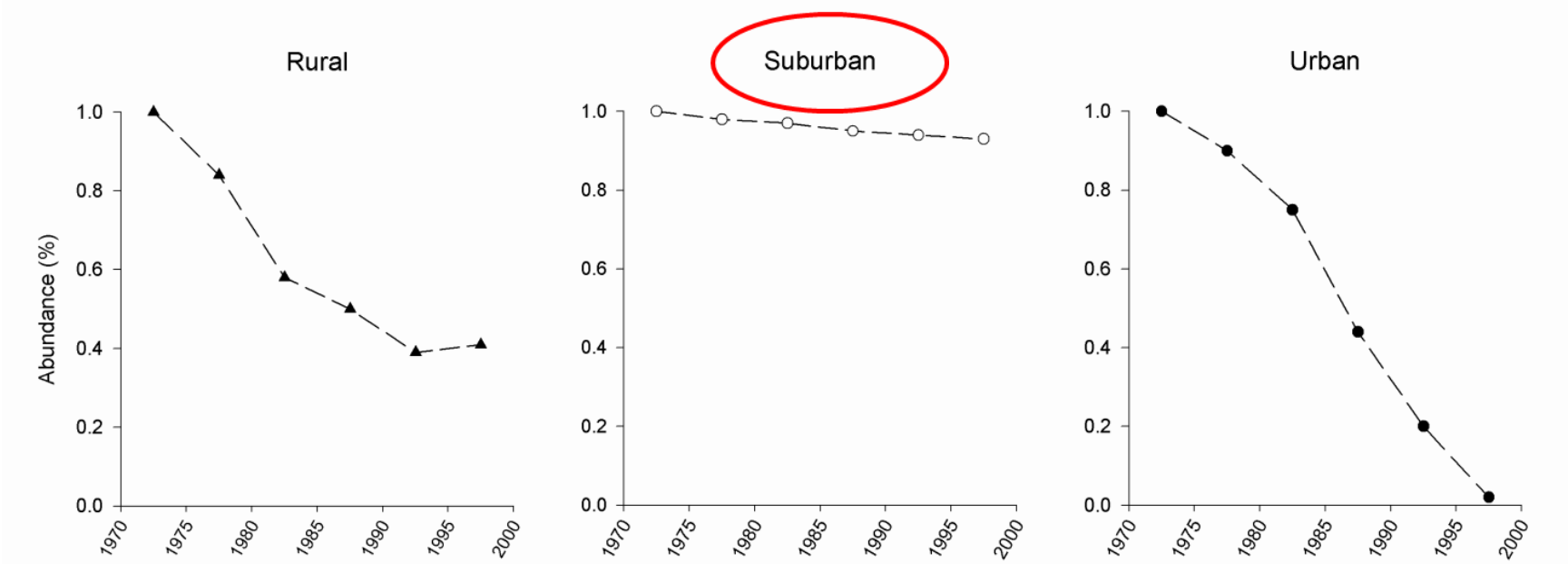
Aalst	Concentric model	Lobe-city model
City circumference (fringe)	+/- 44 km	+/- 60 km
City surface	+/- 3658 ha	+/- 2412 ha

The city fringe of the municipality of Gent (B) shows more biodiversity in comparison with the centre and also with the adjacent rural areas.



From Hermy, et al. 2005

Population trend (1970 -2001) of the house sparrow in some **urban** (London, Glasgow, Edinburgh, Dublin and Hamburg), **suburban** (Stockton, Crewkerne, Guisborough en Sandhurst college in Sussex) and **rural** (common bird census counts in England) areas in Europe



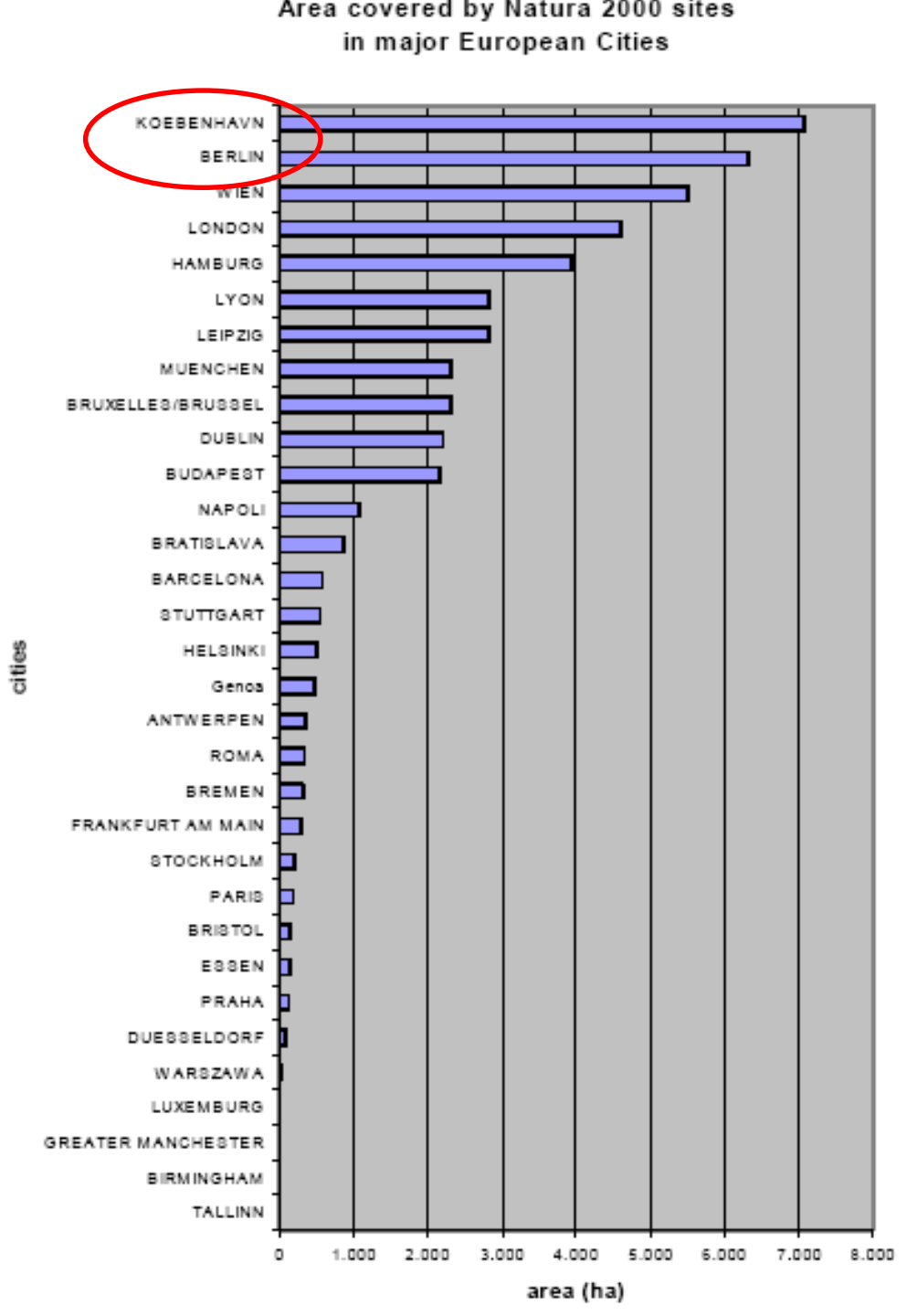
Also here is a strong population decrease in the stony inner cities (urban) and in the intensive agriculture areas (rural). Only in the suburban cityfringe of Ghent, populations of the house sparrow are relatively stable.
(DE LAET, 2007 in VANGESTEL, 2011).

http://redbridgebirdwatching.blogspot.com/2011/01/house-sparrow-census.html

Biodiversity in lobe cities is striking large: Copenhagen, Berlin, …

That's because lobe-cities have a longer city fringe than concentric expanding cities have.

Biodiversity and Natura 2000 in urban areas *A review of issues and experiences of nature in cities across Europe.* Kerstin Sundseth and Geert Raeymaekers; Ecosystems LTD sprl/bvba. **November 2006** (De Blust, 2007)



Structure of this presentation.

- 0. The 17 sustainable development goals of the United Nations.
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Citizens' densities have to be high enough to enable affordable (light)rail public transport in the city lobes of a lobe city.

The densely populated ecoquarter 'Quartier Vauban' in Freiburg (D.) is frequently connected with the centre of the city by tram.

Tjallingii (1996) makes a plea for a minimum of 50 dwellings/hectare , which is far more than the 25 dwellings/ha, as obligatory in Flanders' spatial plan .

Two important tools might be used for the realisation of higher citizens' densities in city-lobes:

1. The introduction of private citizen building groups.
2. The designing of a well-thought public-private gradient (*in green areas, between the buildings and within the buildings*) as a planning tool to realise ecologically and socially sound urban planning.

The formation of **citizen building groups** is a **first key** to establish 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/planner.
- The municipality of Tübingen (D) 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 their project together.
- When their project was accepted, an appropriate allotment was awarded to the building group.

Some advantages of working with private citizen building groups

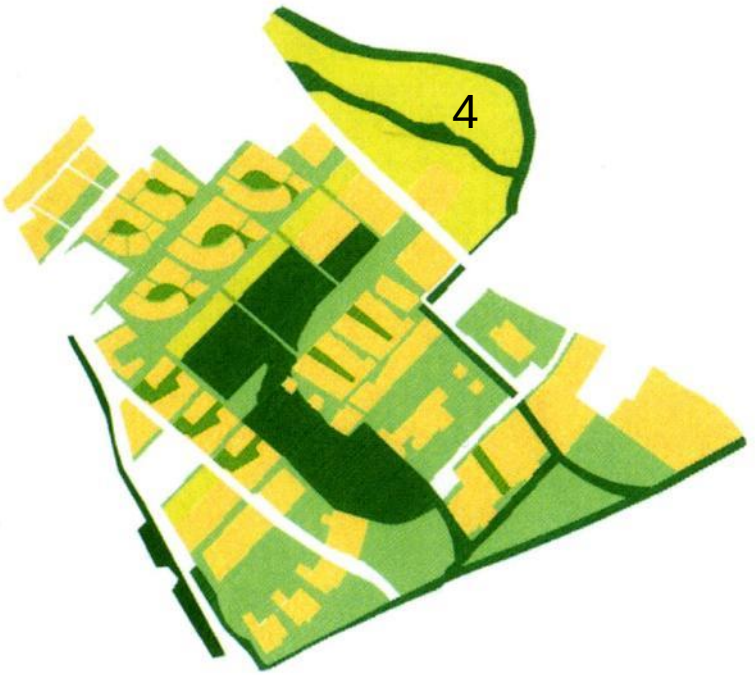
- An important advantage of this building group formula was the fact that the prices were up to 20 % cheaper than they would have been without cooperation.
- Moreover, the traditional aversion of citizens against living in densely occupied city quarters, does not exist (or is not so obvious) amongst 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 promoters.
- Success story: a lot of German cities, Switzerland, The Netherlands, and now also Belgium (www.woneninmeervoud.be)

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 in the green areas



- 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, blurred gradient between private gardens and public green within blue-green fingers.

Very important for urban biodiversity and safe for children.

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).

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)

Semi-public gardens in de eco quarters Loretto-areal and Französisches Viertel (Tübingen, D)

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

Roskilde (DK). Ecowijk *Munksøgård*.

Design car parking areas just at the edge of the eco-quarter, ***not*** at the front-door of the dwellings,.

Freiburg (D). Eco quarter *Quartier Vauban*

Collective parking areas (permeable for rain water).

Ecoquarter *Dyssekilde* (Torup, DK).

Common and central parking in Brondby (DK)
Which decreases the amount of crossroads conflicts

Parking in EVA-Lanxmeer (Culemborg, NL)

1. parking in the peripheries
2. Parking norm ca. 1.0
3. Car sharing wheels4all
4. Parking norm for works close to station; 1:100 m^2
5. Parking norm for works away from station: 1:50 m^2

Eco quarter Viikki (Helsinki, Fin.): common bike and car parking areas and common (water) play garden

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

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 Kwarteel’ in the ecoquarter *EVALanxmeer* with some common facilities in the dark round part of te building (bar, spare rooms, bike parking, …)

Ecovillage *Keuruu* (Fin.)

Common facilities in the ‘community house’.

Findhorn Ecovillage (Scotland, UK),
Find many more examples on the global ecovillage network .

Global Ecovillage Network of Europe

www.gen-europe.org

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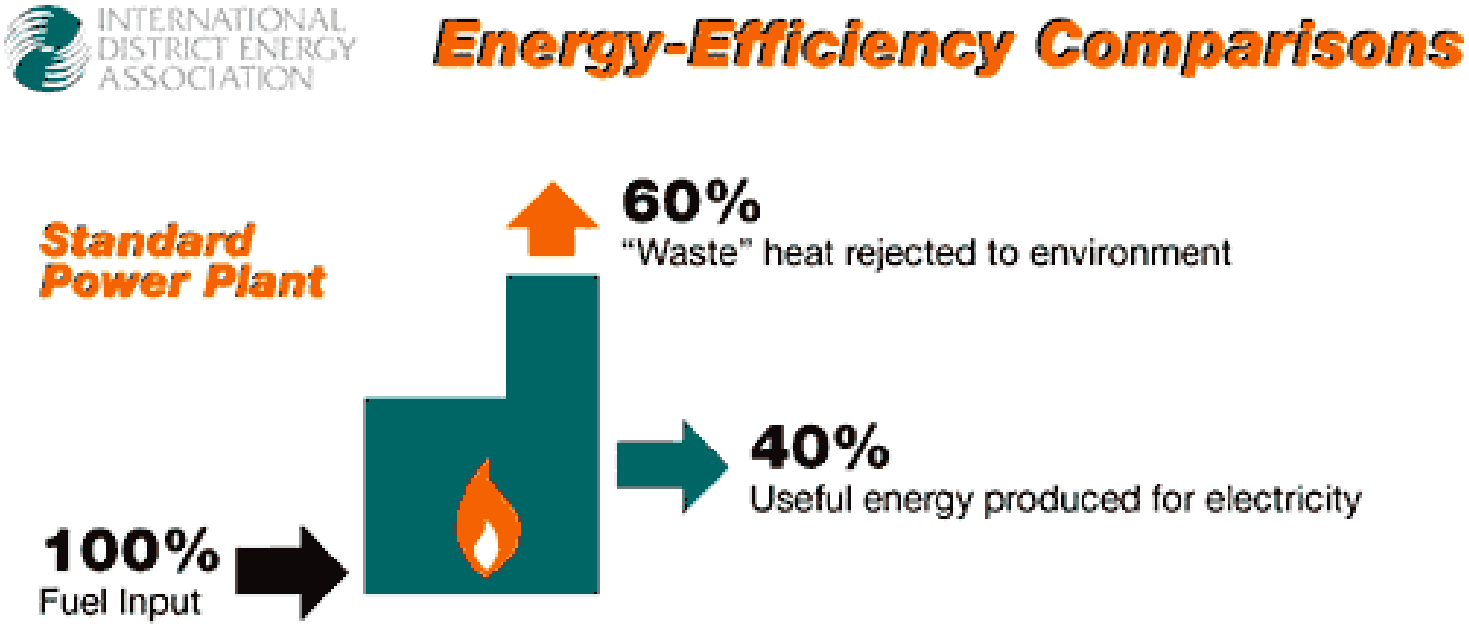
Densely built-up city-lobes can be heated by small plants for **cogeneration of heat and power (CHP).** During hot seasons they can also collectively be cooled, using the same district piping network.

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

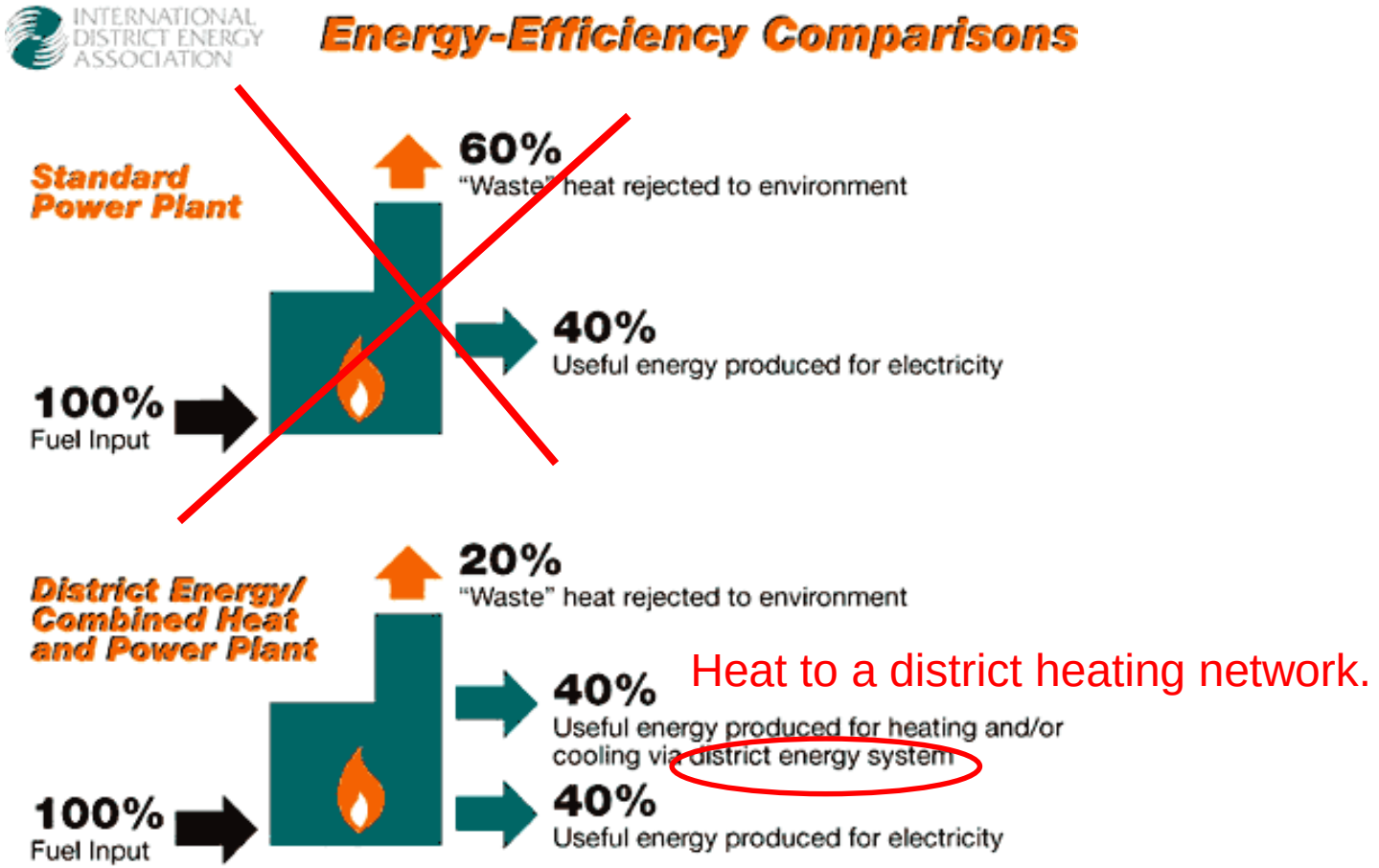
In a standard power plant , more than 60 % of the energy is lost as waste heat, (apart from the primary energy source which is used, such as coal, fossil fuel, uranium, …)



http://www.ecy.wa.gov/climatechange/cat_twg_comments0507.htm

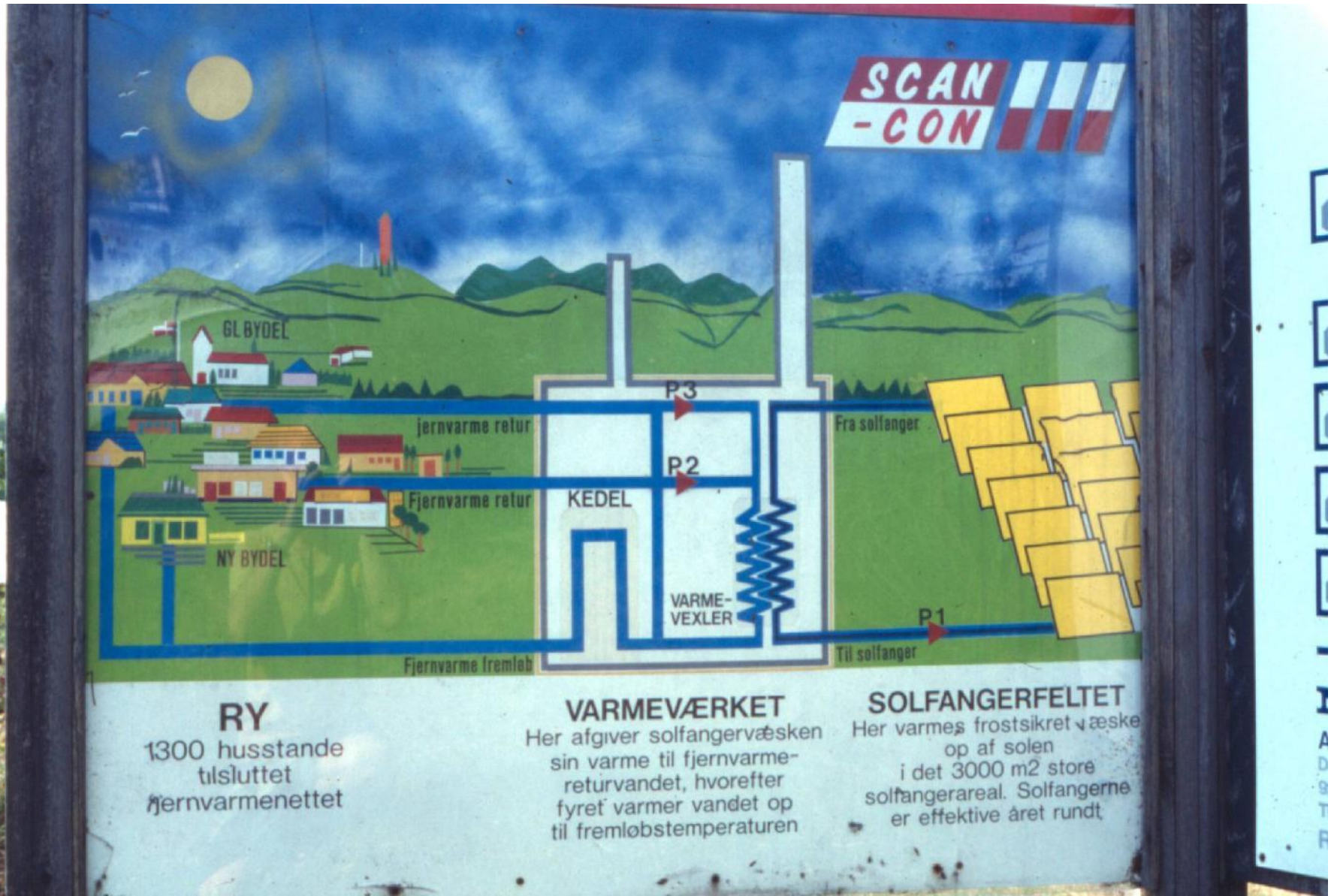
The efficiency is about 40 % electricity production, the power.

Comparison standard power plant with a CHP plant, connected with a district heating network



Het efficiency of a CHP plant is about 80 %:
40 % heat and 40 % power (=electricity).

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




RY VARMEVÆRK
SOLVARMEN YDER NU [redacted] KW

CHP plant (Klitmøller, DK)

The local council decided to build its own cogeneration plant, to feed the local district heating network.

CHP plant (Klitmøller, DK)

Danish district-heating networks are usually owned by a (municipal) cooperative organization, the profits remain local and can be used for financing the local ' commons '.

This cogeneration plant uses natural Danish natural gas as primary fuel and is operating a few hours a day, at the peak moments. The hot waste water is stored in tanks to be used in the local heating network (fjernvarme)

Fuel in Danish CHP-plants is often green.
Biomass: here wood waste from local forestry.

Herning (DK)

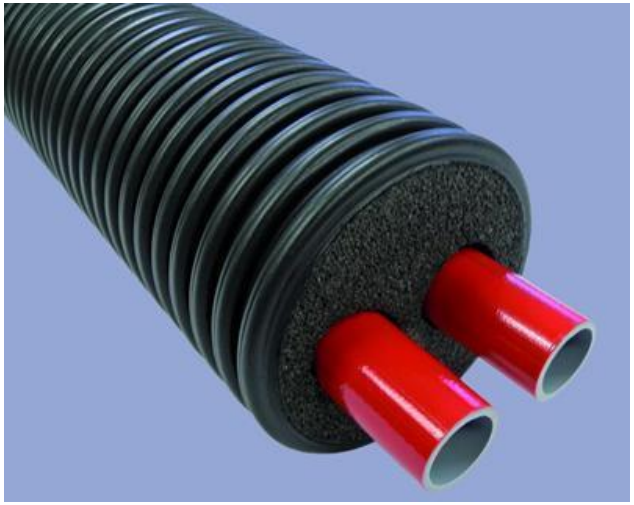
Danish legislation obliges the operators of power plants to re-use the residual heat.

District heating is the easiest way to realise that valorisation

No heat-recovery = no license nor building permission,

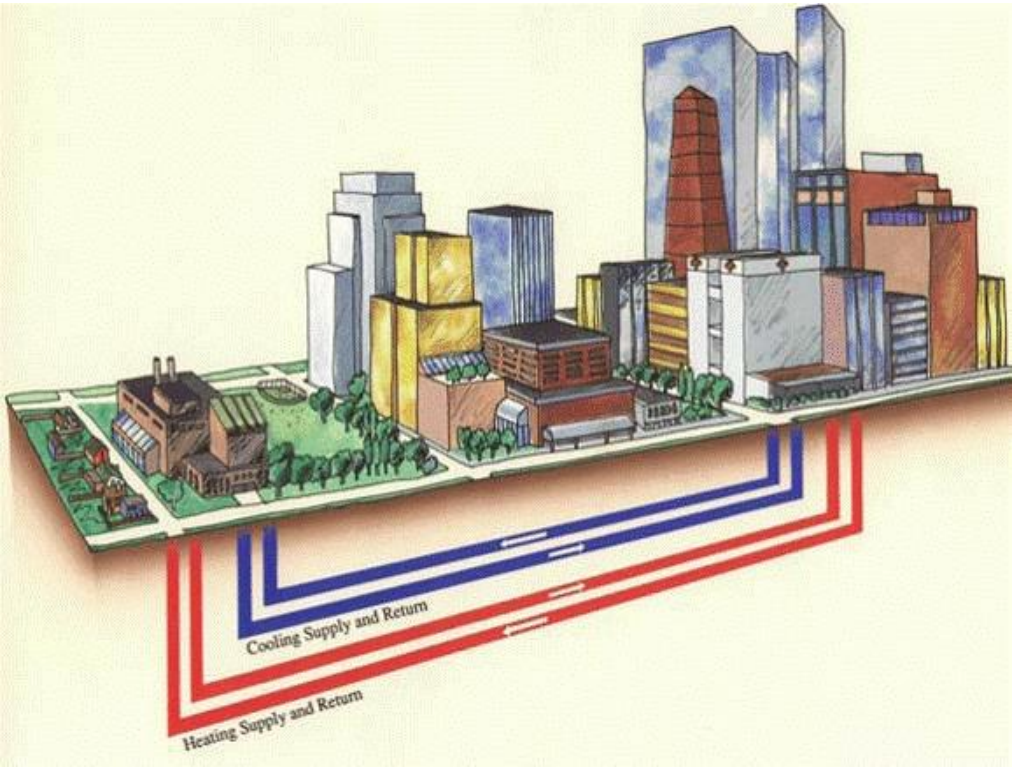
District heating is easy to be combined with the cogeneration of Heat and Power

Riga, Latvia



A well-insulated underground pipeline network provides the transport of warm water in the city and of the cooled water back to the CHP plant.

http://commons.wikimedia.org/wiki/File:2005-08-30-district-heating-pipeline.jpg



Principle of district heating, combined with a CHP plant.

- But then the CHP plant is to be built close enough to customers preferably in the middle of neighborhoods. An adequate **compactness** of dwellings is needed.
- And there is also the need of a sufficient heat demand in the summer, which argues for **mixing housing with other functions** (restaurants, small (ict)businesses, wellness, hotel, pool, ...)
- So restoring the *urban advantage* is urgently needed.

http://www.gaiaenergies.com/District%20Energy%20Systems.html

Also **animal manure** is a source for making biogas.

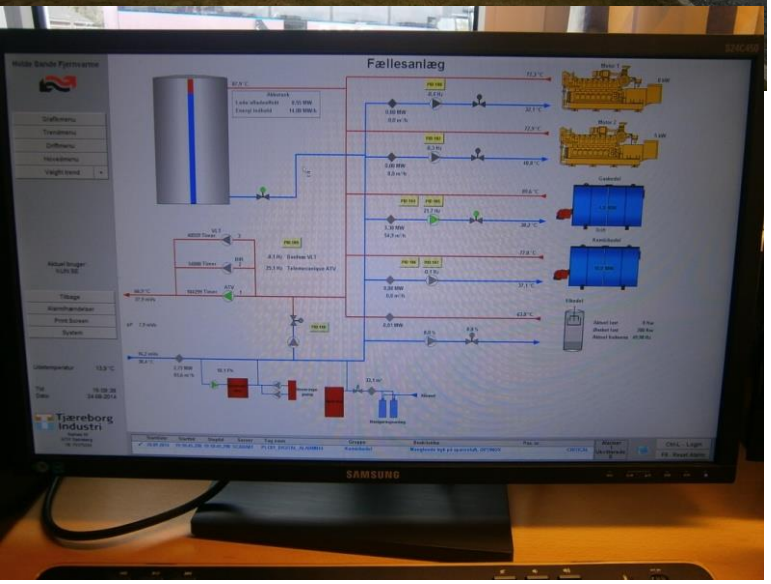
This is not a solution for the eutrophication process by nitrates and phosphates.

Herning (DK). CHP-plant with biogas

Thisted (DK). Heat production with **straw** for local district heating network.

Danish law prohibits burning agricultural waste in open air
(fine particles/smoke air pollution)

Hundreds of local heat networks, connected with local CHP plants form the core of the Danish energy system.

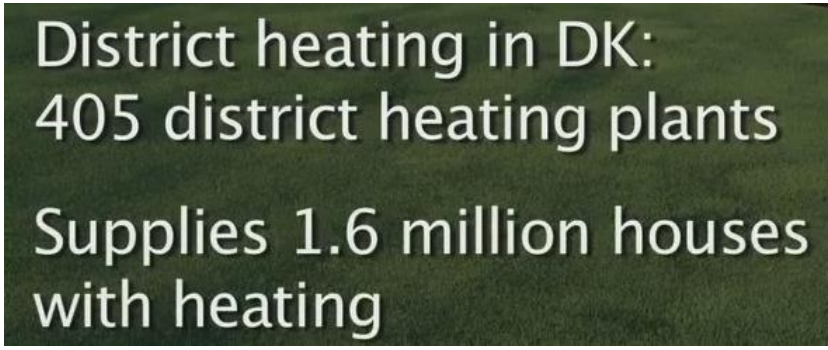


Hot water storage

District heating network of Vorupør, Hvide Sande en Thisted (DK). More than 70 % of Danish dwellings are connected with the district heating network (EN)- ‘fjernvarme’ (DK)).

Denmark has more than 400 local district-heating networks (2014)

- Dimensions of the CHP plant is based on the heat demand, the electricity is considered the by-product of heat production and put on the grid as green power
  To avoid to much heat production (which is not allowed), many of these installations only are used during peak hours (ca.16-20), The heat energy is stored in hot water tanks that can feed the local district heating 24 to 48 hours
- Back-up is guaranteed by mutually linking networks



Danish Parliament voted a ban on nuclear energy in 1985, under pressure from public opinion.

Important problem is the incompatibility of nuclear power with unpredictable green power production (wind and sun).

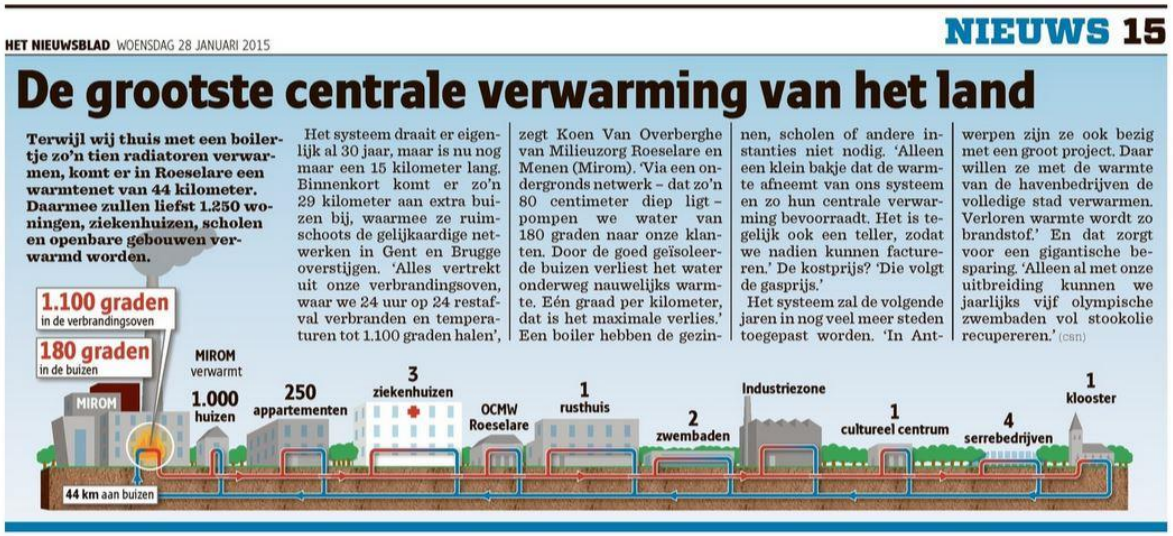
(However, a variable but small part of power is nuclear imported from Germany and Sweden.)

http://www.world-nuclear.org/information-library/country-profiles/countries-a-f/denmark.aspx

TVINDKRAFT

In 1975 volunteers started with the building of the first wind turbine in DK

A Belgian example: heat network of the municipality of Roeselare (B), based on waste heat from the local waste incinerator.



HET NIEUWSBLAD WOENSDAG 28 JANUARI 2015 NIEUWS 15

De grootste centrale verwarming van het land

Terwijl wij thuis met een boiertje zo'n tien radiatoren verwarmen, komt er in Roeselare een warmtenet van 44 kilometer. Daarmee zullen liefst 1.250 woningen, ziekenhuizen, scholen en openbare gebouwen verwarmd worden.

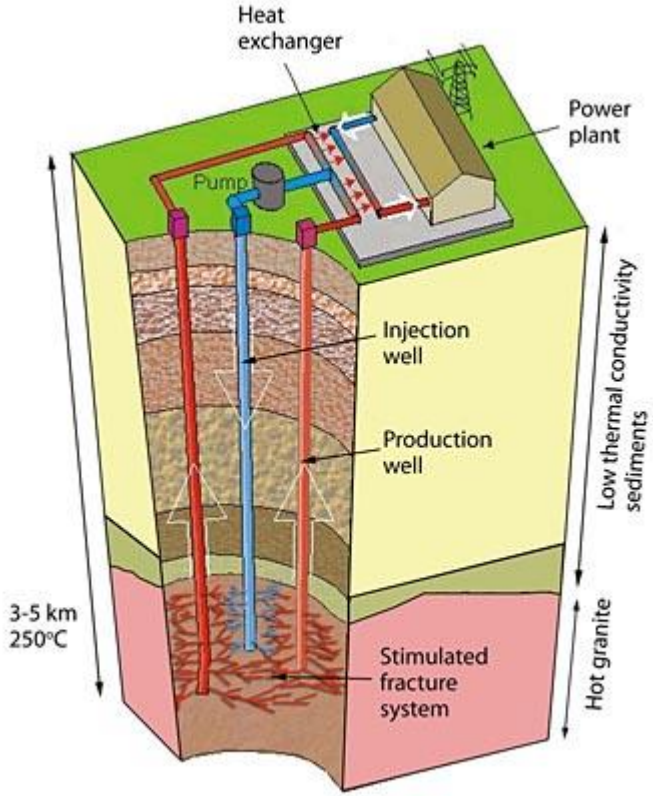
Het systeem draait er eigenlijk al 30 jaar, maar is nu nog maar een 15 kilometer lang. Binnenkort komt er zo'n 29 kilometer aan extra buizen bij, waarmee ze ruimschoots de gelijkaardige netwerken in Gent en Brugge overstijgen. 'Alles vertrekt uit onze verbrandingsoven, waar we 24 uur op 24 restafval verbranden en temperaturen tot 1.100 graden halen', zegt Koen Van Overberghe van Milieuzorg Roeselare en Menen (Mirom). 'Via een ondergronds netwerk – dat zo'n 80 centimeter diep ligt – pompen we water van 180 graden naar onze klanten. Door de goed geïsoleerde buizen verliest het water onderweg nauwelijks warmte. Eén graad per kilometer, dat is het maximale verlies.' Een boiler hebben de gezinnen, scholen of andere instanties niet nodig. 'Alleen een klein bakje dat de warmte afneemt van ons systeem en zo hun centrale verwarming bevoorraadt. Het is tegelijk ook een teller, zodat we nadien kunnen factureren.' De kostprijs? 'Die volgt de gasprijs.'

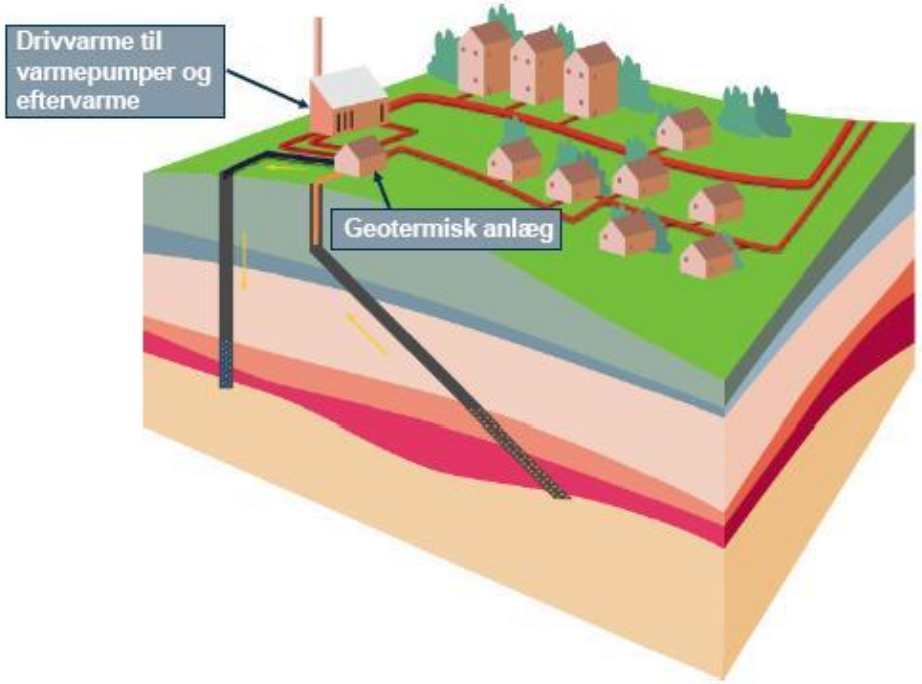
Het systeem zal de volgende jaren in nog veel meer steden toegepast worden. 'In Antwerpen zijn ze ook bezig met een groot project. Daar willen ze met de warmte van de havenbedrijven de volledige stad verwarmen. Verloren warmte wordt zo brandstof.' En dat zorgt voor een gigantische besparing. 'Alleen al met onze uitbreiding kunnen we jaarlijks vijf olympische zwembaden vol stookolie recupereren.' (CSN)

1.100 graden in de verbrandingsoven
180 graden in de buizen
MIROM
MIROM verwarmt 1.000 huizen
250 appartementen
3 ziekenhuizen
OCMW Roeselare
1 rusthuis
2 zwembaden
Industriezone
1 cultureel centrum
4 serrebedrijven
1 klooster
44 km aan buizen

http://http://www.nieuwsblad.be/cnt/dmf20150126_01494664

Turnhout (B) wants to use heat from a *geothermal power plant* as an energy source for the municipal heat network, The Danish municipalities Sønderborg (DK) en Thisted (DK) did so earlier.





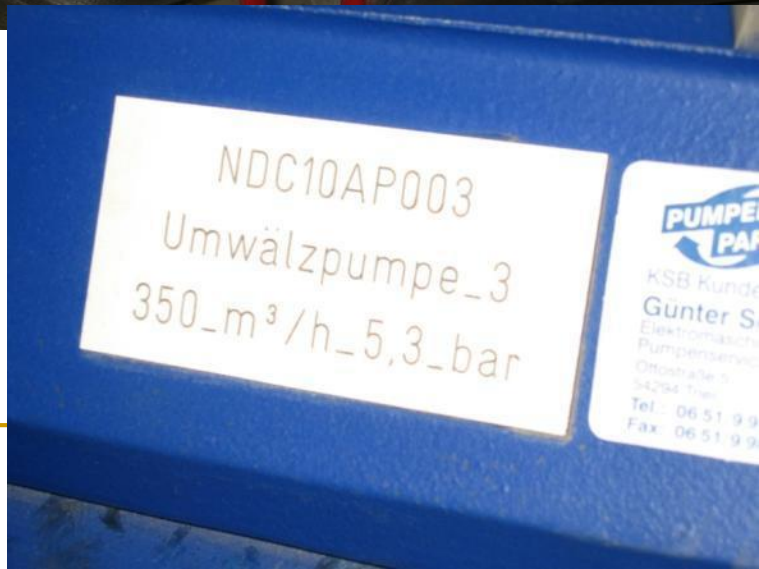
http://groenseizoen.tumblr.com/

http://ing.dk/artikel/5000-huse-i-sonderborg-far-varme-fra-jordens-indre-99785

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

This CHP plant supplies heat to the anthroposophical center of Scandinavia (hospital, school, cultural centre, ... in Järna (S).

District heating of the European quarter of Kirchberg in Luxemburg (L.)



District heating and cooling. Case study Denmark.

http://www.youtube.com/watch?v=-0V5OMS4kzw&feature=endscreen&NR=1

https://www.youtube.com/watch?v=eiBiB4DaYOM

https://www.youtube.com/watch?v=Dv5mDN7wgHI

Watch and study these 3 movies carefully.

- With over 60% of Danish buildings receiving heating and hot water via District Heating (80% of which comes from surplus energy sources) Denmark is the world leader in District Heating and Cooling Technology. District Heating has played a vital role in reducing Danish energy consumption, to the extent that Denmark has been self-sufficient energy-wise since 1997. With District heating and cooling technology Denmark has reduced CO_2 emissions per sq. metre, the share of fossil fuel consumption per sq. metre, and the total energy consumption per sq. metre for space and water heating. In terms of combating climate change and reducing CO_2 emissions, no other technology offers industrial nations the potential of meeting the requirements of energy saving and emissions reduction, without affecting the standard of living and productivity of the nation.
- Thess information films, produced for the Danish District Heating Marketing Foundation and the Danish Board of District Heating illustrates how Danish technology and expertise may play a vital role in helping other nations achieve better energy efficiency and reduced emissions.

Freiburg im Breisgau (Germany)
Plus-energy houses in the eco-quarter *Am Schlierberg*)

Plusenergiewijk *Am Schlierberg* (Freiburg, D.)

De huizen in de wijk Am Schlierberg in Freiburg produceren 36 kWh/m².jaar sinds 2005. (bron www.AKBW.de)

Flanders' Future ?

- By 2030 an additional 330,000 households will have to be accommodated in Flanders. Within the traditional Flemish planning model, dwellings for these households will most probably take the form of detached single-family houses, a typology that consumes too much space and energy and is responsible for gradually urbanizing the whole of Flanders, wasting scarce qualities and resources.

- Initiated by the Flemish Government Architect, this study questions this traditional method of planning and tries to develop a new growth model for Flanders. This trajectory aims to gradually test, adjust, and improve existing planning tools and processes trough a collective effort, passing through different strata of design and policy, from a local to a regional scale. The study will eventually produce an adapted set of contexts and typologies, which will serve as a basis for a series of exemplary and innovative pilot projects in social housing.
- Watch and study:

http://www.posadlabs.com/flemish-metropolitan-dream/

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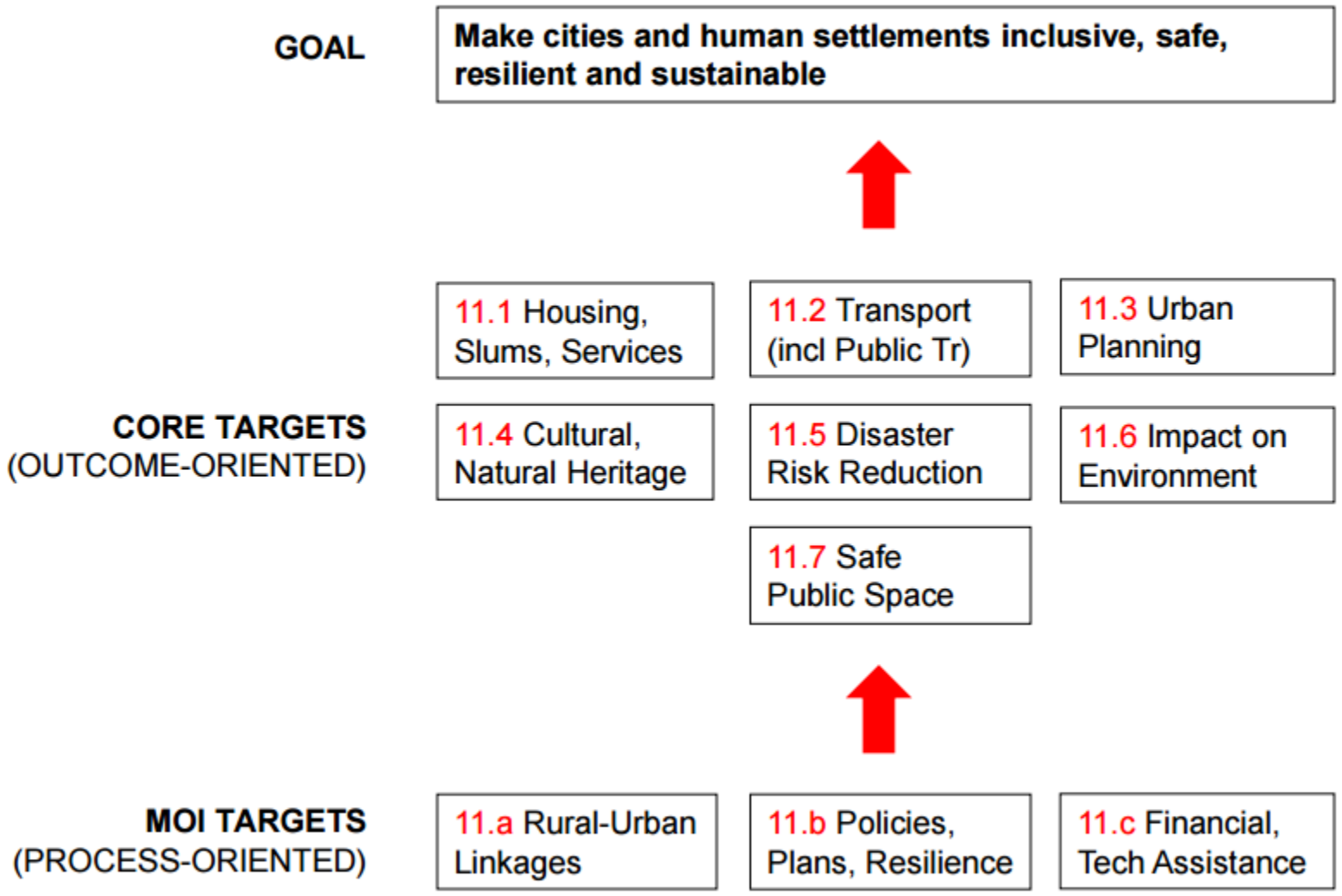
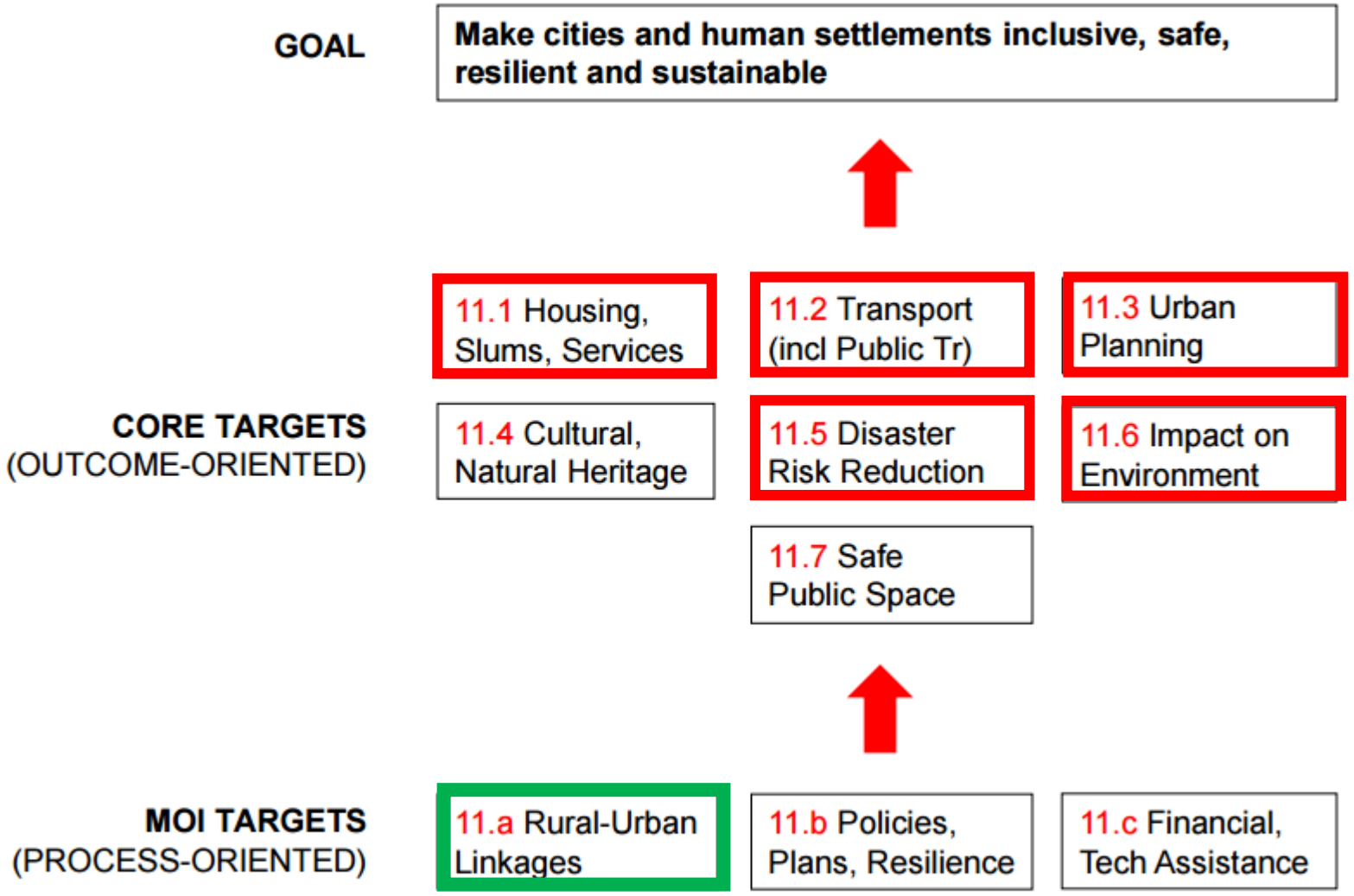
Mapping of SDG 11 Targets



Source : Tuts, 30/11/2015. Lecture UAntwerpen

UN HABITAT
FOR A BETTER URBAN FUTURE

In this lecture we tried to contribute to the UN - SDG 11 urban agenda.



Source : Tuts, 30/11/2015. Lecture UAntwerpen

UN HABITAT
FOR A BETTER URBAN FUTURE

Conclusions (1)

The problem 'Le Corbusier' and 'Frank Lloyd Wright'

- The ideas of **Le Corbusier** (1887-1965) (with the modernistic idea of separation of functions living/working/leisure, CIAM-charter of Athens, 1933)

and

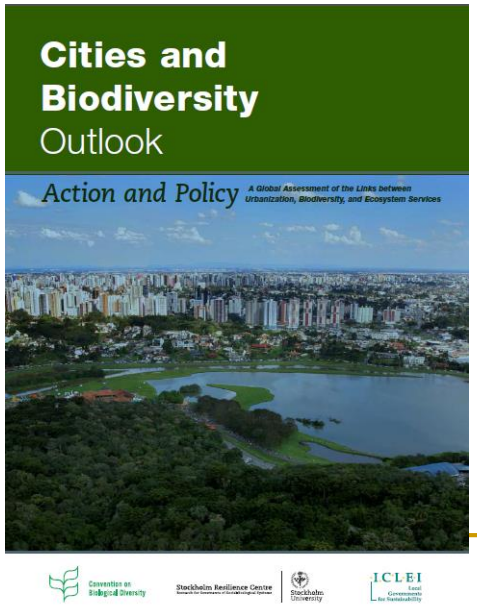
- The ideas of **Frank Lloyd Wright** (1867-1959) (the broadacre city, de suburban allotment as alternative for the city !)

are the deep causes for the huge energy- and mobility crises from the second half of the 20th century.

http://www.architectenweb.nl/aweb/archipedia/archipedia.asp?ID=15258

Conclusions(2): cities and biodiversity do not exclude each other.

- Do not separate urban and rural planning.
- Consider cities as ecosystems.
- Use the scientific knowledge on high- and low-dynamic conditions and arrange these in an ecologically sound way (blue green fingers, lobe-city, …)



www.cbd.int/en/subnational/partners-and-initiatives/cbo.

CONCLUSION (3):

- 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 (4): 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 (5): 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.

CONCLUSION (6): Link with the (American) concept of Transit-oriented development (TOD)

http://www.reconnectingamerica.org

- Transit-oriented development (TOD) is a type of community development that includes a **mixture** of housing, office, retail and/or other amenities integrated into a **walkable** neighborhood and located within a half-mile of quality **public transportation**.
- **That means shifting away from the suburban model with single detached dwellings and private garden.**
- Reconnecting America believes it is essential that TOD creates better access to jobs, housing and opportunity for people of all ages and incomes. Successful TOD provides people from all walks of life with convenient, affordable and active lifestyles and create places where children can play and parents can grow old comfortably.
- **So The lobe-city concept is a spatial translation of Transit-oriented development**.

The lobe-city concept is a spatial translation of Transit-Oriented Development.

Some of the benefits of TOD include (http://www.reconnectingamerica.org)

- Reduced household driving and thus lowered regional congestion, air pollution and greenhouse gas emissions,
- Walkable communities that accommodate more healthy and active lifestyles,
- Potential for added value created through increased and/or sustained property values where transit investments have occurred,
- Improved access to jobs and economic opportunity for low-income people and working families,
- Expanded mobility choices that reduce dependence on the automobile, reduce transportation costs and free up household income for other purposes.


Thanks for your attention!
Welcome on our study trip to the Netherlands in May 2017
Culemborg (NL)
Ecowijk
EVALanxmeer

Sustainable urban planning.

www.ecopolisvlaanderen.be

ROMBAUT, E. & E. HEUTS. 2010. *'Duurzame Stedenbouw' in woord en beeld. Gids met praktijkvoorbeelden voor de transitie naar een ecopolis*. Boek samengesteld voor VIBE vzw en ABLLO vzw (i.s.m. KaHo Sint-Lieven dep. Sint-Niklaas en het departement voor architectuur en stedenbouw Sint-Lucas Gent/Brussel). Uitgeverij Die Keure 164 pp. ill. D/2010/0147/260 ; ISBN 978 90 4860 734 1.

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