Some guidelines for Applying ecosystem-services in climate resilient urban and rural planning. Plea for a lobe city approach. The Ha-Noi case

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

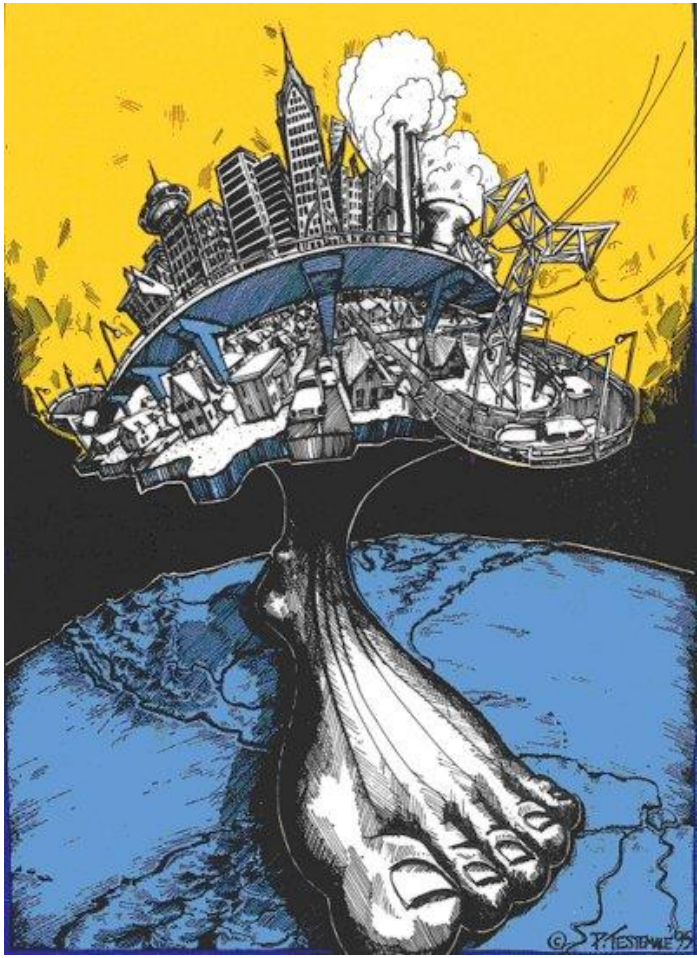
THE GLOBAL GOALS
For Sustainable Development

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

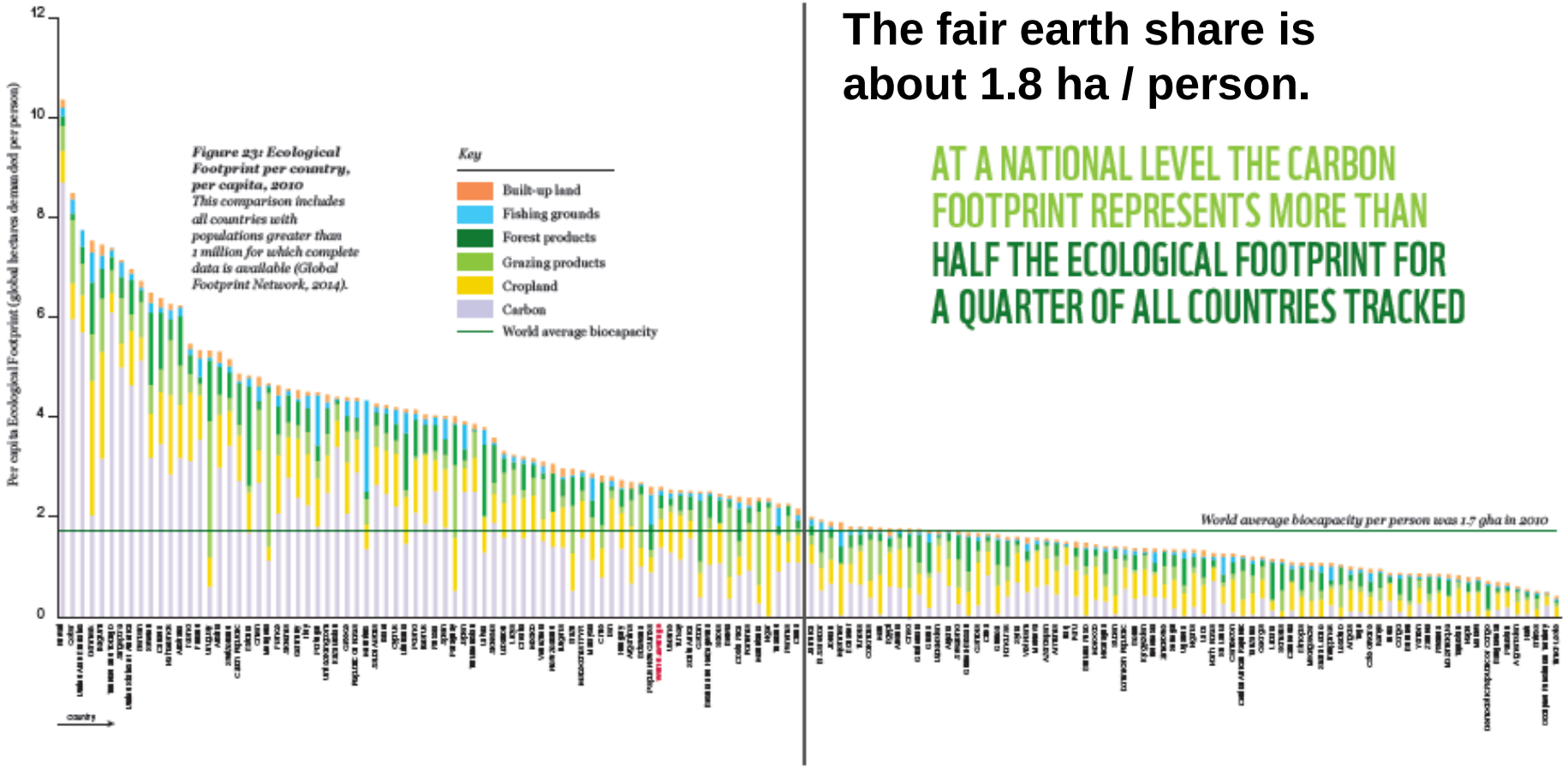
The aim: Searching for climate-proof urban and rural planning tools

- 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/

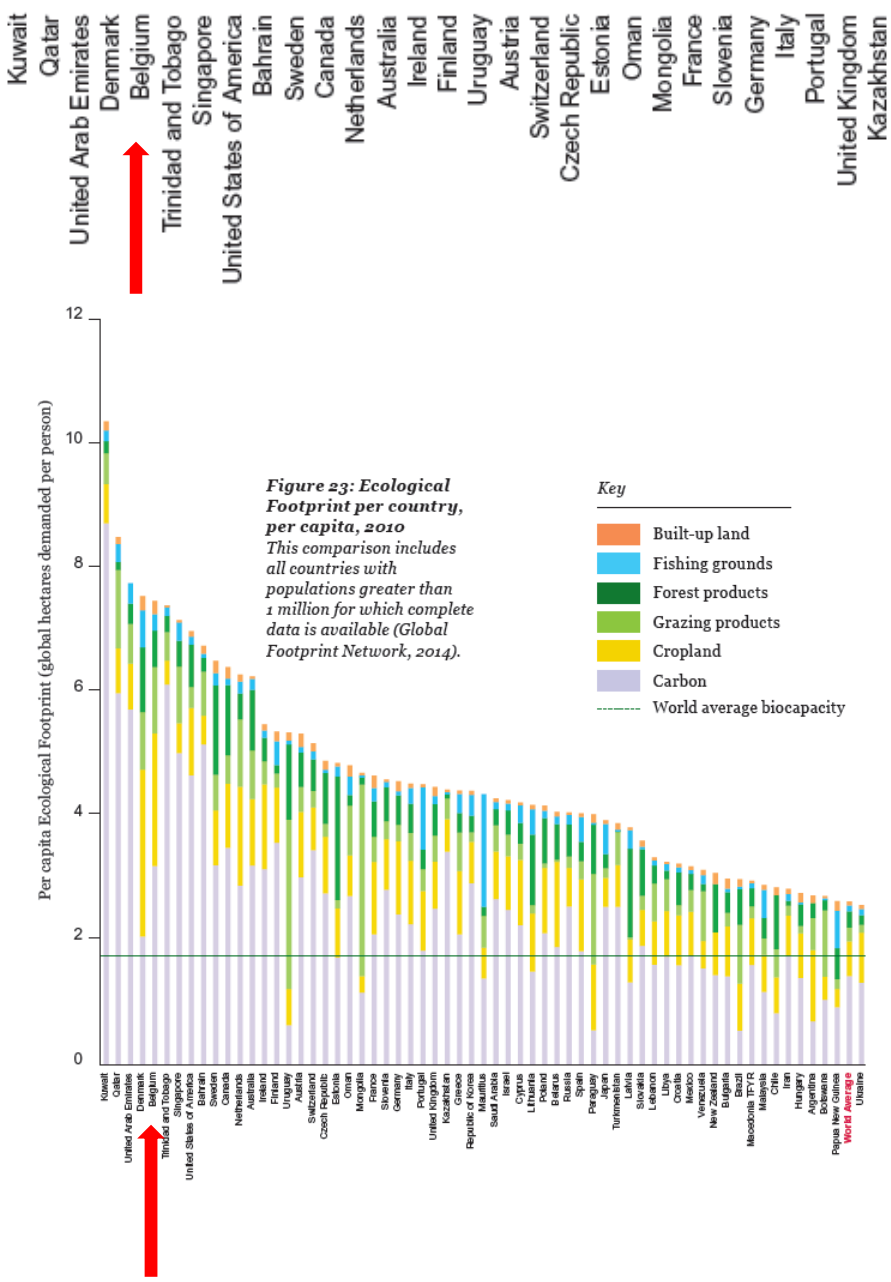


Figure 23: Ecological Footprint per country, per capita, 2010
This comparison includes all countries with populations greater than 1 million for which complete data is available (Global Footprint Network, 2014).

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 and Denmark, very similar to US footprint (WWF, 2014).

Overview of EU-27

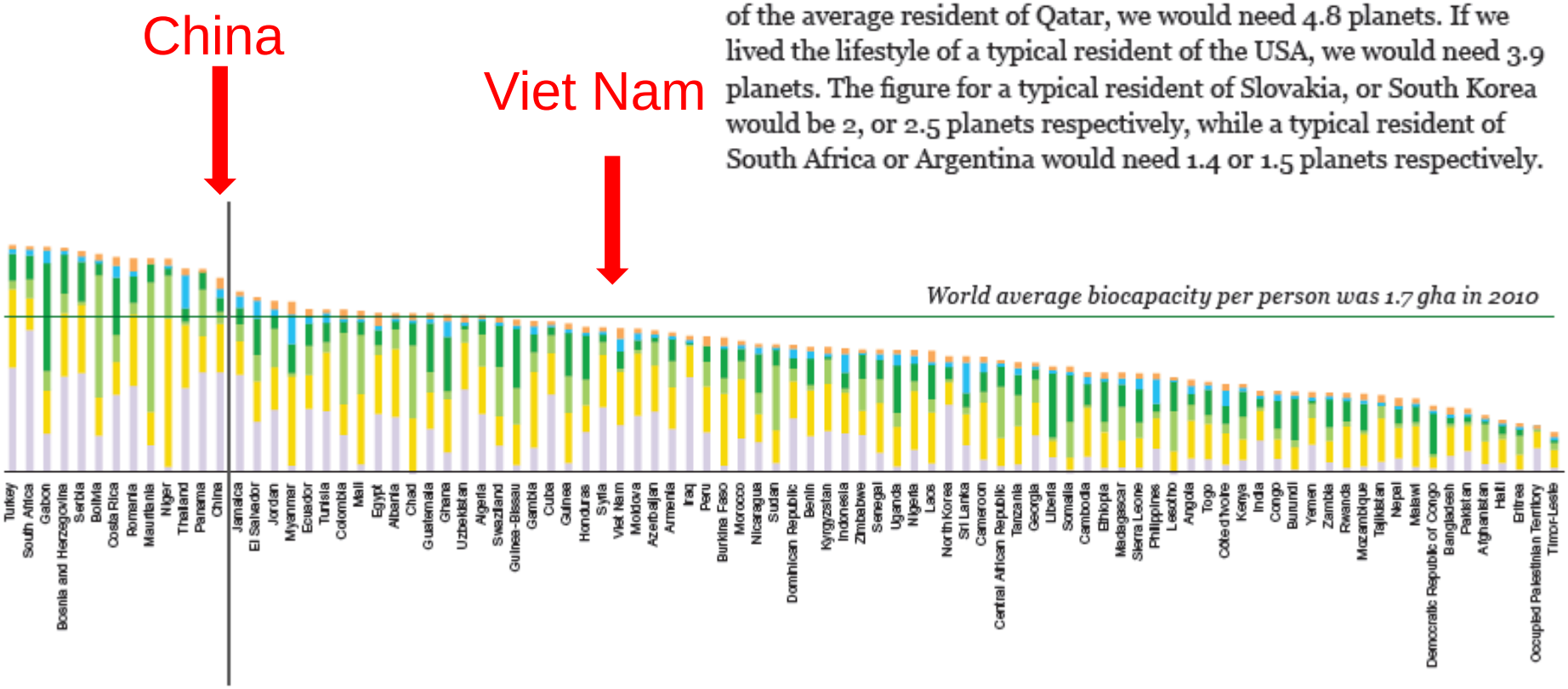
Number of Earths needed if all people on the planet had the Footprint of an average resident of the countries below:

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.



And what to expect, when these developing countries will enlarge their ecological footprints in the future ? …..

And so they do: Shanghai (China) 1987

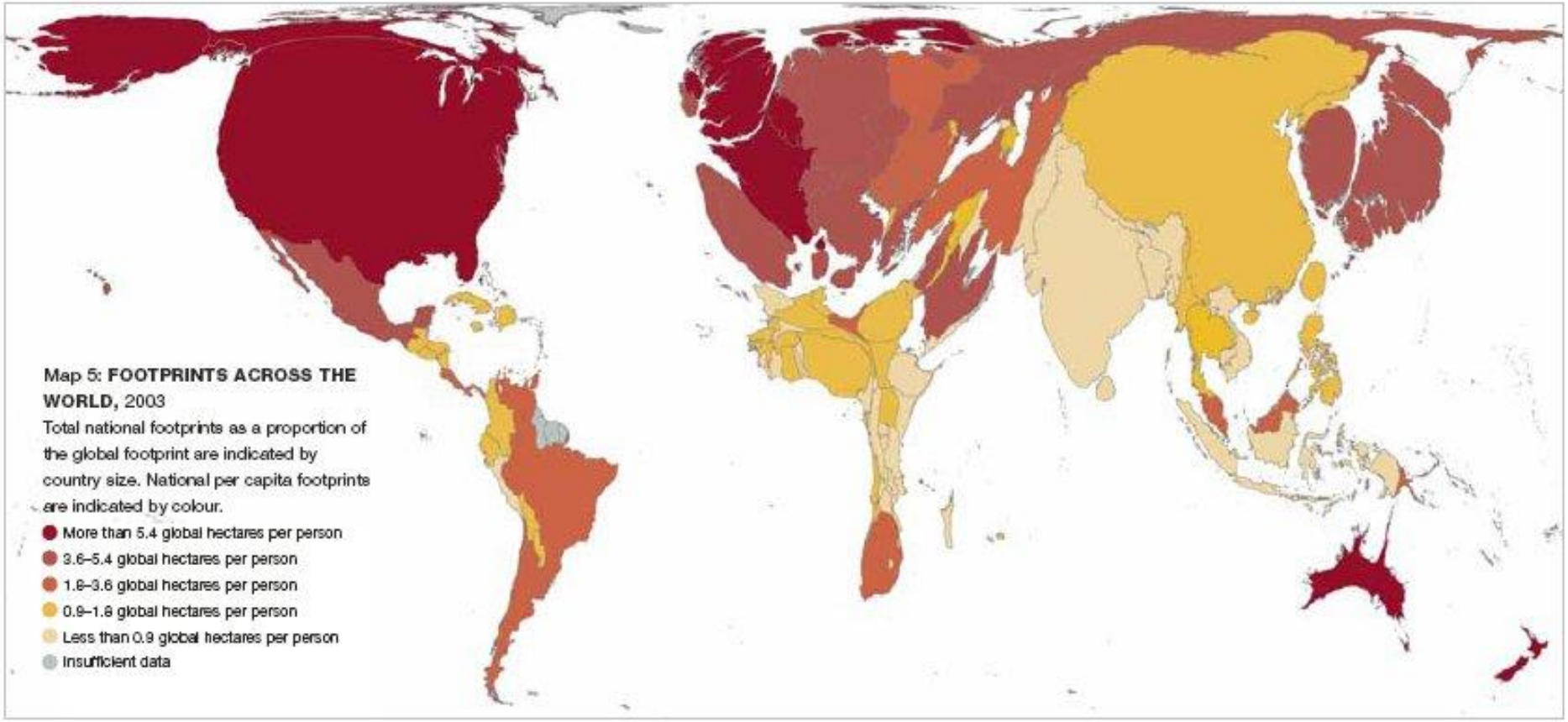
Bron:Wollaert. 30/11/2015. Lecture Uantwerpen
http://cifal-flanders.org/wp-content/uploads/2015/12/CIFAL-Flanders-Intro-Smart-Sustainable-Cities-Peter-Wollaert-30-11-2015.pdf

Shanghai (China) 2012

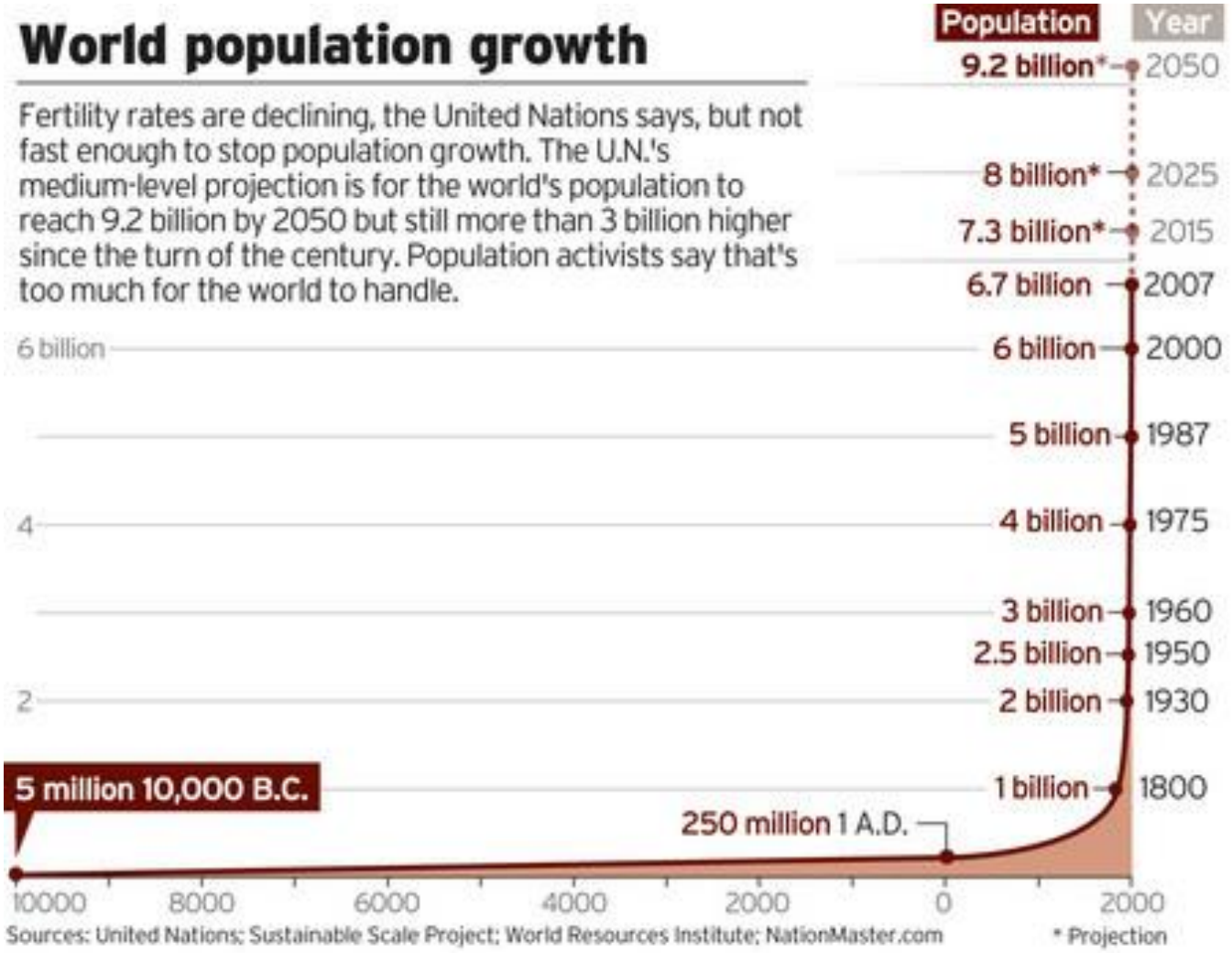
Bron:Wollaert. 30/11/2015. Lecture Uantwerpen

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



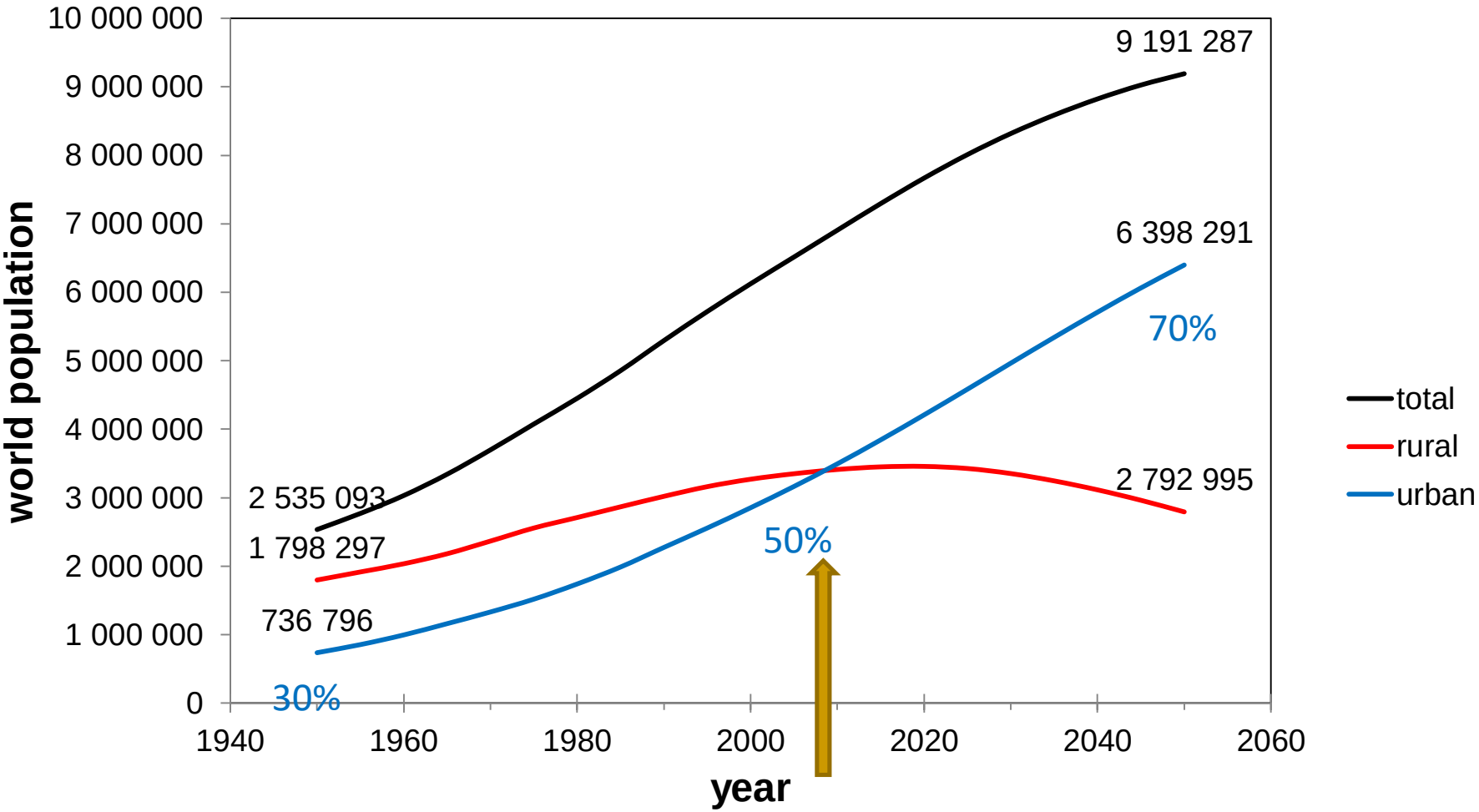
(Disturbing) human population growth curve.



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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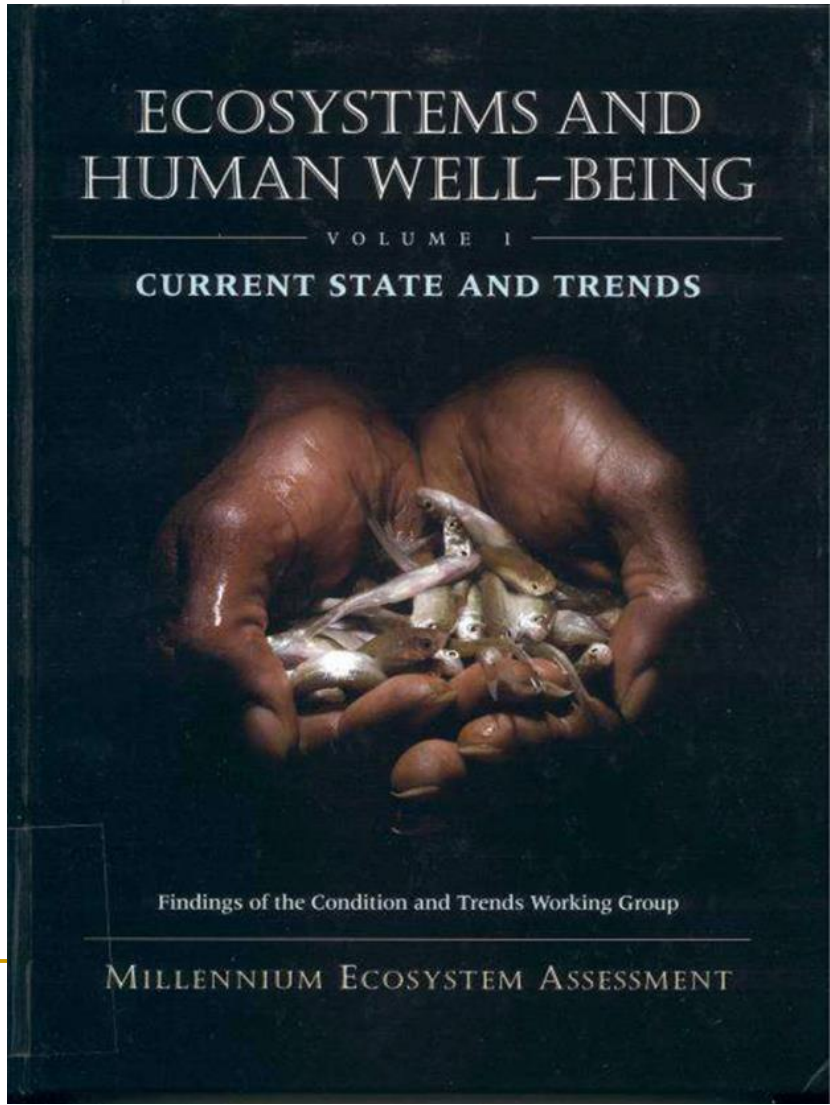
Ecosystem services.

'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)



Ecosystem Services:

The set of services that ' nature ' is offering to our society, **for free** (no payment /money necessary)

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:

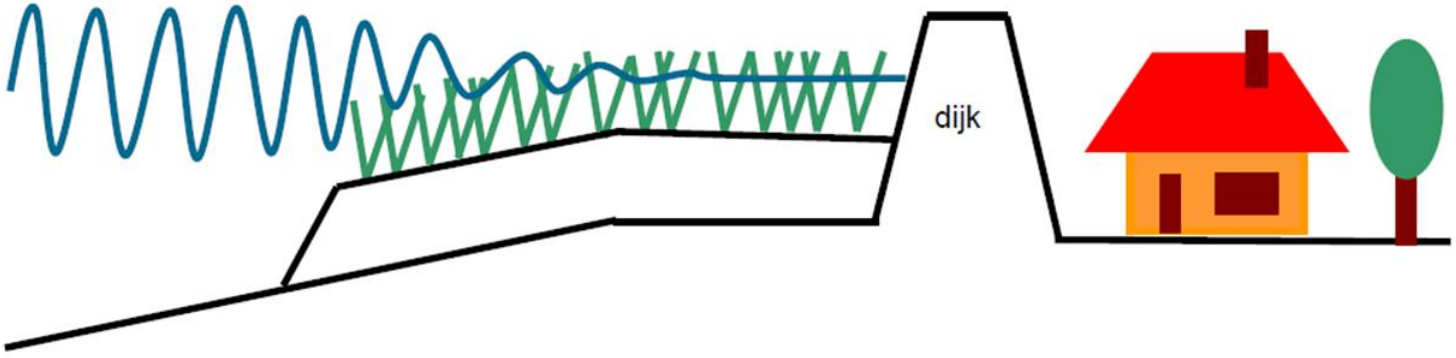
Inspiration,
Aesthetic, Spiritual, Educational,
Recreation,
Health ,...

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. …

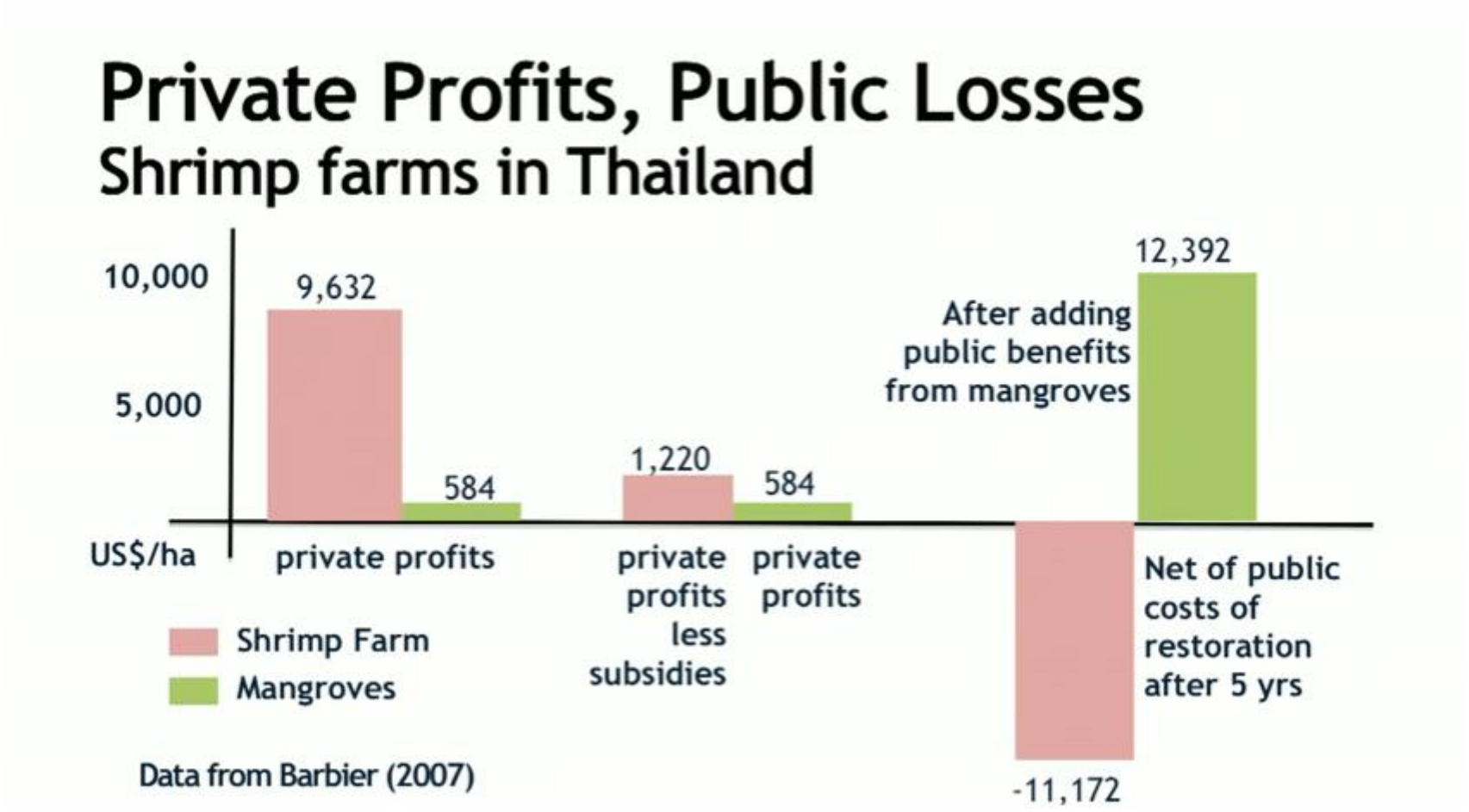
An *ecosystem service* such as coastal protection by mangroves is important for (sub)tropical regions against tsunami's and cyclones, as salt marshes are in Europe against flooding.



Mangroves and salt marshes temper wave power energy

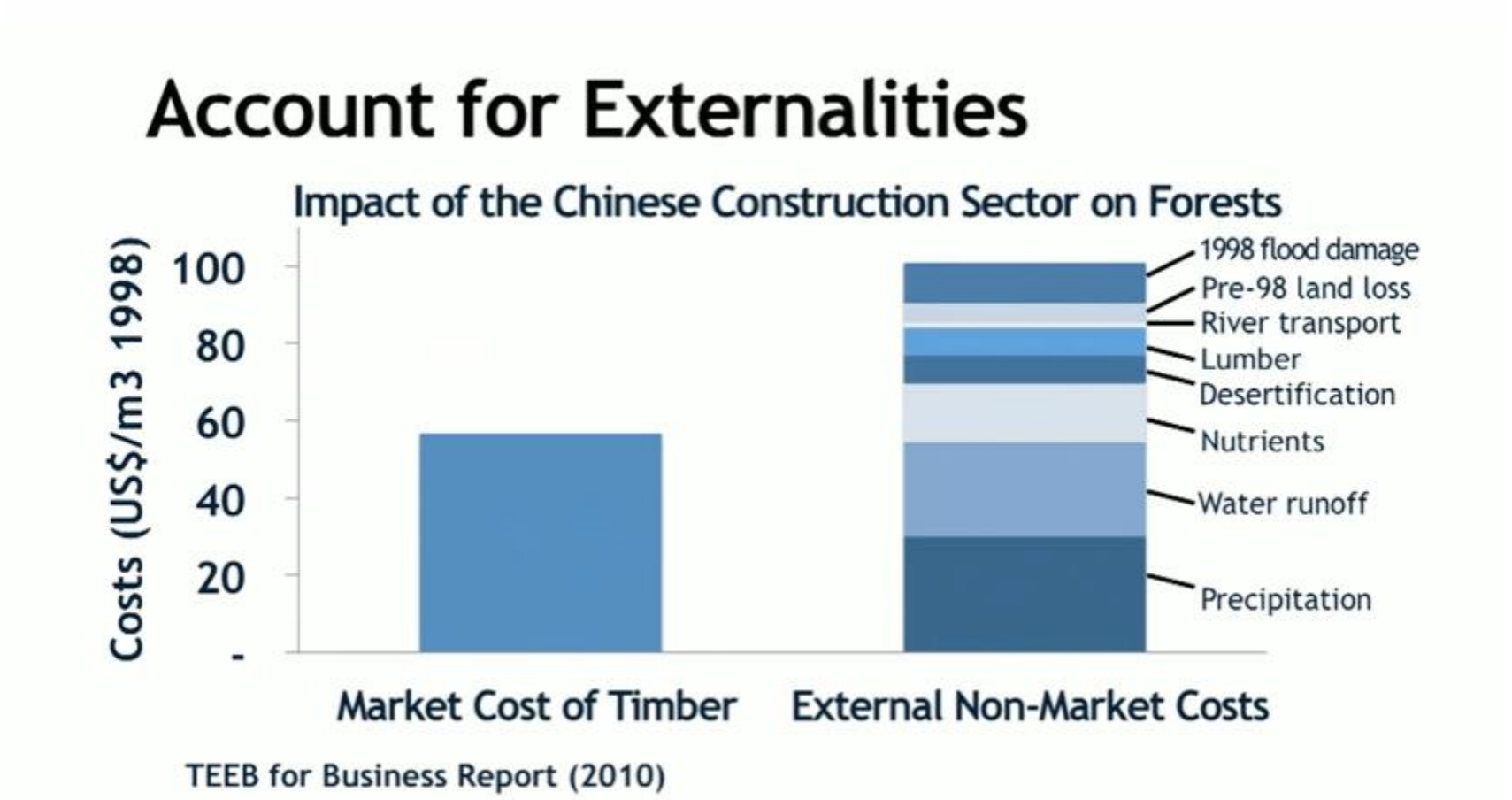
(after MEIRE 2013 ; MEIRE & VAN DYCK, 2014)

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



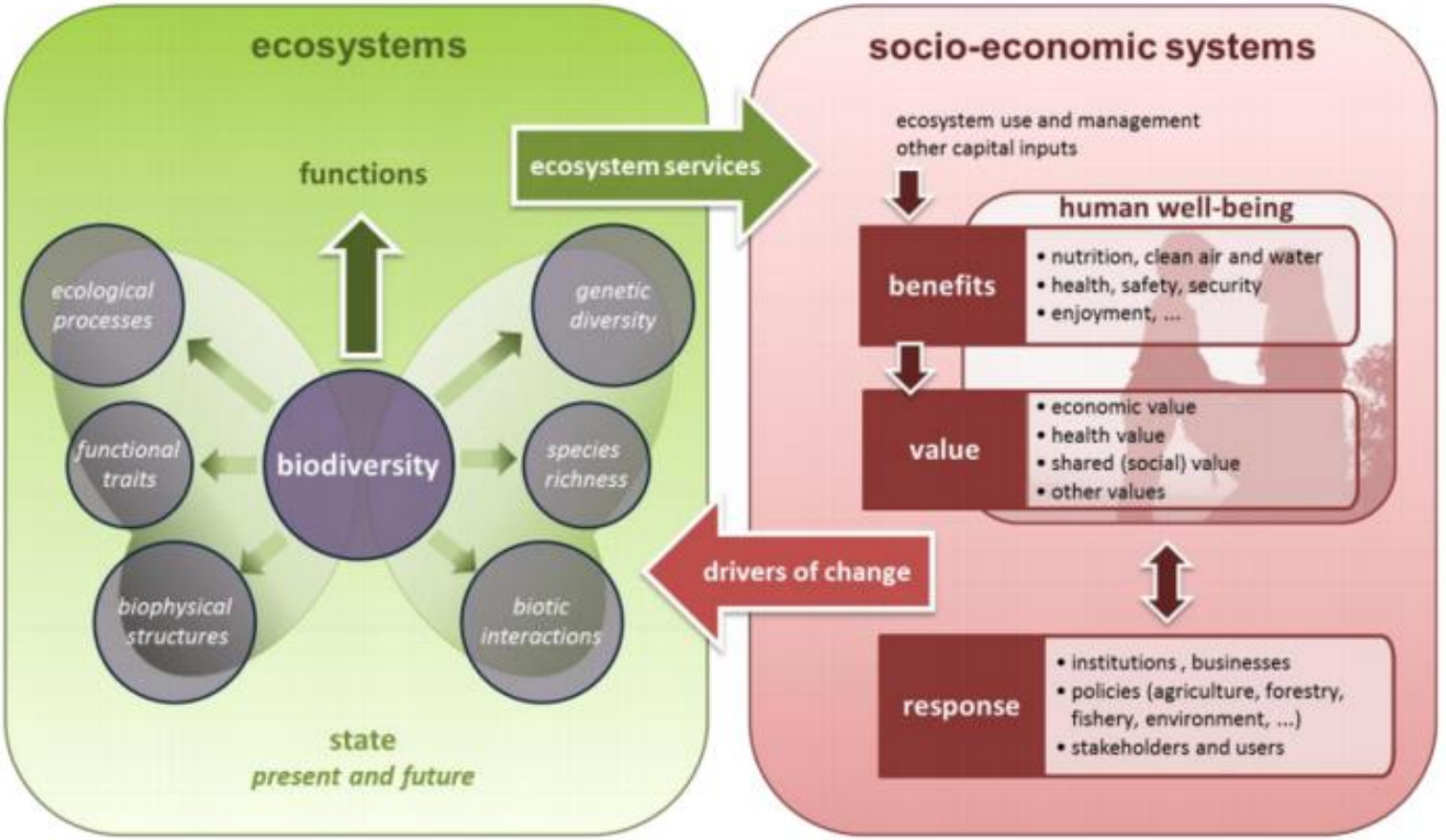
https://www.ted.com/talks/pavan_sukhdev_what_s_the_price_of_nature#t-952648

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

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

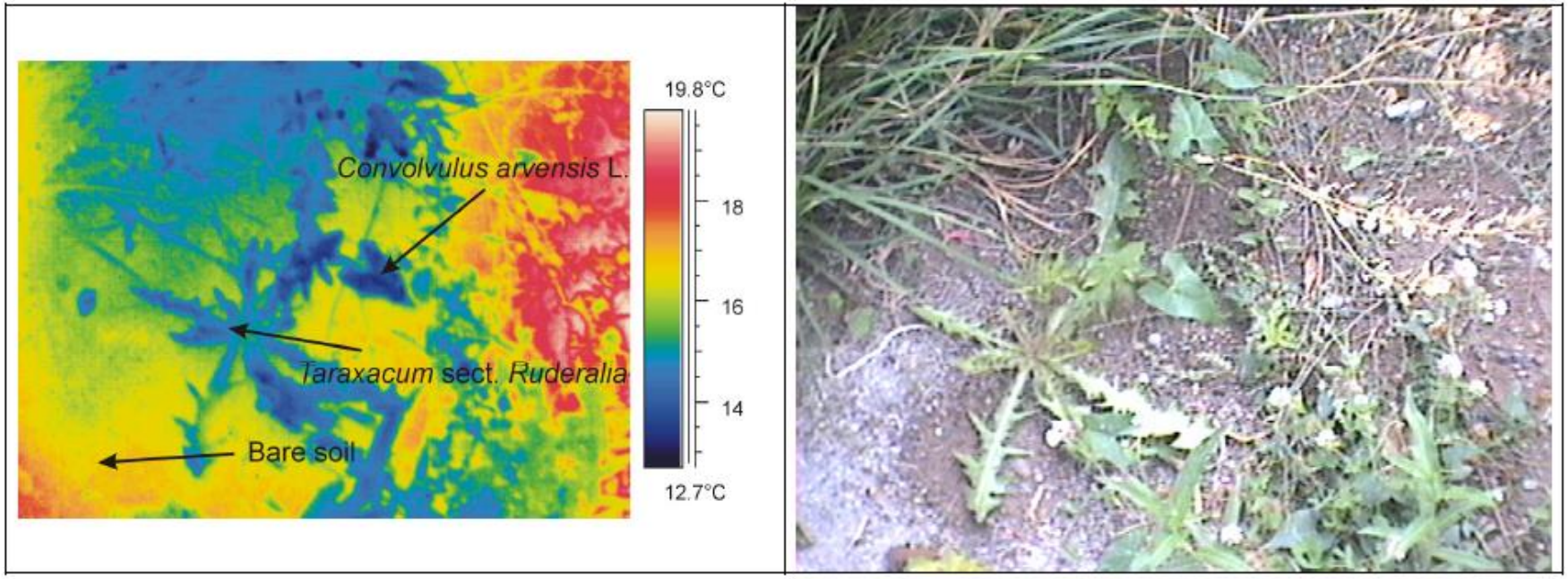


***Fig. 7* Photographs of thin vegetation in the infrared spectrum and in the visible spectrum**. The bare surface of the ground is visibly warmer than the surface of the leaves cooled by transpiration. (Třeboň, Czech Republic, 12 July 2002, 10:00 hrs).

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**.

- **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 called **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/m² of water needs 7,5 MJ /m².

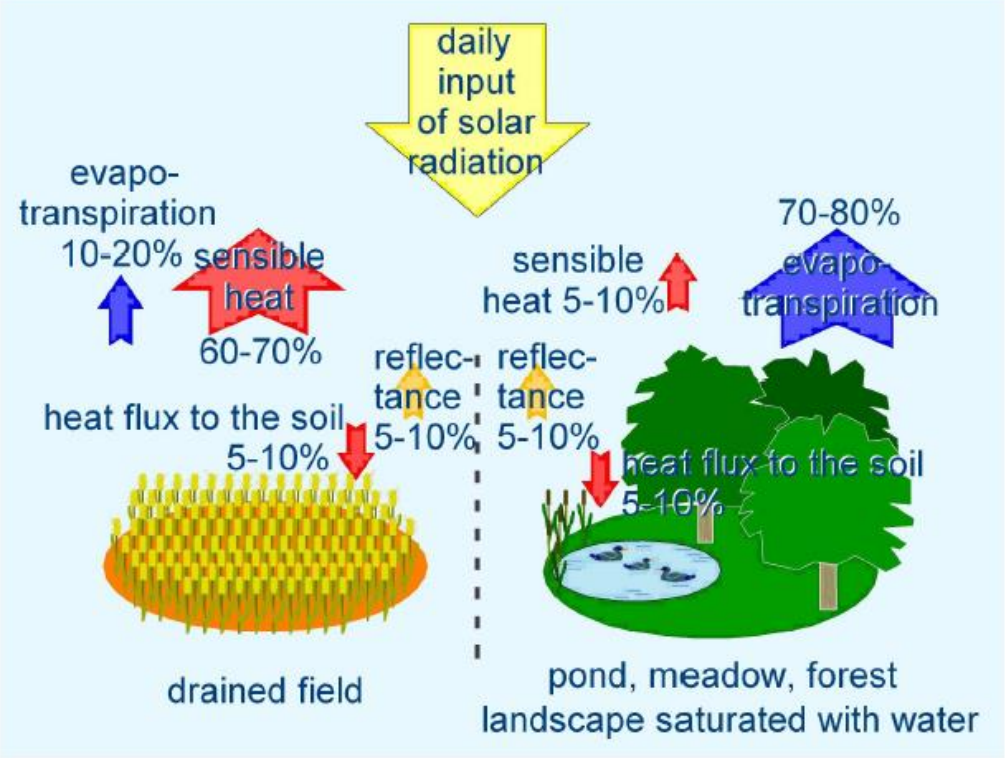


Fig. 4 **The distribution of solar energy on drained land and on a landscape saturated with water**

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 **watercycles**.

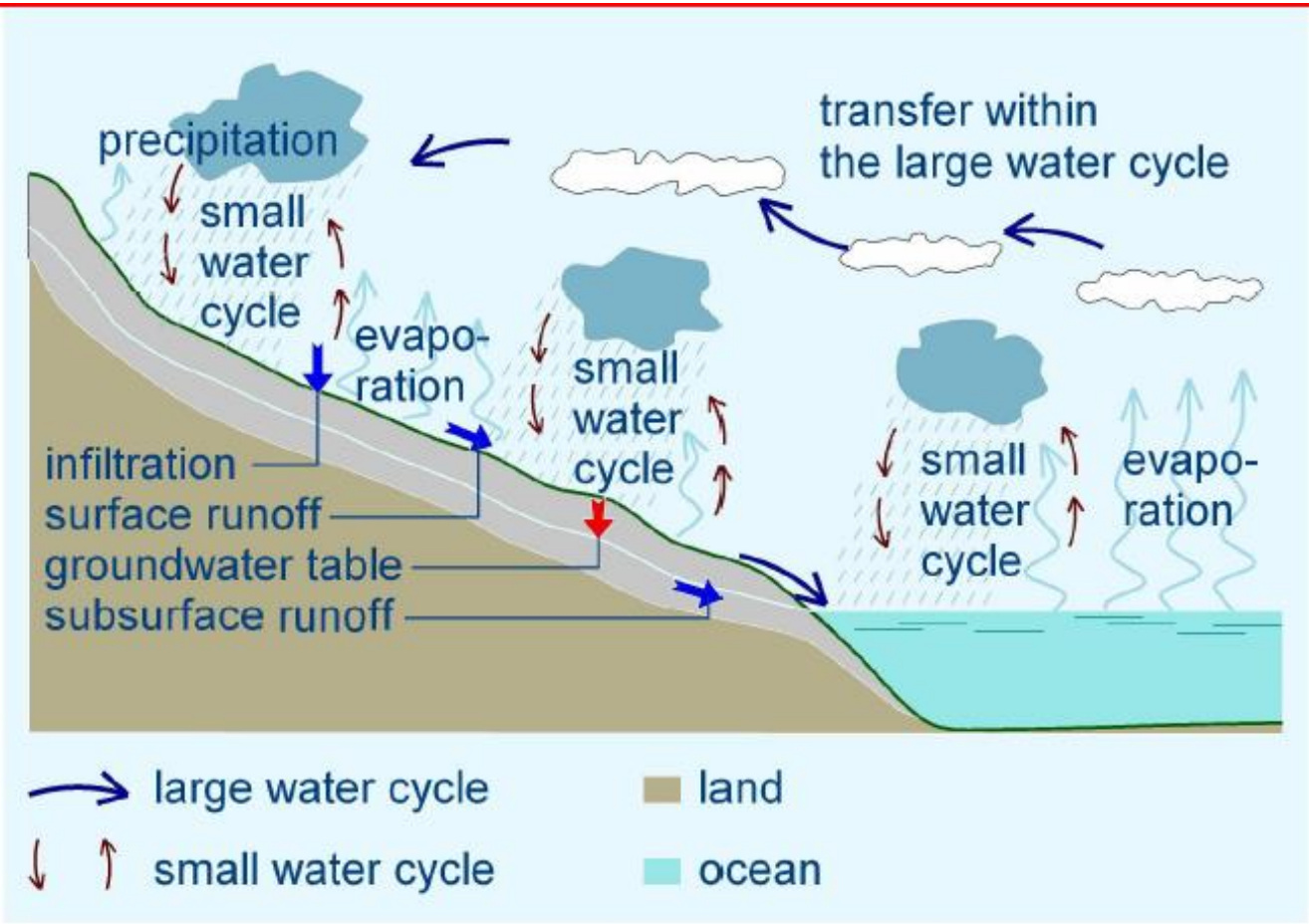


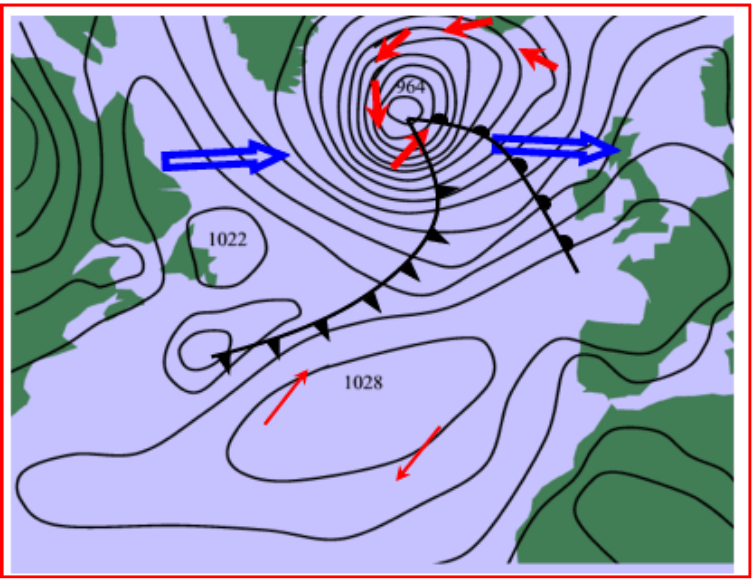
Fig. 1 **The large and small water cycles on land**

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.

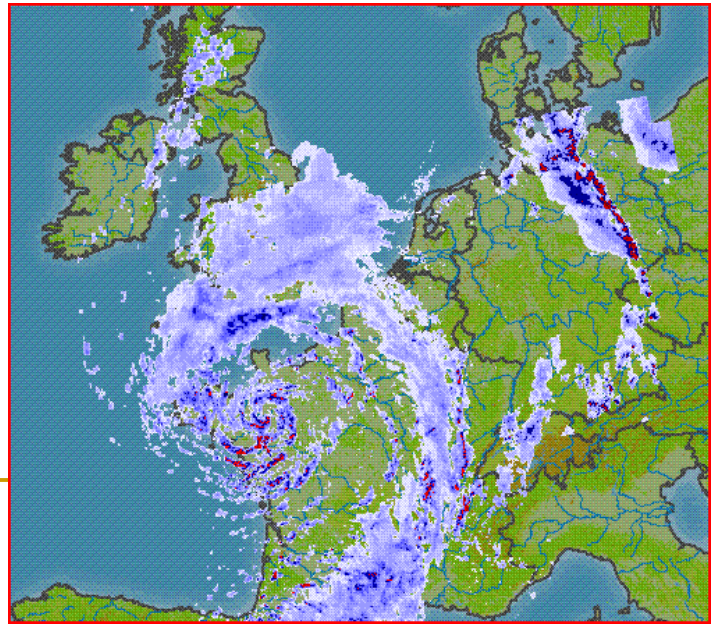
Source: Kravčík, M. et al., 2008.

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**.

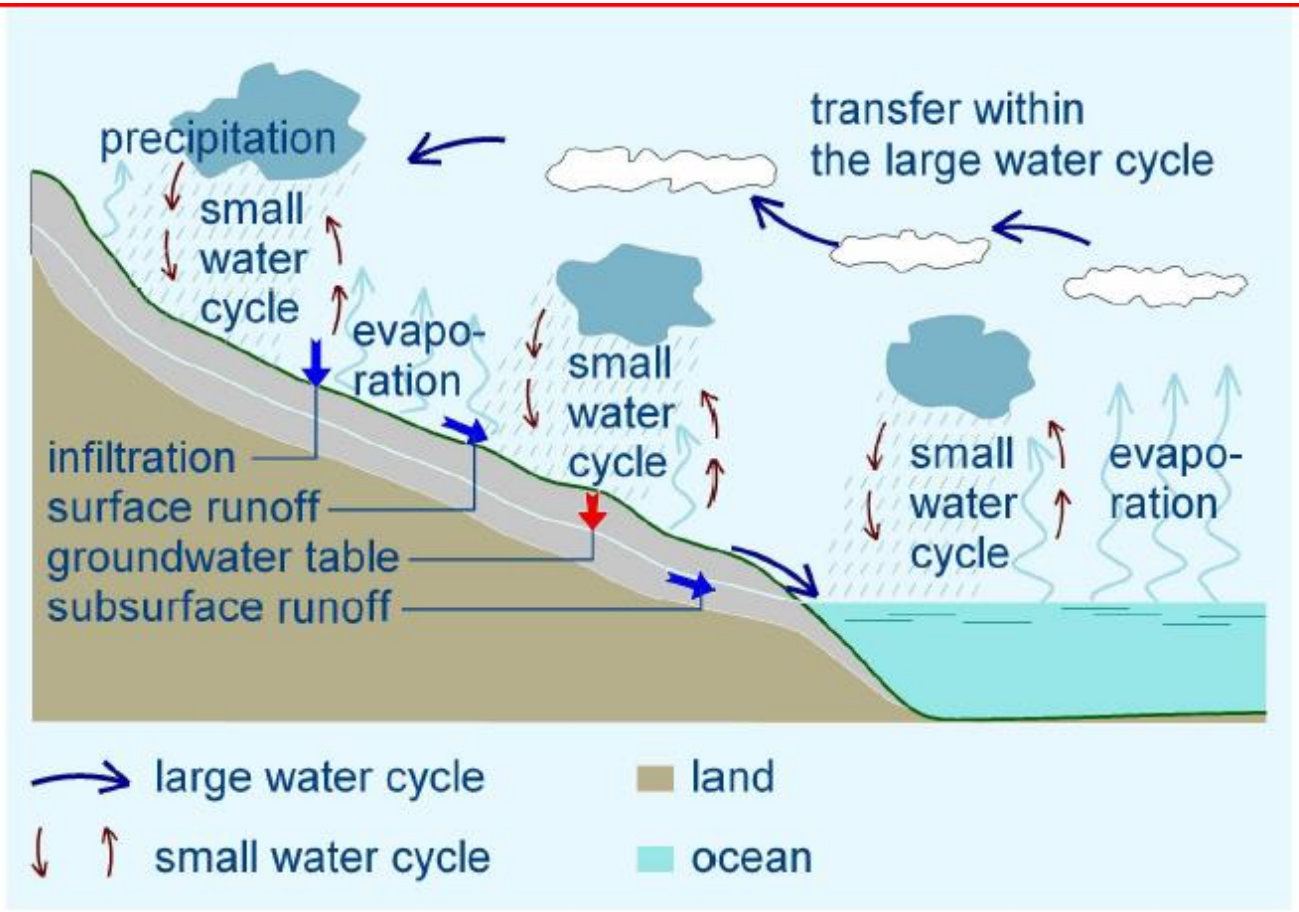


Fig. 1 **The large and small water cycles on land**

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

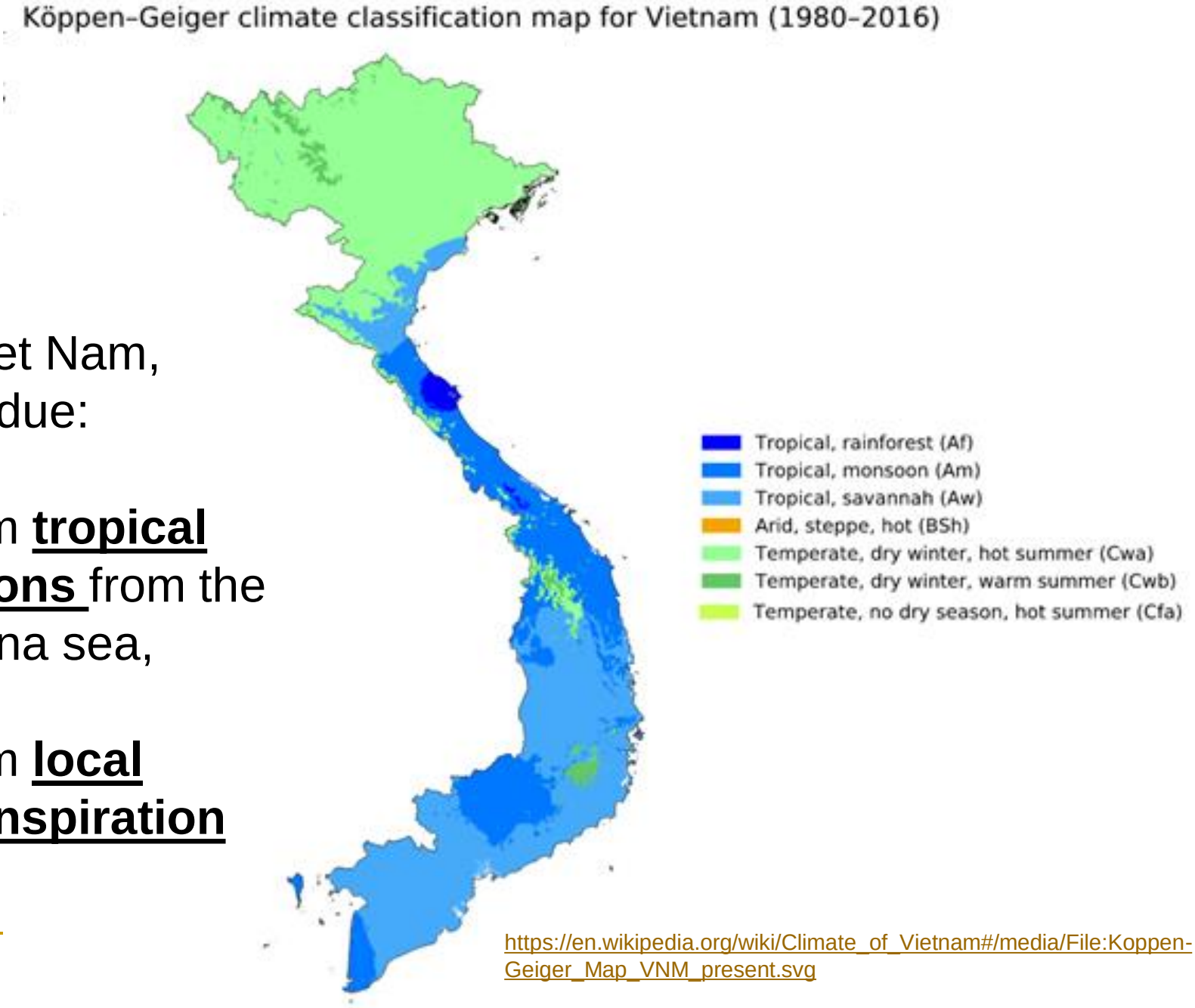
Rain Forest in Viet Nam,
Bach Ma National Park.

https://www.touropia.com/national-parks-in-vietnam/

Also in Viet Nam, rainfall is due:

partly from **tropical depressions** from the south China sea,

partly from **local evapotranspiration**



https://en.wikipedia.org/wiki/Climate_of_Vietnam#/media/File:Koppen-Geiger_Map_VNM_present.svg

A stable water cycle, over time is very important:

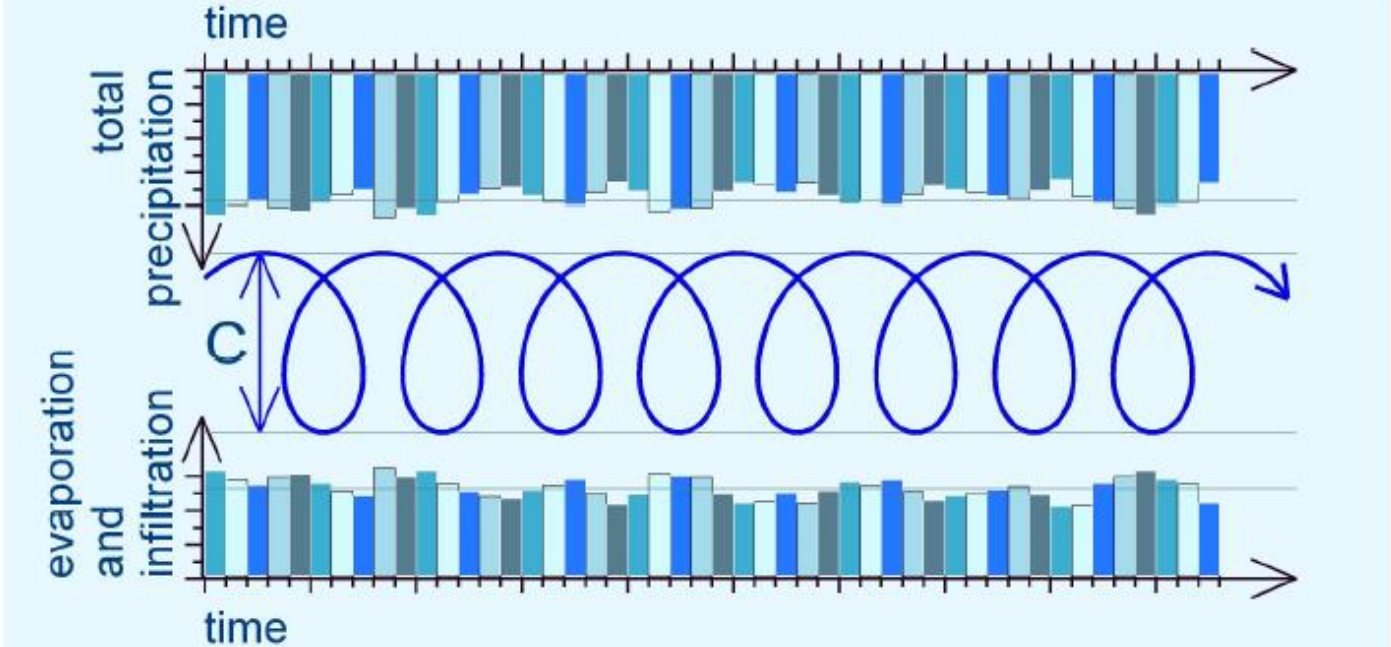


Fig. 2 **Diagram of the long-term stable water cycle on land**

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

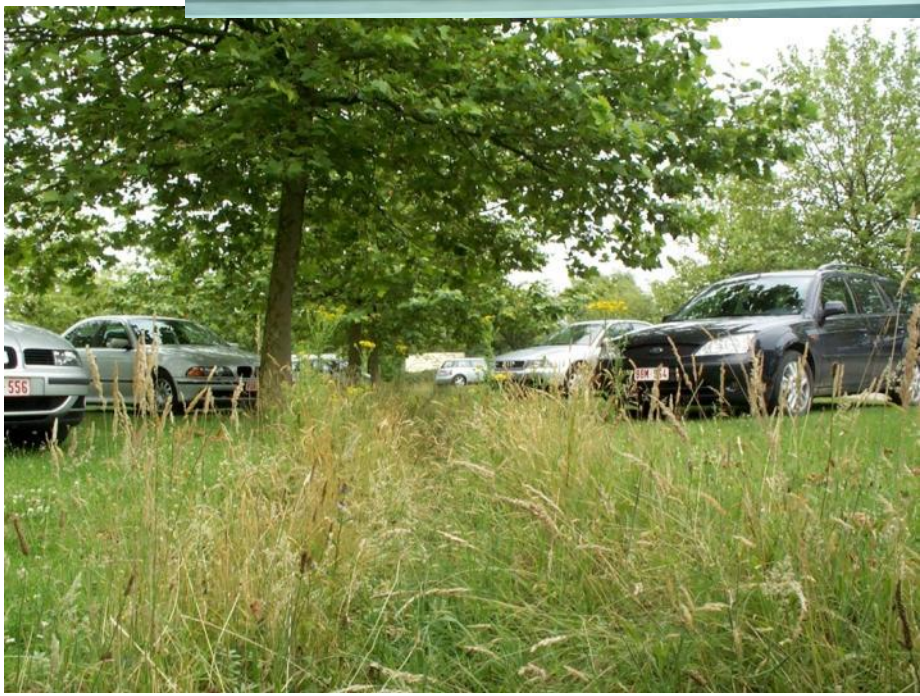
Bad examples: non-permeable sealed parking area, **disturbing local small water cycles**, huge RUN-OFF.

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

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

Good examples: permeable green parkings.

Mechelen (B). Parking
Planckendael (Muizen)



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

Consequences of decreasing the small water cycle.

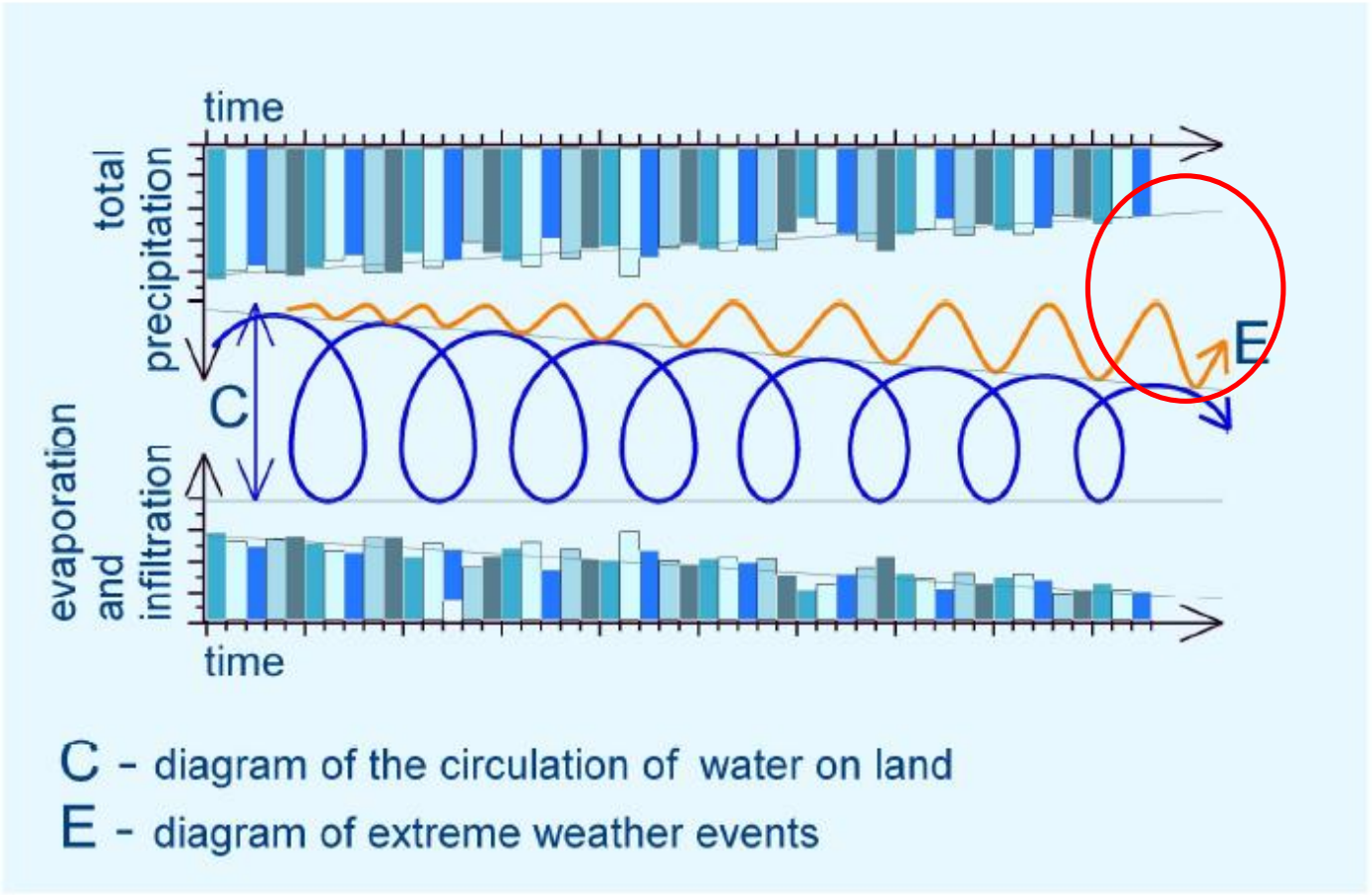


Fig. 17 **The growth of extreme weather with the decrease of water in the small water cycle**

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

Example: Slovakia/Europe, Tatra mountains. Situation 1800.

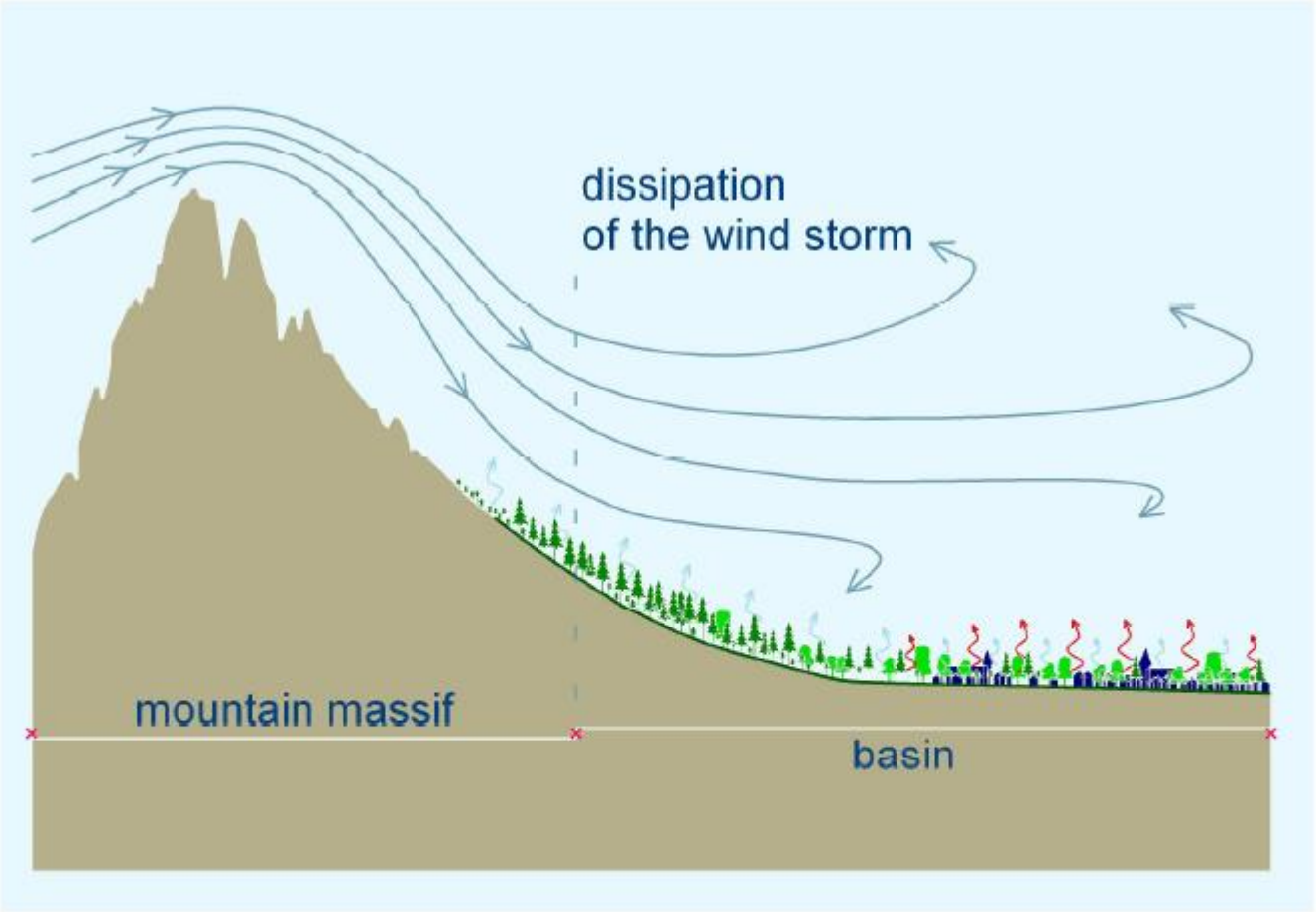


***Fig. 24* The incursion of cold air to the High Tatras regions (the Tatra bora) - the assumed state around the year 1800**

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 in lowland and by draining for agricultural and forestry purposes.

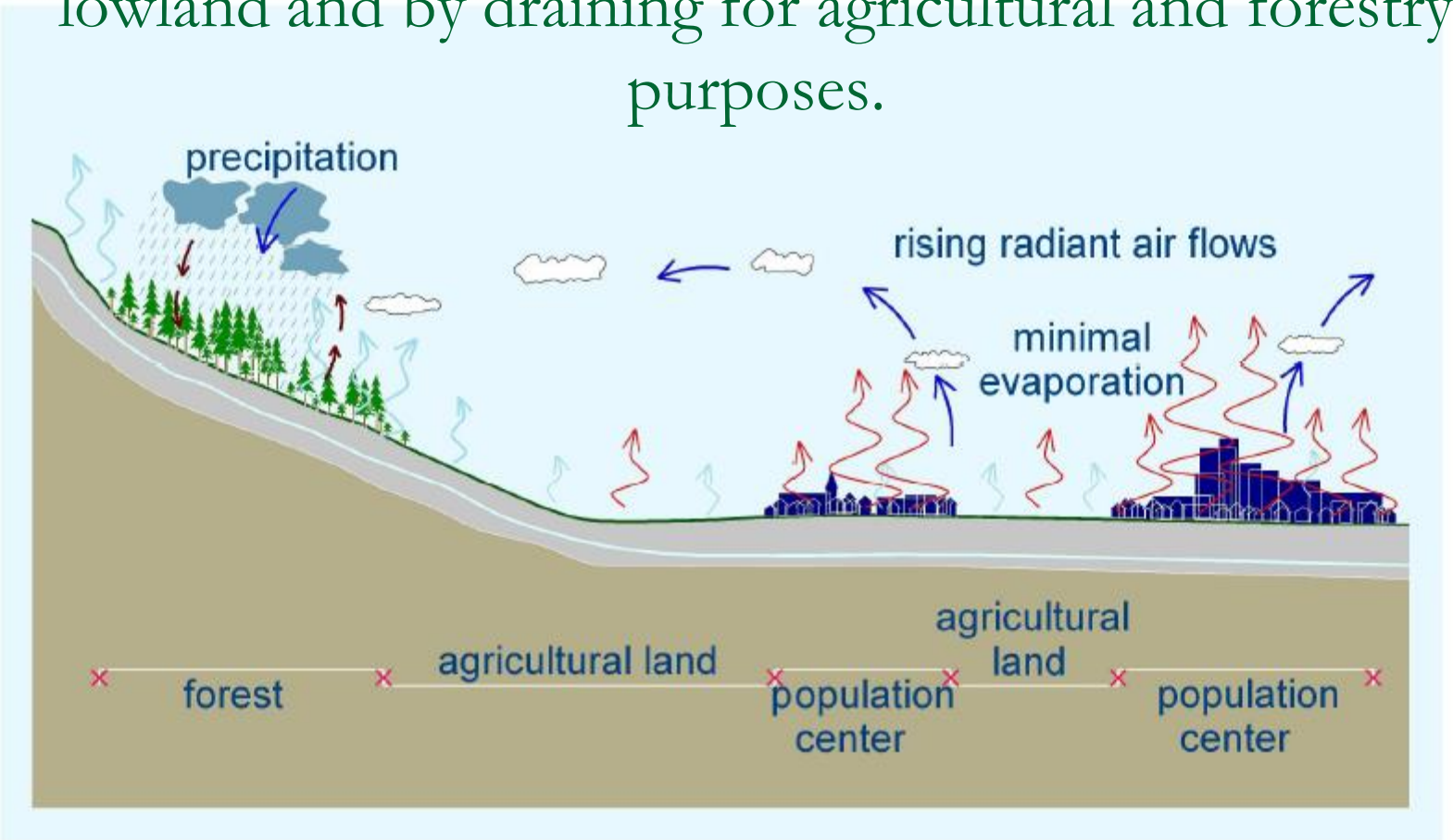


Fig. 18 **The impact of the transformation of land on the destruction of small water cycles**

Rising radiant flows push clouds to cooler environments.

Slovakia/Europe, Tatra mountains. Situation 2004. Growing and increasing temperature contrasts thus: Increasing risks for **extreme weather events**

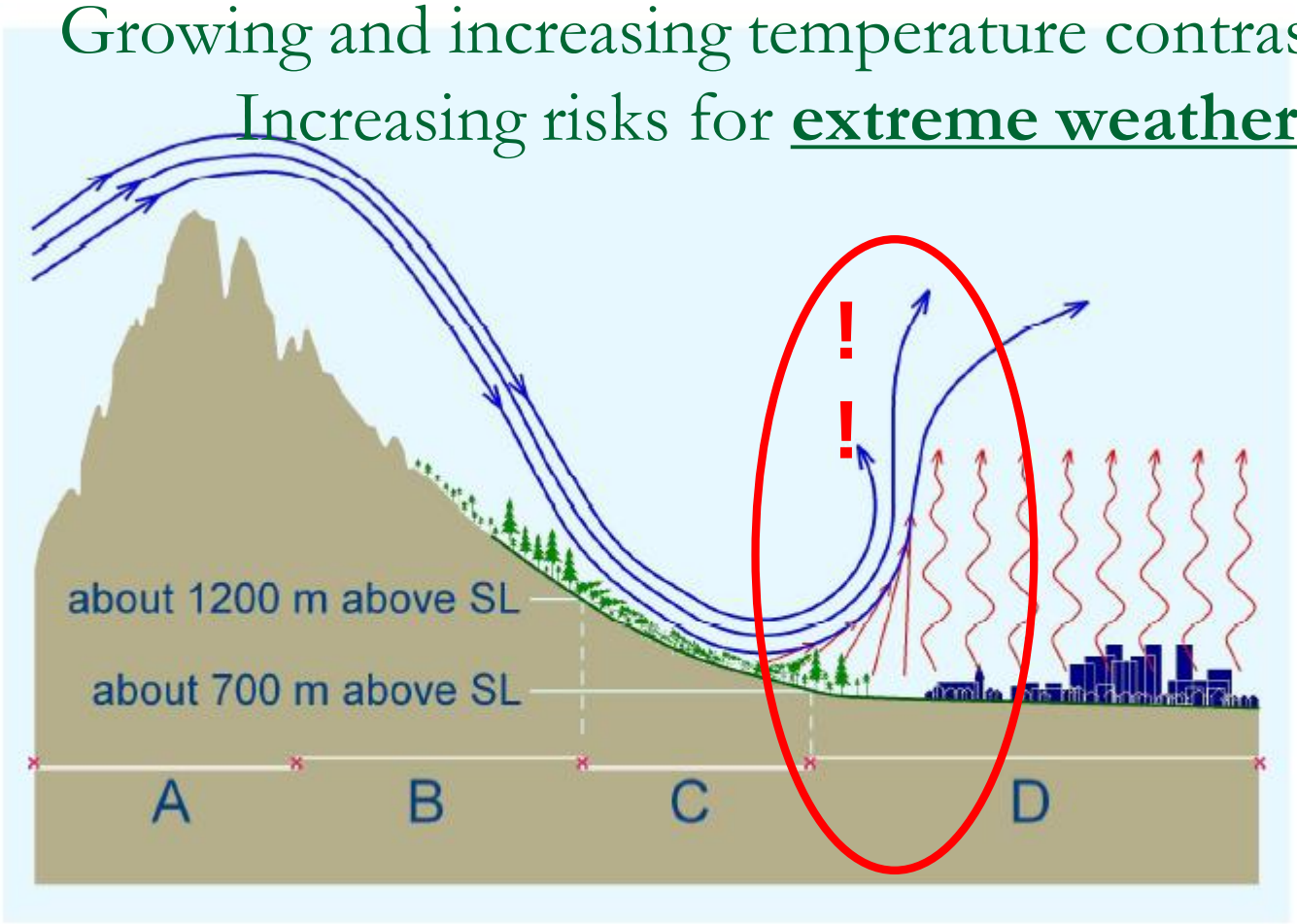


***Fig. 25* Wind storm in the High Tatra mountains, Slovakia, November 19, 2004**
Radiant flows of warmed currents from agricultural-urban areas (zone D) accelerated air currents with the rapidly falling cold front through the ridge of the High Tatra mountains: v(A) 150 – 200 km/h, v(B) < 100 km/h; v(C)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

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

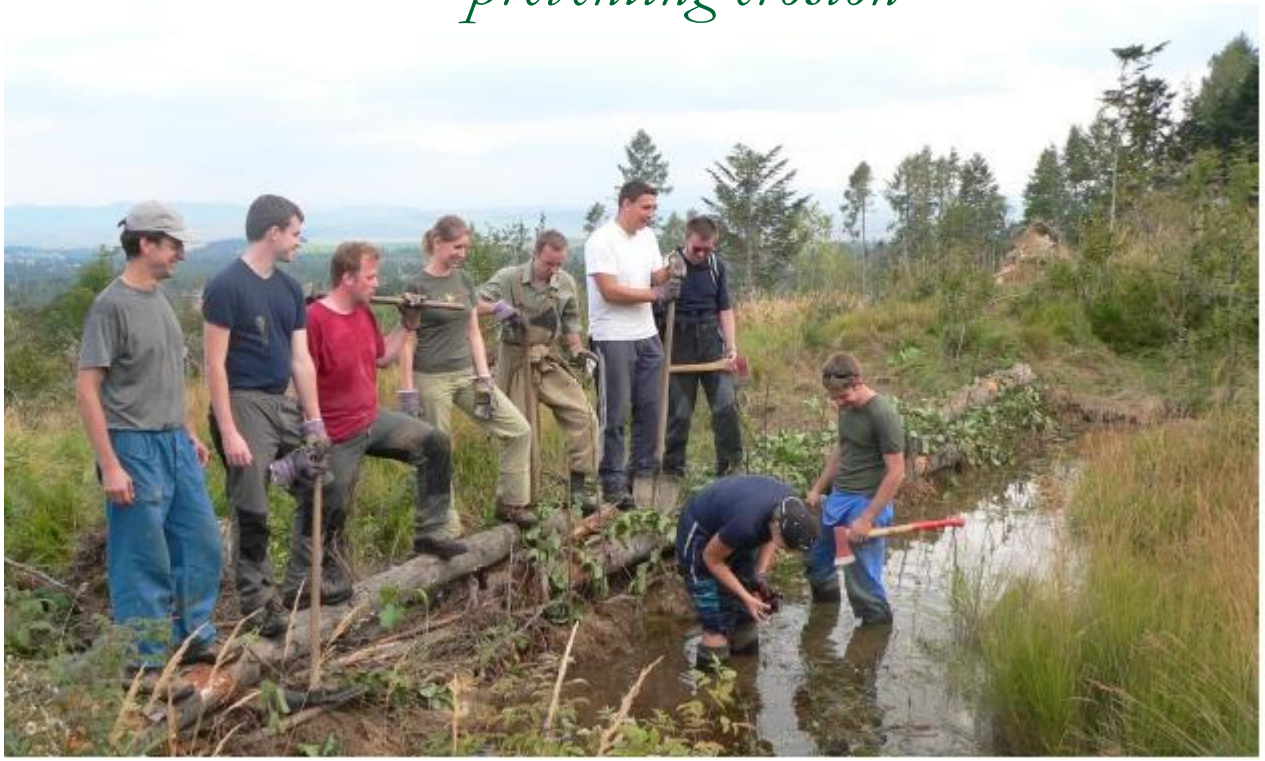


***Fig. 35* A Water Forest in the High Tatras – building water conservation measures on territory destroyed by a natural disaster**

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.

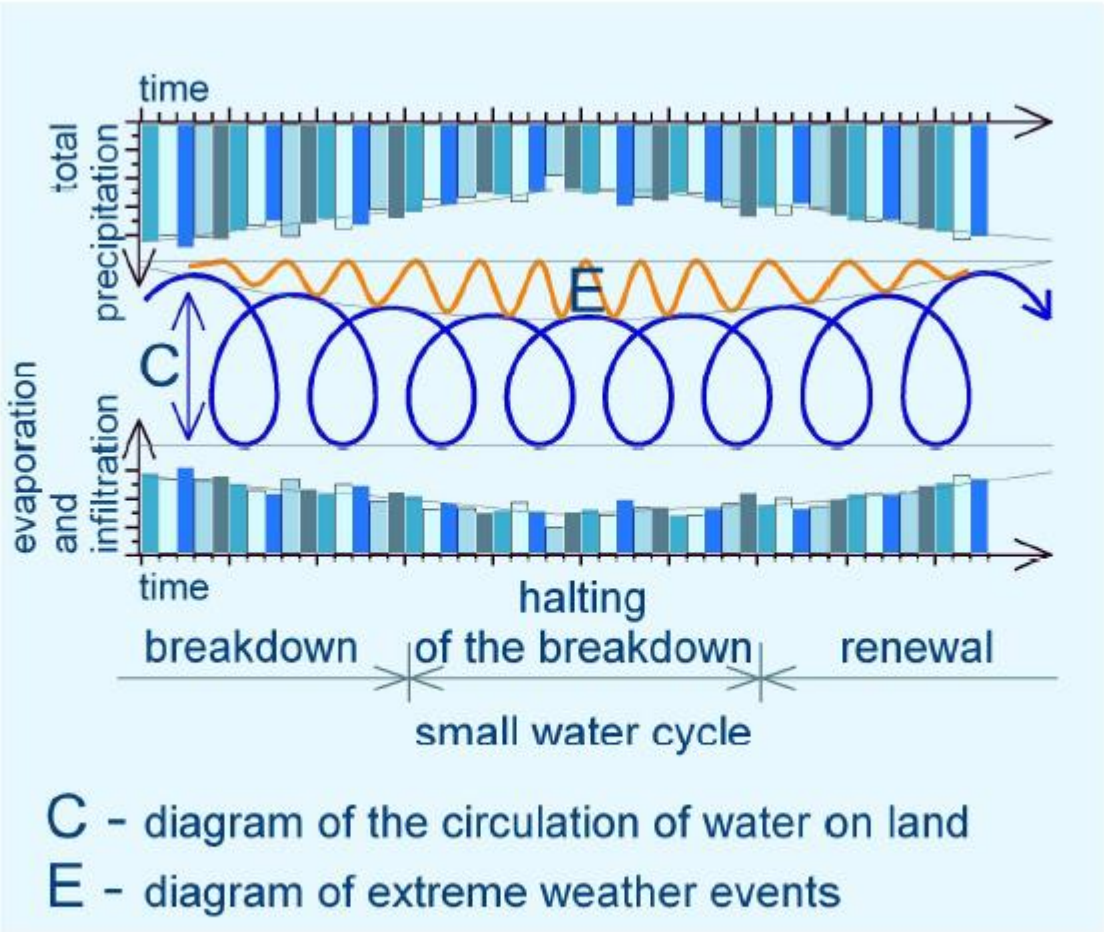


Fig. 27 **The course of destruction of the small water cycle over land until it is halted and then renewed to its original state**

Wetland landscapes remain cooler than dry landscapes. The presence of water/vegetation 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 both rural and 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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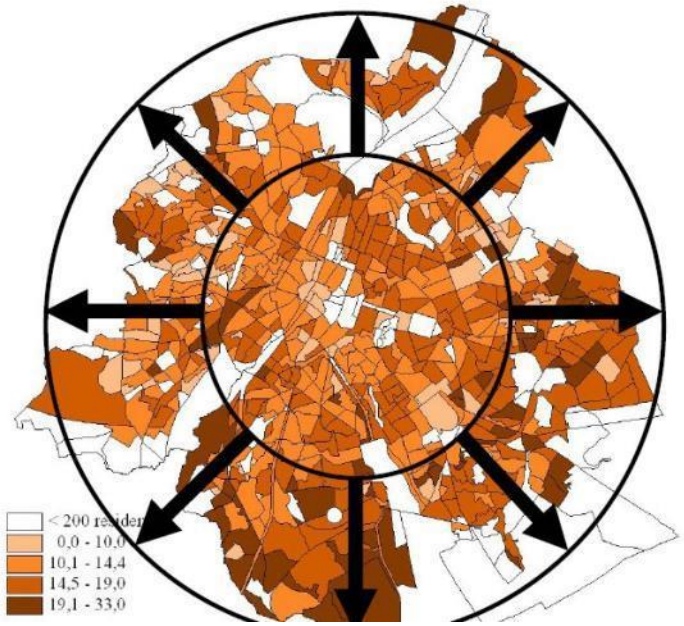
Brussels (1,200,000 inh. ; Belgium, European capital) Younger families with children leave (flee from) the city centre and move to the green city fringe and rural areas.

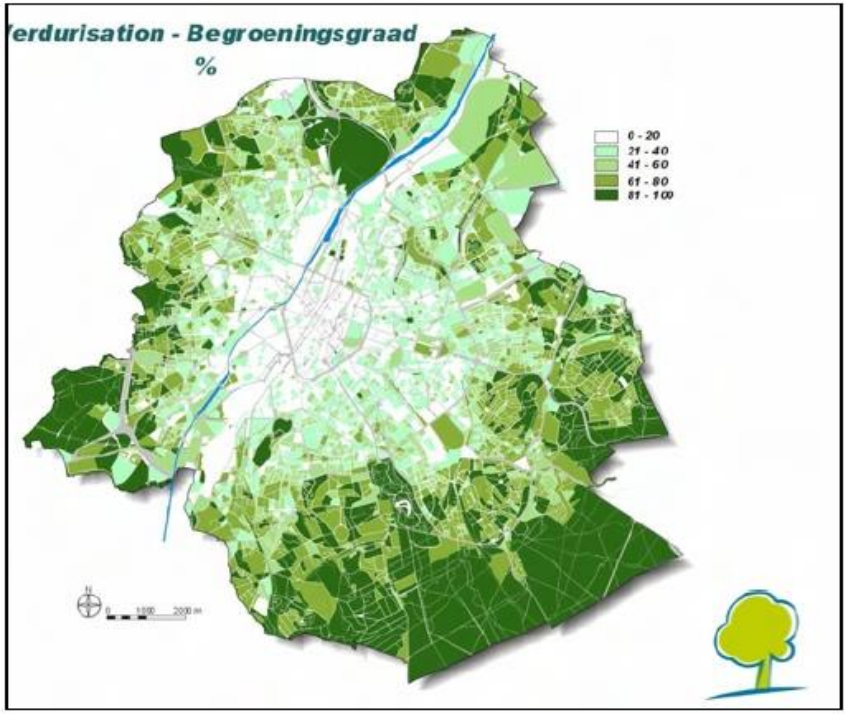
traffic insecurity

lack of adventurous public green

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



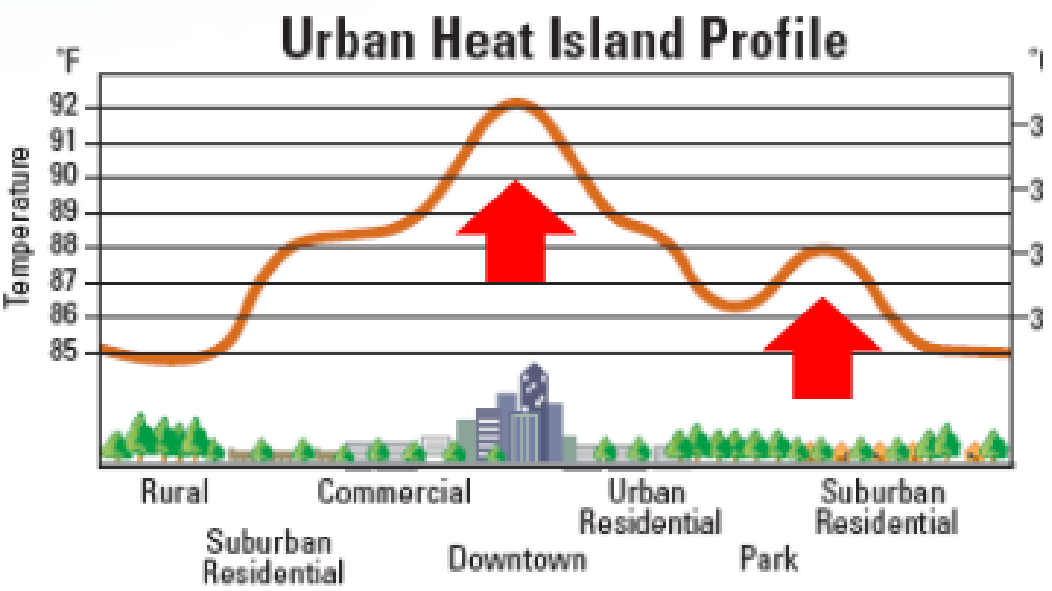
From De Corte, 2005



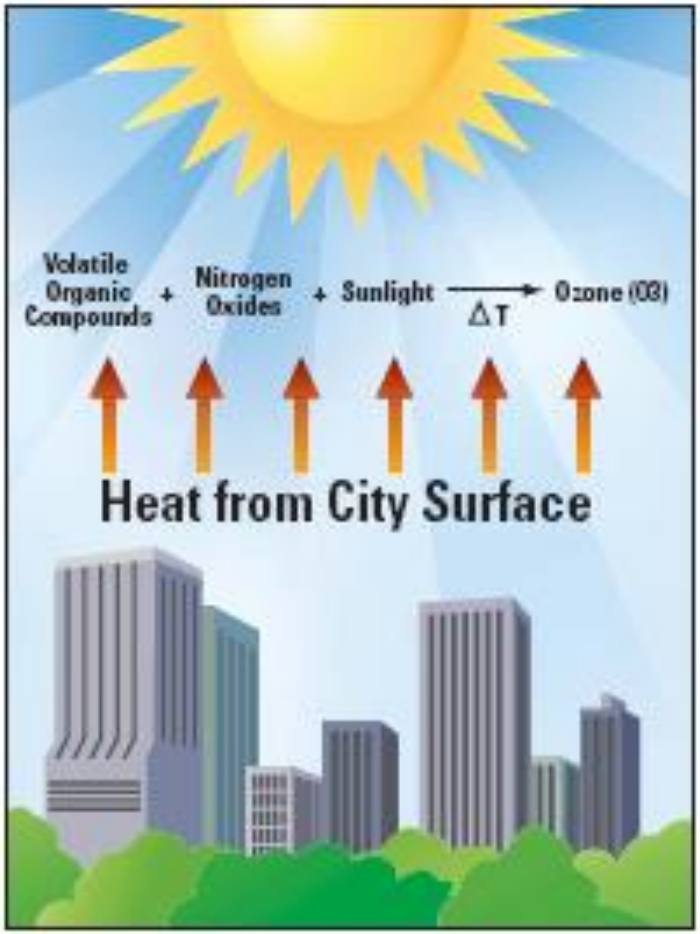
Proportion of green, open spaces in Brussels Capital Region
Source : IBGE-BIM

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

The urban heat island effect increases photochemical smog risks



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



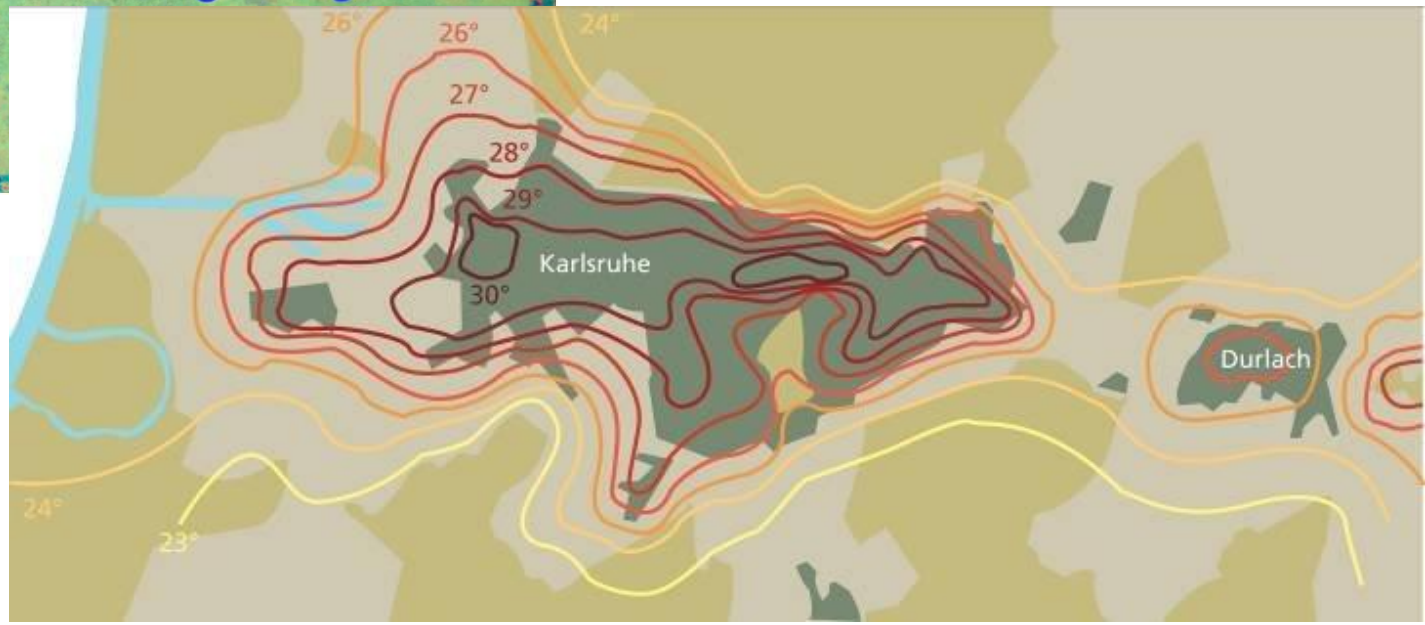
Ozone forms when precursor compounds react in the presence of sunlight and high temperatures.

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

Chemical reactions creating summer smog are catalysed by higher temperatures

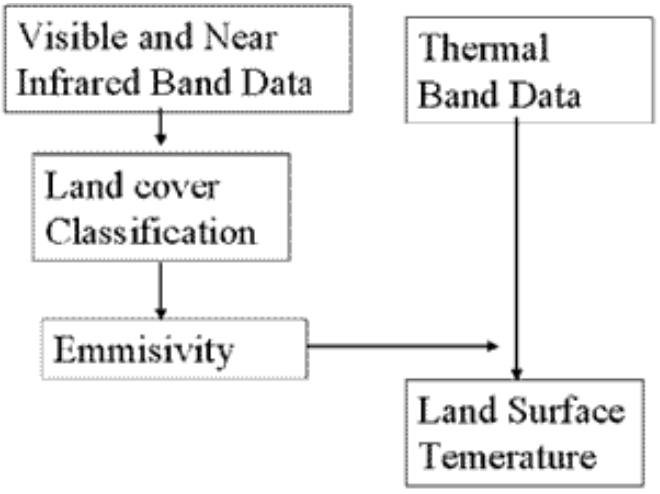
Gartland, Lisa. 2008 . Heat Islands. London, Earthscan,

ISBN 978-1-84407-250-7



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

Some Asian examples



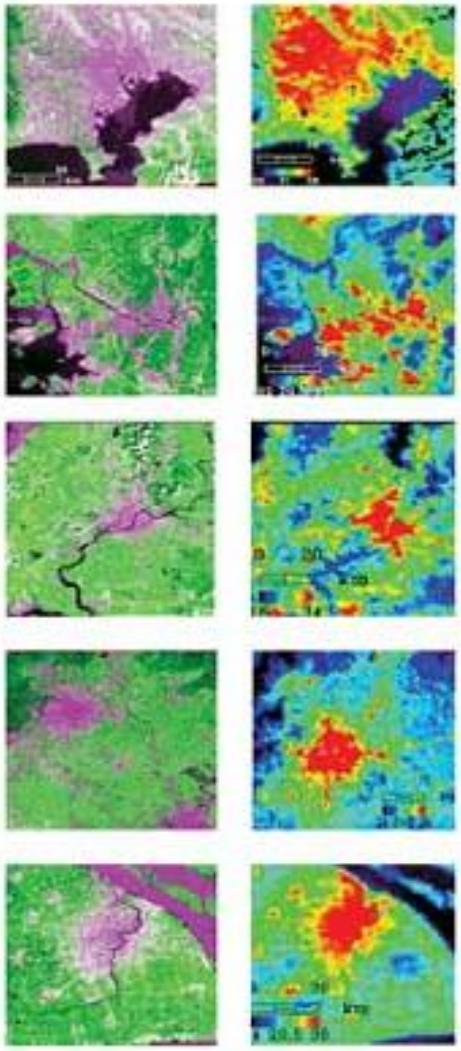
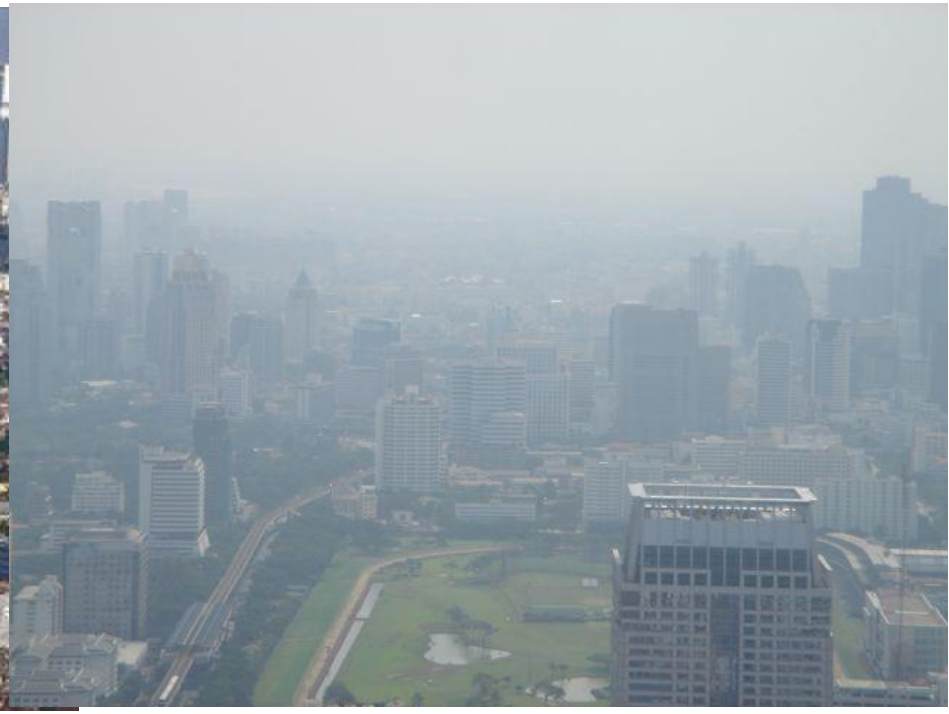


Fig-3 Visible band and thermal band for the study sites (Tokyo, Seoul, Pyongyang, Beijing and Shanghai, from top)

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 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

Photochemical smog in some Vietnamese cities

Photochemical smog threatens public health in HCM City

Update: January, 24/2018 - 18:33

HCM City people suffer from photochemical blindness, a kind of air pollution that's harmful to human health.— Photo nld.com.vn

Viet Nam News HCM CITY — People living in HCM City are suffering from photochemical smog, a kind of air pollution that's harmful to human health.

Last update 10:34 | 08/01/2019

Hanoi streets enveloped by thick smog

Hanoi was covered by thick smog this morning, January 9, amid cold weather with light rain.

Also increasing heat stress problems in **Hanoi** (2019)

VNEXPRESS INTERNATIONAL The most read Vietnamese newspaper

News Business Travel Life Sports Video Perspectives

News

Two killed in Hanoi heatwave

By **Le Nga** June 27, 2019 | 01:16 pm GMT+7

» HANOINEWS

Hanoi sets free shelters for workers to avoid scorching heat

Updated at Monday, 29 Jul 2019, 12:14

The Hanoitimes **- The project is organized by the Vietnam Red Cross and funded by the German Red Cross.**

» Hanoi ensures steady power distribution amid scorching heat

» Hanoi's residents struggle with blazing heat

» How long is scorching heat in Hanoi lasting?

» Vietnam undergoes record-breaking heat wave

https://e.vnexpress.net/news/news/two-killed-in-hanoi-heatwave-3944281.html

http://www.hanoitimes.vn/hanoinews/2019/07/81e0d9fa/hanoi-sets-free-shelters-for-workers-to-avoid-scorching-heat/

Figure 1 shows the land use changes before and after the implementation of the master plan. To meet the demands of expanding urban development, 28% of the natural land will be allocated for the urban construction land. In total, the constructed land will rise sharply by almost three times, from 46,340 ha (14%) to more than 129,500 ha (39%).

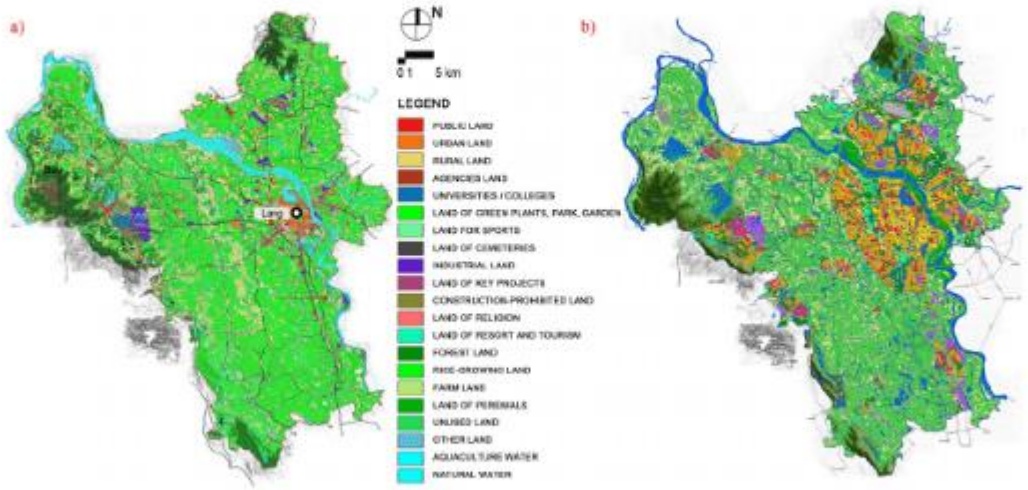


Figure 1. Land use and land cover for (**a**) the current status and (**b**) the Hanoi Master Plan 2030. Source: Vietnam Institute of Architecture, Urban and Rural Planning (VIAP), 2011.

Buildings **2015**, *5*, 933-947; doi:10.3390/buildings5030933

OPEN ACCESS

buildings

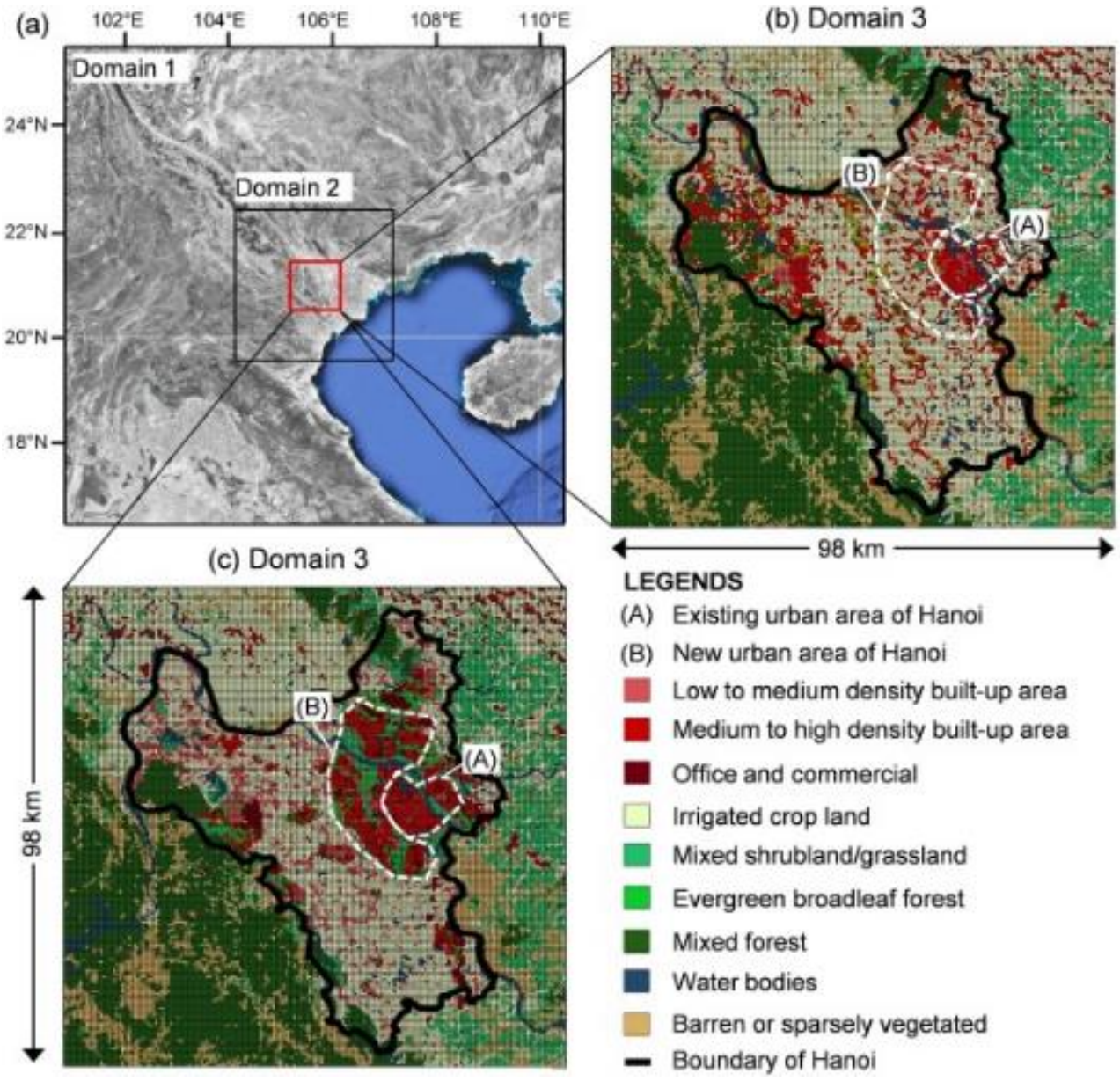
ISSN 2075-5309

www.mdpi.com/journal/buildings/

Article

Configuration of Green Spaces for Urban Heat Island Mitigation and Future Building Energy Conservation in Hanoi Master Plan 2030

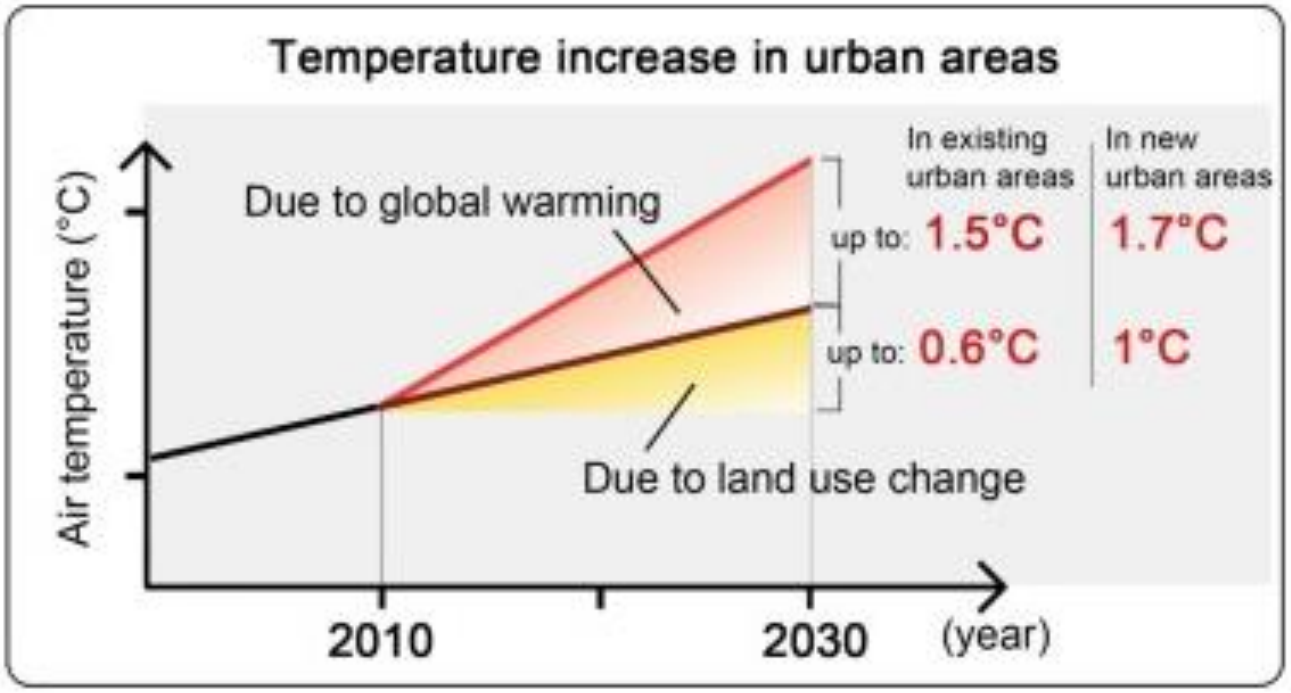
Andhang Rakhmat Trihamdani [1,*], Han Soo Lee [2], Tetsu Kubota [3,†] and Tran Thi Thu Phuong [4]


(a)
102°E
104°E
106°E
108°E
110°E
24°N
22°N
20°N
18°N
Domain 1
Domain 2
(b) Domain 3
(B)
(A)
98 km
(c) Domain 3
(B)
(A)
98 km
LEGENDS
(A) Existing urban area of Hanoi
(B) New urban area of Hanoi
Low to medium density built-up area
Medium to high density built-up area
Office and commercial
Irrigated crop land
Mixed shrubland/grassland
Evergreen broadleaf forest
Mixed forest
Water bodies
Barren or sparsely vegetated
Boundary of Hanoi

Highlights of this 'Ha Noi casestudy'

- The study assess urban temperature increase in Hanoi by the 2030s under the influence of global warming.
- The urban temperature is projected to increase along with global warming.
- Global warming will contribute, at most, 71% of the temperature increase in existing urban areas in the 2030s.
- The temperature increase will likely offset cooling effect from any of UHI mitigation measures.

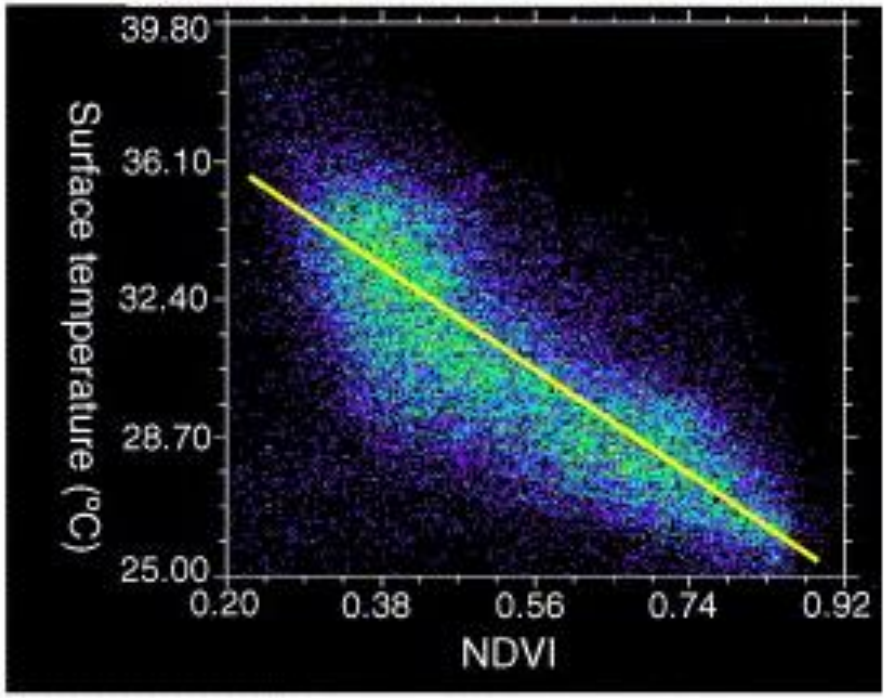
The Ha Noi case



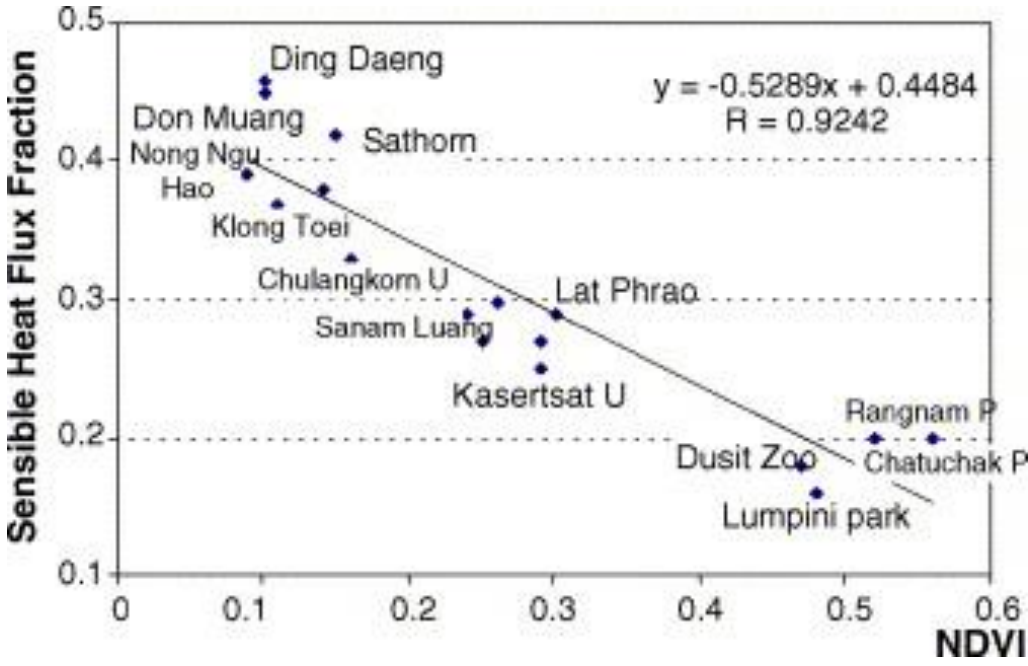
Impacts of land use changes from the Hanoi Master Plan 2030 on urban heat islands: Part 2. Influence of global warming

Han Soo Lee [a], Andhang Rakhmat Trihamdani [a], Tetsu Kubota [a] ✉, Satoru Iizuka [b], Tran Thi Thu Phuong [c]

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)

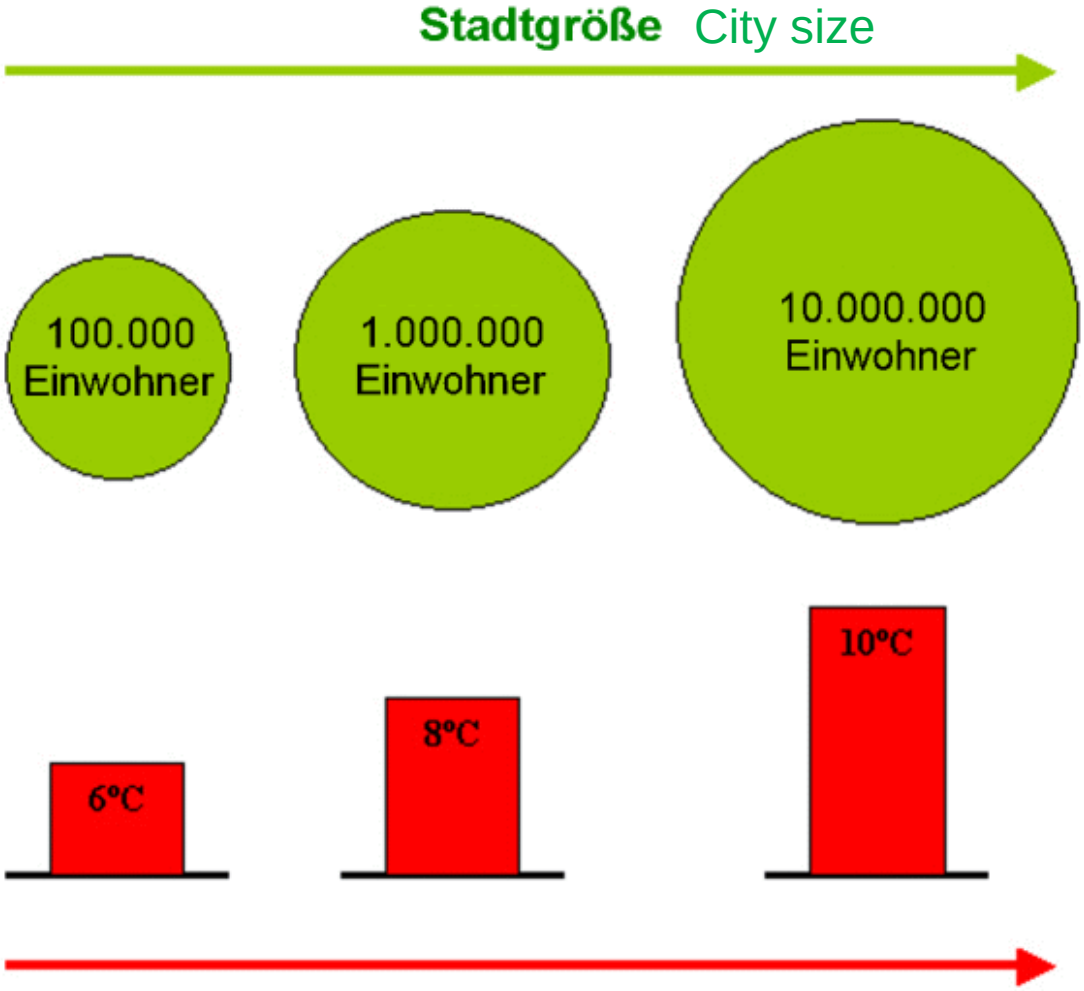


Scatterplots of day-time surface temperature vs. vegetation index for Bangkok in February 2002.



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)

Another ecosystem service

of vegetation
decreasing stormwater RUN-OFF

Increasing urbanisation, increases storm water run-off and is raising flooding risks in rural areas downstream of cities

Urbanisation is increasing storm water **run-off**.

By **VnExpress, Reuters** April 12, 2017 | 03:19 pm GMT+7

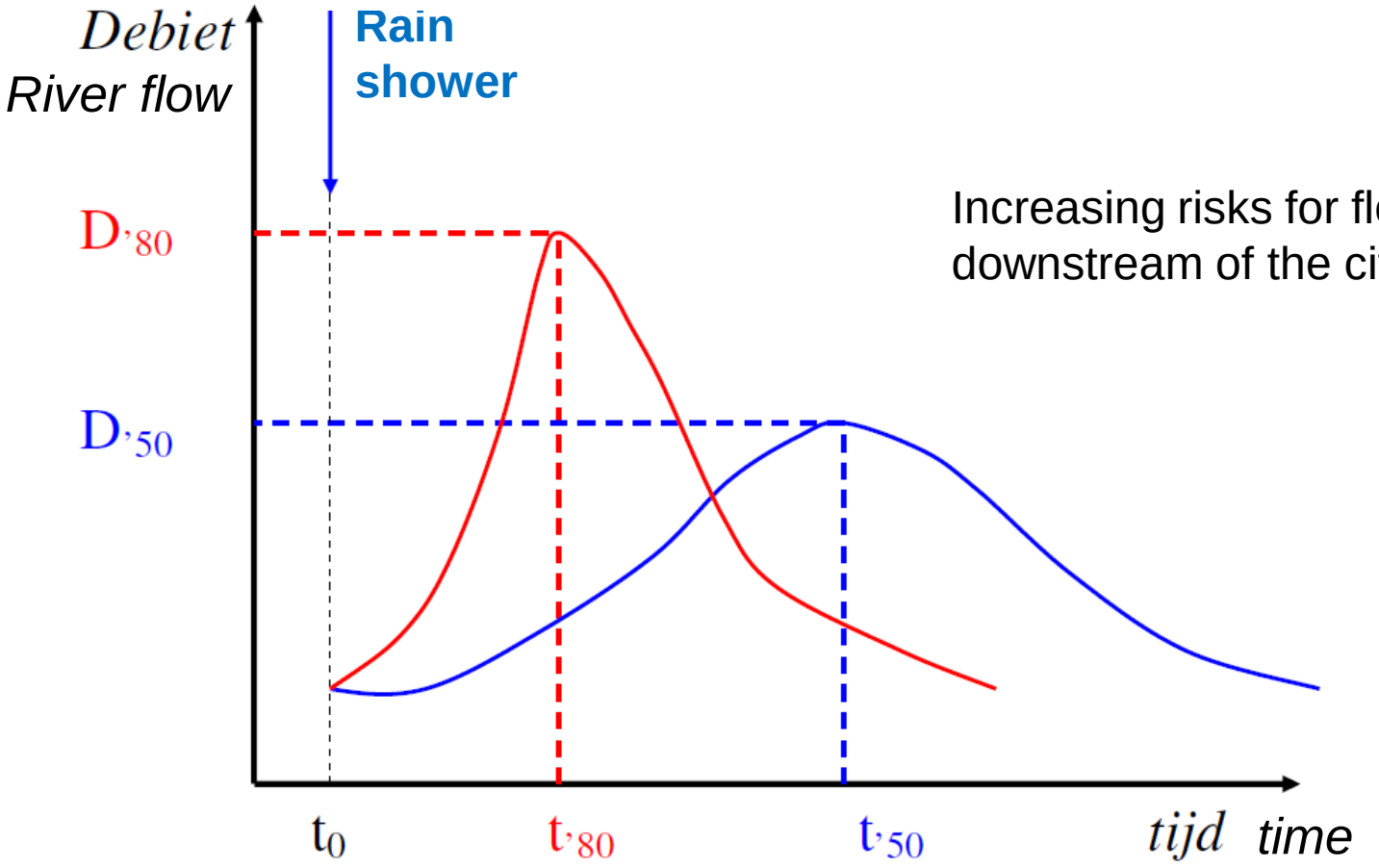
Health experts say too much heat can be fatal. Photo by VnExpress/Ngoc Thanh

Mean annual rainfall in Viet Nam ranges from 700 to 5,000 mm (28 to 197 inches) although most places in Vietnam receive between 1,400 to 2,400 mm

Each m^2 sealed surface means an obstacle for 1400 to 2400 litres (**140 to 240 buckets**!!) of rainwater /year.

http://www.stephanebeel.com/selected-works.html

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

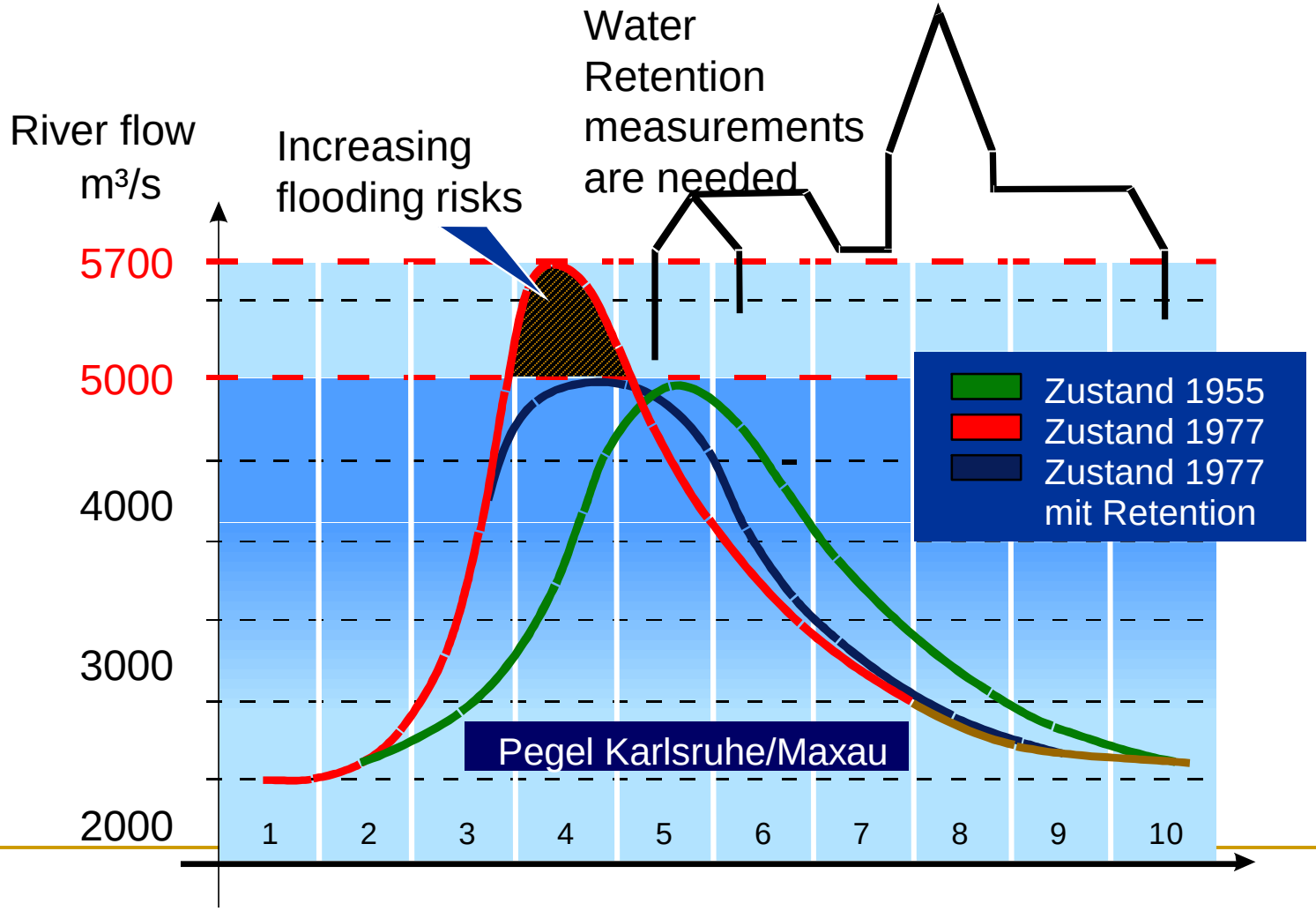


Increasing risks for flooding, downstream of the cities

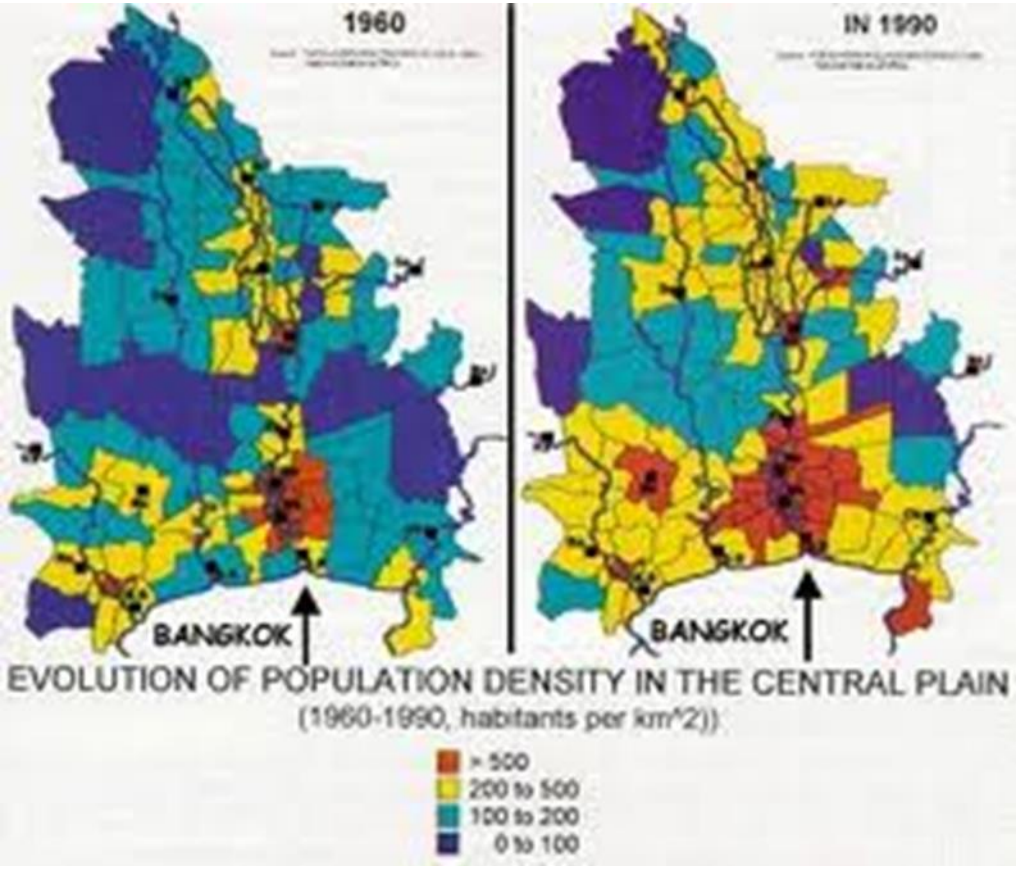
Current peak river flow rates from inland to the North Sea are **higher** and come **earlier** in the time after a rain shower, compared with the years 1950.

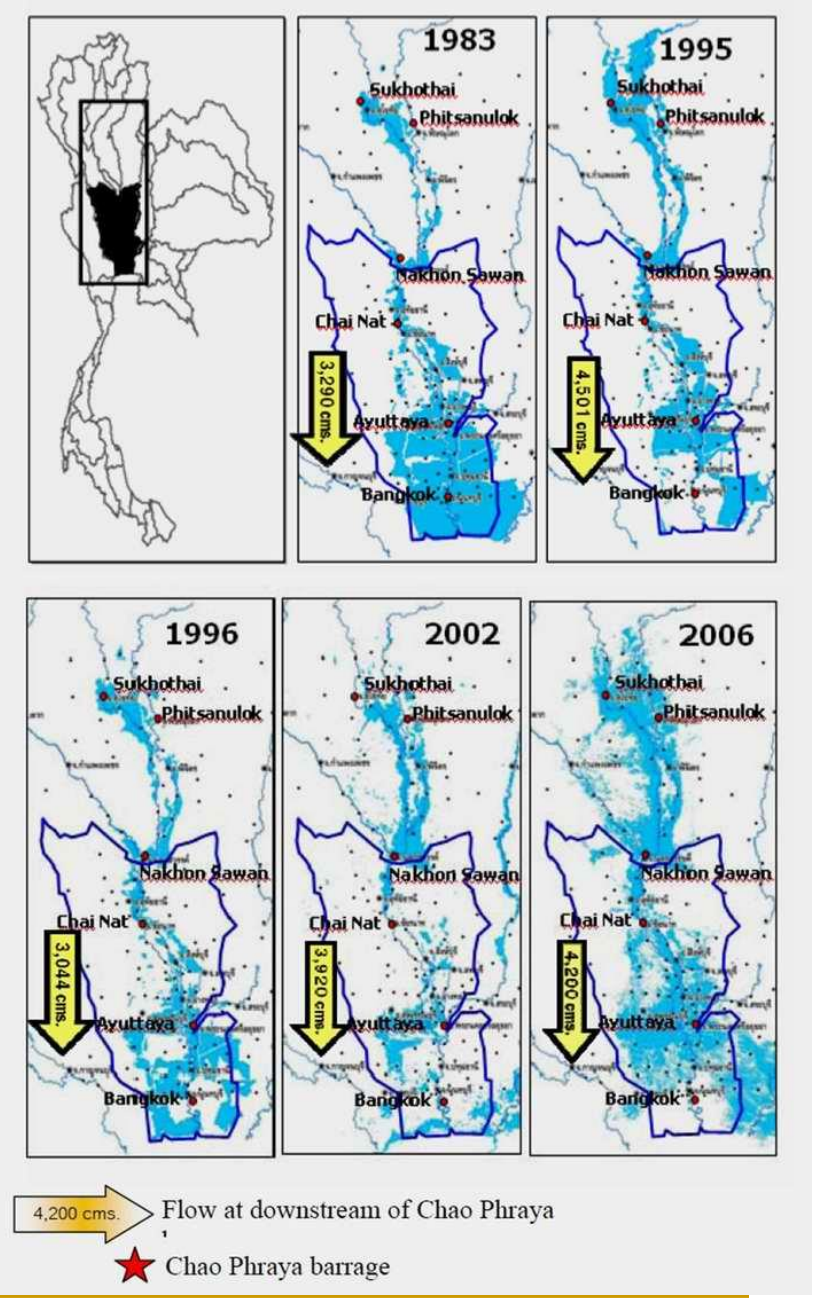
The same is the case all over Europe: example of the river **Rhine**, in the border region between France and Germany.

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



Same problems in Asia: Bangkok and surroundings 1960's – 1990's





http://www.goodstuff4u.multiply.com

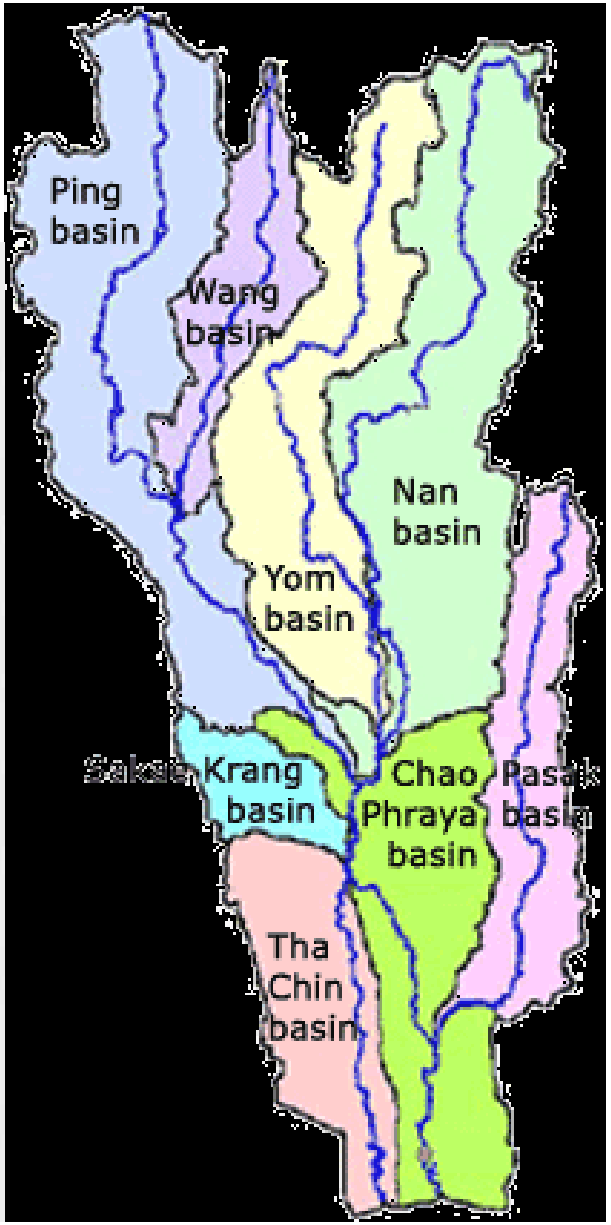
http://bebasbanjir2025.wordpress.com/pengendalian-banjir-mancanegara/thailand/

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

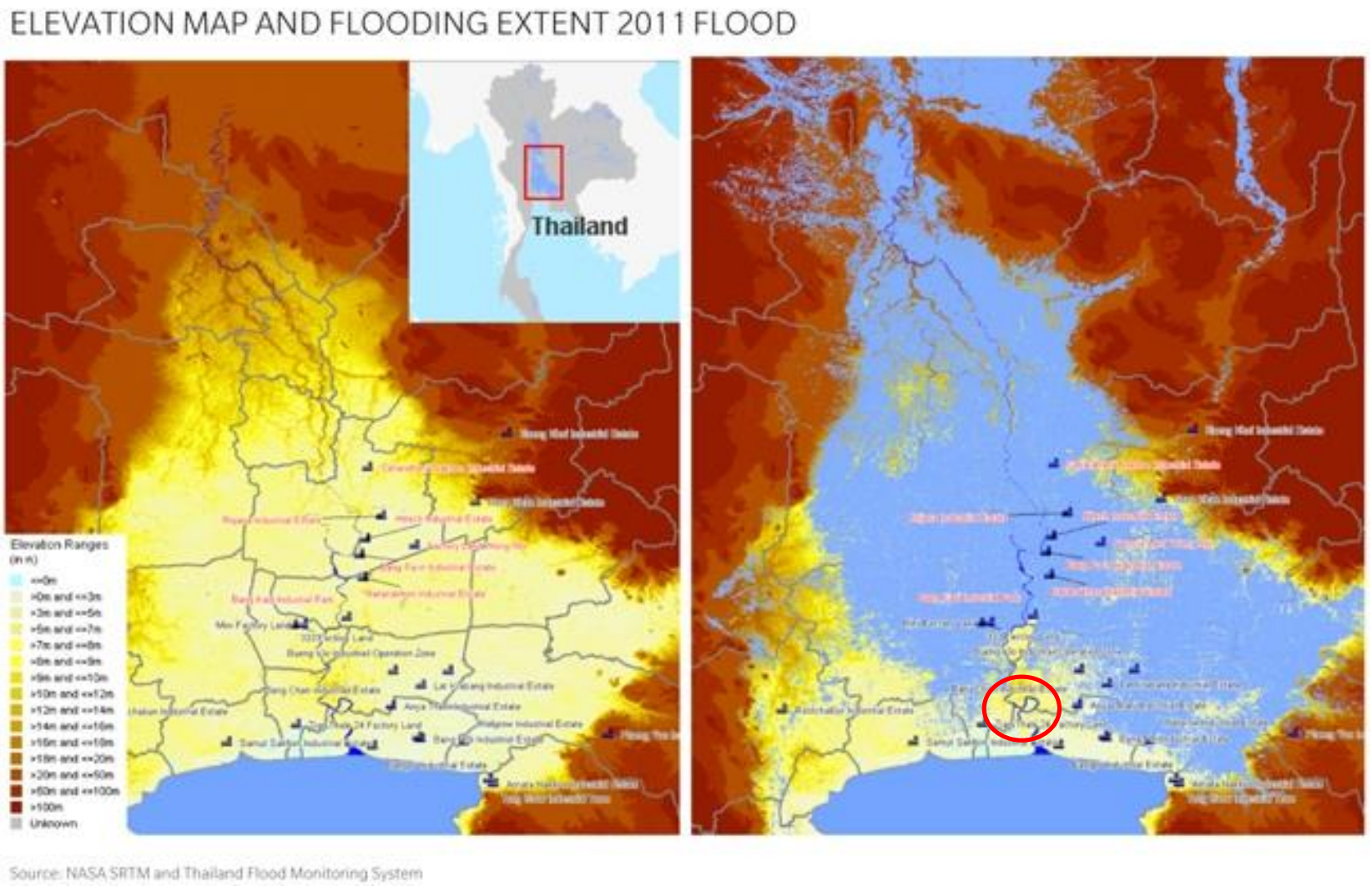
		1942	1983	1995
Human Intervention	Forest cover[a]	166,000 km^2	106,000 km^2	92,000 km^2
	Area denuded	--	60,000 km^2	74,000 km^2
	Reservoir capacity	Nil	23,000 million m^3	24,000 million m^3
	Flood protection	2,230 km^2	12,900 km^2	14,400 km^2
	Urban area[b]	51 km^2	389 km^2	528 km^2
Natural Causes	Rainfall 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

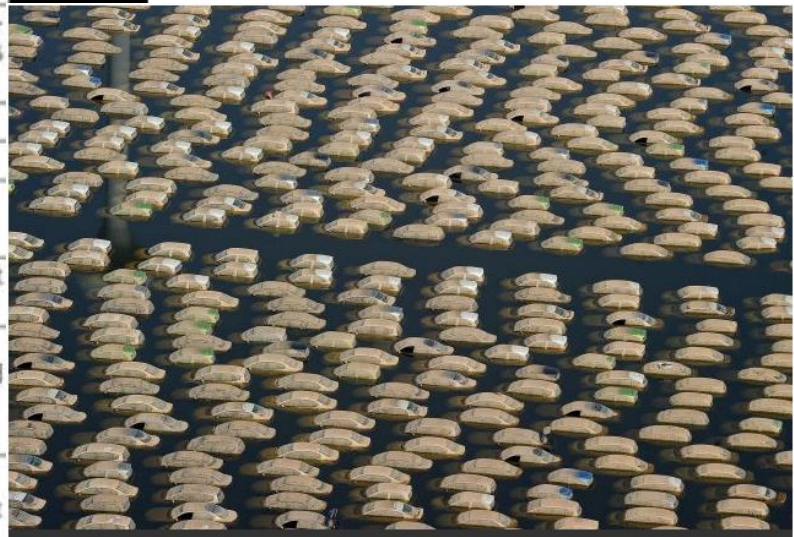
Thailand's economy contracted sharply in the fourth quarter of last year after the kingdom's worst floods in half a century pummelled manufacturing and tourism in south-east Asia's second largest economy, official figures released on Monday showed.

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.

Conclusion: Design not only energy-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 roofs are good to combine with solar panels, because temperature of the panels is lowered [1]

https://www.pinterest.co.uk/pin/141089400804430143/?lp=true

https://www.greenem.nl/een-groen-dak-en-zonnepanelen/

https://www.optigroen.nl

[1] For most solar panels the efficiency is lowered with 0,4 percent per degree above 25° Celsius, with loses up to more then 6 % on extreme hot days.
https://www.ilumen.be/nl/renderen-zonnepanelen-minder-goed-als-het-warm-is/

Rooftop vegetable gardening is trendy

City of Antwerpen, Belgium

City of Dhaka, Bangladesh

Due to a scarcity of land in the city, Dhaka residents are growing vegetable and fruits on their rooftops **Rajib Dhar/Dhaka**

https://www.weforum.org/agenda/2014/11/how-rooftop-gardens-can-help-combat-flooding/

https://www.dhakatribune.com/bangladesh/dhaka/2019/04/27/demand-for-organic-produce-drives-rooftop-gardening

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.
https://cleantechnica.com/2017/12/04/berlin-reusing/ SPONGE CITIES

https://www.youtube.com/watch?v=4w7lsydq8ks

Green walls
All green learning centre (Thailand)

9 Moo 4 Baan Nonkradon, Payayen, Pak Chong, Nakornratchasima
30320 ; Tel. 081-8757172 , 086-4686362
info@allgreenlearningcenter.org

LEARN MORE ABOUT ‘FOREST- CITIES’

- https://youtu.be/G4LxWO0wlbE

arch. : Vo Trong Ngia (Vietnam)

https://inhabitat.com/fruit-trees-grow-on-the-roofs-of-this-rammed-earth-home-in-hanoi/

When Trees Meet Buildings | The B1M

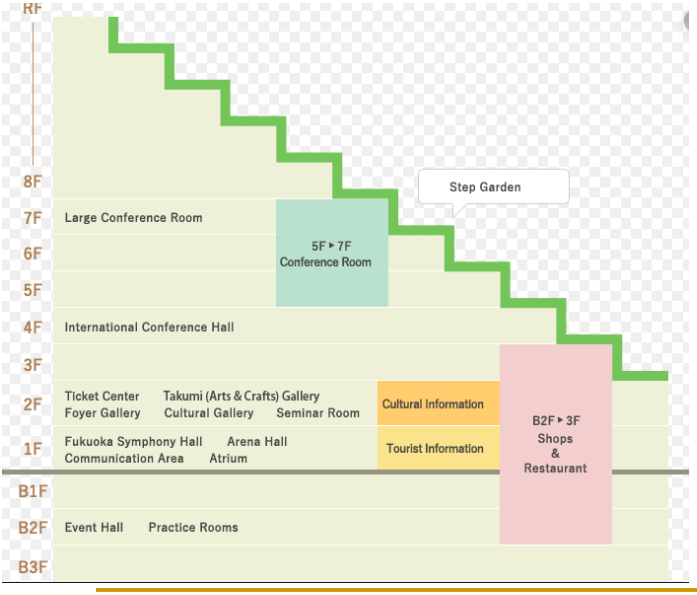
Watch and study:

https://www.youtube.com/watch?v=4w7lsydq8ks

For recent projects around the world

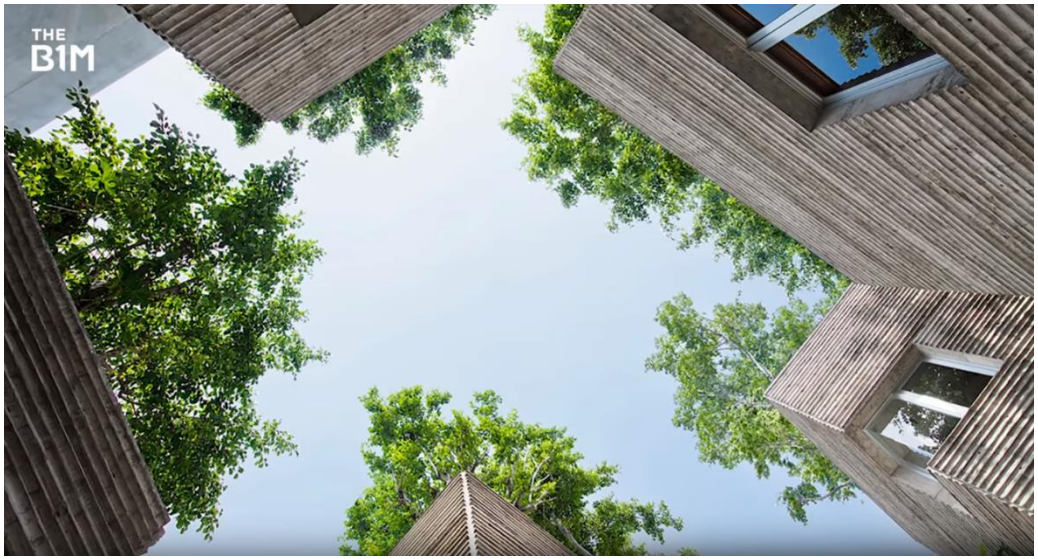
….Japan …

https://www.greenroofs.com/projects/acros-fukuoka-prefectural-international-hall/



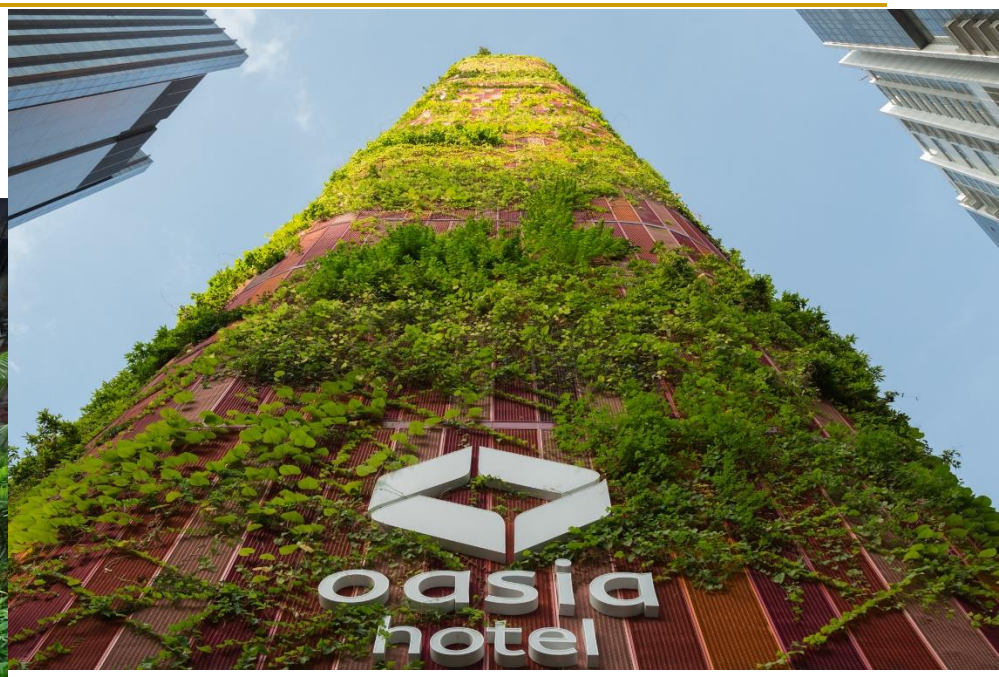
Pioneering green architect Emilio Ambasz transposed a nearly 100,000-square-meter park in the city center onto 15 stepped terraces of the ACROS Fukuoka Prefectural International Hall. The design for ACROS Fukuoka proposes a powerful new solution for a common urban problem: reconciling a developer's desire for profitable use of a site with the public's need for open green space. The plan for Fukuoka fulfills both needs in one structure by creating an innovative agro-urban model.

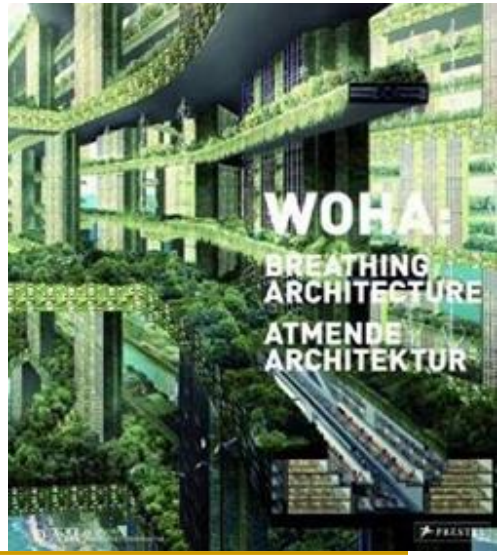
Fukuoka (Jap.) Acros cultureel centrum
Arch. : Emilio Ambasz, 1994



House for trees
arch. : Vo Trong Ngia (Vietnam)

Arch. : Vincent Callebaut (Taipei, Taiwan)
https://www.youtube.com/watch?v=4w7lsydq8ks





Arch. : WOHA architecten
Hotels Singapore

https://www.amazon.com/WOHA-Breathing-Architecture-Micaela-Busenkell/dp/3791351869

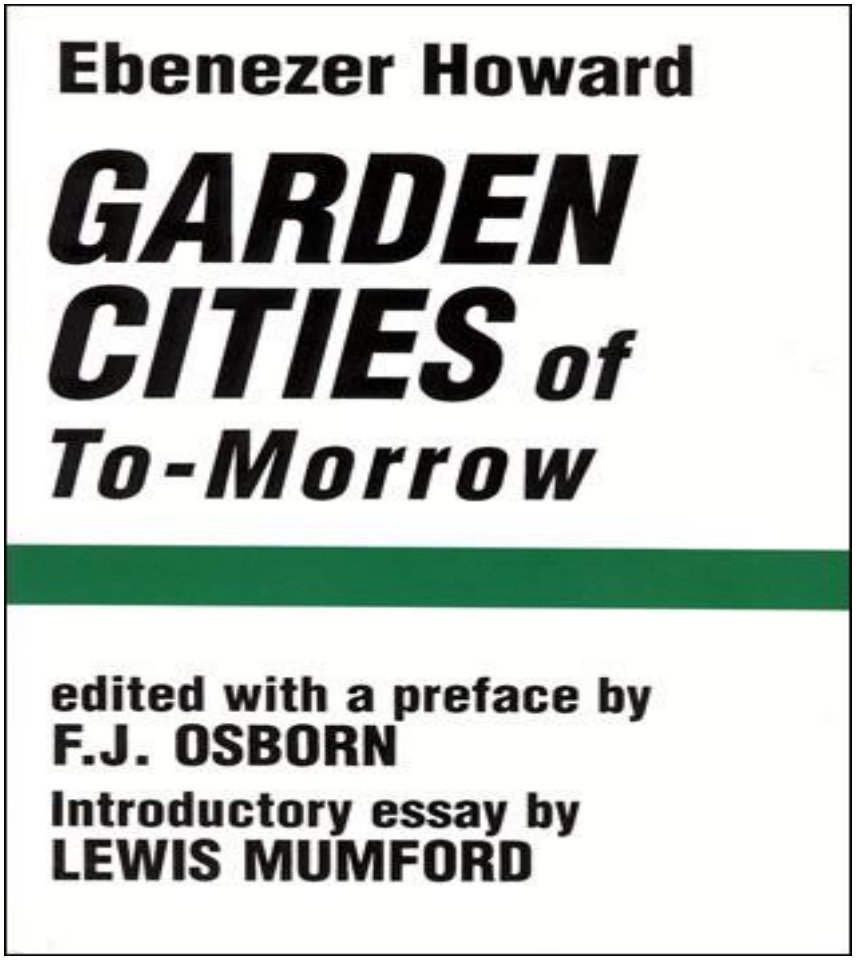
Eidfjord (N). Hardangervidda national park

Hovden (N): water-neutral ecoquarter in a rural area.

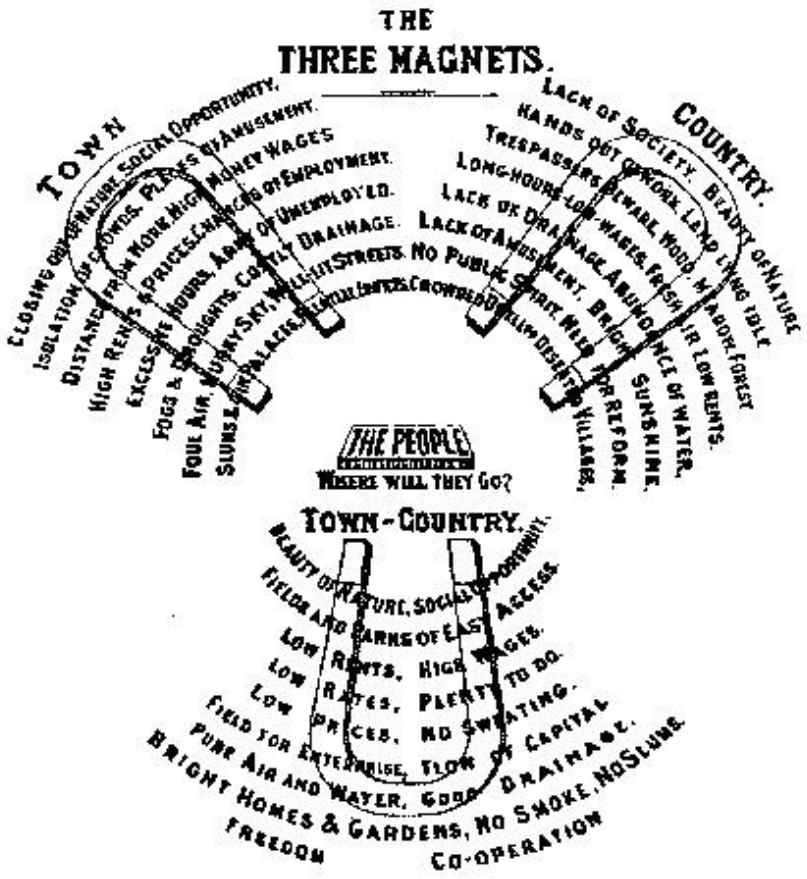
Structure of this presentation.

- 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. The **lobe city** as a solution ?
- 6. How to raise densities without losing residential qualities: restoring the urban advantage
- 7. Higher densities versus district heating and cooling
- 8. 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

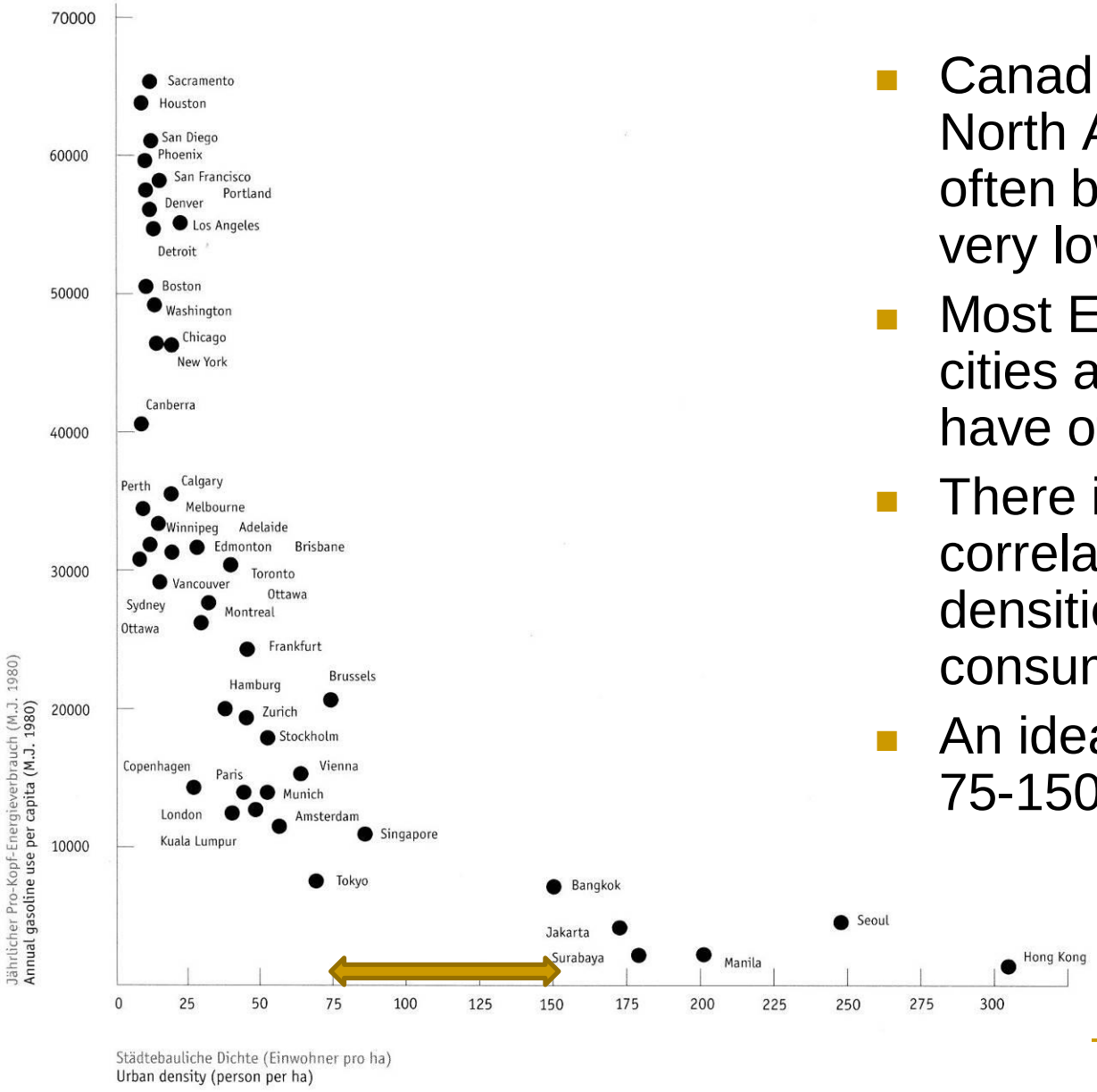
SUBURBIA =
the broad acre city (sensu Frank Lloyd Wright)

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.

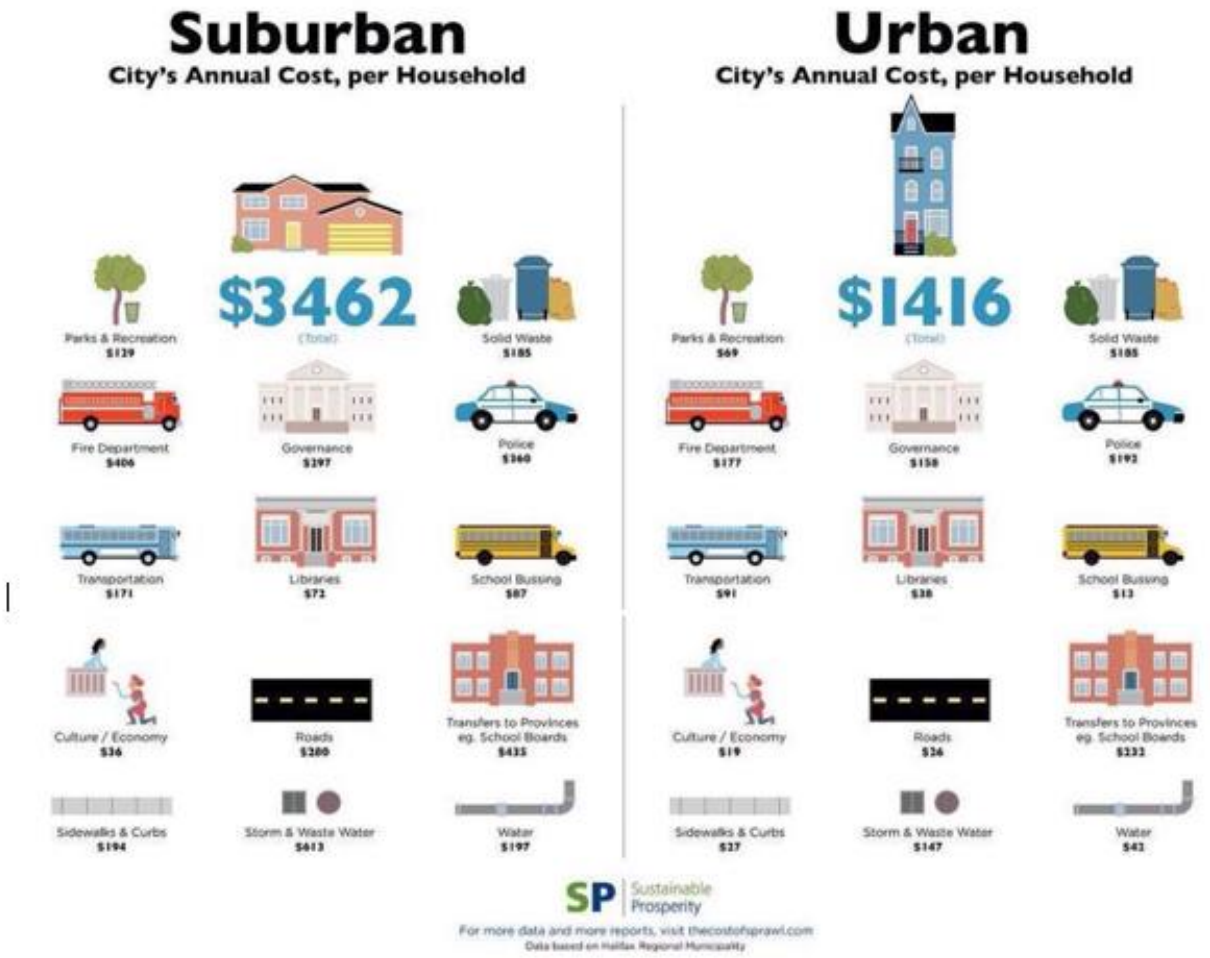
Newman, Peter; Kenworthy, Jeffrey, *Cities and Automobile Dependence: A Sourcebook,* Avebury Technical, Aldershot, Brookfield, Hong Kong, Singapore, Sydney 1992

‘urban sprawl’ (Belgian example), leads to unpayable public services (public transport, sewage systems, post service, health care at home,…)

Flanders (Belgium): 'detached suburban houses ….'

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

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



Unfortunately, this 'American way of life' is being copied all around Europe and the world.

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

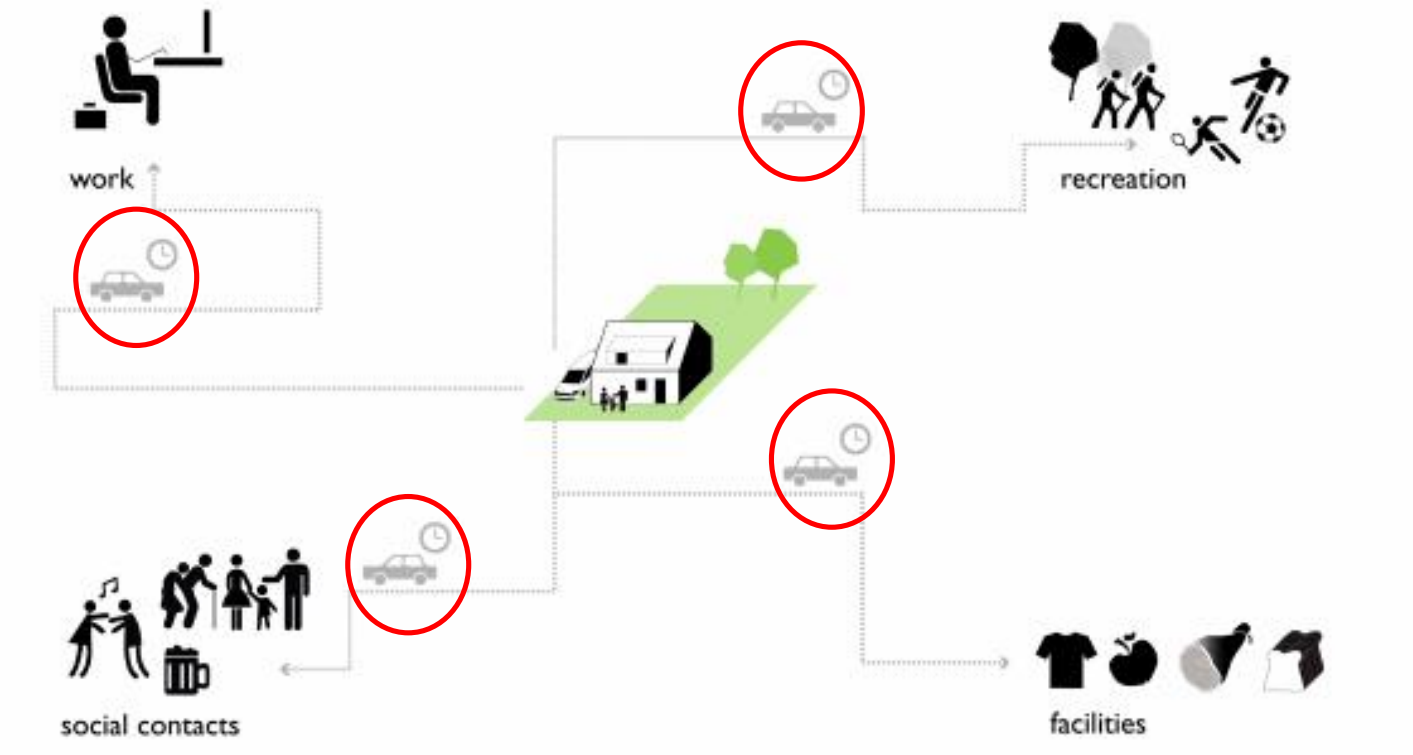
Flickr/lindenbaum

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

Another important part of the explanation is the car-based separation between dwellings/working area's/recreation-leisure



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 the spatial separation of needed functions.

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

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. The **lobe city** as a solution ?
- 6. How to raise densities without losing residential qualities: restoring the urban advantage
- 7. Higher densities versus district heating and cooling
- 8. Conclusions

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

- How to combine rural and urban features together in **another way** than *suburban 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

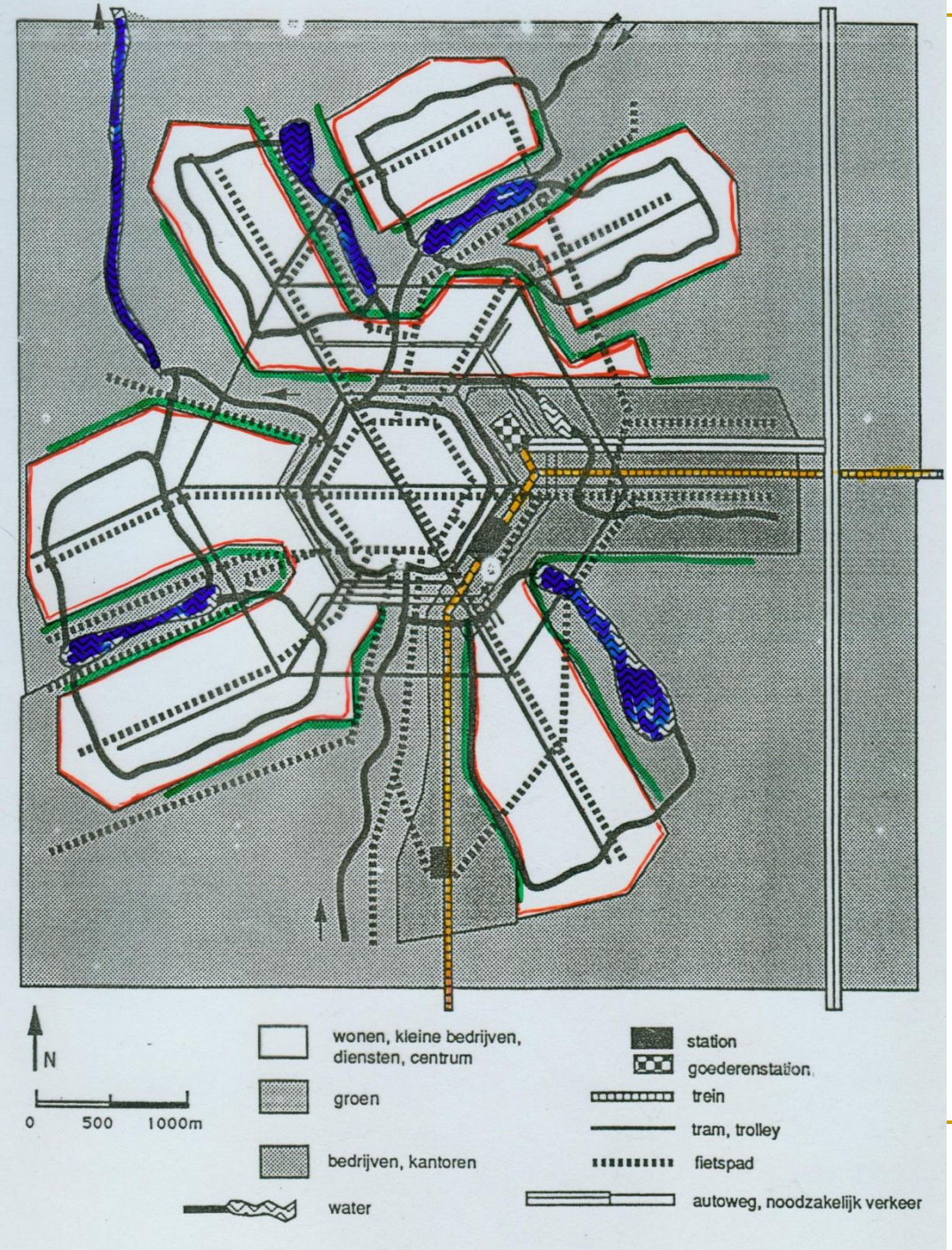
Urban Sprawl → Compactness

Segregation → Integration

Congestion → Connectivity

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

UN HABITAT
FOR A BETTER URBAN FUTURE



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

Compact high-dynamic city lobes

(fast lane)

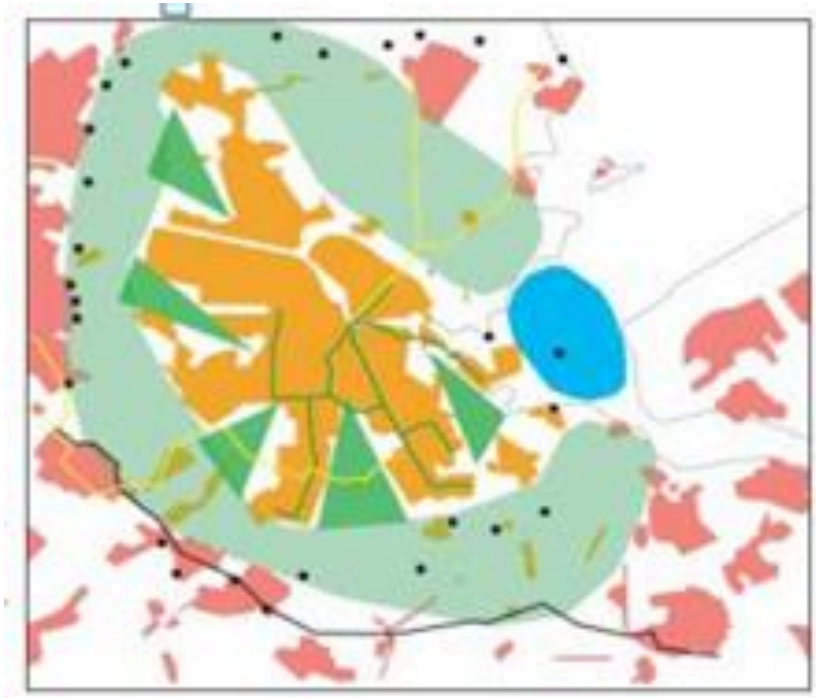
Separated from each other by

Low–dynamic blue-green fingers

(slow lane)

From Tjallingii, 1996

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



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

The lobe-city model = Star-shaped city model

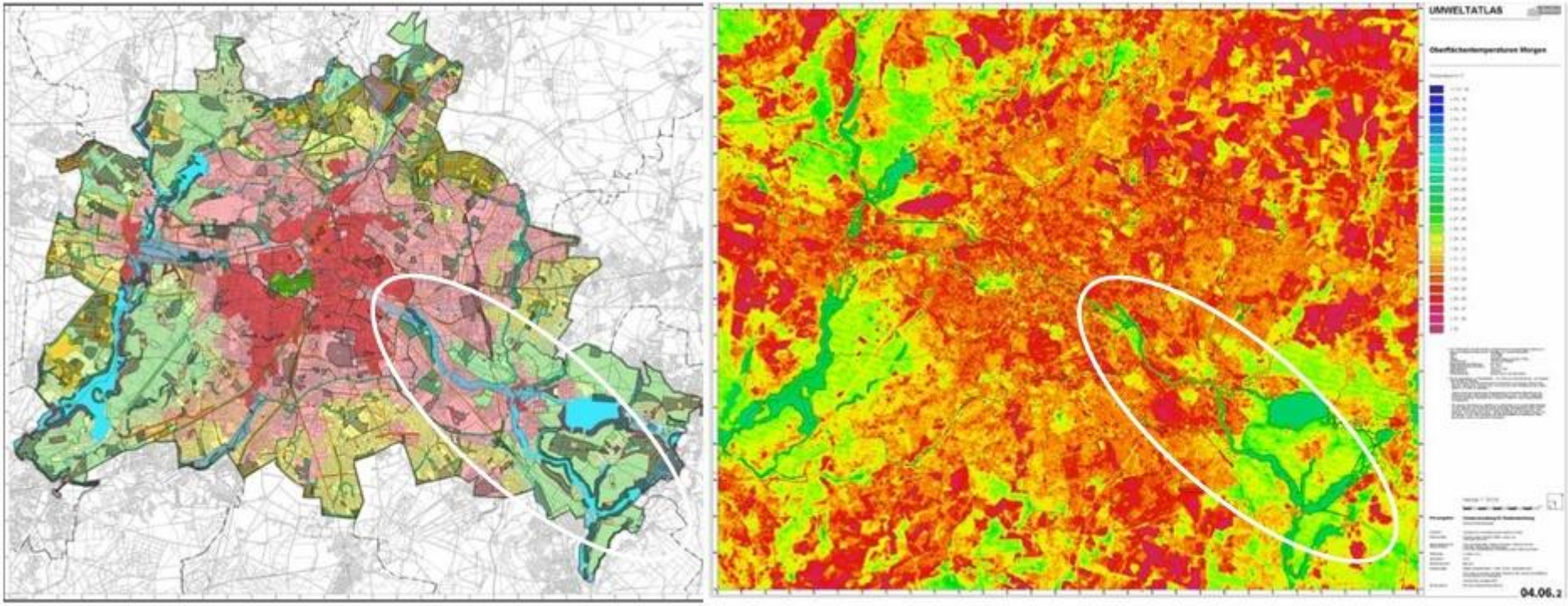
- The lobe-city model was developed in the first half of the 20th century.
- To varying degrees, this model was used in Denmark for the “fingerplan” in Copenhagen (Denmark) (1948), the general plan to extend Amsterdam (The Netherlands) (1935) and in cities such as Hamburg, Köln (1927), Berlin, Stuttgart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

Look also :

Pierer, C., Creutzig, F., 2019, Star-shaped cities alleviate trade-off between climate change mitigation and adaptation, Environmental Research Letters https://iopscience.iop.org/article/10.1088/1748-9326/ab2081

https://www.cleanenergywire.org/news/star-shaped-cities-best-option-climate-friendly-urban-planning-study

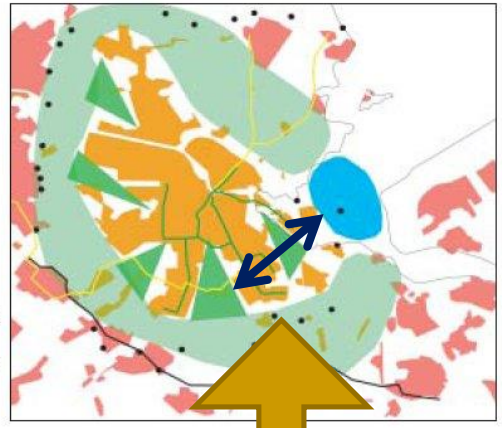
The blue-green fingers are tempering the heat island effect in Berlin (3,400,000 inh. ; Germany)



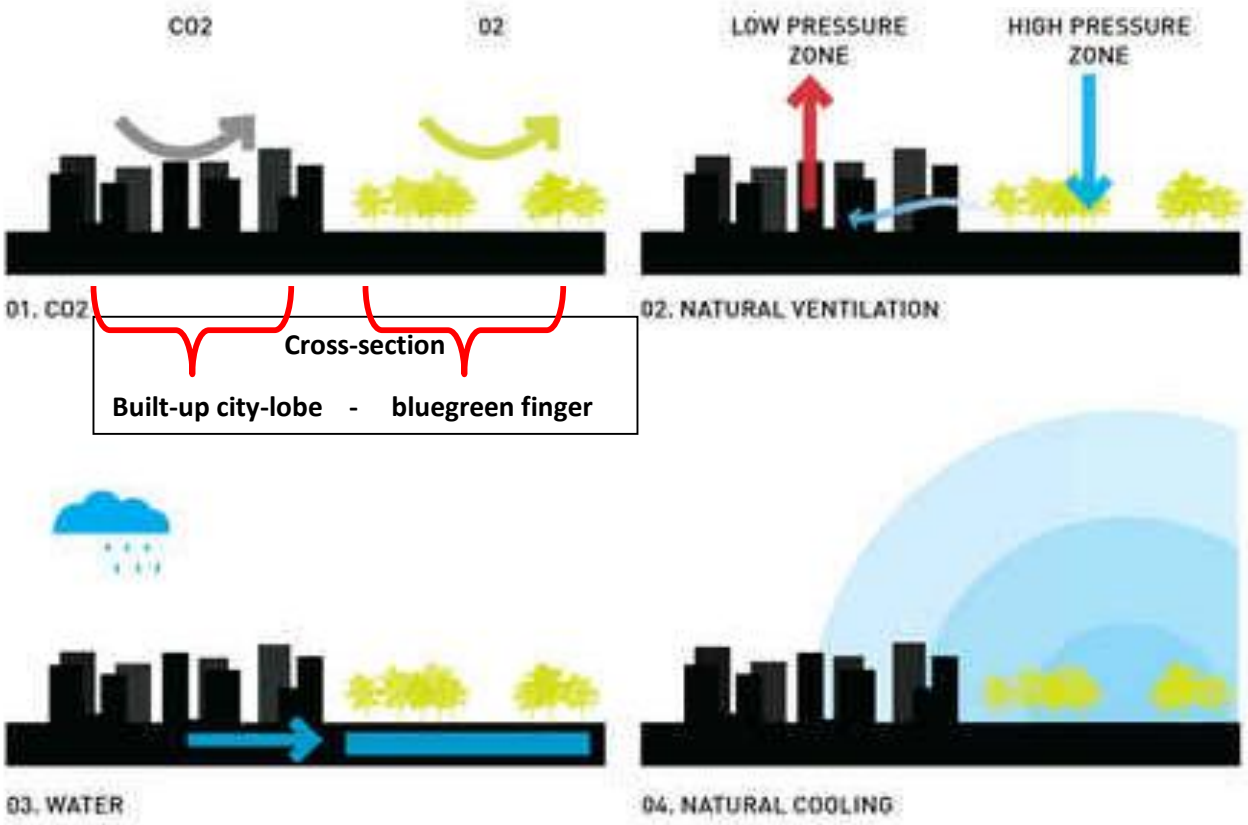
Infrared picture of hot city-lobes and cooler blue-green fingers of Berlin. (Cloos, 2006)

Urban blue-green fingers as a cooling infrastructure.

4 **ecosystem services** of blue-green networks



► 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/

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

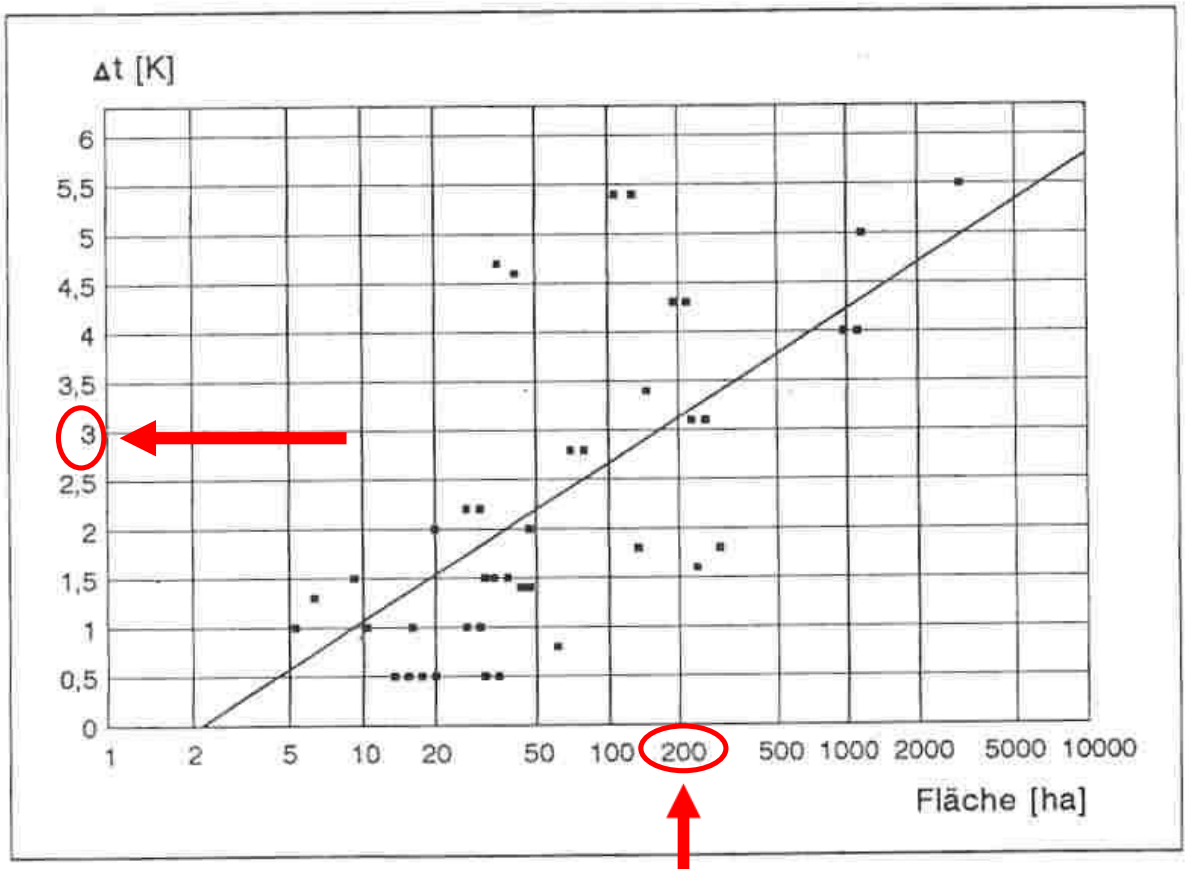
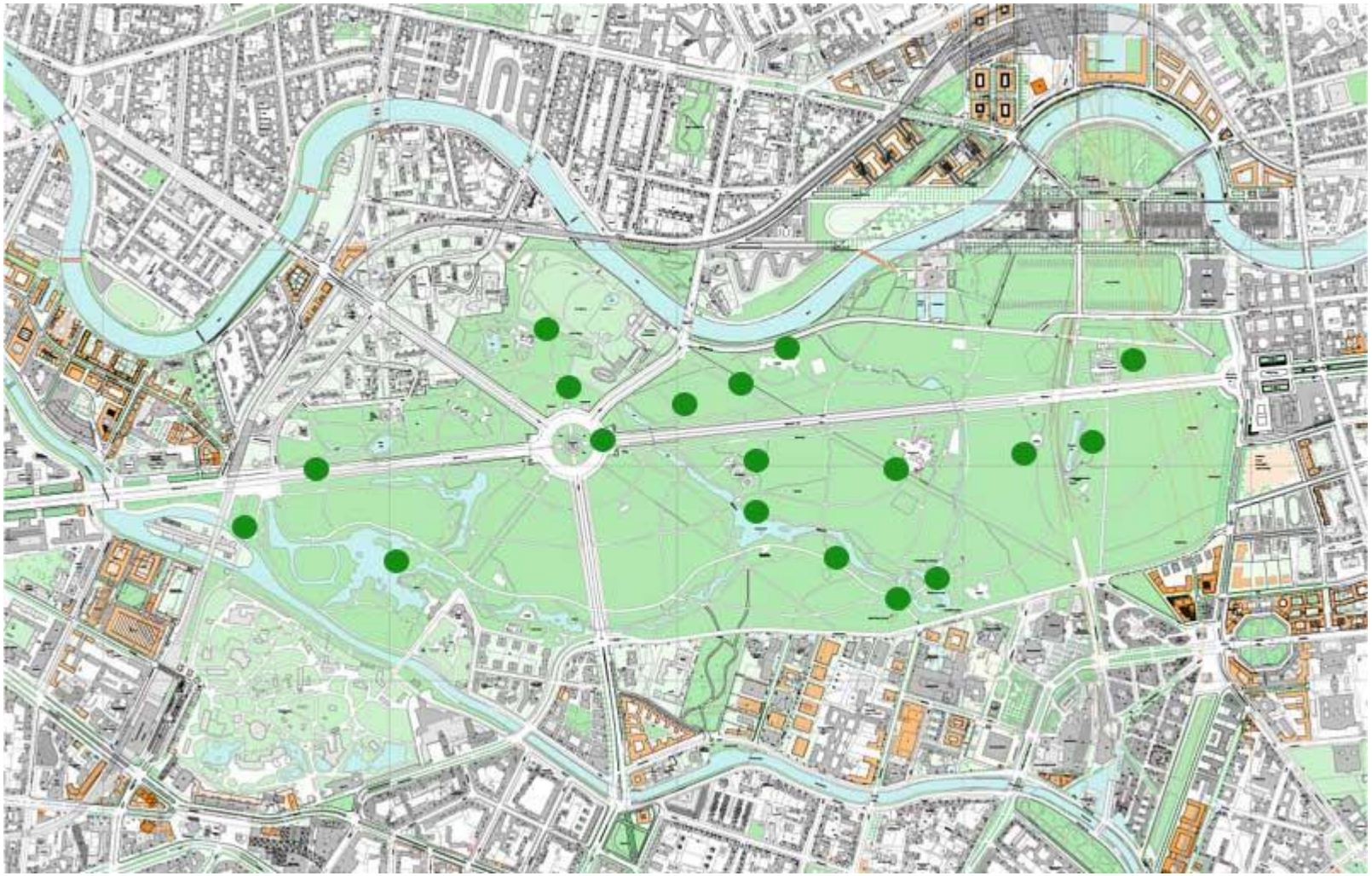


Abb. 6-21: Temperaturdifferenzen (Δt) verschiedener Berliner Grünanlagen zu ihrer Umgebung in Abhängigkeit von ihrer Größe in einer mäßig austauscharmen Strahlungsnacht (9. 07. 1982, 23.00 h MEZ) bei NE- bis E-Wind (nach v. Stülpnagel 1987).

Tiergartenpark (Berlin, Germany), surface 210 ha.

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



Influence of the Tiergartenpark (Berlin) on **temperature**

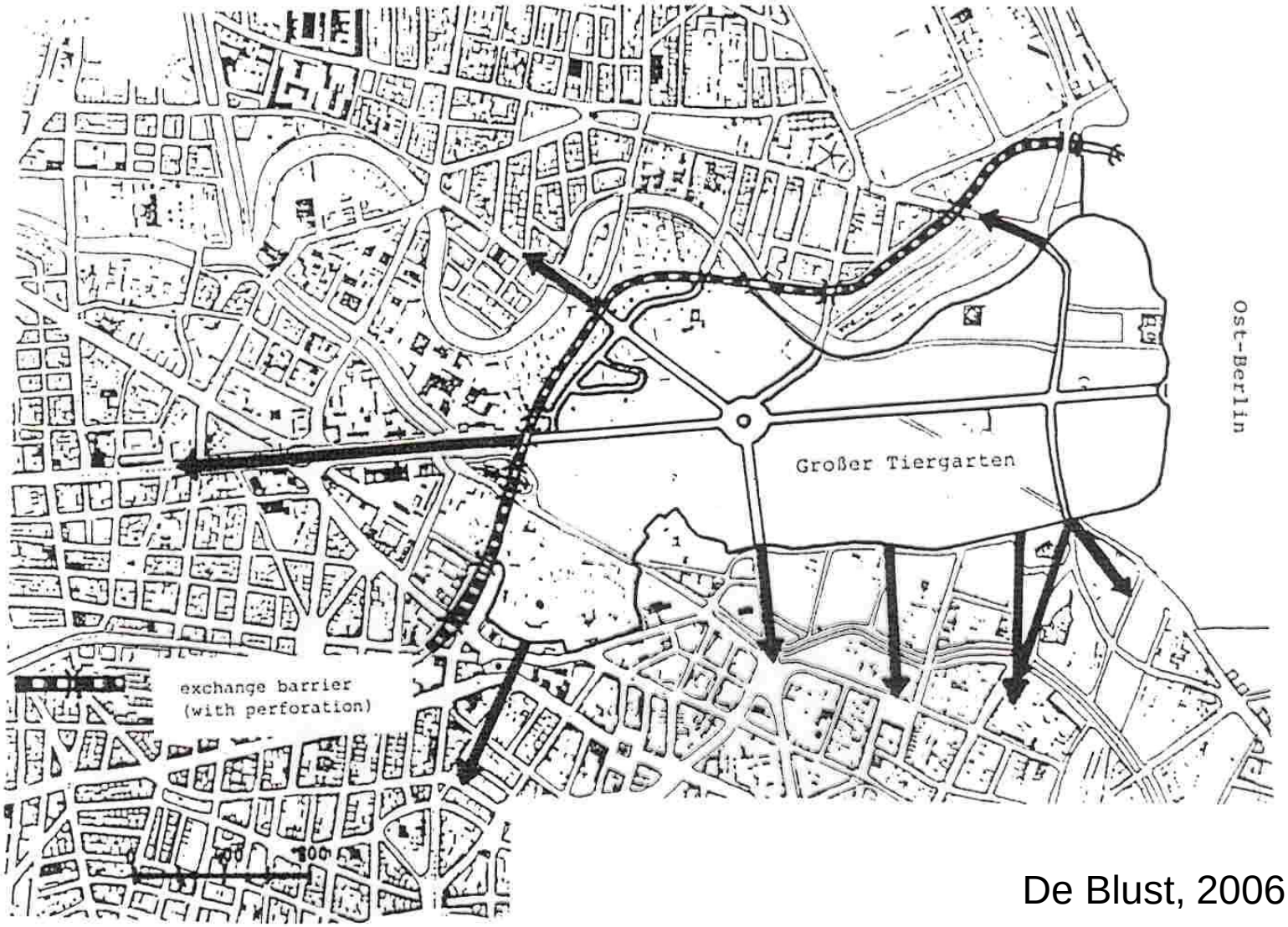
FIG. 26.2. Horizontal temperature distribution at the inner-city area of Berlin (West) 30.3.1978 23^{30h}

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 approach of Houten (NL) 50,000 inh.

- This municipality is world-wide known as an example of **bicycle -based city planning**, in the context of a lobe-city.

- Each residential district is accessible via a **loop** by car/motorbike from city ring. If you want to drive by car/motorbike from one district to another, you have to drive back to the city ring.

The lobe-city of Houten (NL)

- **Urban blue-green network is separating all city districts from each other for cars/motorbikes.**
- For cyclists and pedestrians/walkers, all districts are interlinked strongly by footpaths, bicycle-paths, foot-bridges, …

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: urban farming and children-farms, cemeteries, outdoor sports infrastructure, historic fortifications, city parks, etc.

The finger plan of Copenhagen (DK) 1,800.000 inh.

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

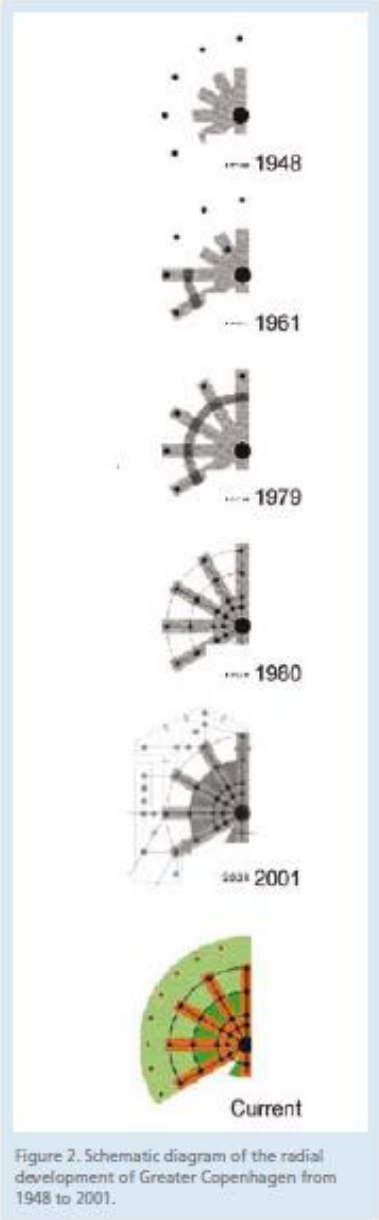


Figure 2. Schematic diagram of the radial development of Greater Copenhagen from 1948 to 2001.

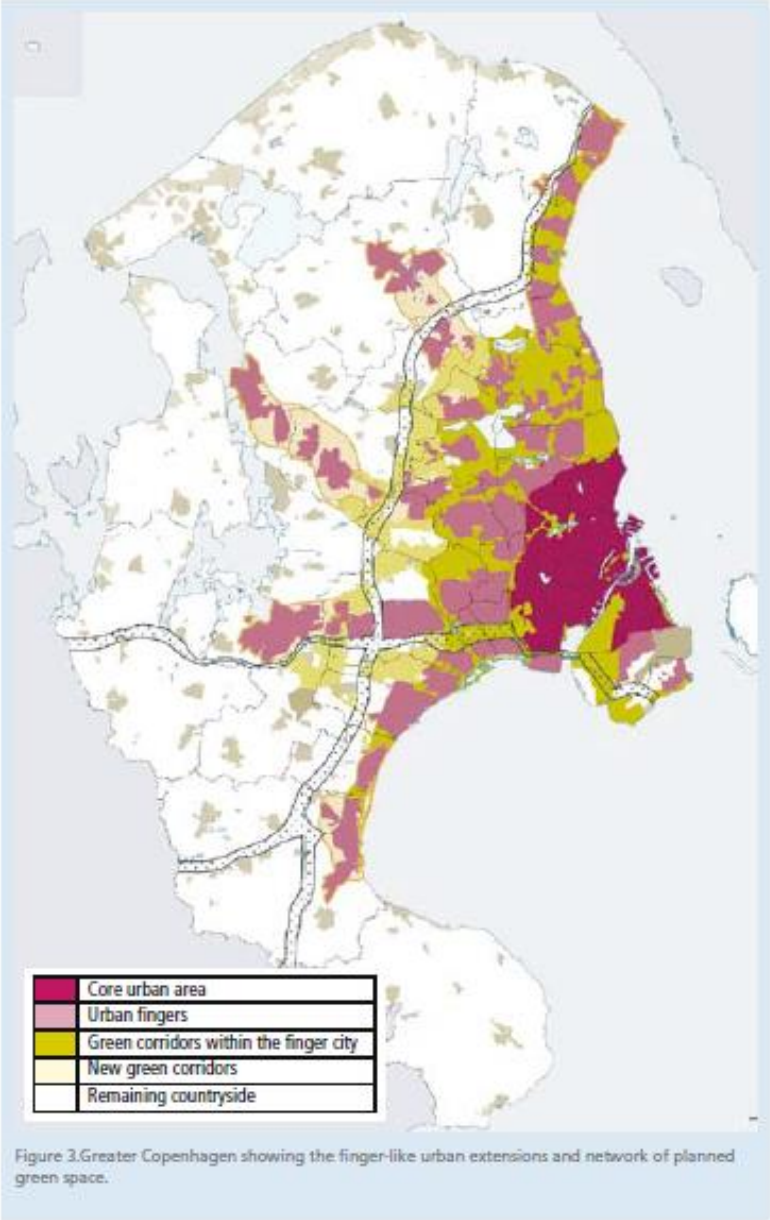


Figure 3.Greater Copenhagen showing the finger-like urban extensions and network of planned green space.

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 (public transport) separated by green wedges.

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

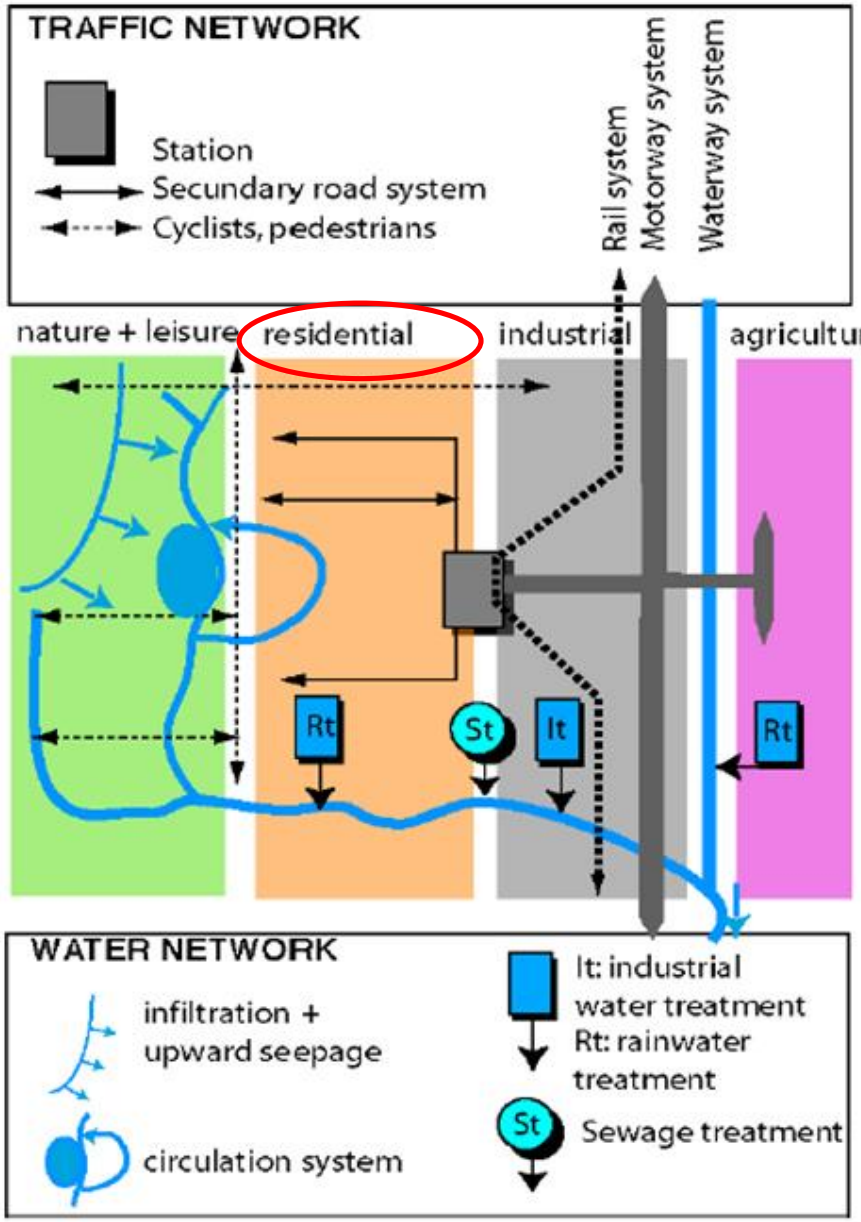
- This is a spatial planning strategy in which the water network is carrying the blue-green fingers

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

- So there is a need to design CONTRAST, very close to each other, because people need both:

high dynamic residential/shopping/industry lobes very close to low dynamic water/green/nature/leisure fingers.

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 extensive sports infrastructure, ….
- Within the built-up city lobes (FAST LANE) all the high dynamic activities are planned, such as industrial activities, trade services, residential area's, shopping, mass recreation (football-stadion, …)…

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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 (Germany) is frequently connected with the centre of the city by light-rail/tram.

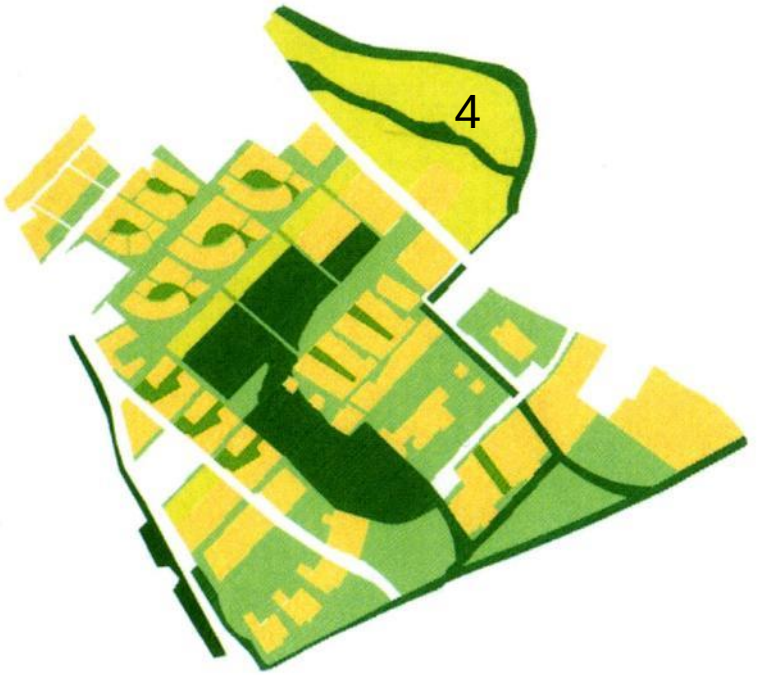
High densities in the eco quarter *Vauban* (Freiburg, Germany)

Designing a well thought **public-private gradient in the green areas** is **the 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.

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

Casestudy Kolding (DK).

The municipality is maintaining the inner garden, in exchange for (limited) access for the public, networking common gardens leads to **safe short-cuts** through the inner city

Kolding (DK)

Utrecht (NL)

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

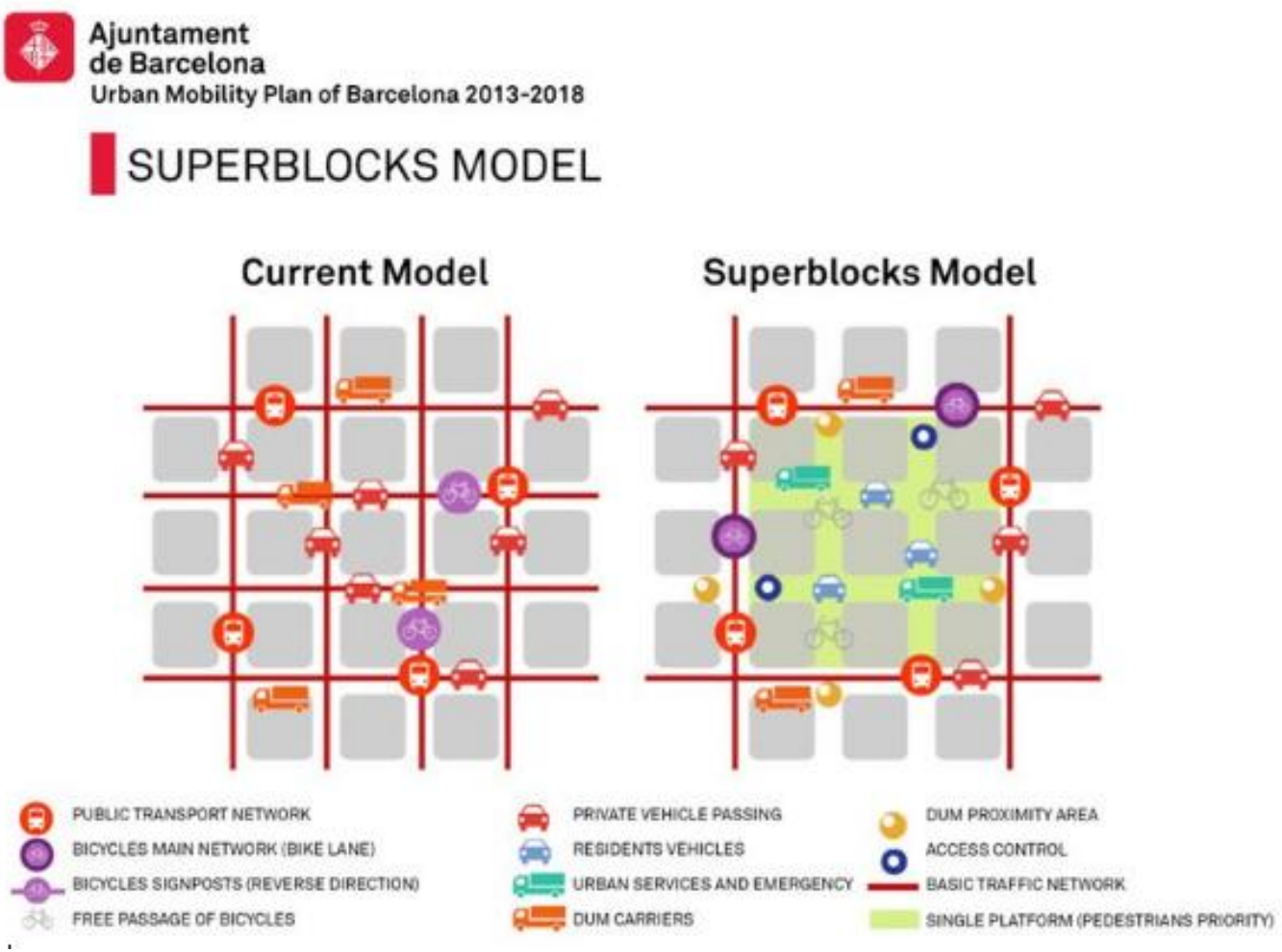
Malmö (S)

Culemborg (NL)

Copenhagen (DK)

City of Barcelona (Spain ; 1,700,000 inh.)

City of Barcelona (Spain ; 1,700,000 inh.).



Municipality is striving for, greening the street level and limited car-access (residents only): per nine city blocks one superblock is created

Car-sharing is actively promoted in a lot of European cities

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*

In more rural or suburban area's: Common and central parking in Brondby (DK), which decreases the amount of crossroads conflicts

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.

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, …)

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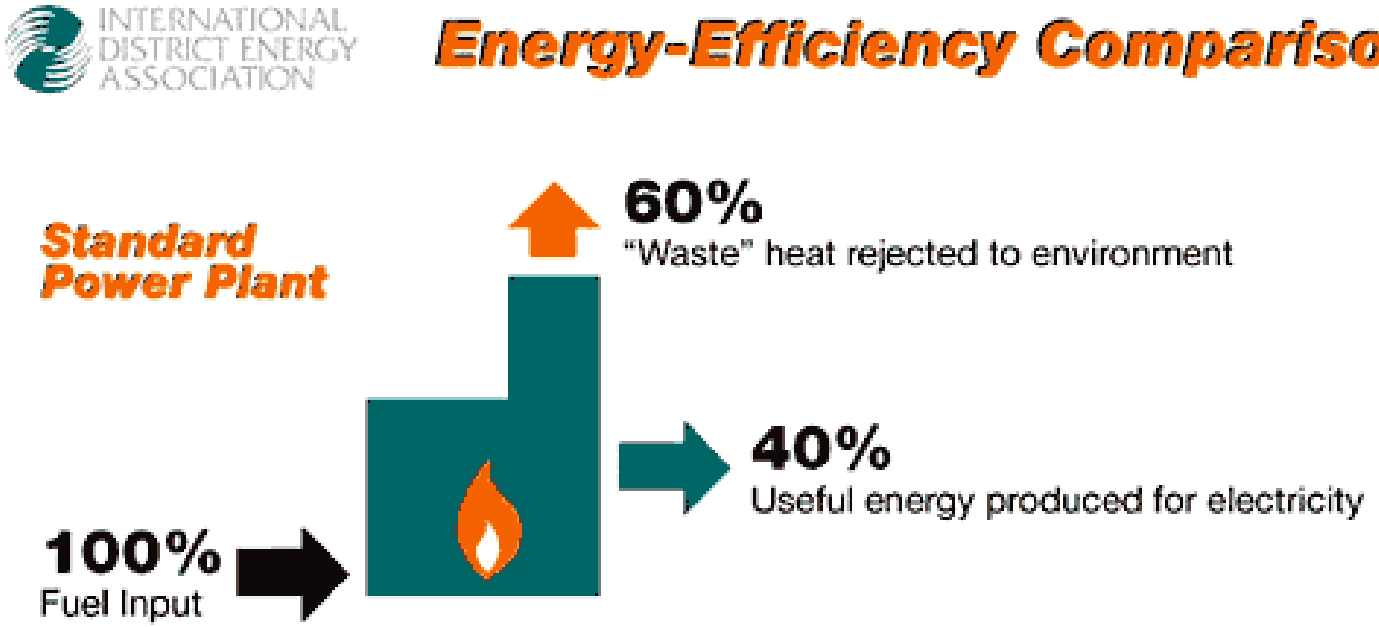
Densely built-up city-lobes can be heated by small plants for **cogeneration of heat and power (CHP).**
During hot seasons they can also collectively be cooled, using the same district piping network.

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, …)

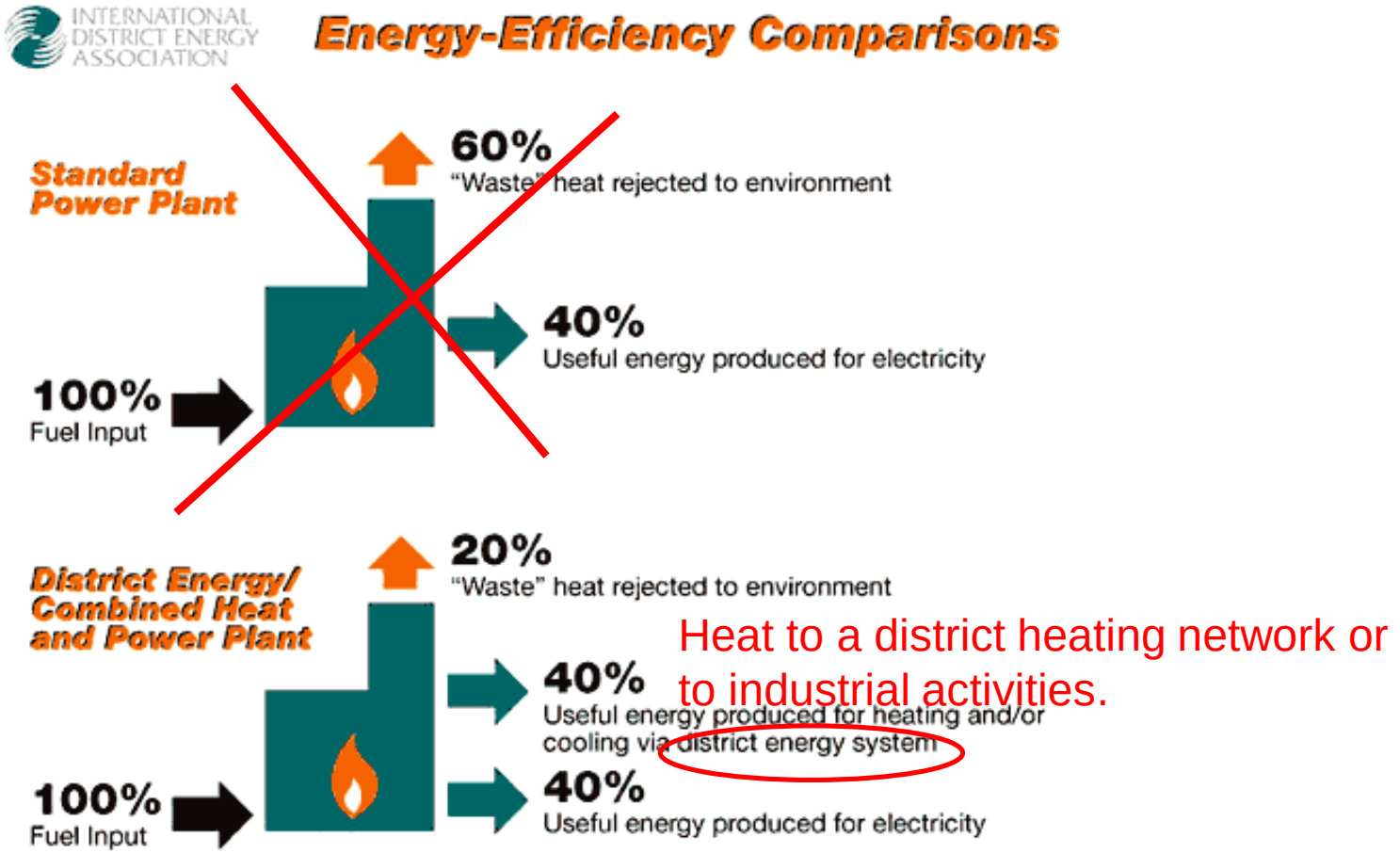
Forbidden by law in more and more countries (Denmark, …)



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

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

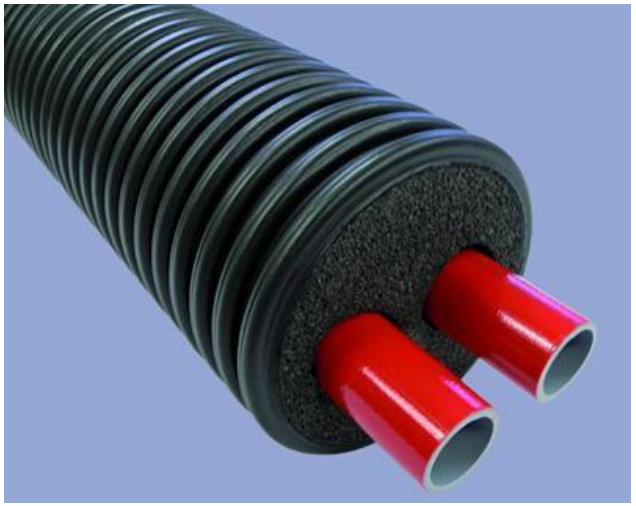
Comparison standard power plant with a CHP plant, connected with a district heating network or steam/heat transport to industrial activities



Het efficiency of a Cogeneration Plant Heat and Power (CHP) is about 80 %: 40 % heat and 40 % power (=electricity).

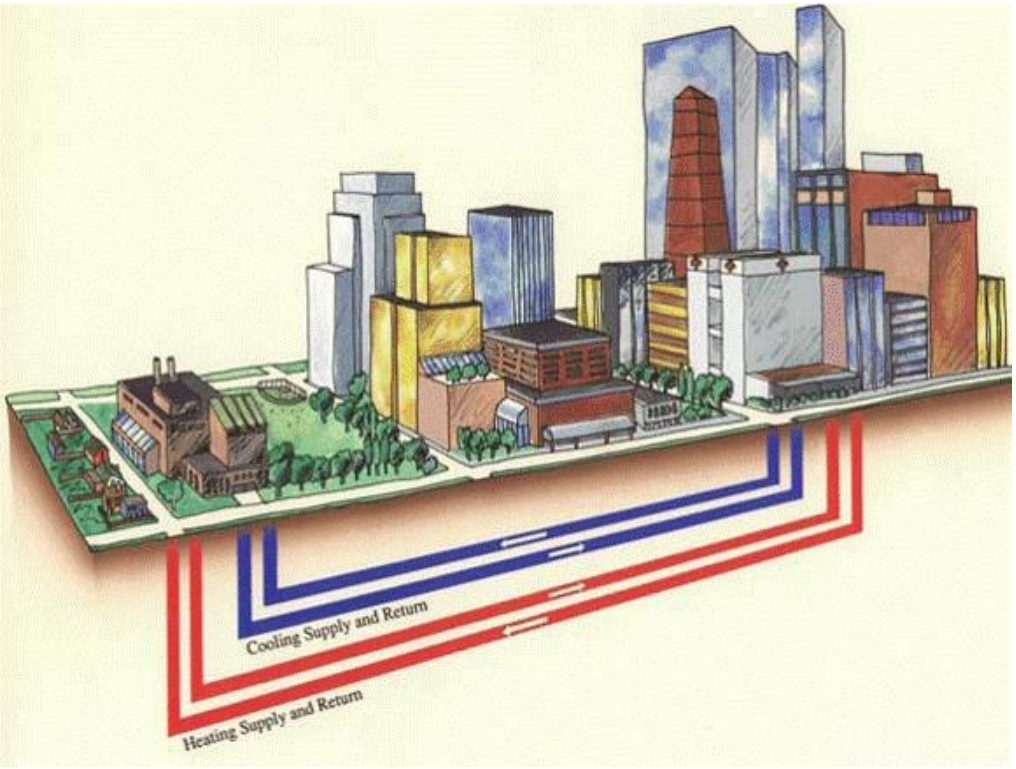
District heating is easy to be combined with the cogeneration of Heat and Power. In hot climates the heat-network can be connected to industrial zones

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.

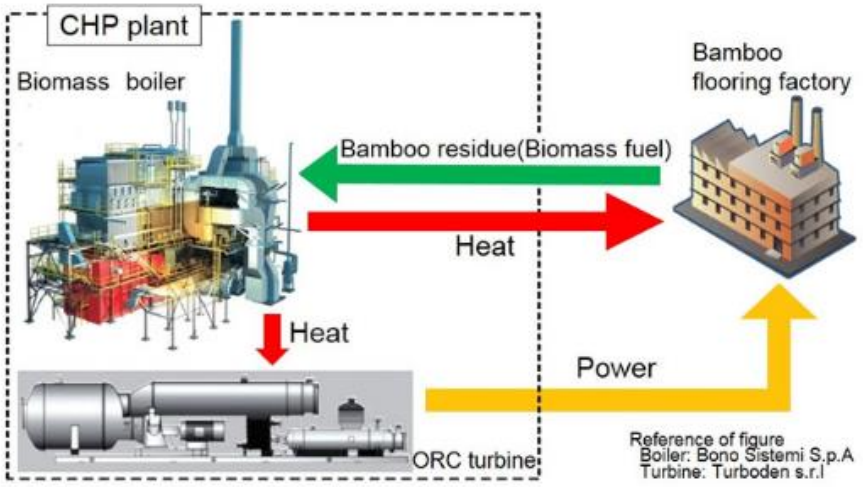
- But then the CHP plant is to be built close enough to customers preferably in the middle of neighborhoods. An adequate **compactness** of dwellings is needed.
- And there is also the need of a sufficient heat demand in the summer, which argues for **mixing housing with other functions** (restaurants,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

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

Example: A CHP energy-plant powered with bamboo residue

Diesel consumption for supplying heat and power at the new bamboo flooring factory of African Bamboo PLC (Hawassa Industrial Park) is reduced through the installation of a biomass combined heat and power (CHP) plant. The CHP plant consists of a biomass boiler (12MW) and an organic rankine cycle (ORC) turbine(1.2MW) for power generation. The Installed capacity is 12MWth and 1.2MWe. All of the heat and power generated are consumed in the factory. Bamboo residue is used as the biomass feedstock.

Host Country	Ethiopia
Year	2015
Type	JCM Model Project
Sector	Renewable Energy



http://gec.jp/jcm/projects/15pro_eth_01/

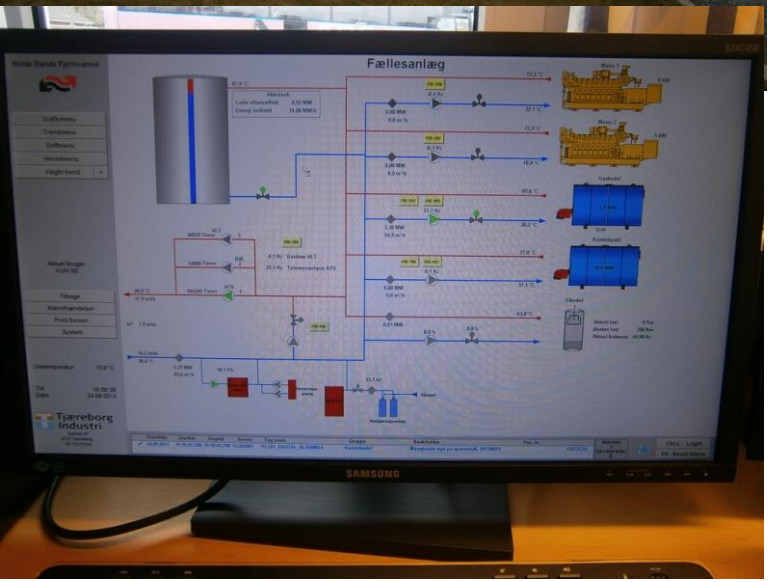
Also in Vietnam, bamboo biomass energy has some potential to be a part of the alternatives for fossil energy, especially when used in *combined heat and power plants (CHP)* which produce not only electricity but also heat (for industry,…).

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)

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)).

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

Important problem is indeed 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.)

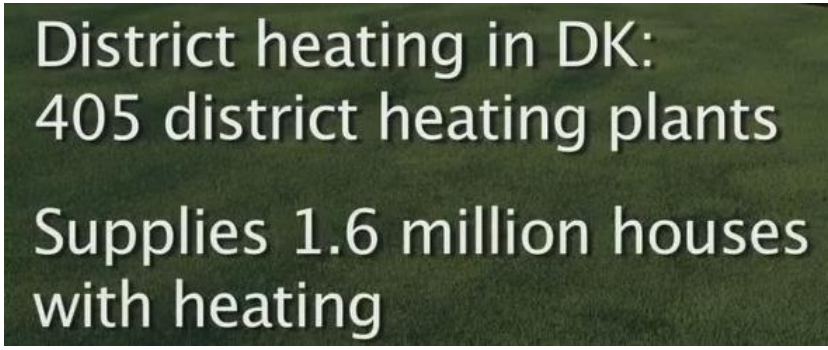
http://www.world-nuclear.org/information-library/country-profiles/countries-a-f/denmark.aspx

TVINDKRAFT

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

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



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*)

Plus-energy-quarter *Am Schlierberg* (Freiburg, D.)

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

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Conclusies(1): Designing urban area's using S2N[1] (like in lobe-cities) can **buffer** climate change (global warming and changes in precipitation) because :

- **blue-green fingers** offer 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*.

- **blue-green fingers** *temper the urban heat island effect*, because the stimulate urban ventilation, based on convection.

[1] ***S2N***: strategy of two networks: planning tool using bluegreen fingers alternating with compact built-up city lobes

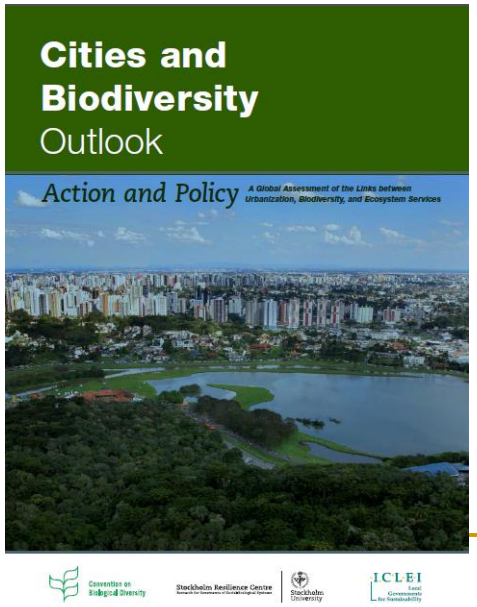
Conclusions(2): Designing with S2N[1] (like in **Lobe cities)** can help to **avoid** further climate changes because they:

- 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 CO_2 can be decreased strongly.

[1] ***S2N***: strategy of two networks: planning tool using bluegreen fingers alternating with compact built-up city lobes

Conclusions(3): 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, …)



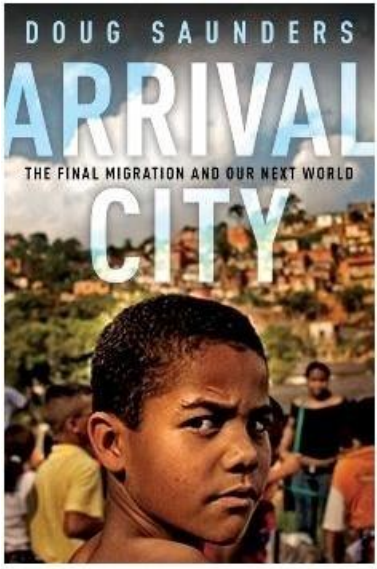
https://www.cbd.int/doc/health/cbo-action-policy-en.pdf

Ten Key Messages

1. Urbanization is both a challenge and an opportunity to manage ecosystem services globally.
2. Rich biodiversity can exist in cities.
3. Biodiversity and ecosystem services are critical natural capital.
4. Maintaining functioning urban ecosystems can significantly enhance human health and well-being.
5. Urban ecosystem services and biodiversity can help contribute to climate-change mitigation and adaptation.
6. Increasing the biodiversity of urban food systems can enhance food and nutrition security.
7. Ecosystem services must be integrated in urban policy and planning.
8. Successful management of biodiversity and ecosystem services must be based on multi-scale, multi-sectoral, and multi-stakeholder involvement.
9. Cities offer unique opportunities for learning and education about a resilient and sustainable future.
10. Cities have a large potential to generate innovations and governance tools and therefore can—and must—take the lead in sustainable development.

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,

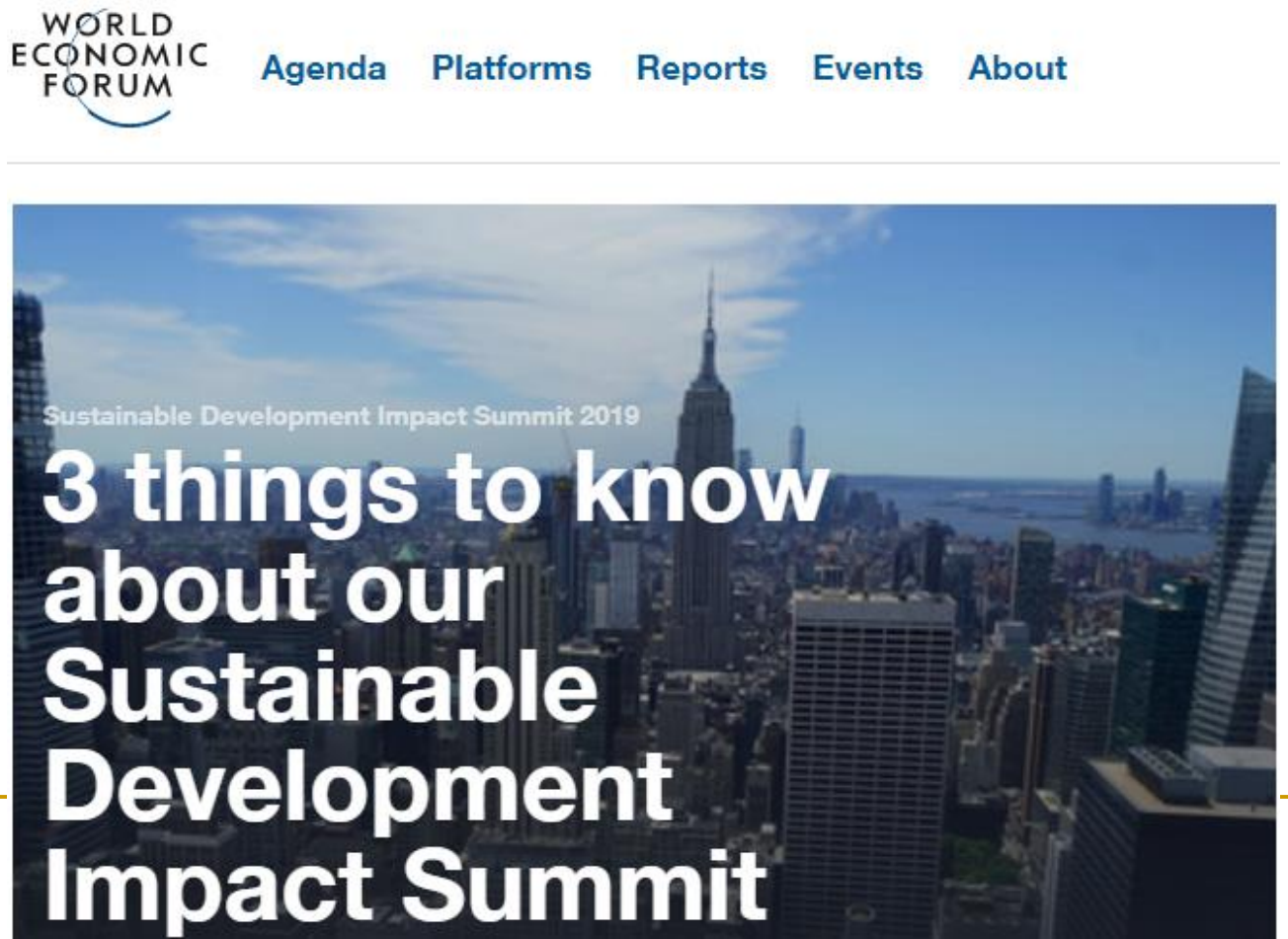
- Saunders says explicitly, that the ideas of the famous French architect Le Corbusier and of the ‘Congrès international d'Architecture Moderne (CIAM)’, which pleaded for a strict separation of areas for working, for dwellings and for recreation (ideas on which in so many countries, planning was based 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

Tackling climate change is
not only about ecology, it is about economy.
Doing nothing about climate change will cost far more than starting now with climate resilient city-planning using
ecosystem-services



- Thank You
- Cảm ơn bạn

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