Urban biodiversity
A contradictio in terminis ?

A plea for well-thought densification: better social cohesion and more urban biodiversity.
EUROPEAN EXPERIENCES AND EXAMPLES

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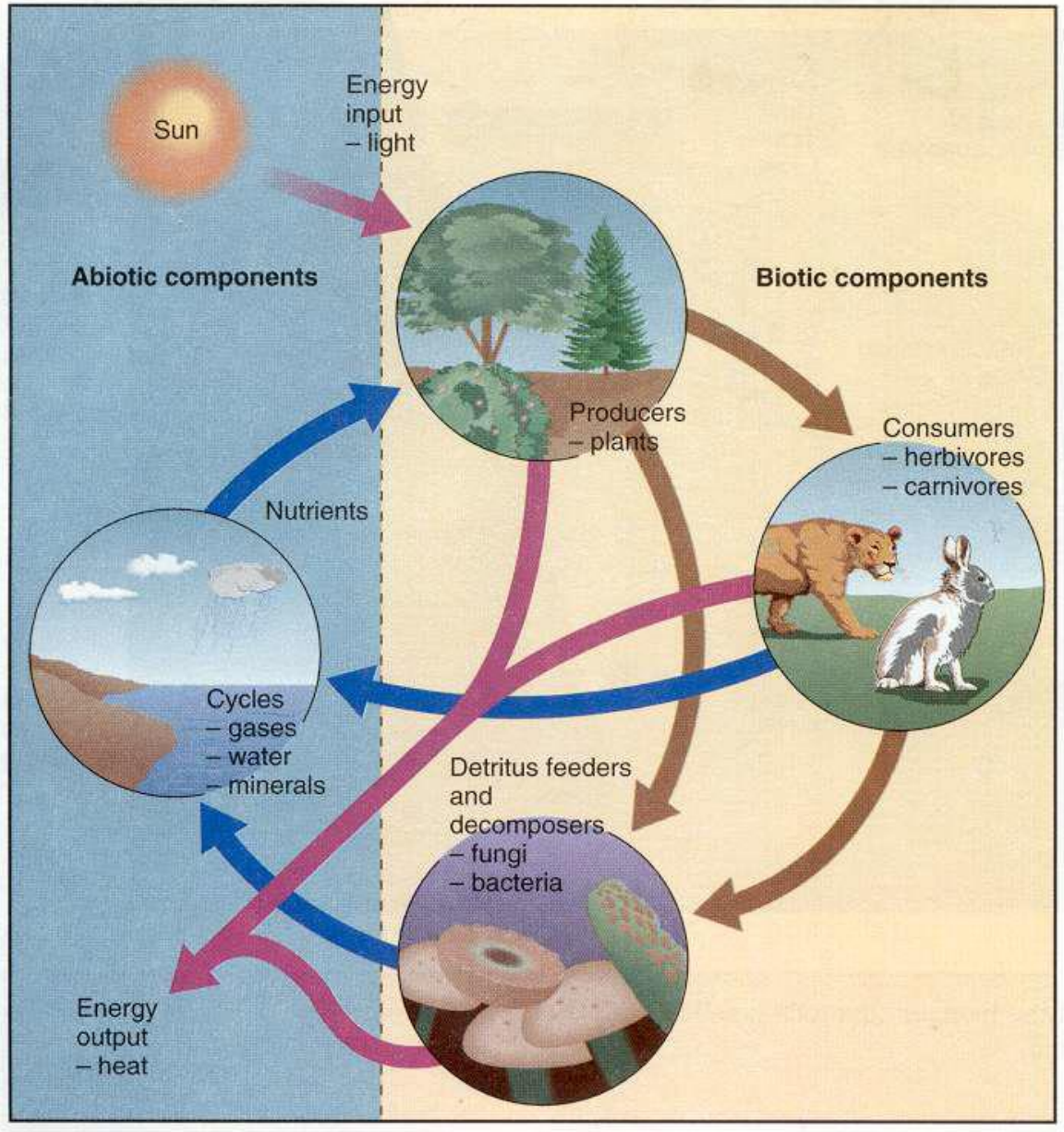
Luca School of Arts, BELGIUM
LUCA

Base the design principles on the following scientific basic laws and guidelines from **ecology science.**

- 1. Abiotic conditions are dominant over biotic conditions. Plants and animals need the right abiotic environment, but also human activities depend on appropriate abiotic conditions. (SCHROEVERS, 1982).
- 2. Abiotic conditions: weak or dominant ? Sustainable gentle gradients provide a wide variety of organisms (blurred borders). (VAN LEEUWEN, 1966b).
- 3.Time is dominating over space, Process (time) is the cause; pattern (space) is the consequence. (Relation theory, VAN LEEUWEN, 1966)
- 4. Design blue green infrastructure, connecting corridors and stepping stones as much as possible within (urban) landscapes and avoid creating borders, fences and obstructions. (Island theory, MC ARTHUR & WILSON, 1967).
- 5. Consider cities as ecosystems and approach them with the tools and insights from ecology science. (BREUSTE ET AL., 2008). Designing a well-thought public-private gradient within a lobe-city framework is a key success factor towards an increasing contribution of urban green and gardens to typical local biodiversity. That is because such a gradient contributes to increasing horizontal ecological relations and connectivity between isolated blue-green urban islands. (ROMBAUT, 2008, 2011).

Ecosystems


Sun
Energy input – light
Abiotic components
Biotic components
Producers – plants
Consumers – herbivores – carnivores
Nutrients
Cycles – gases – water – minerals
Detritus feeders and decomposers – fungi – bacteria
Energy output – heat

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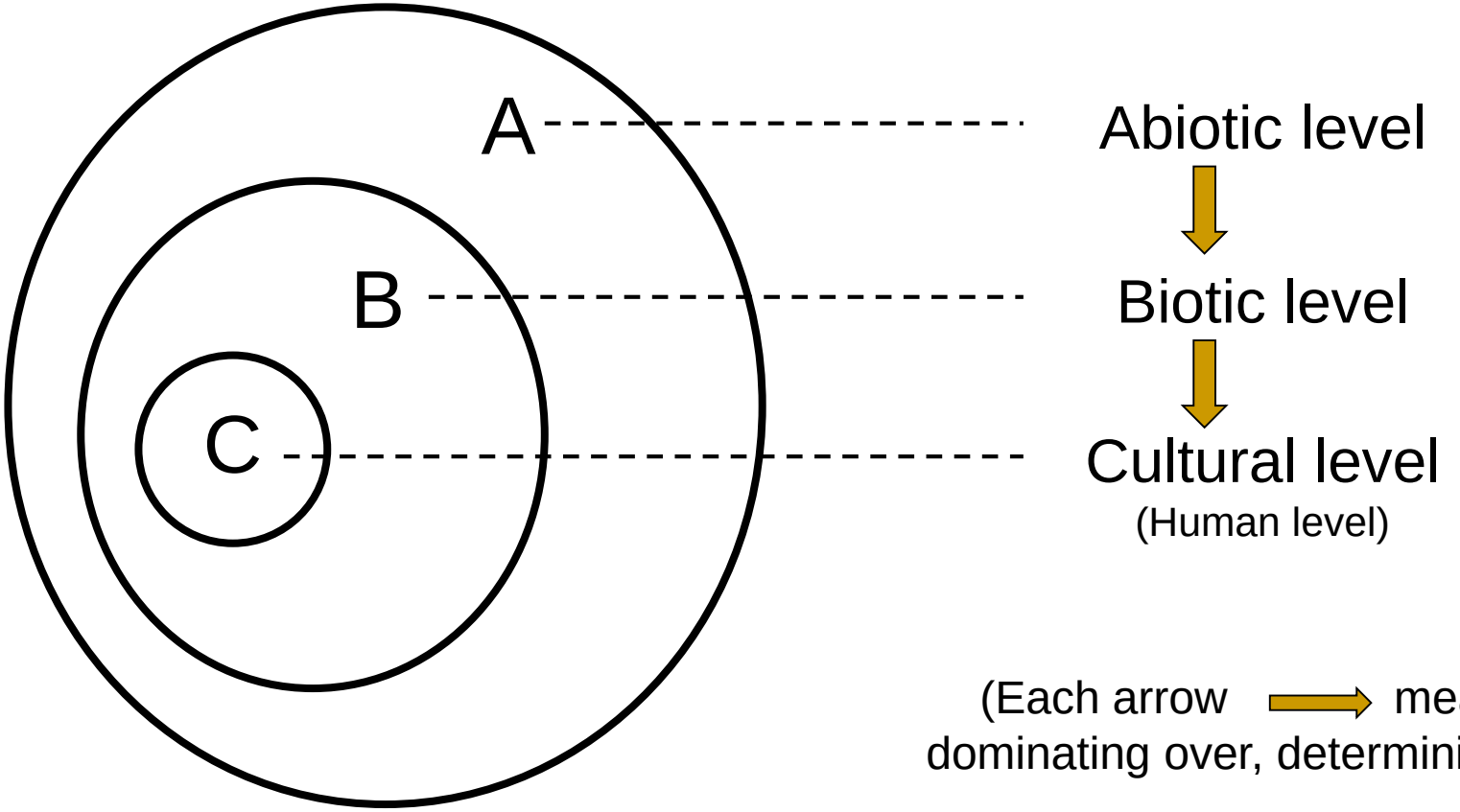
(1) Human activities depend on an intact biotic and abiotic level.

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)*

HUMAN ACTIVITIES DEPEND ON AN INTACT BIOTIC AND ABIOTIC LEVEL.

VAN LEEUWEN (1979) EN SCHROEVERS (1982)

SOME CONSEQUENCES:

1. When species disappear (or occur), an exploration of possible causal changes in the abiotic conditions is desirable.

2. When we want to avoid species to extinct or if we want species to be introduced, then steering (managing) of the abiotic conditions is most efficient.

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(2) Ecological conditions: dominant or weak ?

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

  silence < noise

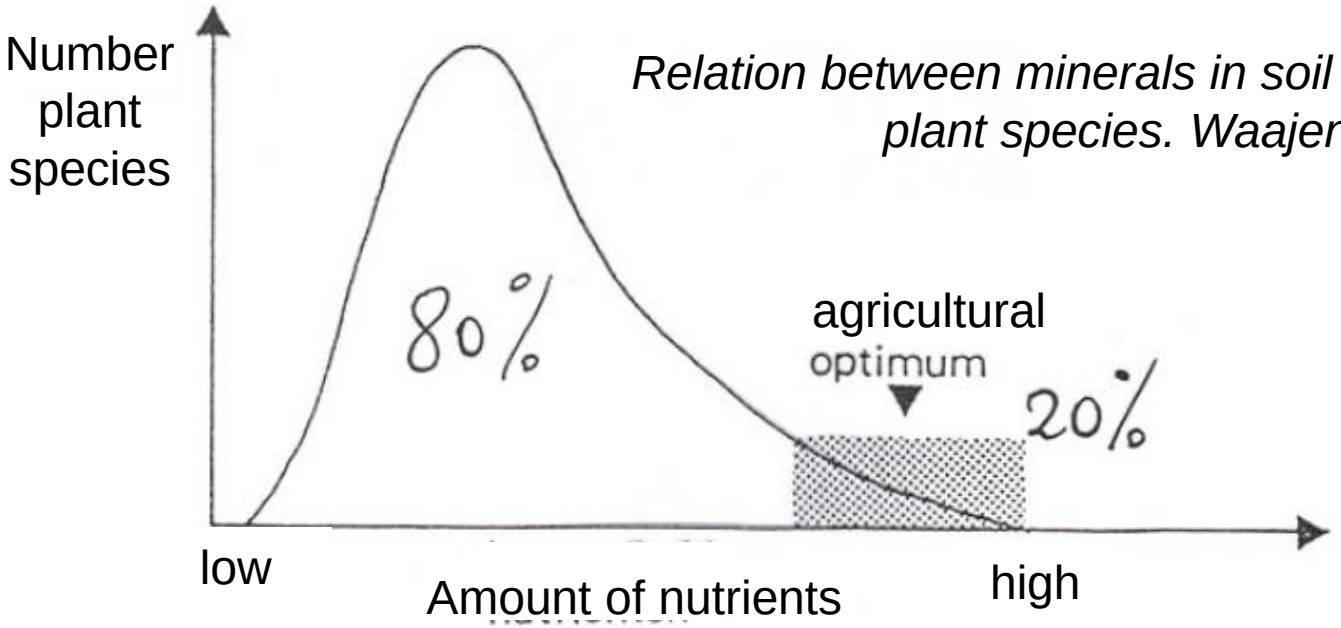
  clean < dirty

  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.

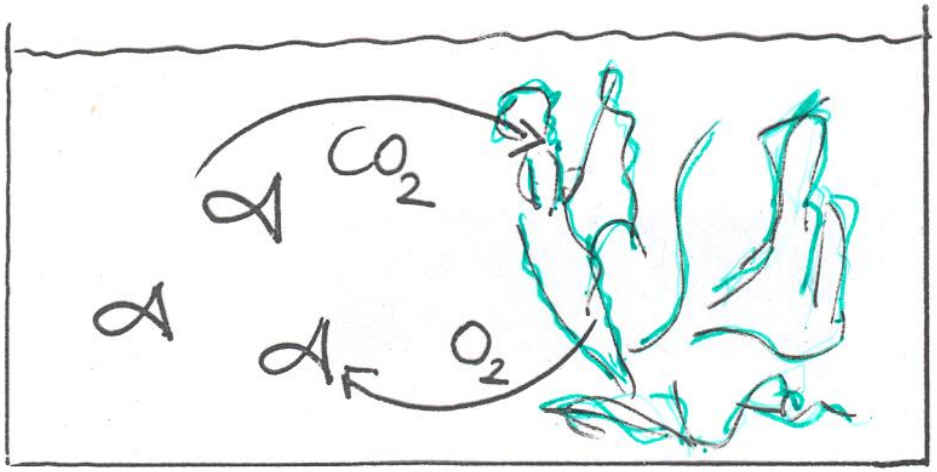
- In habitats characterized by a lot of **dominant, aggressive abiotic conditions** (dirty, salt, high dynamic, a lot of nutrients (eutrophic),….), very few species can grow: 20 %. Biodiversity is low. Those species will occur in very large populations with a big biomass: very few species but very high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

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

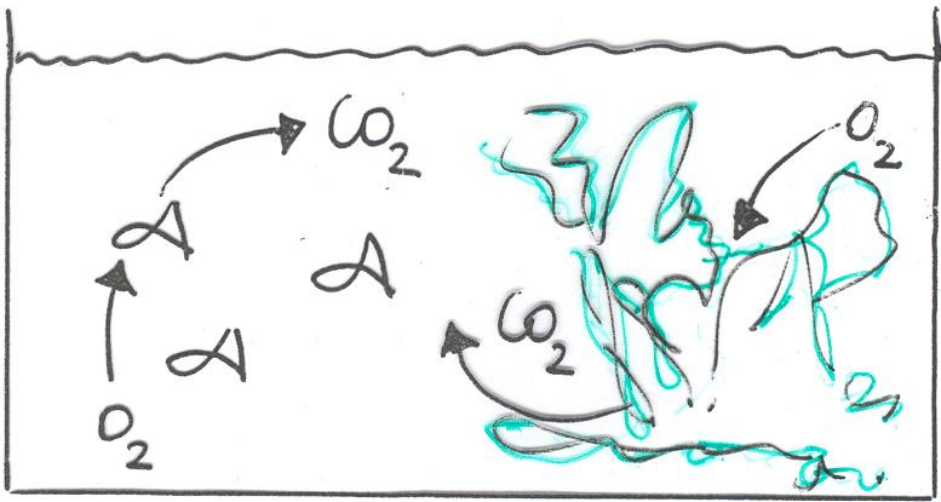
ANTHROPOGENIC DYNAMICS

EXAMPLE: EFFECTS OF EUTROPHICATION.

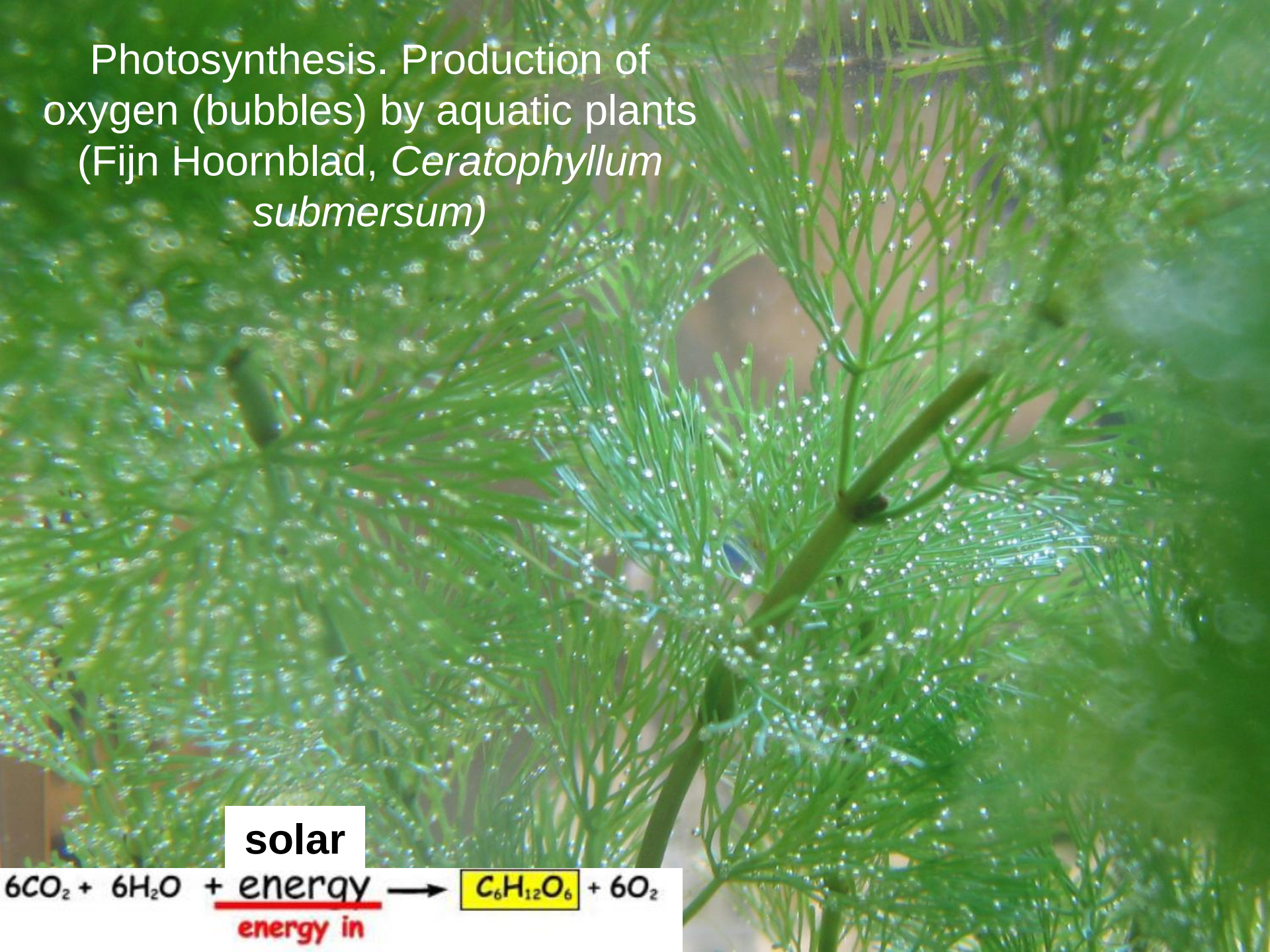
Day: plants (algae) produce O_2
animals consume O_2



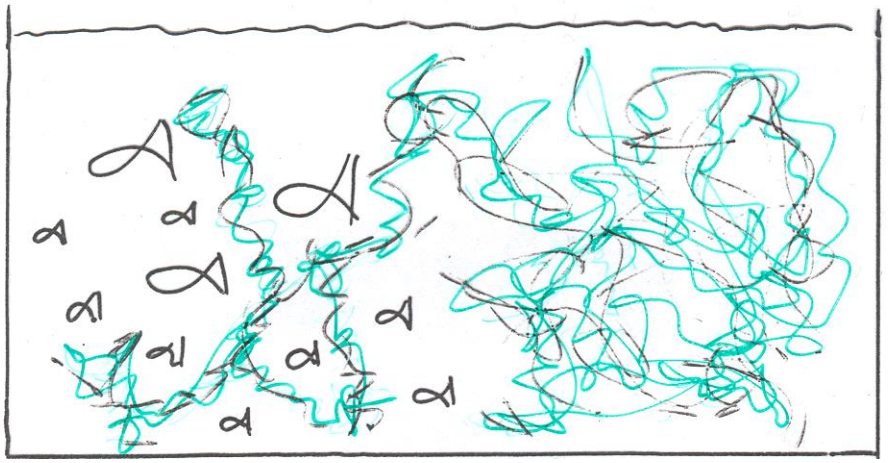
Night: *all* organisms consume O_2



Photosynthesis. Production of oxygen (bubbles) by aquatic plants (Fijn Hoornblad, *Ceratophyllum submersum)*



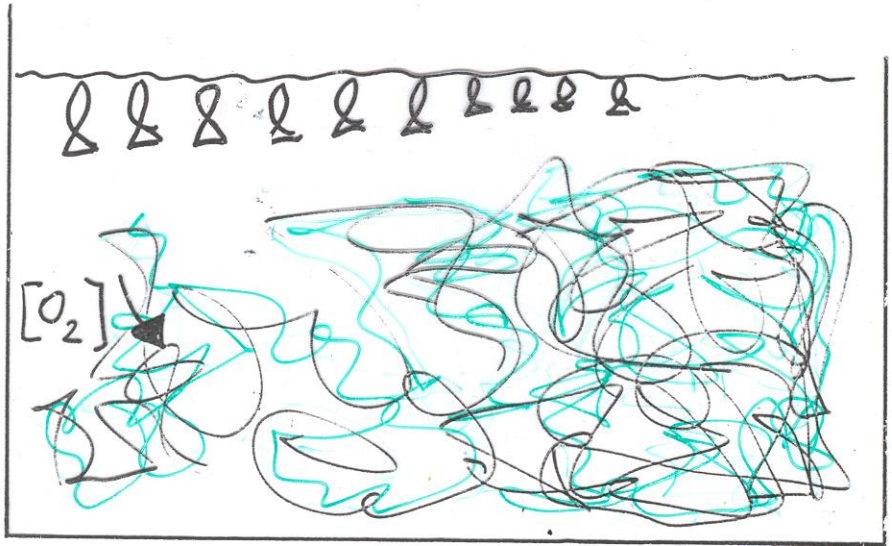
Minerals → phosphates
Nitrates



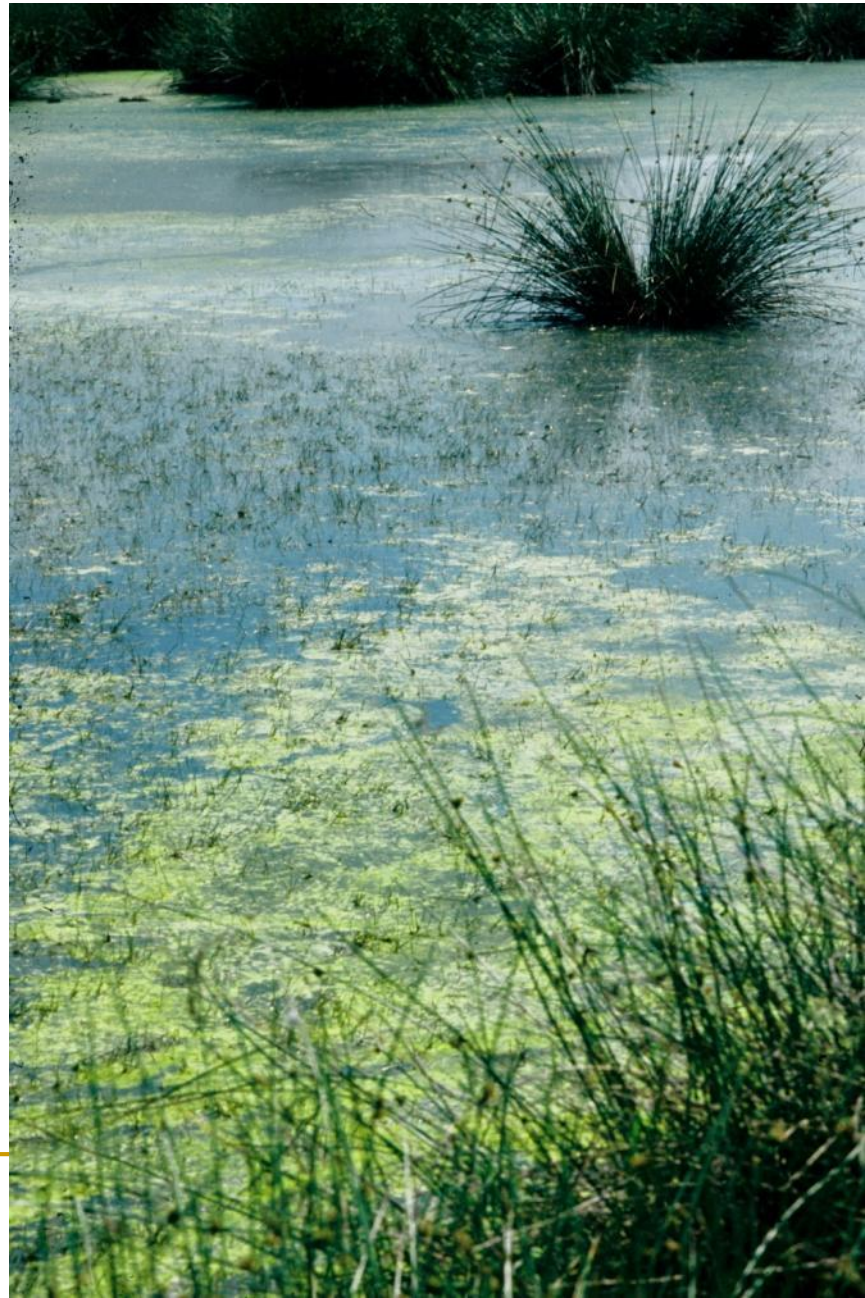
Day: After fertilization: more algae and more animals of a few tolerant species, which massively expand, the water becomes ‘pea soup’ green

Night: *all* organisms consume O_2

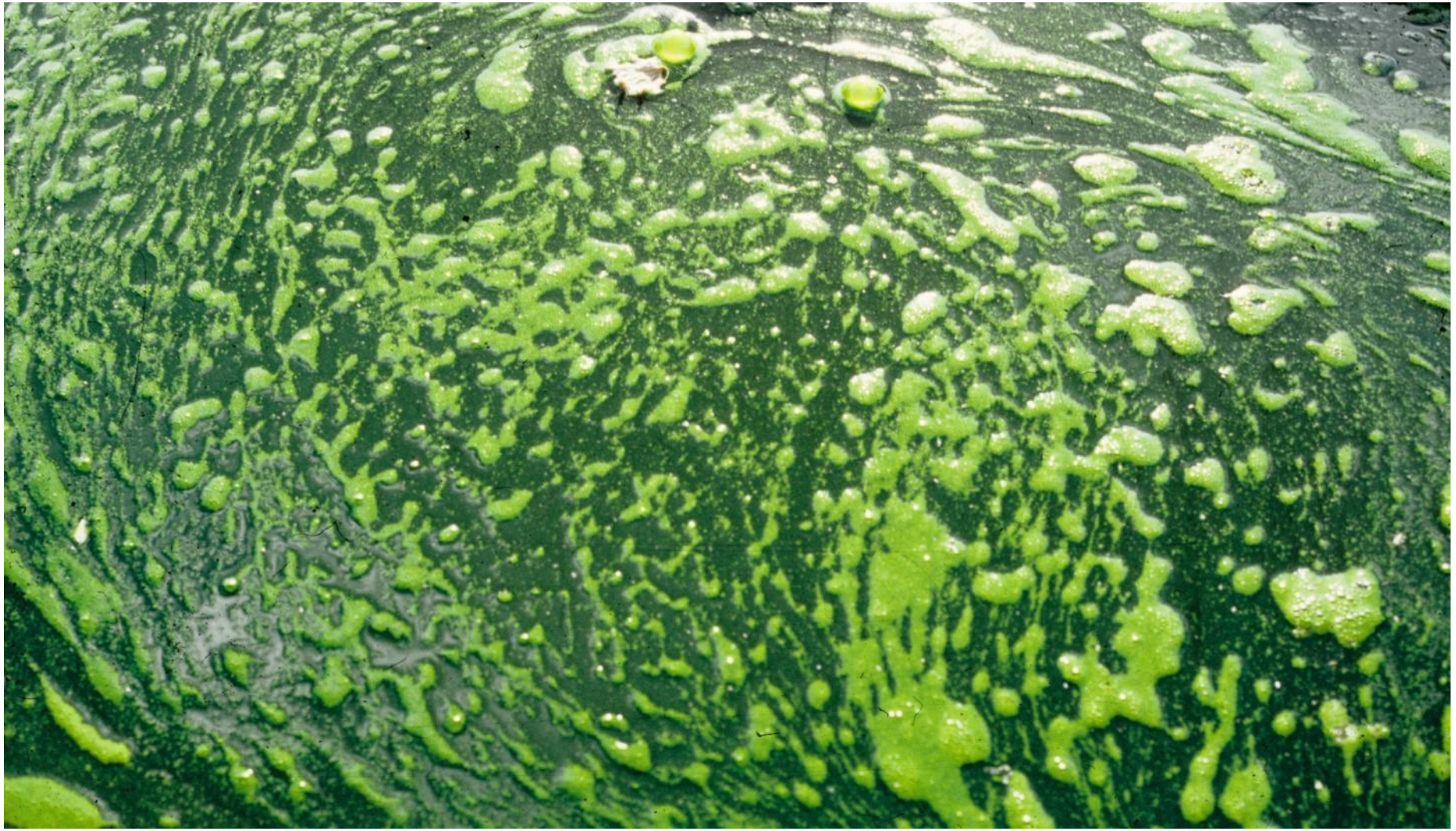
➡ anaerobic (faster in hot water)



Excessive algae growth due to fertilization **(= eutrophication)**



Eutrophication: algae bloom.



Algae bloom in France: no swimming allowed

Pas de baignade, les étangs d'Apigné ont le bloom

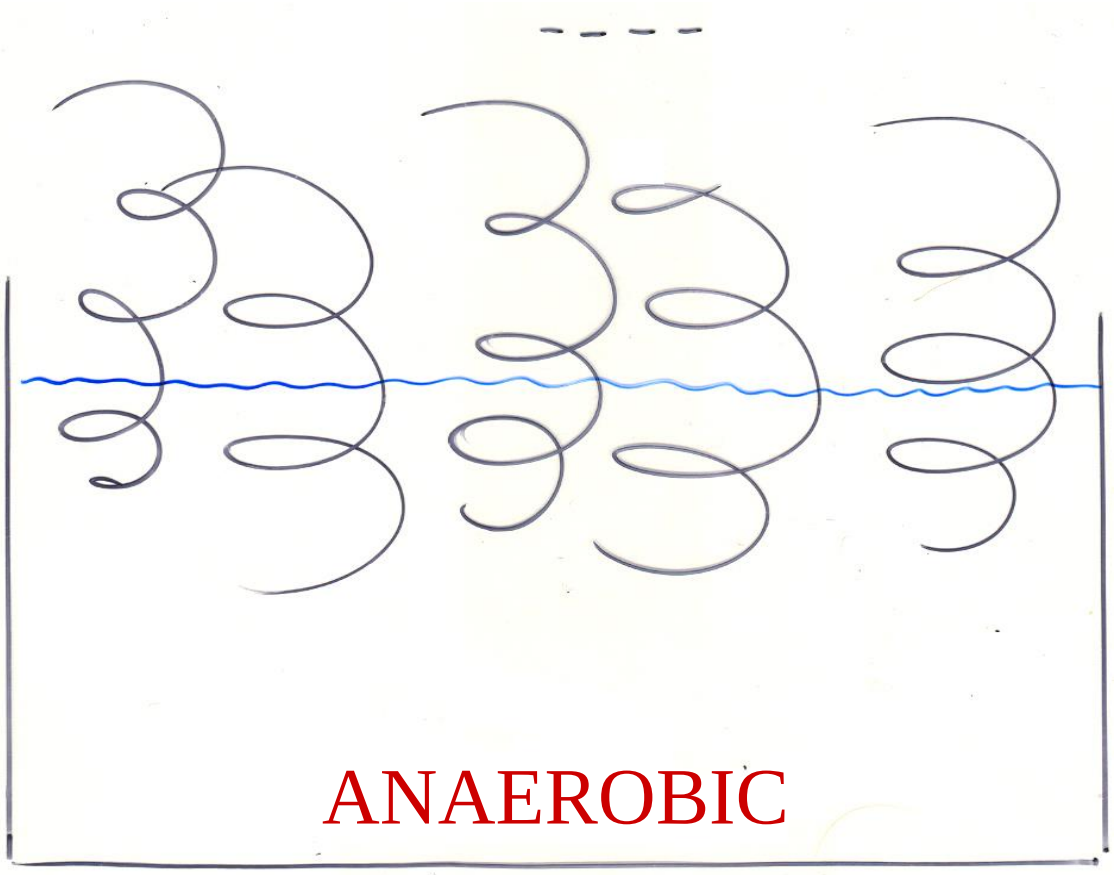
La pellicule d'algues contient des bactéries. La preuve? Lorsqu'elle est en nombre, l'eau peut prendre une coloration verte ou bleue. C'est le cas aux étangs d'Apigné depuis le 3 juillet. Du coup, la baignade y est interdite.

http://www.rennes.maville.com/actu

Algae bloom in Qingdao (China), the city which hosted the sailing part of the Beijing 2008 Olympics. Chinese authorities and common people, trying to solve the problem

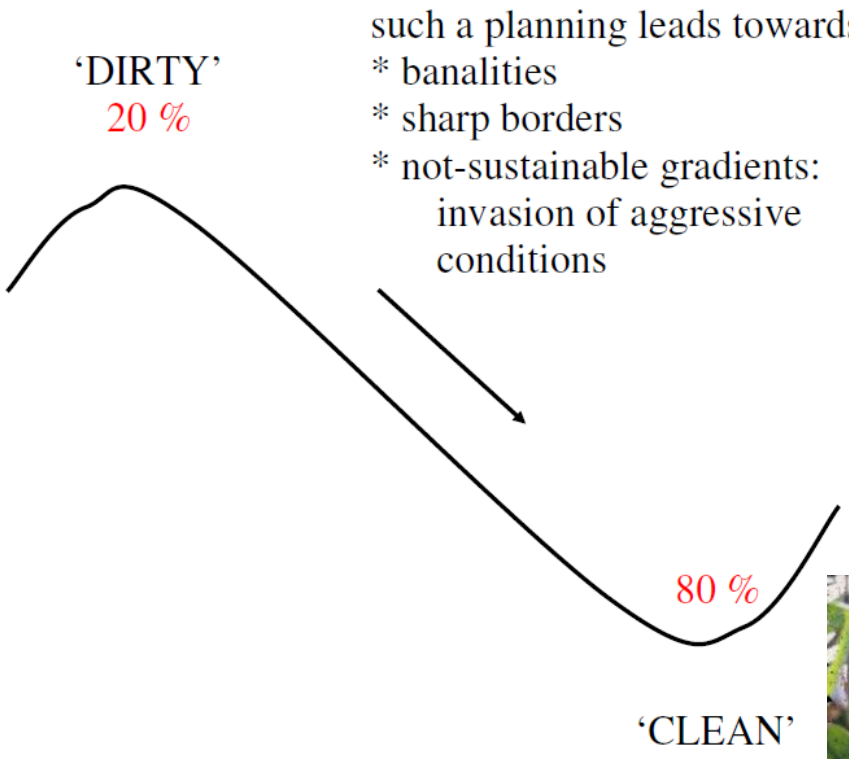
http://seawayblog.blogspot.com/2008/07/qingdao-and-algae-bloom.html

CH_4 , H_2S *SMELL*



O_2-free ➡ anaerobic digestion by bacteria and other micro-organisms leads to odor. Risk of growth of *Clostridium botulinum* that causes botulism (mortality of waterfowl). Risk is greatest in the summer semester.

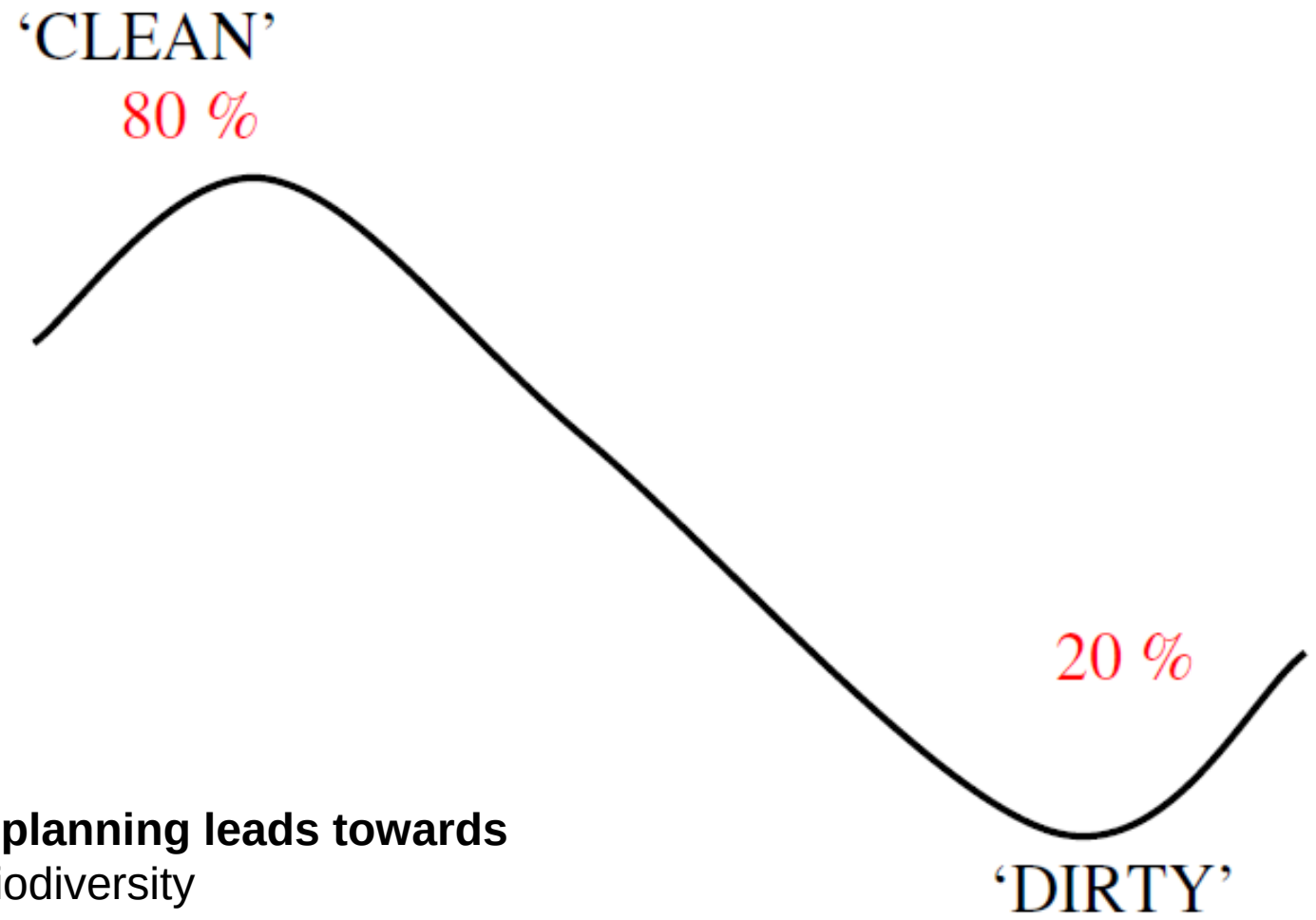
Anthropogenic dynamics. Situation to avoid by design.



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.

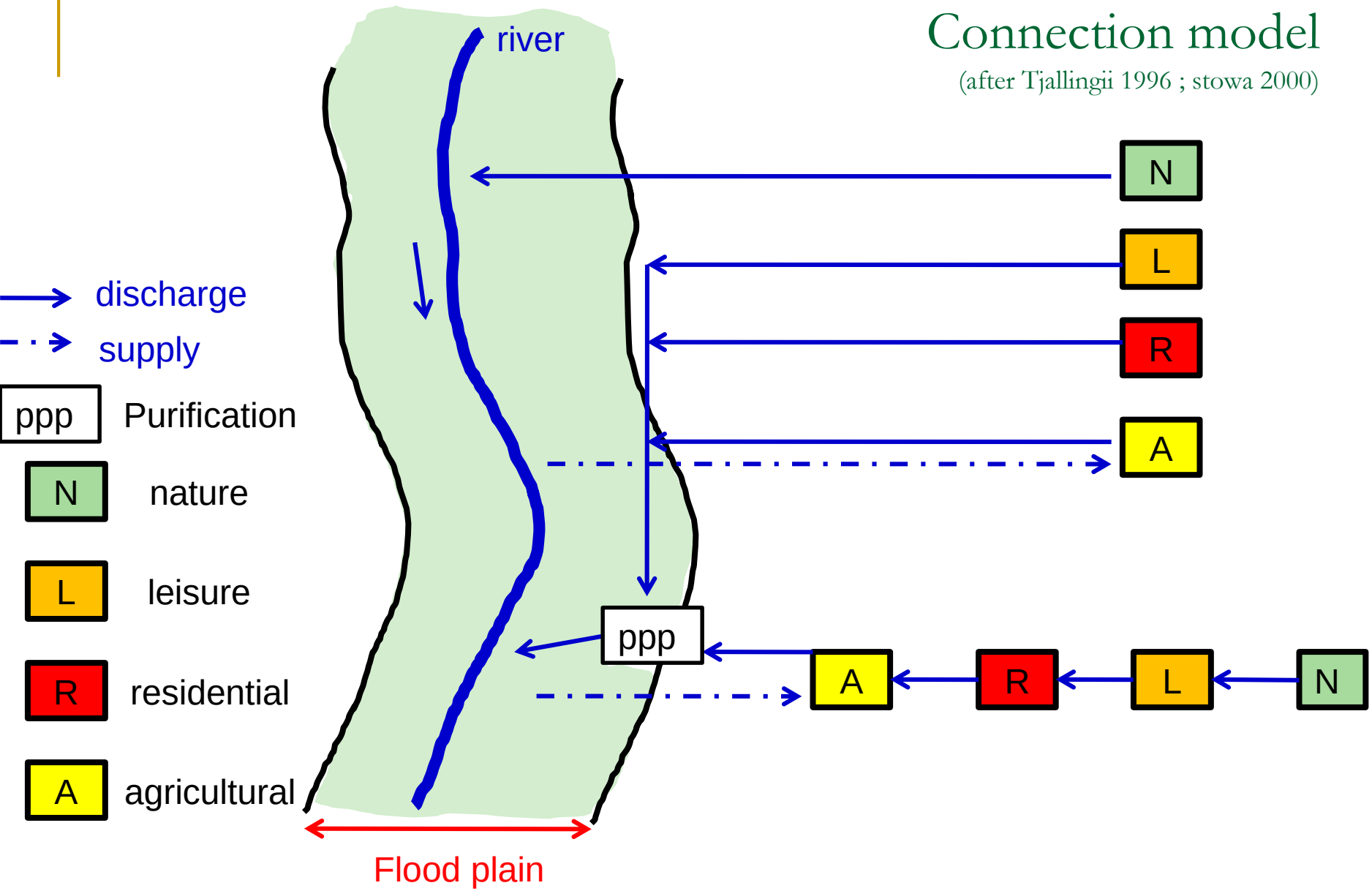


Such a planning leads towards

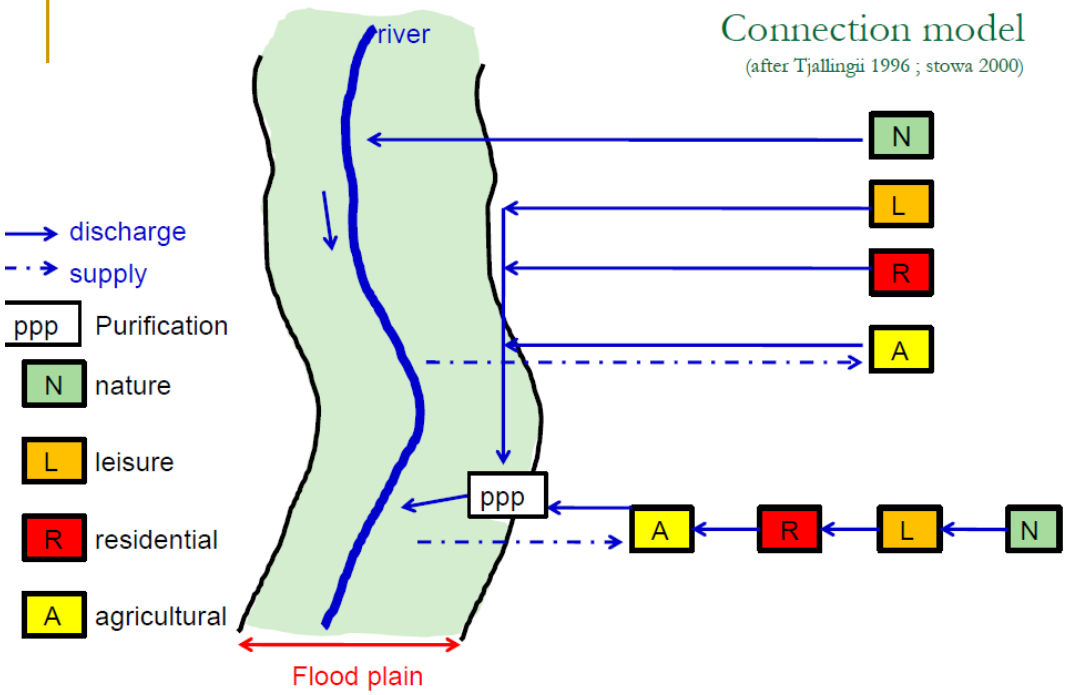
* high biodiversity
* sustainable gradients
* increasing differentiation

Connection model

(after Tjallingii 1996 ; stowa 2000)



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



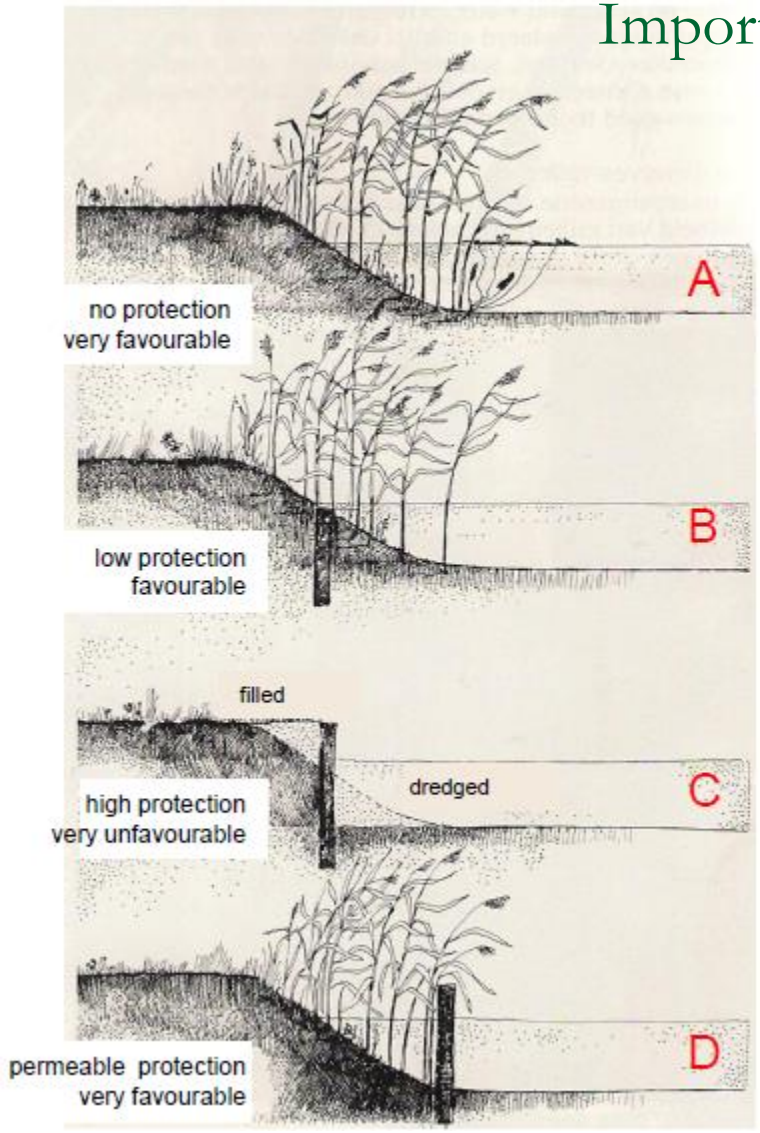
This connection model can be used to design a sustainable regional water system. In this connection model the underlying ecological principle is to create a stable gradient by allowing water to **flow from clean (in low-dynamic surroundings) to polluted (in high-dynamic surroundings)**, from nutrient-poor 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

Small scale applications: In (urban)gardens design, dry oligotrophic sand is put on top ....

De kleine Aarde (Boxtel, NL)

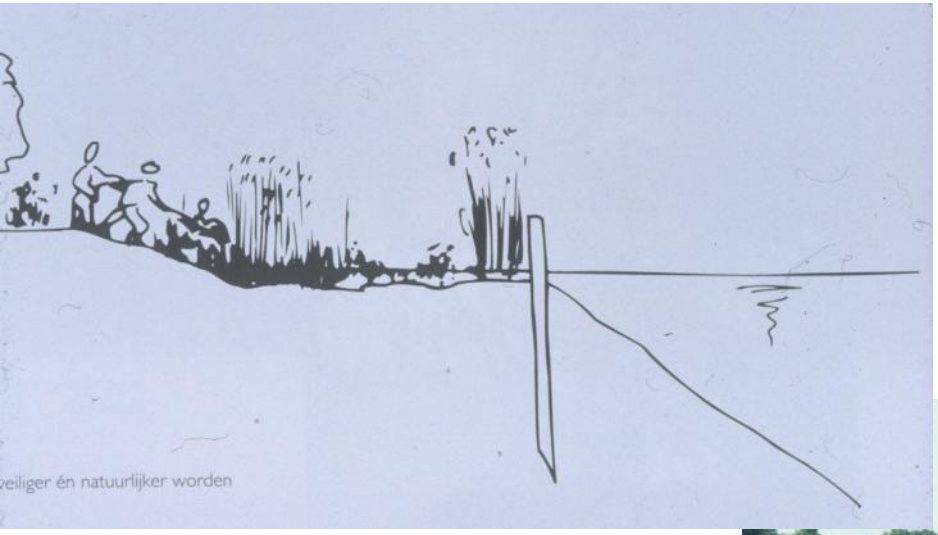
...and the wet, eutrophic clay is put down...
Importance of gentle gradients in (urban) landscapes for biodiversity (and for safety of children)



Some camp shedding methods enable rich nature (B and D).

Culemborg (NL), ecoquarter EVALanxmeer Natural camp shedding provides rich nature, also within residential areas

Nature friendly permeable bank protection (Kromme Rijnproject, Utrecht (NL))



Nature friendly permeable bank protection (Kromme Rijnproject, Utrecht (NL))

A missed opportunity.
Sharp, abrupt boundaries: little biodiversity and moreover unsafe for children.

Houten (NL)

What about Bangkok's potential ??

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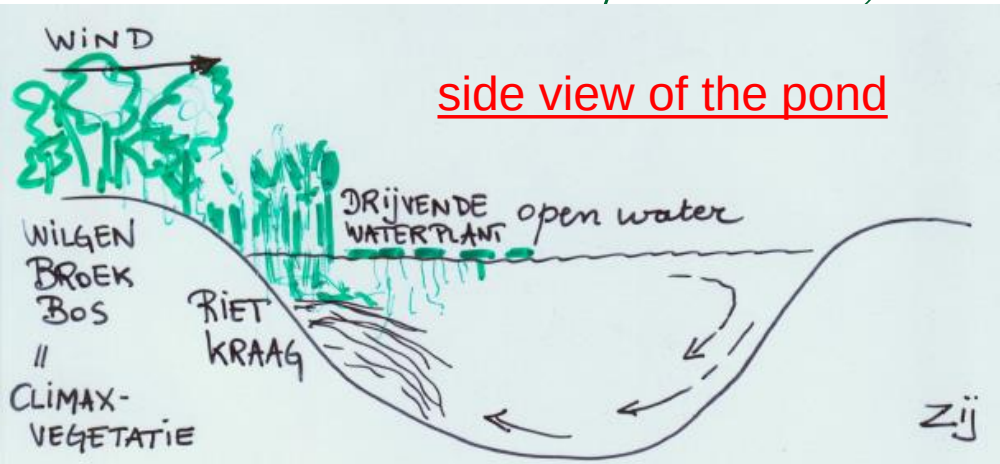
(3) Relation theory of VAN LEEUWEN (1966): time is dominant over space.

- Pattern (spatial) is determined by processes (temporal).
- Ecological sound green management (process) is the cause of a huge spatial diversity with a huge biodiversity (pattern) .
- So urban and rural planning of blue green areas (space) only leads towards high diversity, when the appropriate (ecological) management is applied (time).

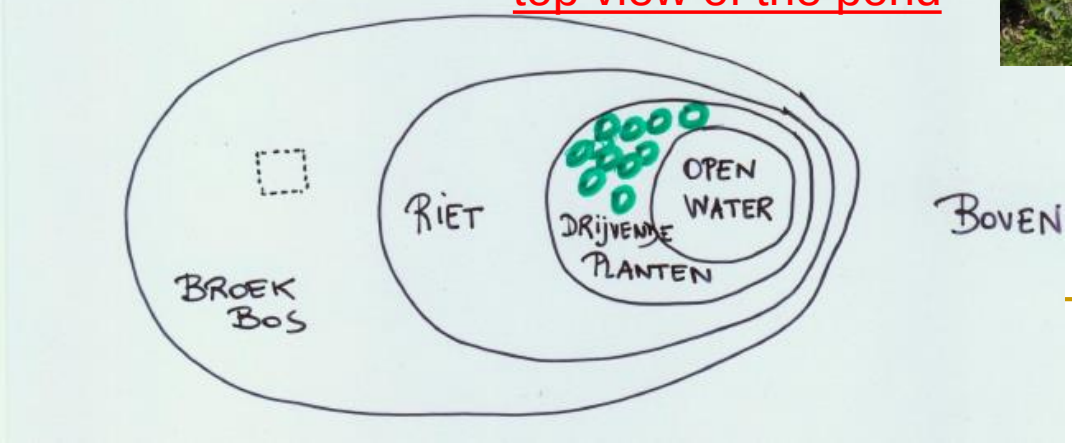
Example. **Natural succession** to marsh vegetation, to peat swamps and finally to climax swamp forest vegetation is starting from open water:

so the succession process always determines the pattern in landscape.



side view of the pond

top view of the pond



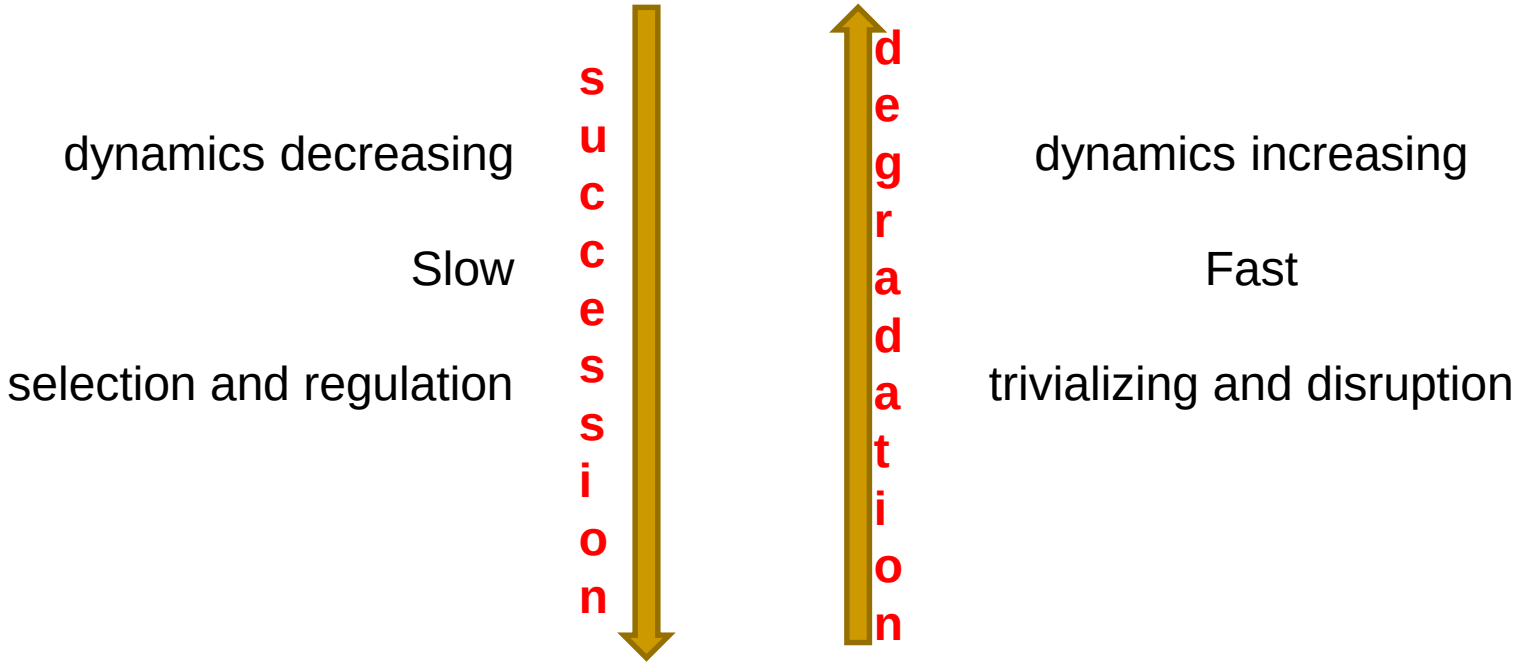
Once again, the landscape is the result of a process.

This is a universal ecological process, taking place all over the world, within and determined by the local abiotic conditions.

WETLANDS INTERNATIONAL
Thailand Office

Example: Phru Toh Daeng Peat swamp forest (Thailand), http://www.wetlands.org

ROBUST pioneer community
high dynamics
few species in large numbers
biomass production is high



FRAGILE climax community
low dynamics
many species in low numbers
biomass production is low

SCHEME: NATURAL SUCCESSION & DEGRADATION

High water levels forced people to extensive activities.

Hayfields

The seventh month (July) was once the hay month in Europe.
By then the spring flowers produced seeds and all the young birds fledged.

'*Wetlands with high significance for biodiversity*' for some people, for others '*worthless swamps*'.

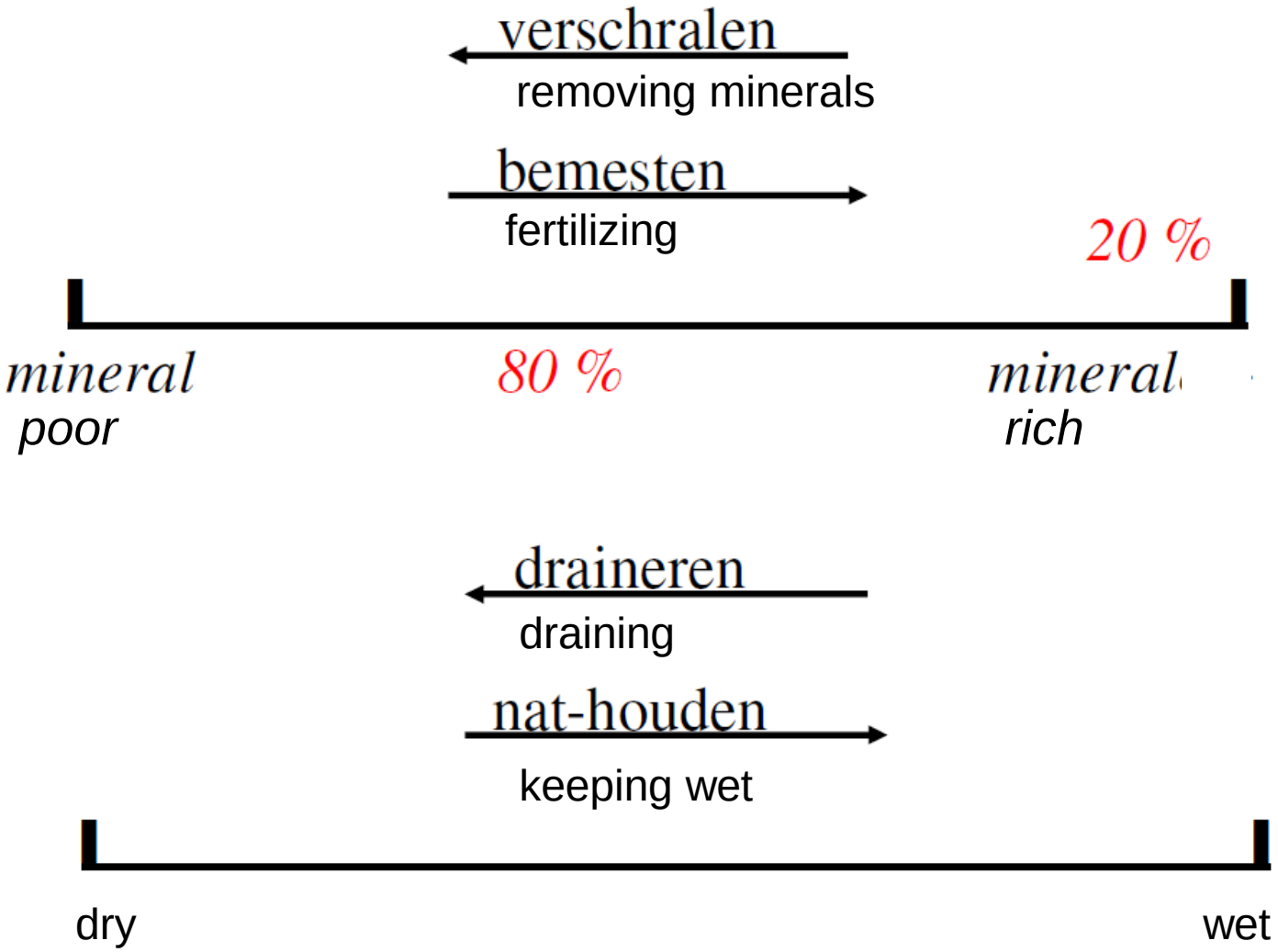
Haying as a nature management tool

Haying removes nutrients, a poorer soil is attractive for a lot of species such as this orchid species (e.g. :*Dactylorhiza majalis*).

Drainage for intensive agriculture: degradation.

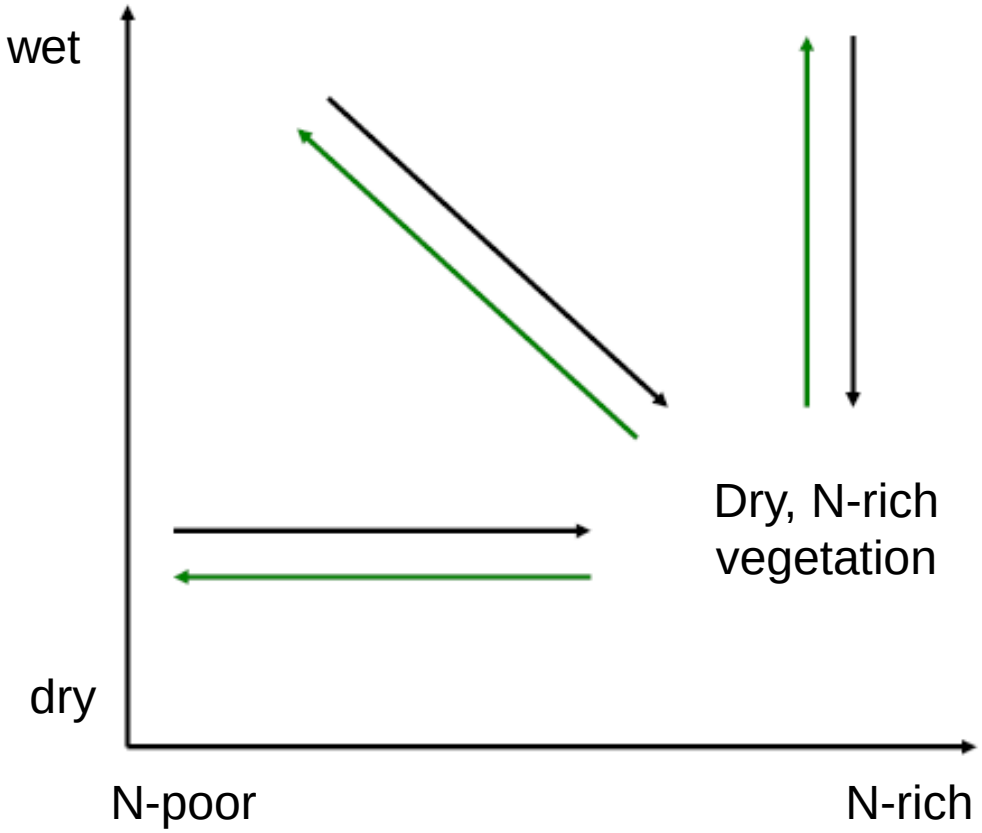
Drainage is accelerating mineralization processes and more minerals are released into the soil which become **drier** and **richer in nitrogen**.

ANTHROPOGENIC DYNAMICS: Features and Terminology



ANTHROPOGENIC DYNAMICS.

Culture technology versus nature technology



culture technology

Draining and fertilizing

Convergent: **banalities**

nature technology

Keeping wet and removing minerals

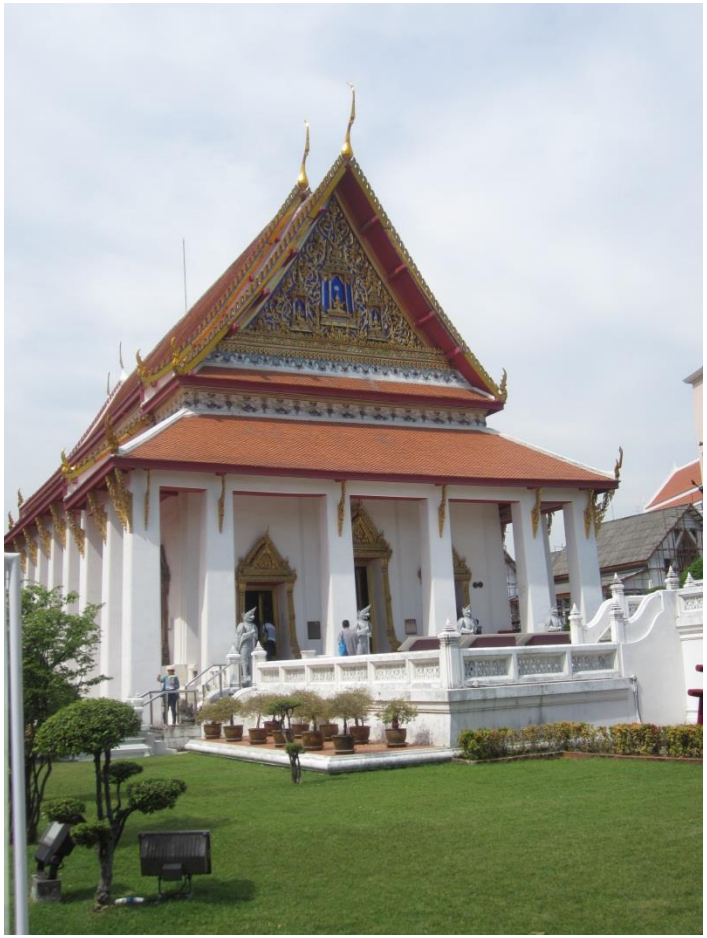
divergent: **diversities**

Delft (NL): changing towards ecological ***urban river bank management***. The lawn management is still very intensive. The Blue Heron *(Ardea herodias)* needs not only a correct **pattern** (gradient) but also a correct **process** (ecological management)

Too intensive (mowing) management (*process*) leads to sharp borders and low biodiversity (*pattern*)…

Hingene (B)

…all over the world



Bangkok (Th), National Museum

These insights are applied to the management of roadsides, Wallonië (B.),
Extensive and late haying increases biodiversity

- So ecologically sound landscape management is the cause of a great spatial landscape diversity and biodiversity.
- Using the appropriate ecological management techniques (processes) is leading towards a great diversity. (haying to minimize nutrients, grazing cattle, reintroducing flooding,…).

Extensive grazing along the river Rhine Millingerwaard (NL)

Extensive grazing as a (cheap) management tool.

Heckrunderen
(http://www.wildernis.eu/NL/?l1=83.Begrazing)

Red deers (edelherten) in the Oostvaardersplassen

http://www.ark.eu/ark/ark-voor-u/advies-over-natuurontwikkeling/oostvaarderswold

Wisenten *(Bison bonasus, Europese bison)* grazing and pruning
National Park Zuid-Kennemerland (NL) http://www.ark.eu/ark/ark-voor-u/begrazingsbeheer

Gent (B): applying extensive grazing (with sheep)of river banks in the city centre as a cheap management tool.

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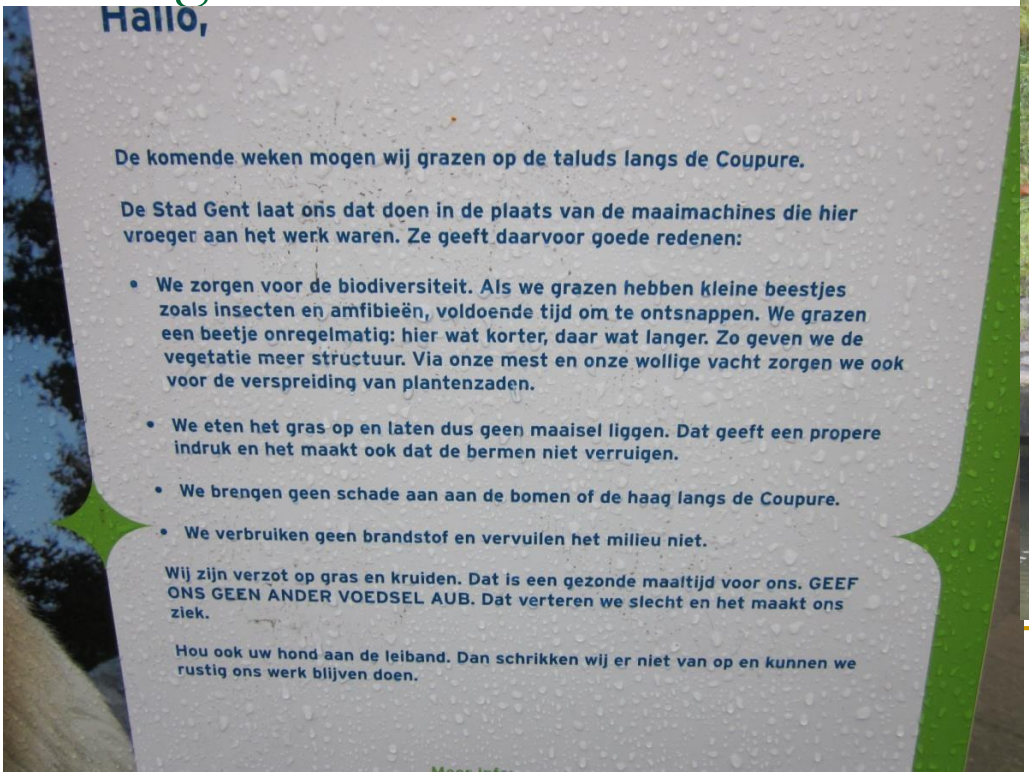
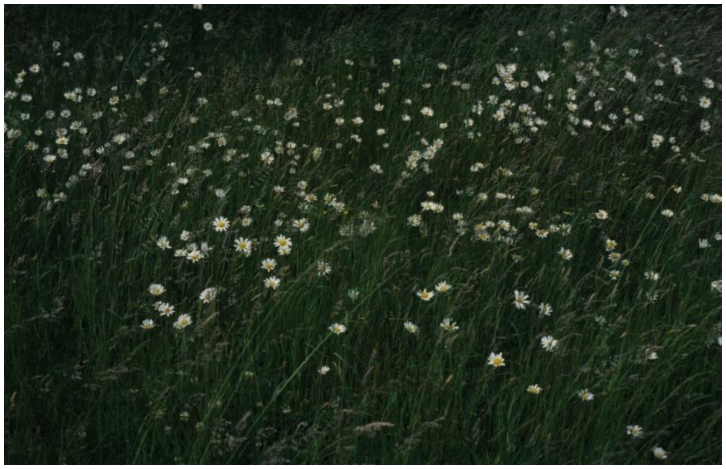


Ecological green management in city park Aalst (B.)

Bosorchis (Dactylorhiza fuchsii)

A growing area of the lawns are maintained, using ecological principles. Haying once or twice a year decreases the amount of minerals such as nitrogen and phosphorus. As a consequence rare orchid species occur in this urban city park again.

Shifting towards ecological green management, enhancing biodiversity
Heks (Limburg, B.)



A compromise was found: intensive lawn management along the paths, (cheaper) ecological sound grassland management elsewhere.

Also in small (city)gardens, nature value increases enormously, when those ecological principles are applied.

De Klinge (B)

Sint-Gillis Waas, B (with an ecological swimming pond)

Biodiversity in gardens in Great Britain

Taxonomische groep	soorten in tuin	aantal soorten in GB	% # soorten in tuin t.o.v. GB
Bijen	51	252	20
Bladwespen	58	481	12
Dagvlinders	21	62	34
Duizendpoten	7	46	15
Gaasvliegen	18	55	33
Hooiwagens	10	23	43
Inheemse bloemplanten	166	1500	11
Lieveheersbeestjes	9	24	38
Loopkevers	28	342	8
Mieren	2	36	6
Nachtvlinders (macro's)	263	881	30
Oorwormen	1	4	25
Sluipwespen	533	2028	26
Sprinkhanen en krekels	3	28	11
Wespen	41	297	14
Zweefvliegen	91	256	36
Totaal aantal soorten	1302	6315	21

Number of species of plants and animals in a classical garden in Leicester (GB).

surface: **741 m²**

The research lasted 15 years.

Also comparison with the number of species in GB (Owen 1991).

More and more cities and city dwellers become aware of the value of urban green.

Kortrijk (Belgium, 2009)

Helsinki
(Finland)

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(4) Design and create connections as much as possible and as little separations as possible (Island theory, Mc Arthur & Wilson, 1967).

CONNECTIVITY is as important for maintaining and restoring urban biodiversity, as it is in rural areas.

So design **blue-green networks**, also through urban areas.

The **Lobe City concept** is a very suitable urban expansion model to achieve these biodiversity goals (and to mitigate climate impact of cities).

HORIZONTAL RELATIONSHIPS VERSUS SPATIAL PLANNING: connecting ?

(Island Theory , Mc Arthur & Wilson, 1967)

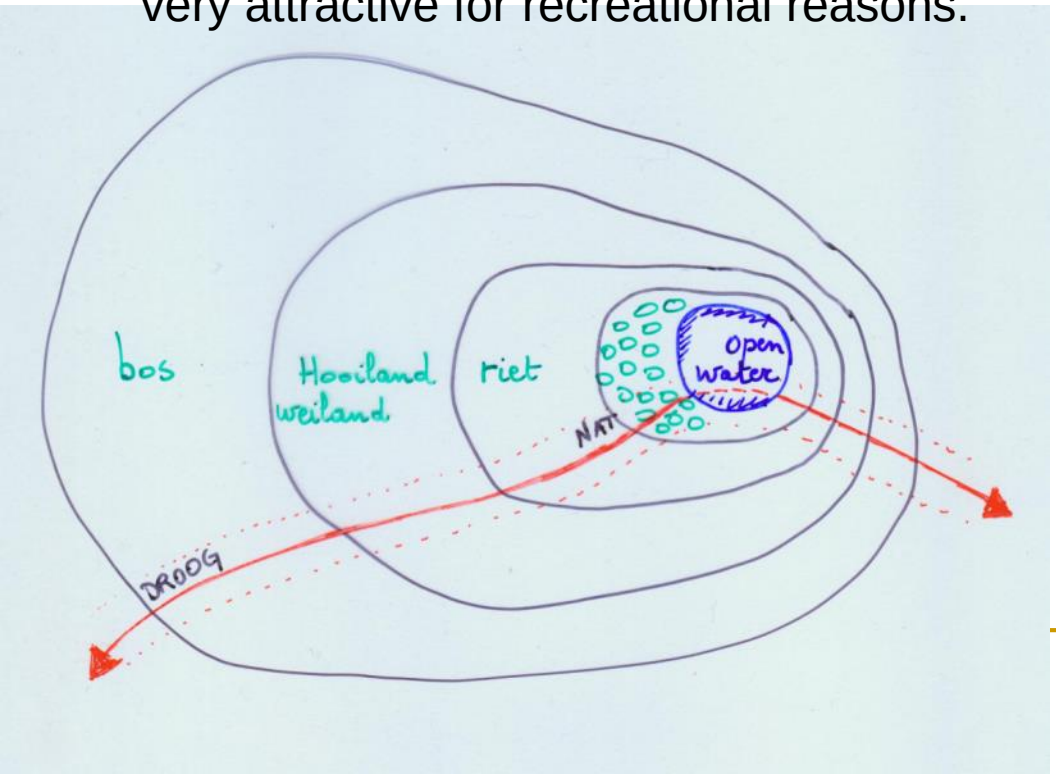
Theorem:

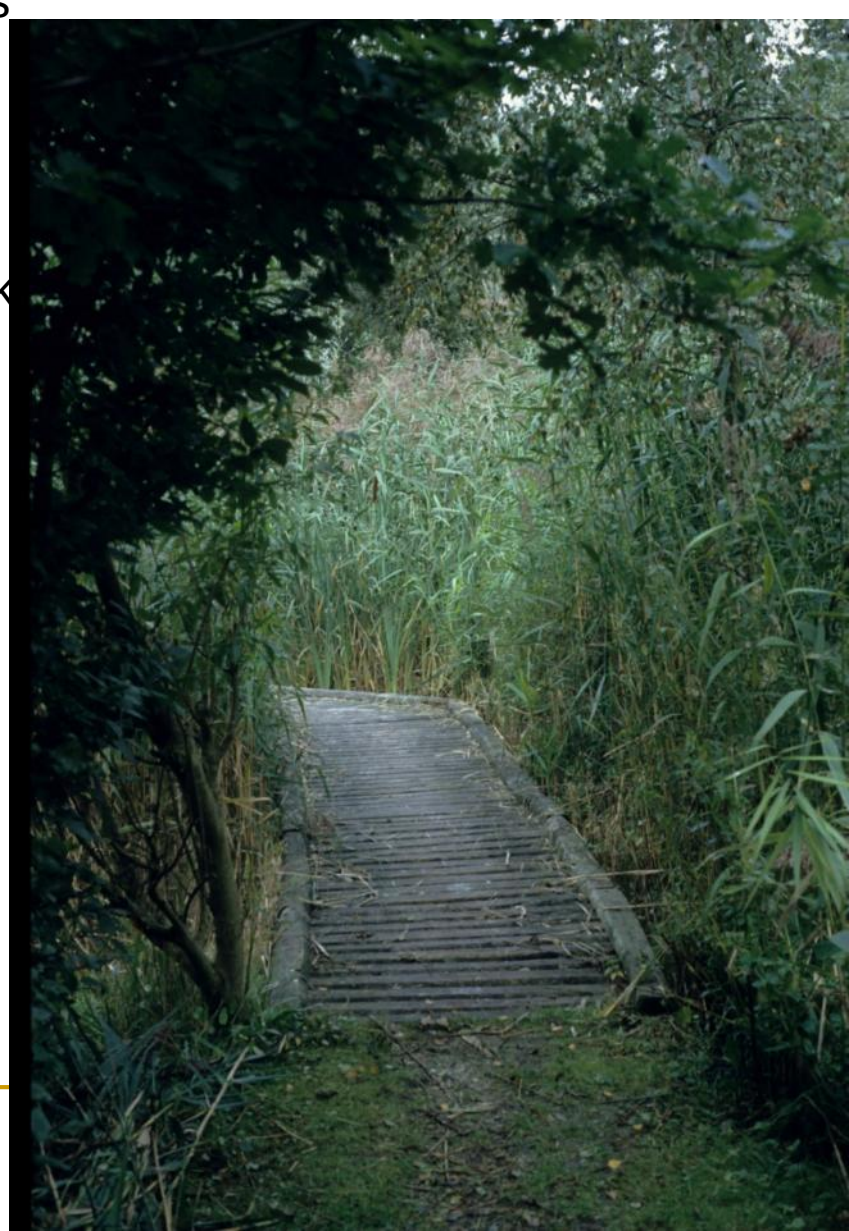
If the insulation between two fragile communities is increasing (= island situations), then migration of species between them becomes impossible. Part populations can become so small that they might easily extinct (genetic isolation, incest, ...).

Design guidelines:

- 1. Design a good environmental quality between fragile ecosystems (environmental quality standards, green infrastructure, corridors, stepping-stones, ...).
- 2. The preservation of existing green infrastructure in the expansion zones for residential areas (combined with wadis), in industrial expansion zones , in land development projects, ..., saves time in achieving higher biodiversity quality (unfortunately often tabula rasa)

•3. Avoiding separation, obstruction and fence effects for plants and animals when designing infrastructure, is very important. This often means building the infrastructure (walking or cycling tracks) perpendicular to the abiotic gradient (slope). This means designing infrastructure perpendicular to the vegetation boundaries instead of parallel. As a consequence people walk or cycle through very different landscapes and vegetations in gardens and parks, which is also very attractive for recreational reasons.





HORIZONTAL RELATIONSHIPS VERSUS SPATIAL PLANNING: separation where necessary, connecting where possible.

(Van Leeuwen, 1973)

- **Theorem:**

  Dominant abiotic factors have the ability to spread rapidly. If the protection of fragile communities against aggression from outside is wanted, then the designer has to isolate and separate in his design.

- **Design guidelines:**

  The maintenance of spatial variation suggests so in that case a certain degree of isolation, to avoid an extension of robust systems at the expense of fragile systems.

Design a separation (buffer) where necessary and maintain connections where possible.

Application: wildlife bridges or ecoducts

In the province of Limburg, Belgium there is already since 5 years such a wildlife crossing, the ecoduct Kikbeek. That this bridge is very useful for animals to pass the highway, is shown with images made by night made by TVLimburg of wildlife crossing the ecoduct.

- This is a link to a film of TV Limburg, which documents the use of the ecoduct Kikbeek over the E 314 (Maasmechelen, Belgium)

Source: www.weertfm.nl / http://www.tvl.be/nl/2009-11-18/exclusieve-beelden-van-wild-op-het-ecoduct/

This ecoduct is built in 2006 on the N25 (Flanders, Belgium). It connects 2 parts of forest (Meerdaalwoud). Monitoring results tell us that it is used by roe deer, badger, wild boar, small mammals, amphibians, insects, spiders, ...

Source: www.iene.info

The **city level**.

Concentric expansion of cities has a lot of disadvantages:

Lack of ventilation with fresh and humid air (summer smog)

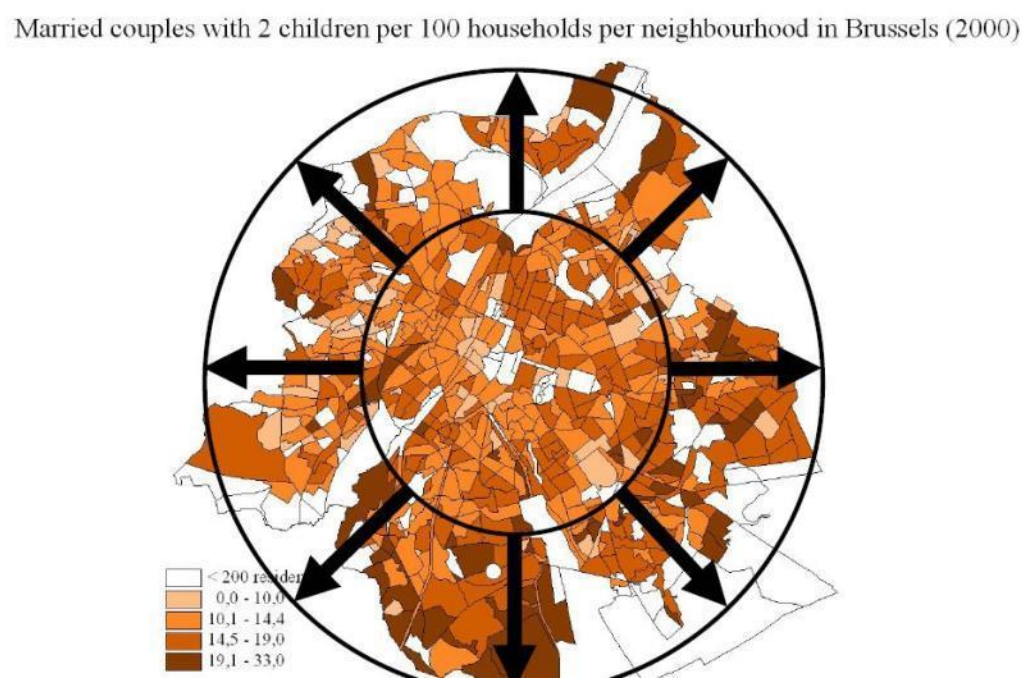
Increasing distances to the rural areas

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

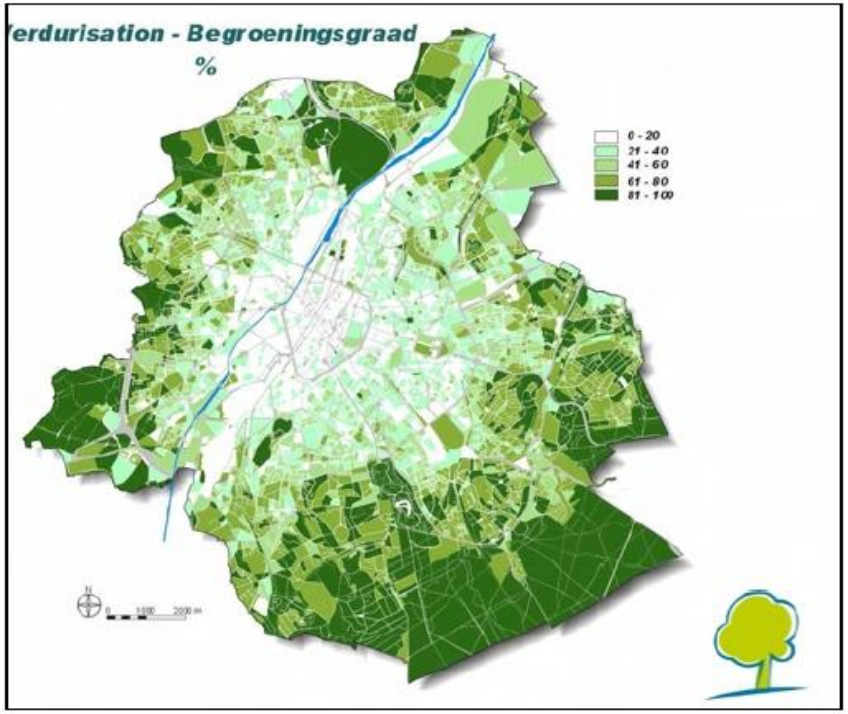
Brussels (1,100,000 inh. ; Belgium, European capital) Younger families with children leave the city centre and move to the green city fringe and rural areas.

traffic insecurity

lack of adventurous public green

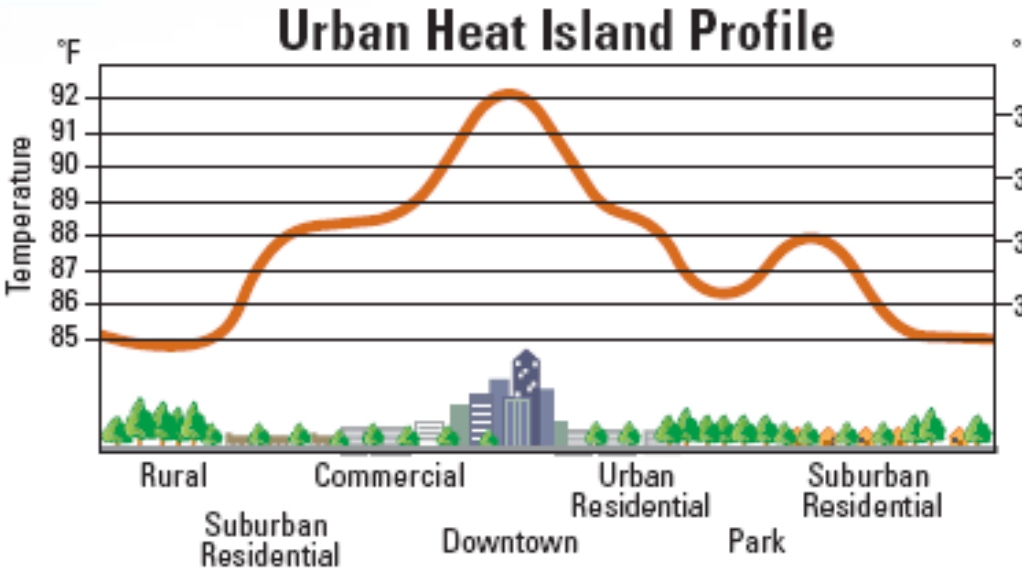


From De Corte, 2005

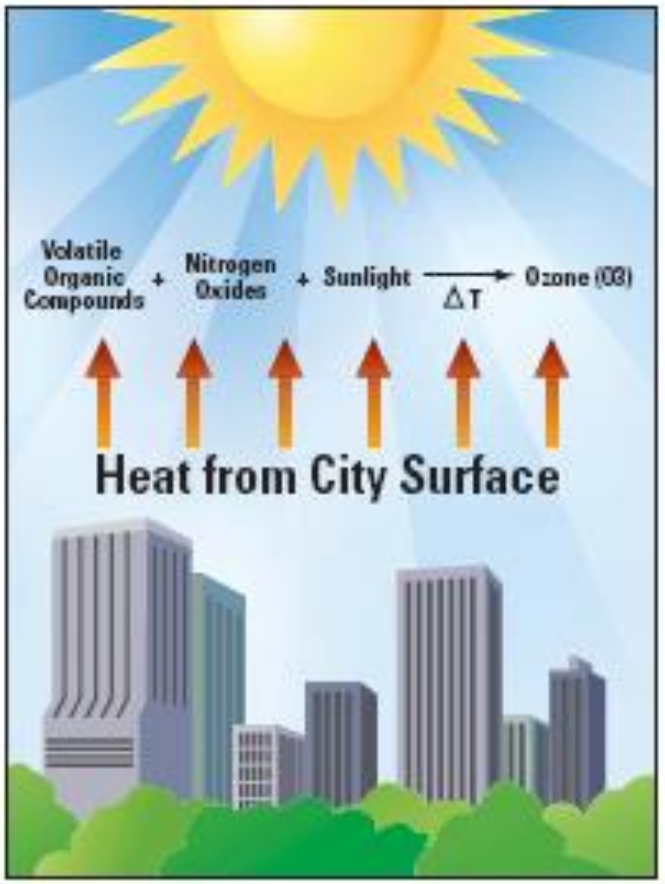


Proportion of green, open spaces in Brussels Capital Region
Source : IBGE-BIM

The urban heat island effect (UHI).

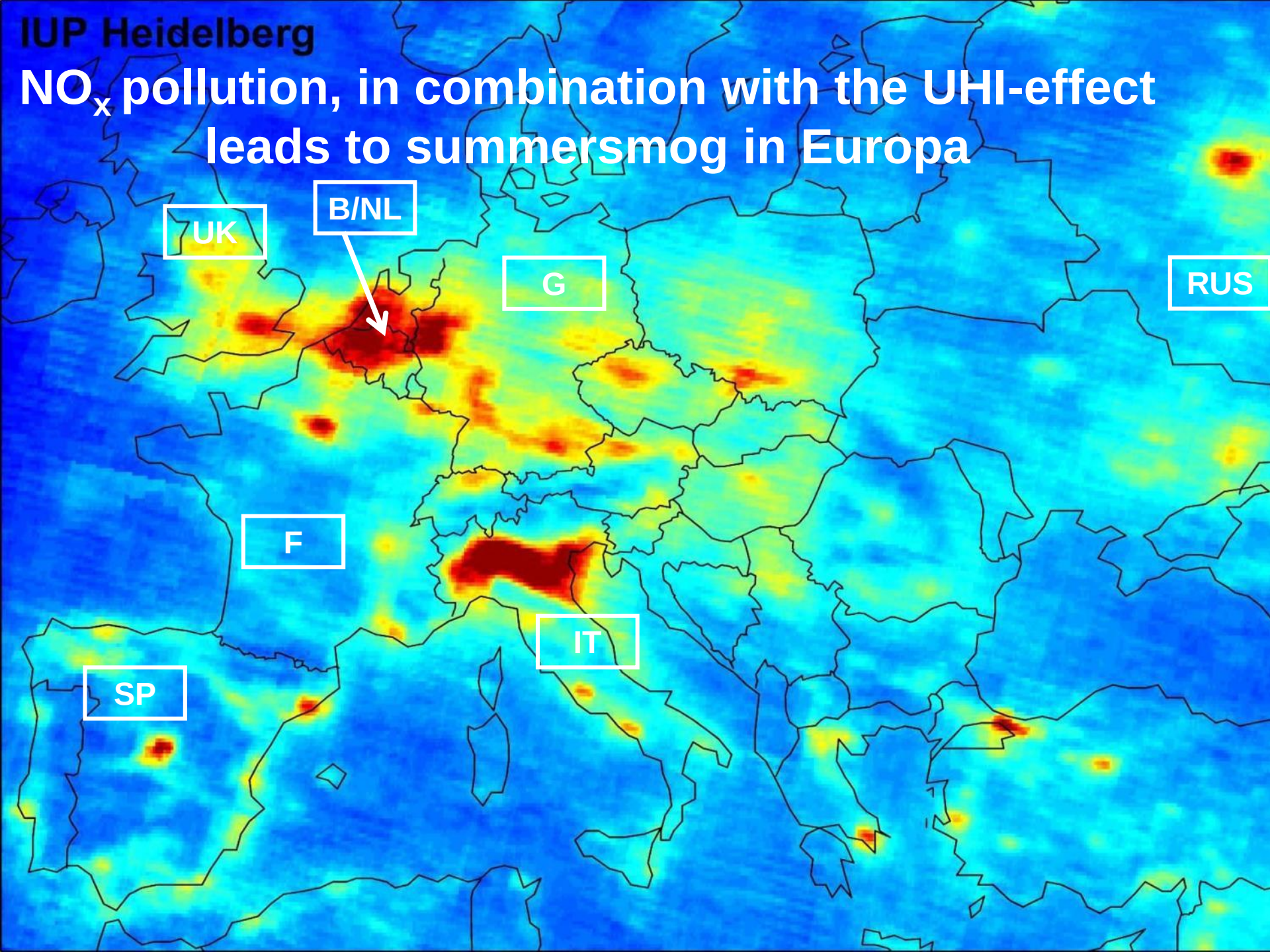


Heat islands are often largest over dense development but may be br up by vegetated sections within an urban area.



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

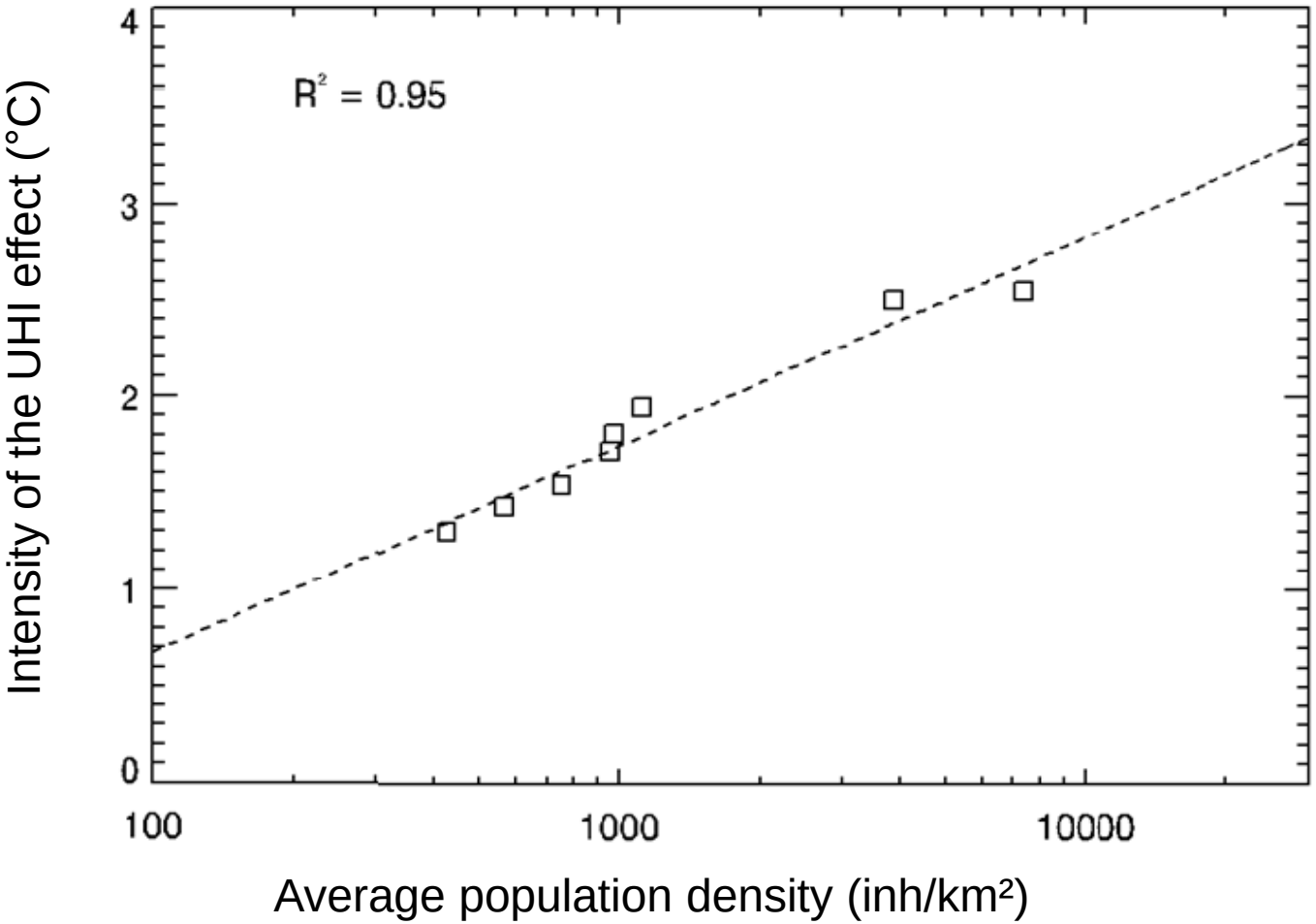
http://www.epa.gov/heatislands/resources/pdf/HIRIbrochure.pdf


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

UHI-effect: a 'hot' scientific topic

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

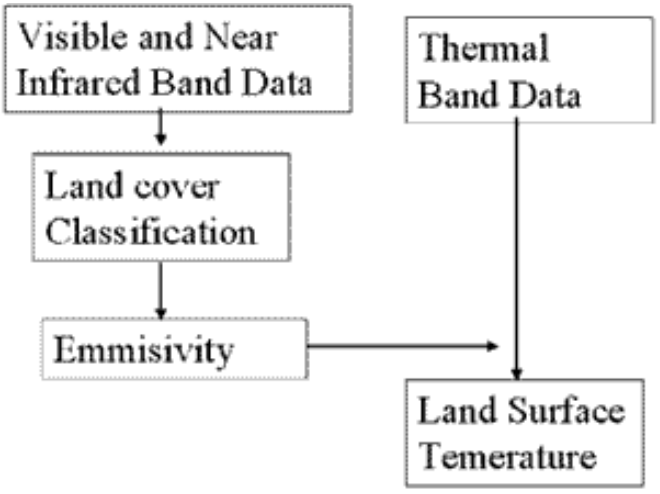
ISBN 978-1-84407-250-7



There is a strong positive correlation between population density and the urban heat island (UHI) effect (De Ridder et al. In prep)

source: Aertsens Joris, et al. (2012). “Daarom groen! Waarom u wint bij groen in uw stad of gemeente”; Studie uitgevoerd in opdracht van: ANB – Afdeling Natuur en Bos; 128 p.

Some Asian examples



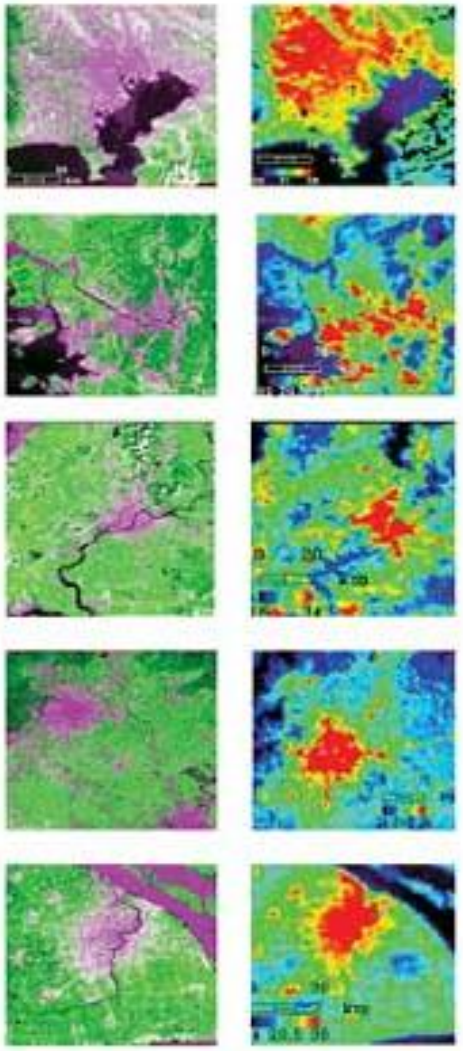
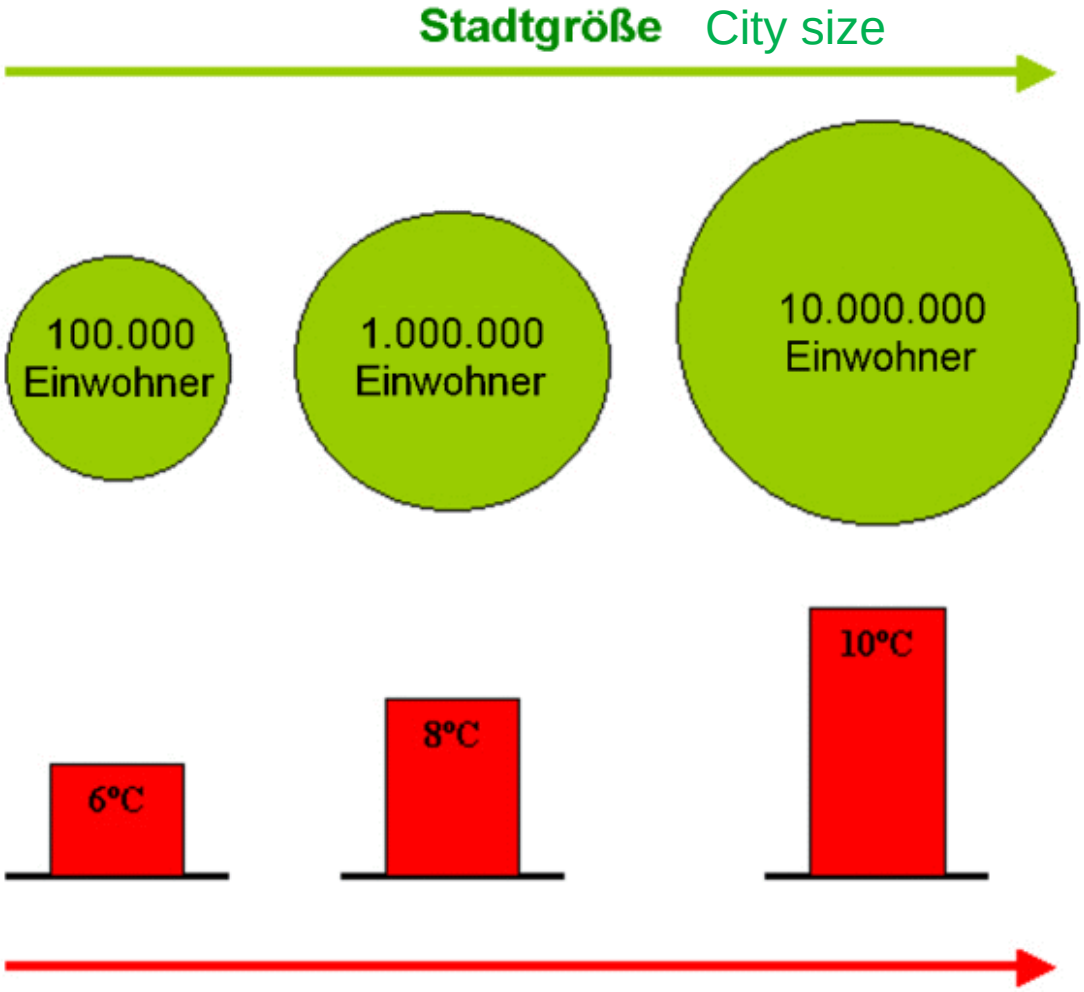
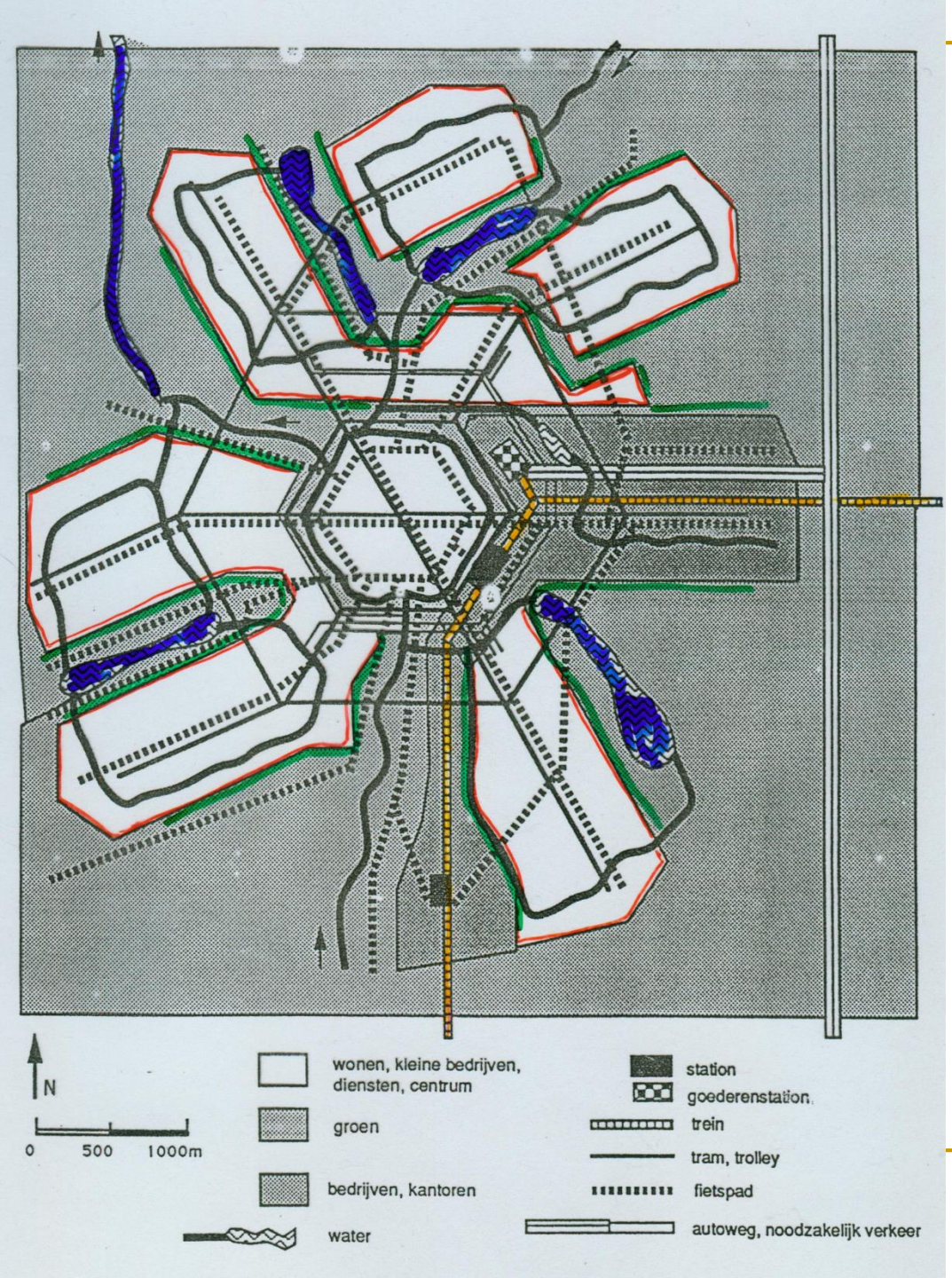


Fig-3 Visible band and thermal band for the study sites (Tokyo, Seoul, Pyongyang, Beijing and Shanghai, from top)

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



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)



There is a Solution to temper the urban heat island effect: Building cities following **the lobe-city model.**

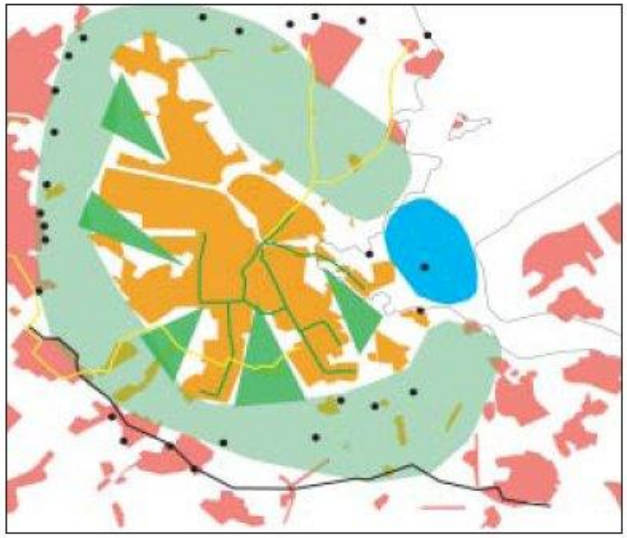
Built-up city-lobes

separated by

Blue-green fingers (wedges)

From Tjallingii, 1996

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



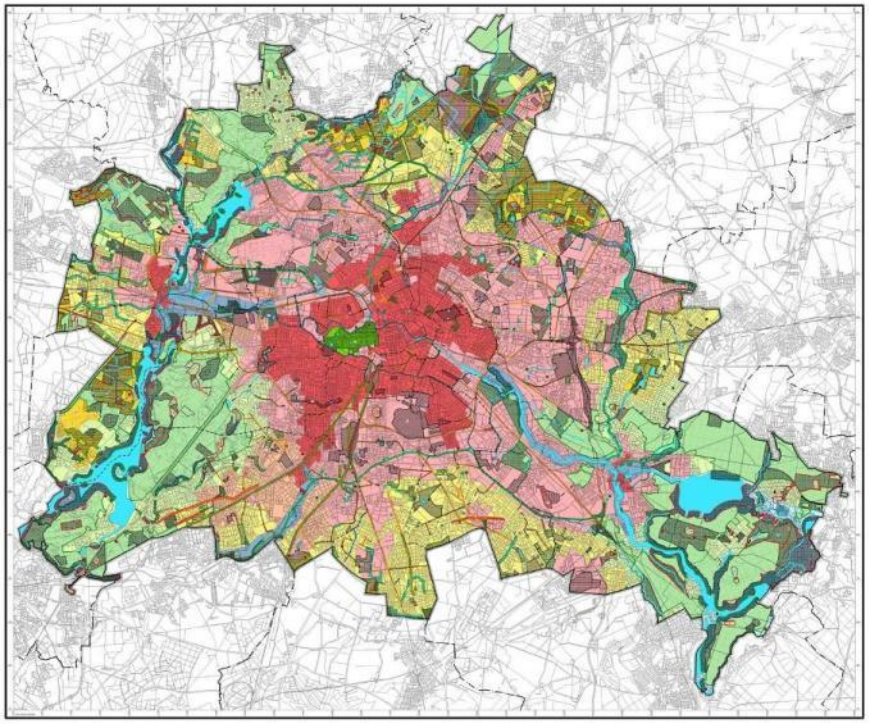
e Amsterdamse lobbenstad ligt een
one. Daaromheen ontstaat langzamer-
en krans met bebouwing, een
amde kransstad.
sterdam 'finger city' is surrounded by
belt. A garland of construction is
ly appearing around it, a so-called
city.

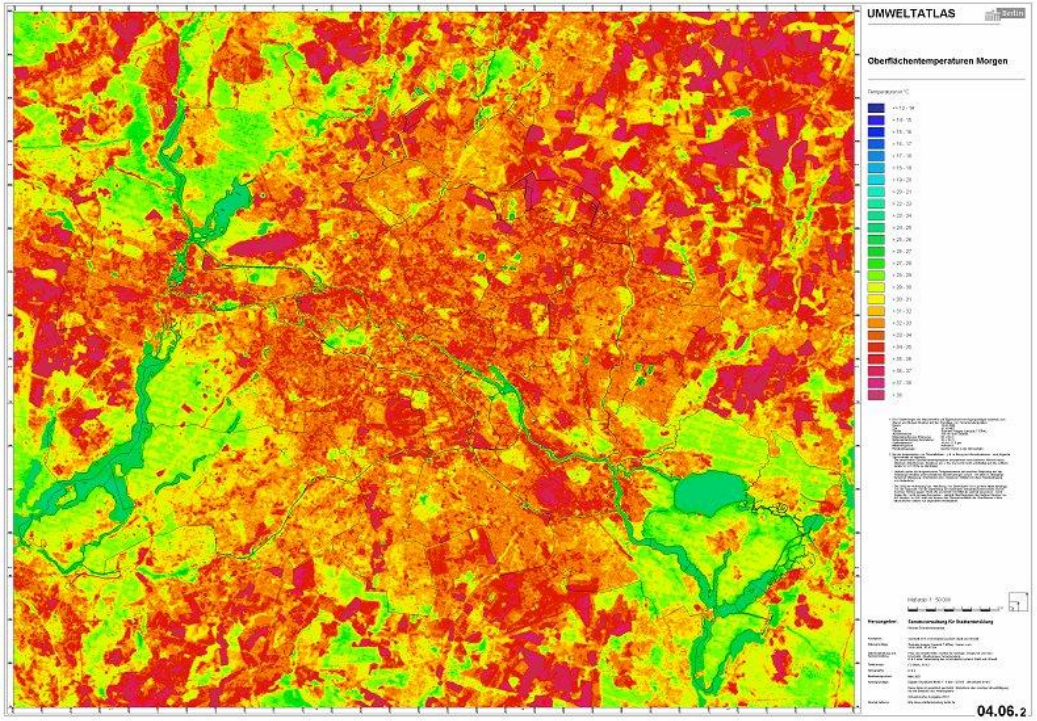
Amsterdam (750,000 inhabitants ; The Netherlands). From Gieling, 2006

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.

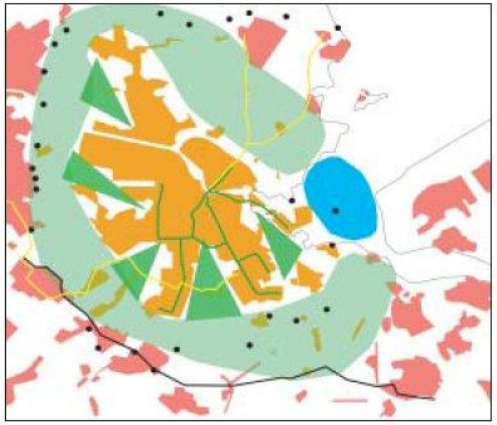
The blue-green fingers are tempering the heat island effect in Berlin (3,400,000 inh. ; Germany)



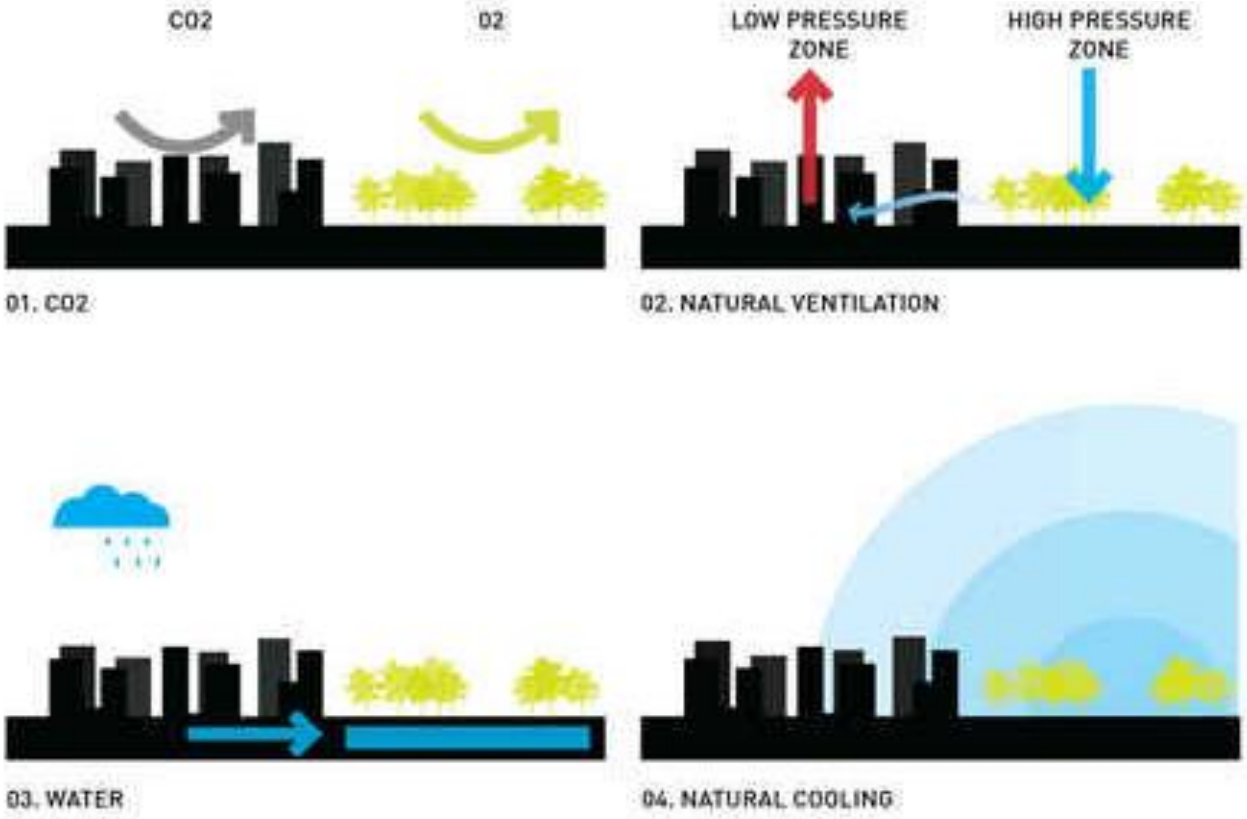


Infrared picture of hot city-lobes and cooler blue-green fingers of Berlin. (Cloos, 2006)

Advantages of a lobe-city city expansion.



► 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.



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

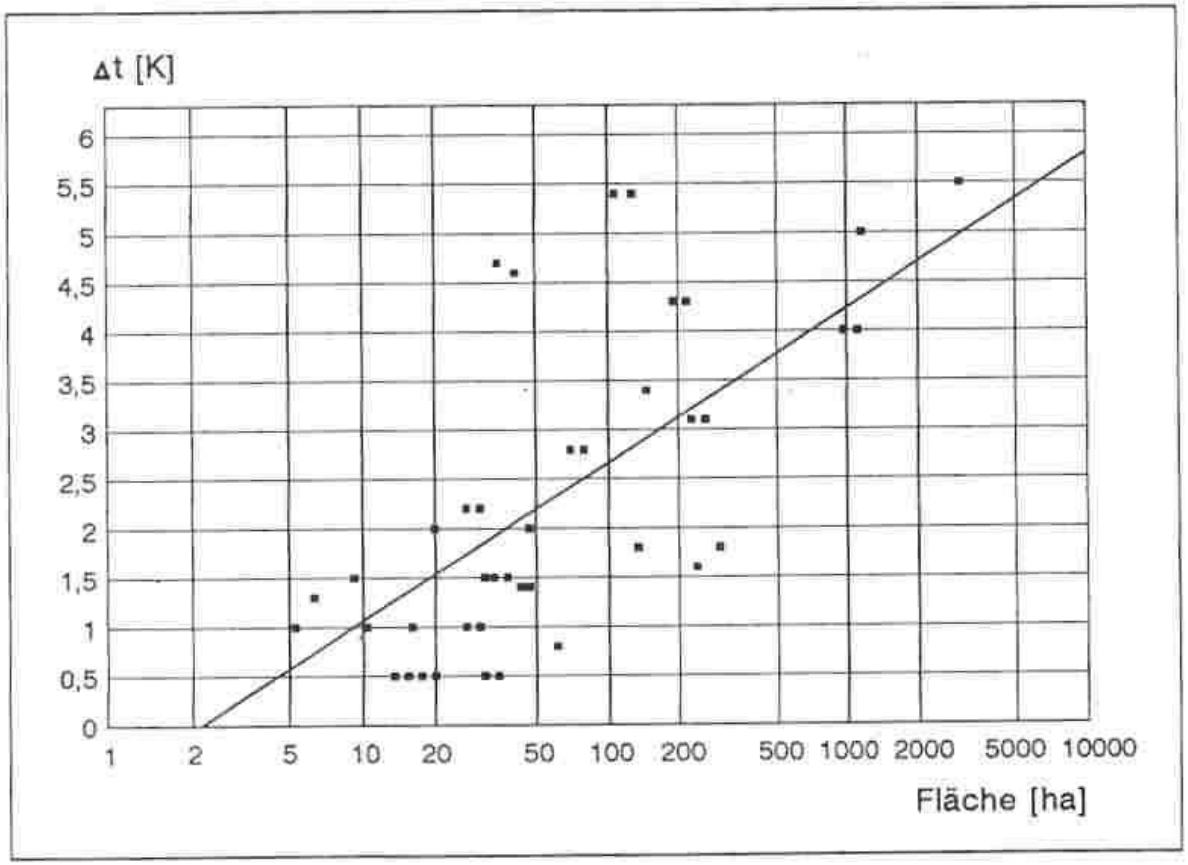
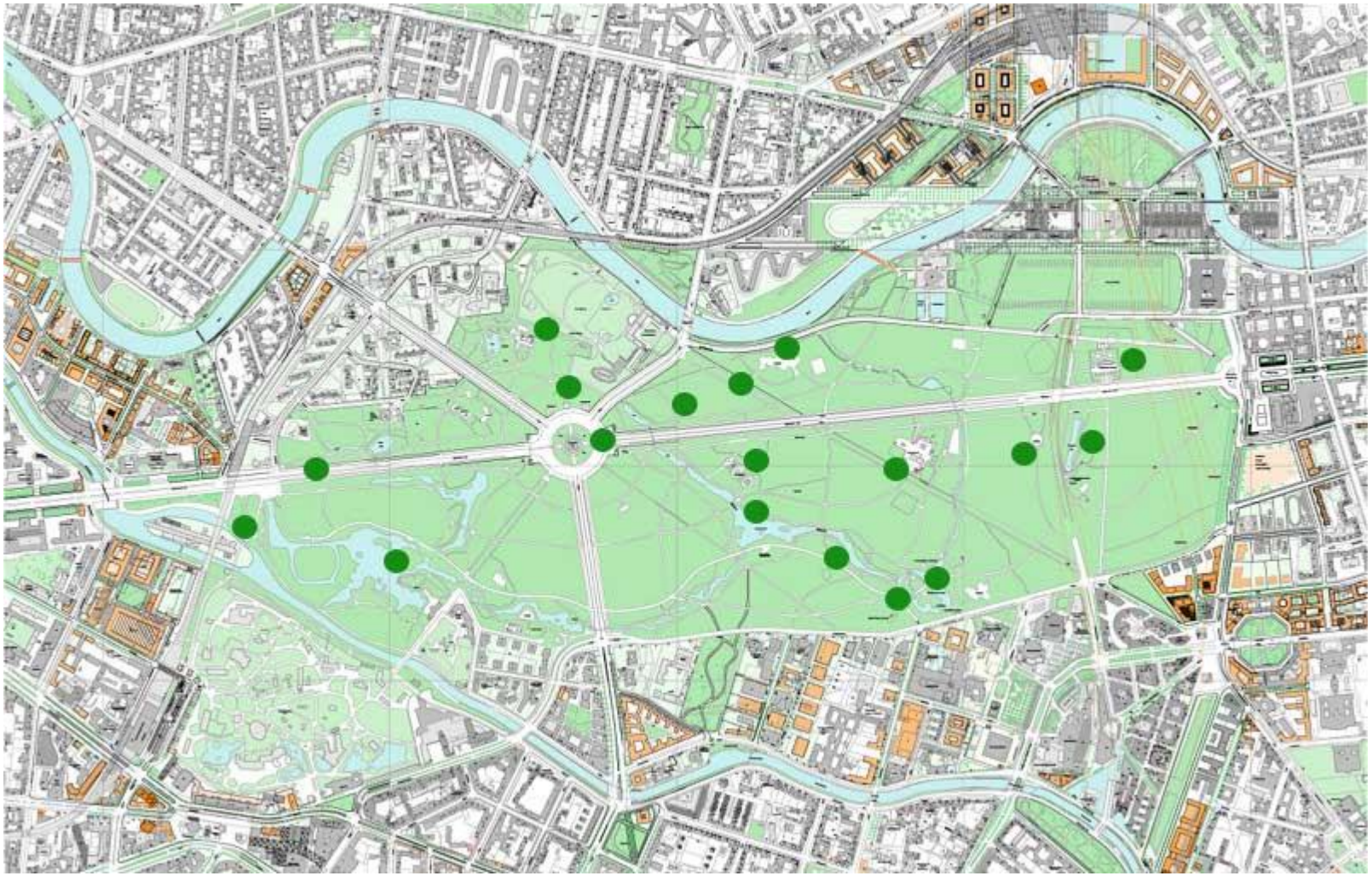


Abb. 6-21: Temperaturdifferenzen (Δt) verschiedener Berliner Grünanlagen zu ihrer Umgebung in Abhängigkeit von ihrer Größe in einer mäßig austauscharmen Strahlungsnacht (9. 07. 1982, 23.00 h MEZ) bei NE- bis E-Wind (nach v. Stülpnagel 1987).

Tiergartenpark (Berlin), surface 210 ha.

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



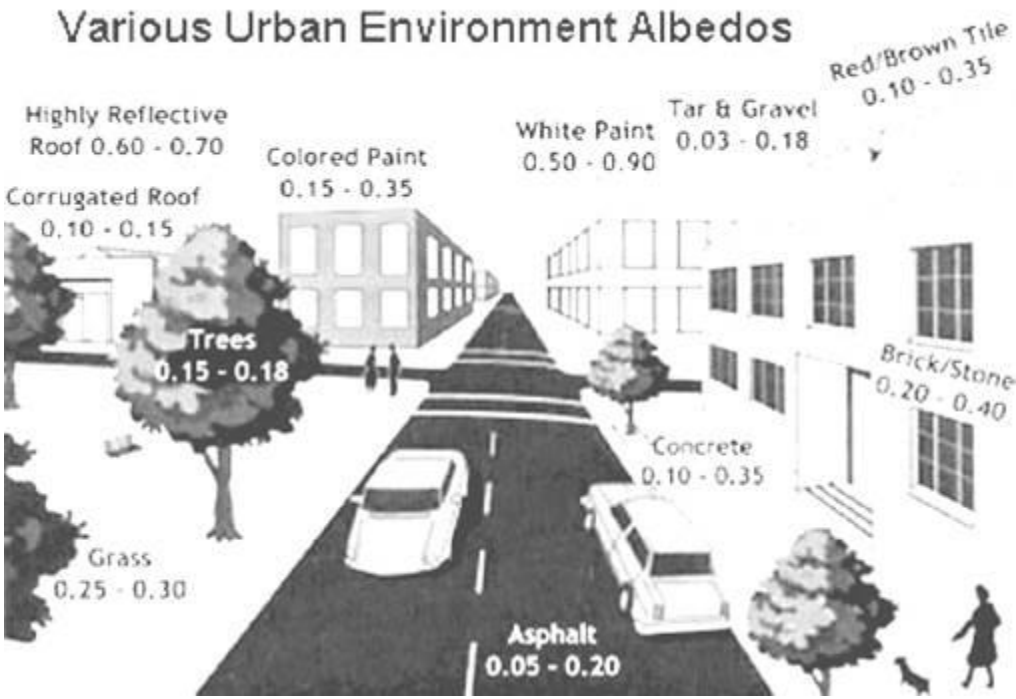
Influence of the Tiergartenpark (Berlin) on temperature

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

from De Blust, 2006.

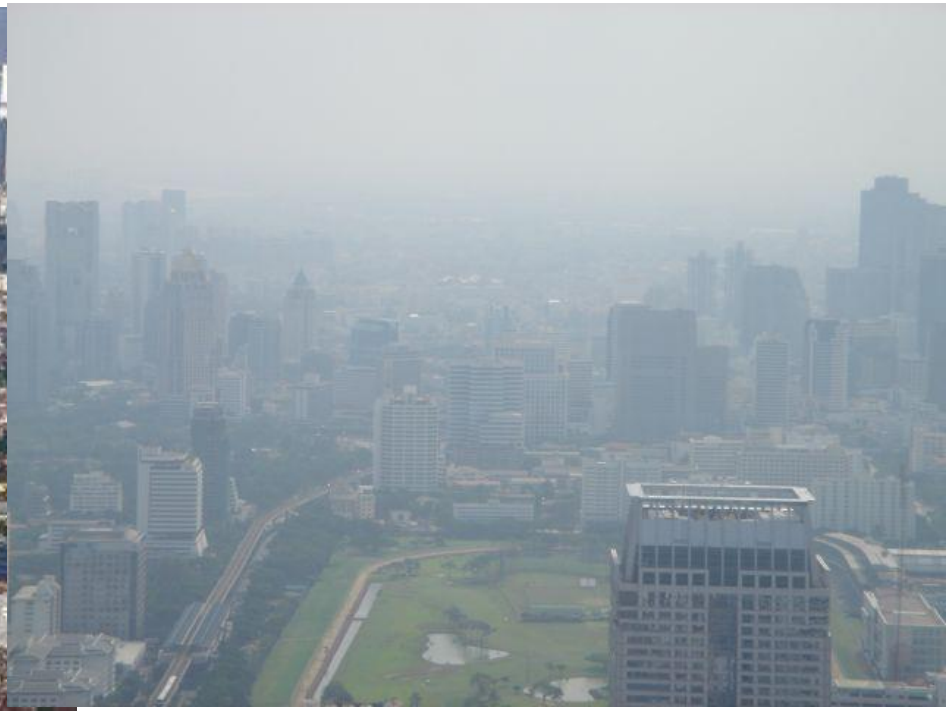
Albedo

The most influential property in the formation of urban heat island is that of albedo. Albedo is defined as the ration between the light reflected from a surface and the total light falling upon a surface. As the picture shows, albedo can range greatly. Clearly, the albedo of vegetation is much greater than that of civil structures, resulting in structures absorbing much more solar radiation than trees and plants.



http://pupclass.blogspot.com/2009/01/urban-heat-island-formation-in-context.html

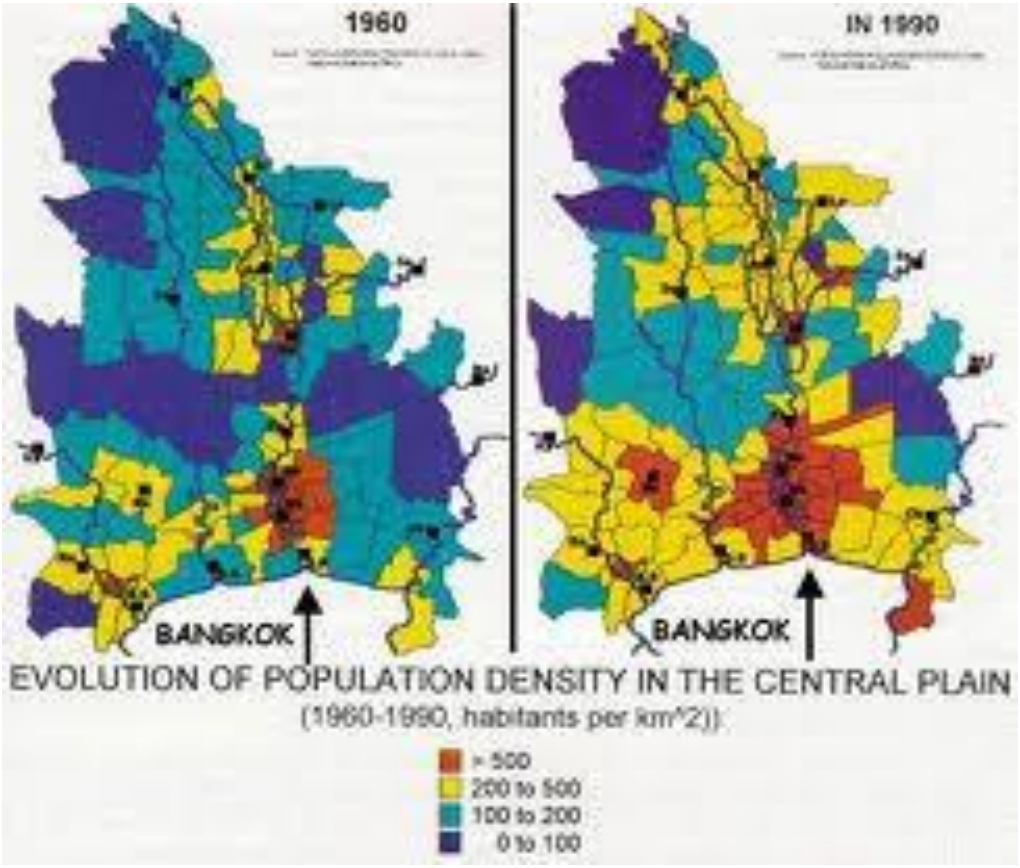
As in so many other concentric growing unplanned cities, also **Bangkok** suffers from these problems: heat island effect and summersmog,



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

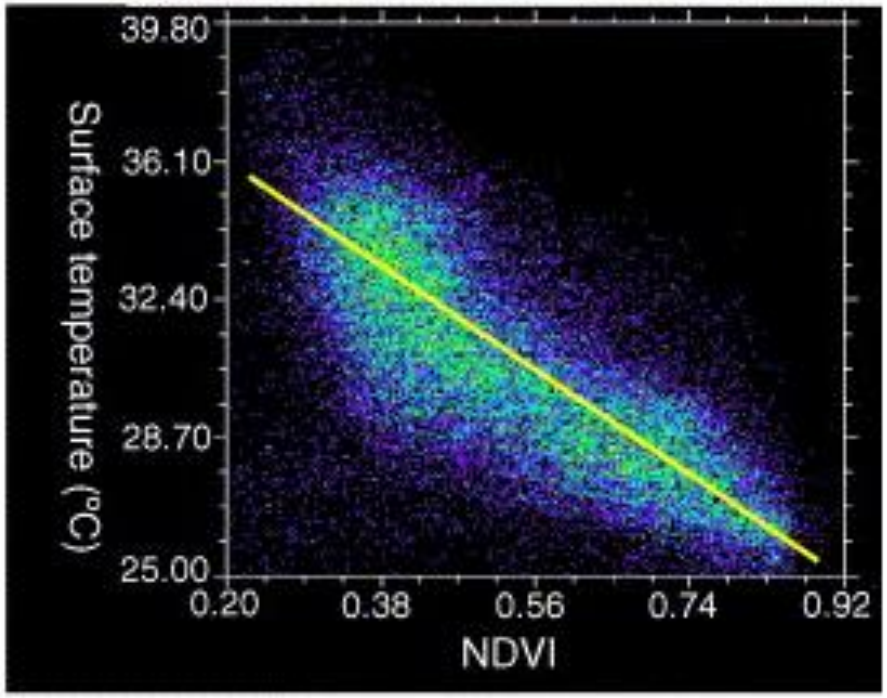
http://www.tkolar.com/travel/Asia/Thailand/Bangkok/Bangkok.html

Bangkok and surroundings 1960's – 1990's

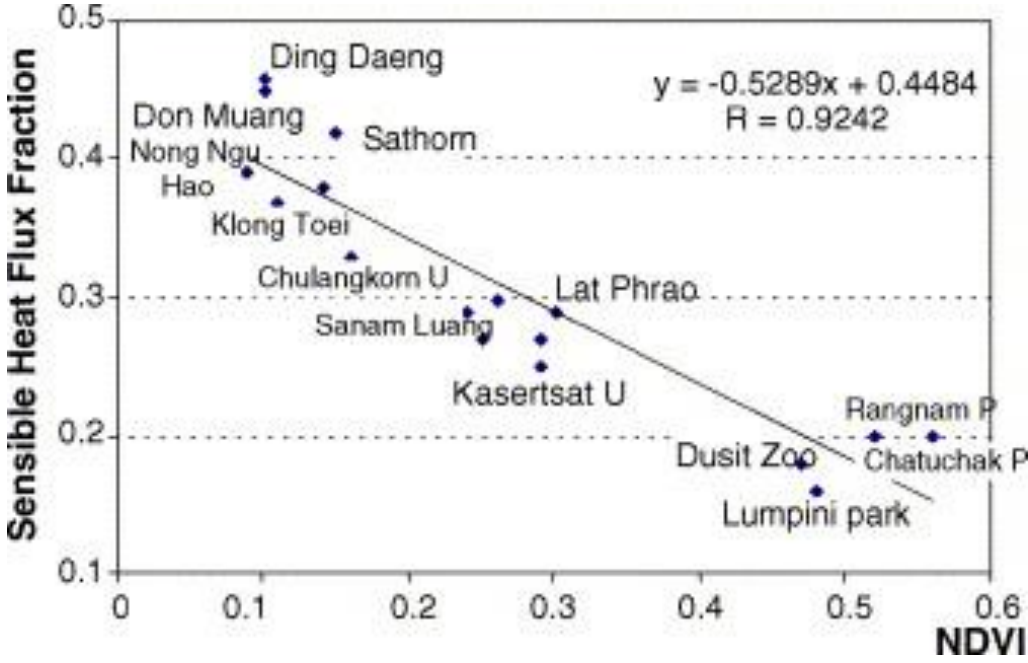


http://www,goodstuff4u.multiply.com

Effects of vegetation: 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

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.

The lobe-city of Houten (50,000 inh., 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.

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

The finger plan of Copenhagen (capital of DK)

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

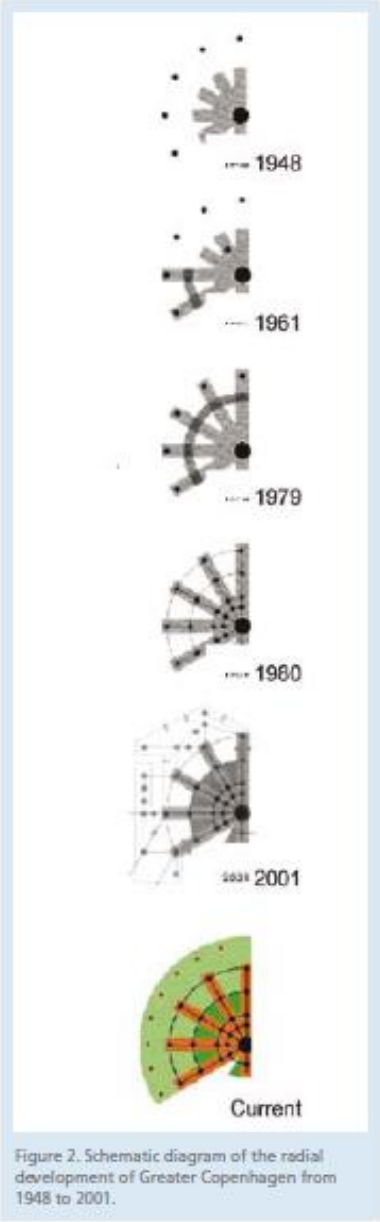


Figure 2. Schematic diagram of the radial development of Greater Copenhagen from 1948 to 2001.

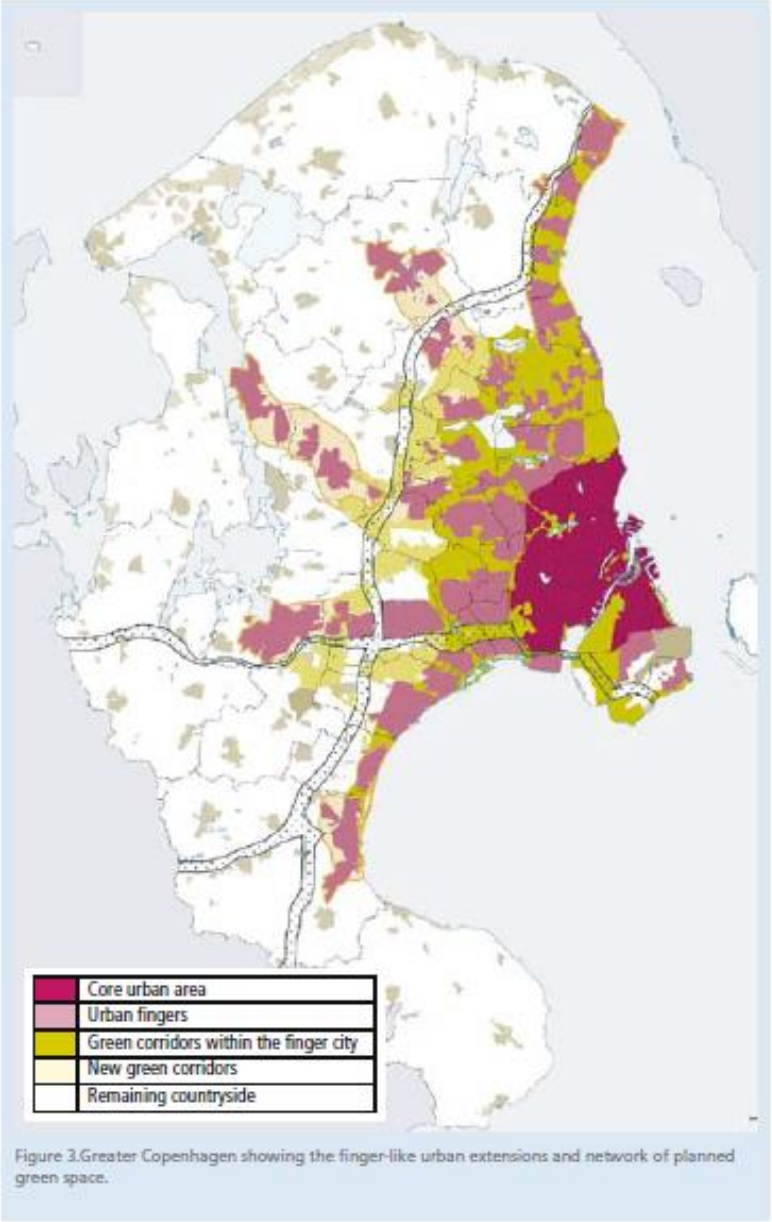


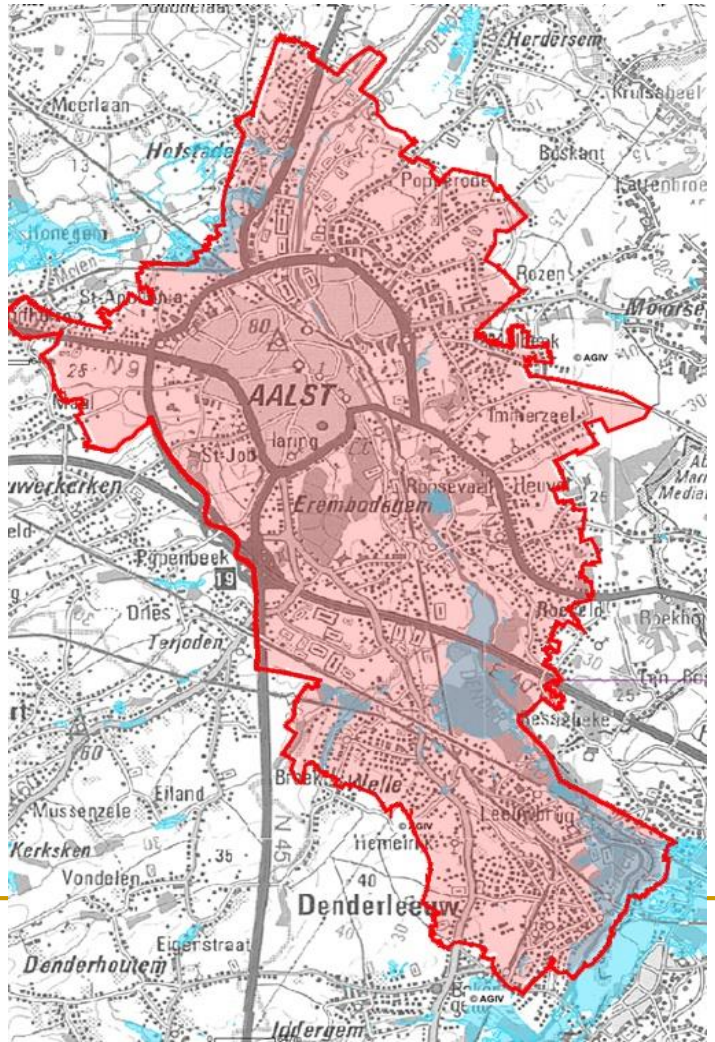
Figure 3.Greater Copenhagen showing the finger-like urban extensions and network of planned green space.

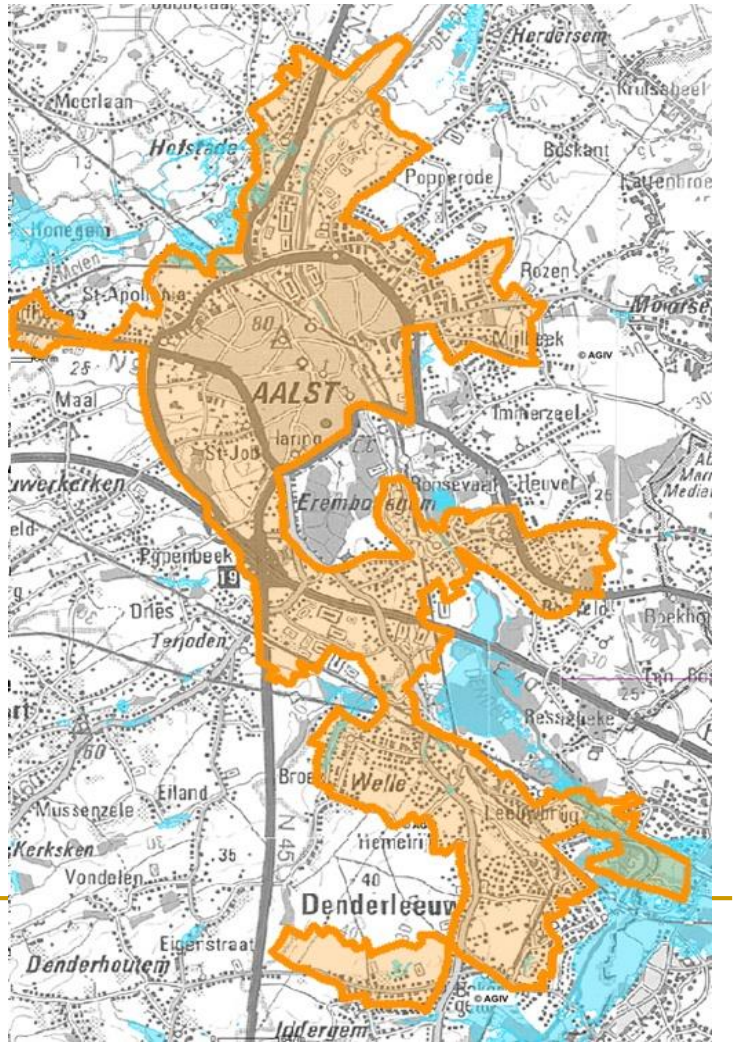
The Finger Plan includes not only the relatively small Municipality of Copenhagen covering the centre part of the city with app. 0.5 mill citizens but in addition take in the Greater Copenhagen Area, and thus also covers 34 adjacent municipalities.

source: UCD, 2008.

More advantages of a lobe-city city expansion: blue-green fingers offer space for flooding

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

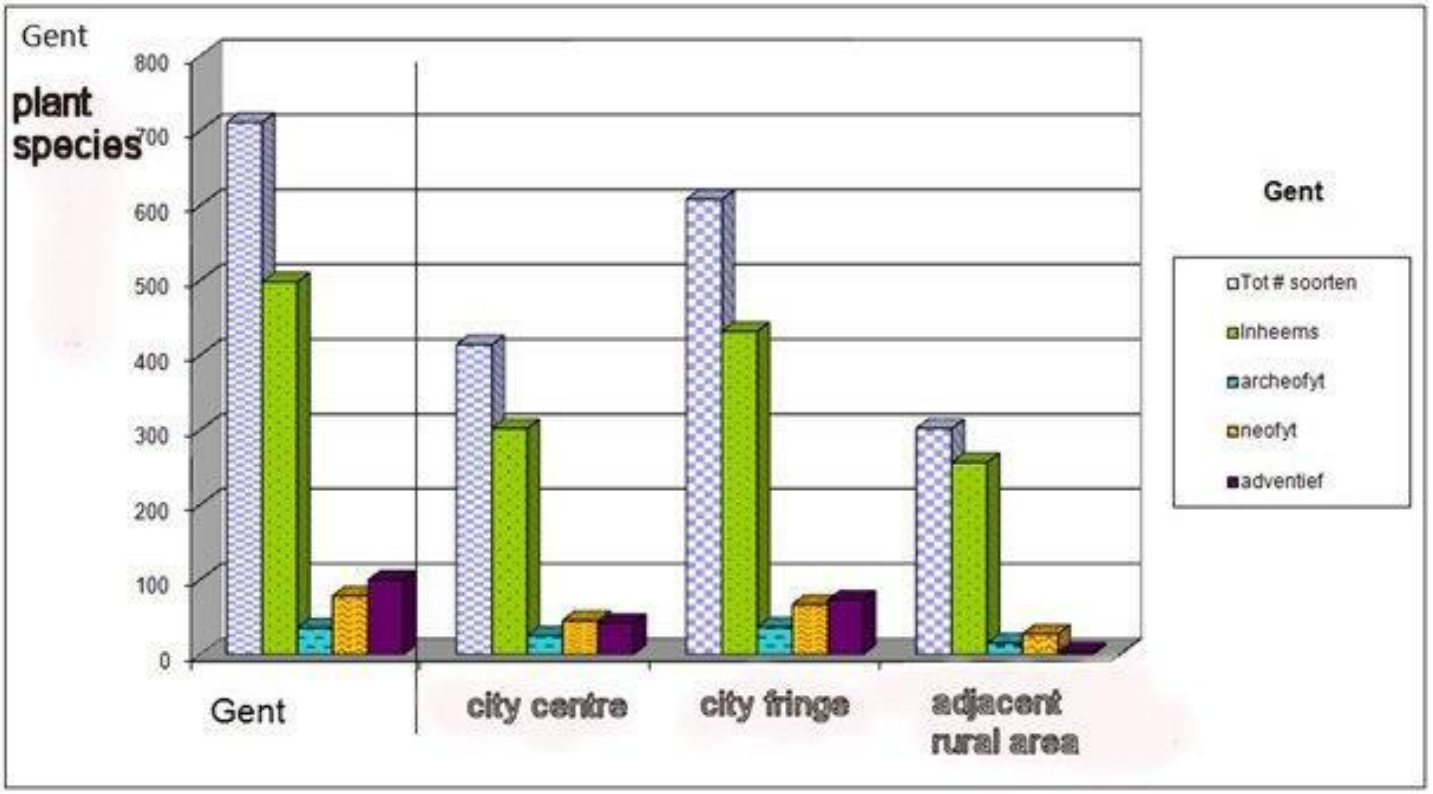




In the blue green fingers a lot of urban functions can get a place : City's and children's farms, cemeteries, sports fields, fit-o-meter, historic fortifications, parks, public gardens etc.

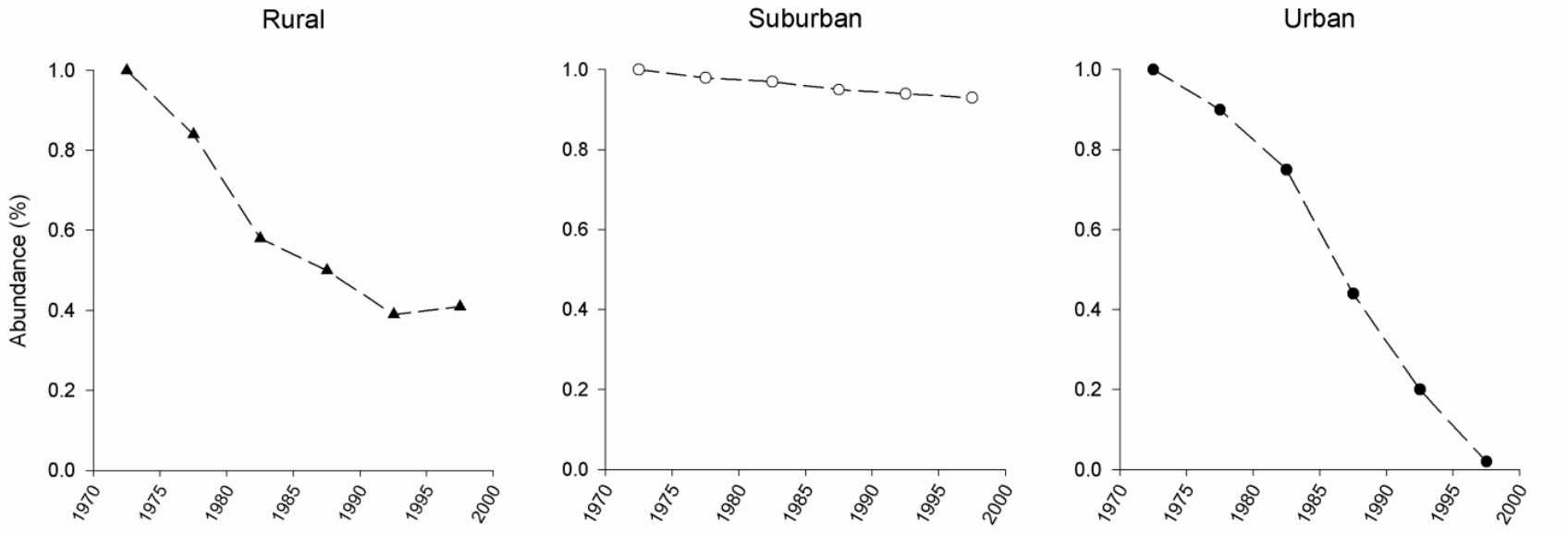
Lobes cities have a long urban edge zone. That is interesting because city fringes often show a greater biodiversity.

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



From Hermy, et al. 2005

Population trend of the house sparrow *(Passer domesticus)* (1970-2000) in Gent (B).



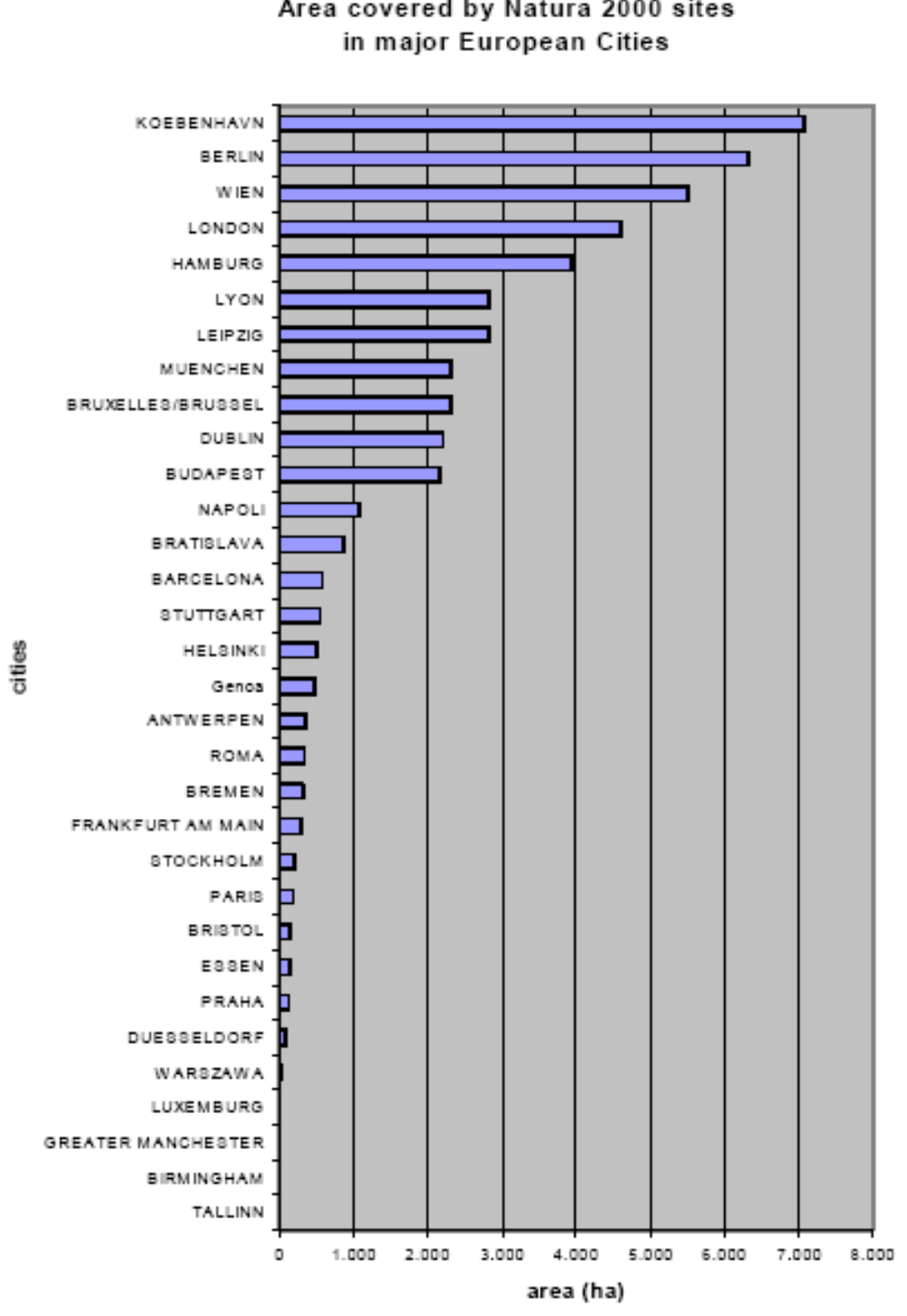
Also here is a strong population decrease in the stony inner cities (urban) and in the intensive agriculture areas (rural). Only in the suburban cityfringe of Ghent, populations of the house sparrow are relatively stable.
(DE LAET, 2007 in VANGESTEL, 2011).

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

As a consequence urban biodiversity in lobe-cities is striking large: Copenhagen, Berlin, …

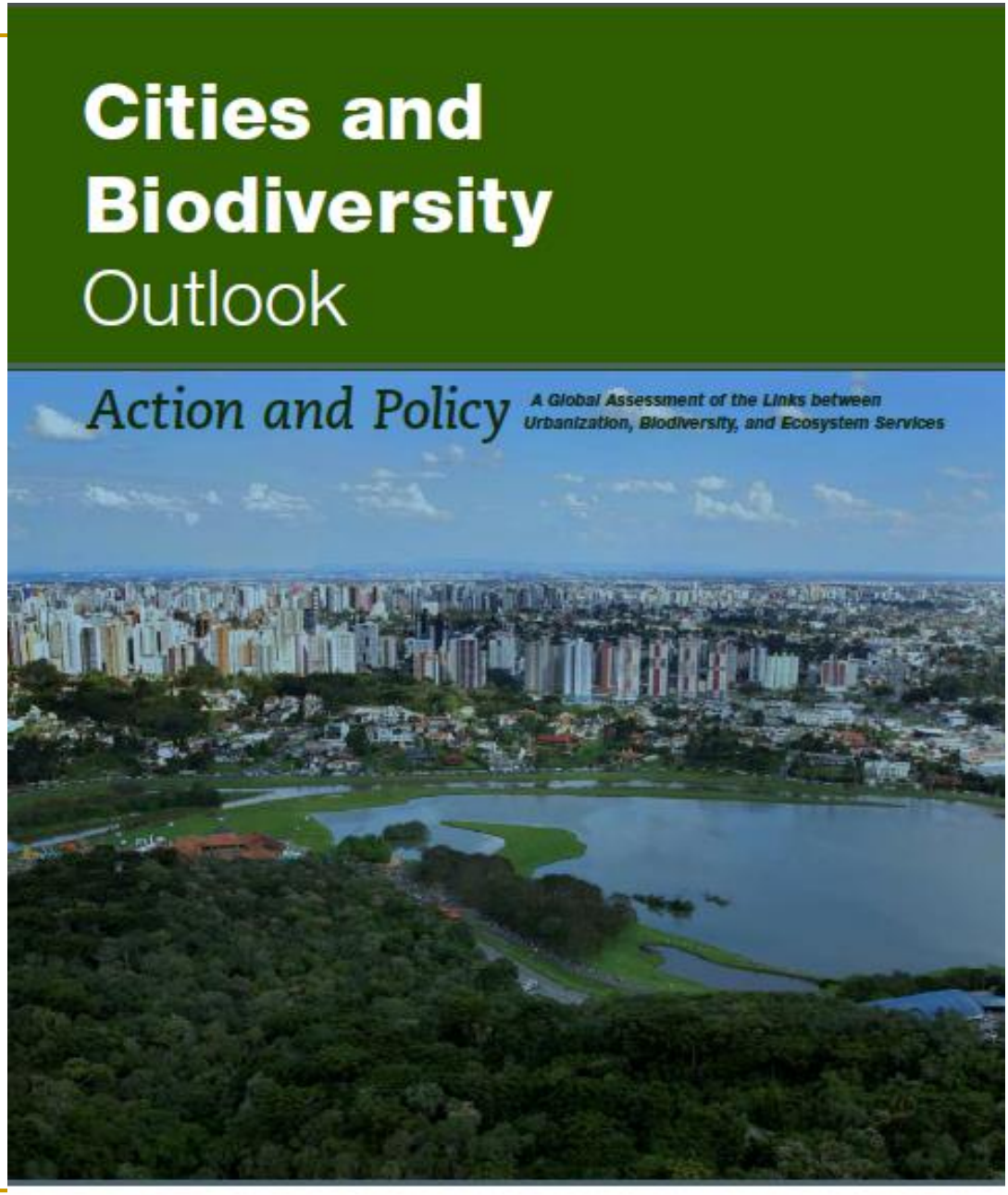
That's because lobe-cities have a longer city fringe than concentric expanding cities have.

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)



Cities and biodiversity

- The full text of Cities and Biodiversity Outlook is available online at www.cbd.int/en/subnational/partners-and-initiatives/cbo.
- Cities and Biodiversity Outlook was supported by the Government of Japan through the Japan Biodiversity Fund, by the European Union and several national research councils in Europe through BiodivERsA, and by SIDA through The Resilience and Development Program—SwedBio.



Convention on Biological Diversity
Stockholm Resilience Centre
Stockholm University
ICLEI Local Governments for Sustainability

Tropical and subtropical wildlife versus urban blue-green fingers

- Of course there is a need for more research to look carefully whether blue-green wedges close to dwellings in tropical and subtropical regions always are safe in terms of wildlife.
- One can imagine citizens in south Asia, Africa or south America being anxious living too close to dangerous wildlife.
- The European situation is quite different, for dangerous animals for example are rarely living close to cities.
- Further social and biological research on this topic is urgently needed.

Base the design principles on the following scientific basic laws and guidelines from **ecology science.**

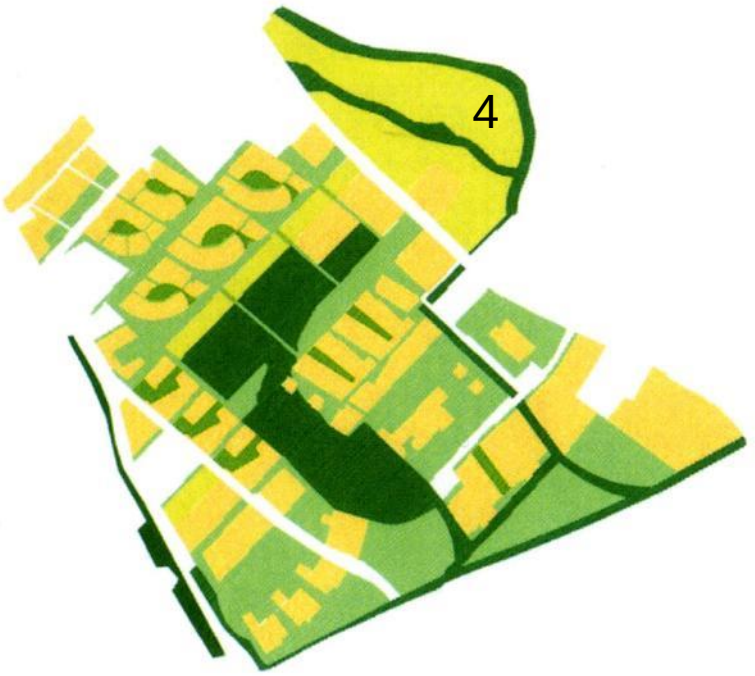
- 1. Abiotic conditions are dominant over biotic conditions. Plants and animals need the right abiotic environment, but also human activities depend on appropriate abiotic conditions. (SCHROEVERS, 1982).
- 2. Abiotic conditions: weak or dominant ? Sustainable gentle gradients provide a wide variety of organisms (blurred borders). (VAN LEEUWEN, 1966b).
- 3.Time is dominating over space, Process (time) is the cause; pattern (space) is the consequence. (Relation theory, VAN LEEUWEN, 1966)
- 4. Design blue green infrastructure, connecting corridors and stepping stones as much as possible within (urban) landscapes and avoid creating borders, fences and obstructions. (Island theory, MC ARTHUR & WILSON, 1967).
- 5. Consider cities as ecosystems and approach them with the tools and insights from ecology science. (BREUSTE ET AL., 2008). Designing a well-thought public-private gradient within a lobe-city framework is a key success factor towards an increasing contribution of urban green and gardens to typical local biodiversity. That is because such a gradient contributes to increasing horizontal ecological relations and connectivity between isolated blue-green urban islands. (ROMBAUT, 2008, 2011).

(5) Designing a well thought **public-private gradient in the green areas** is **a key** towards higher citizens'densities, without quality loss.

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.

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)

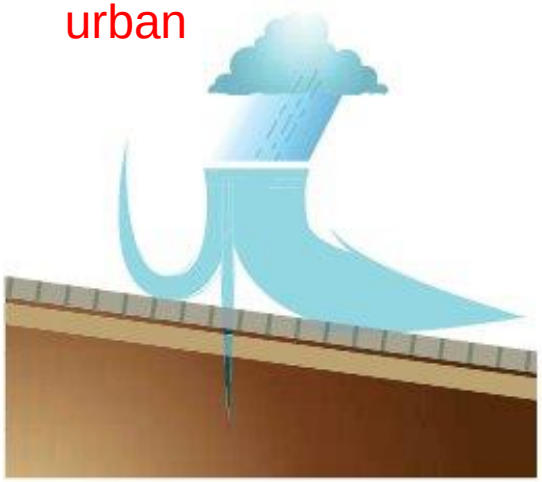
Copenhagen (DK)

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

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

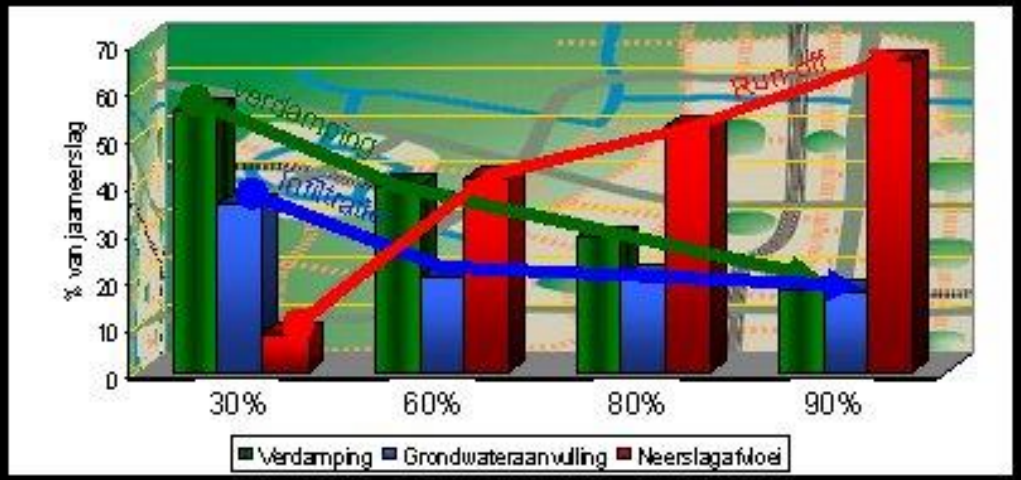
rural

urban



Probleemstelling

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



10-50% (30%) (matig); eengezinswoningen met kl.tuinen, zijwoningen
45-75% (60%) (gemid); woningblokken in buitenwijken
70-90% (80%) (steil); stedelijke woonblokken, industriegebouwen
85-100% (90%) (zeer steil); woonblokken in stadscentra, dense industrieterreinen

Afd. Bos, Natuur en Landschap

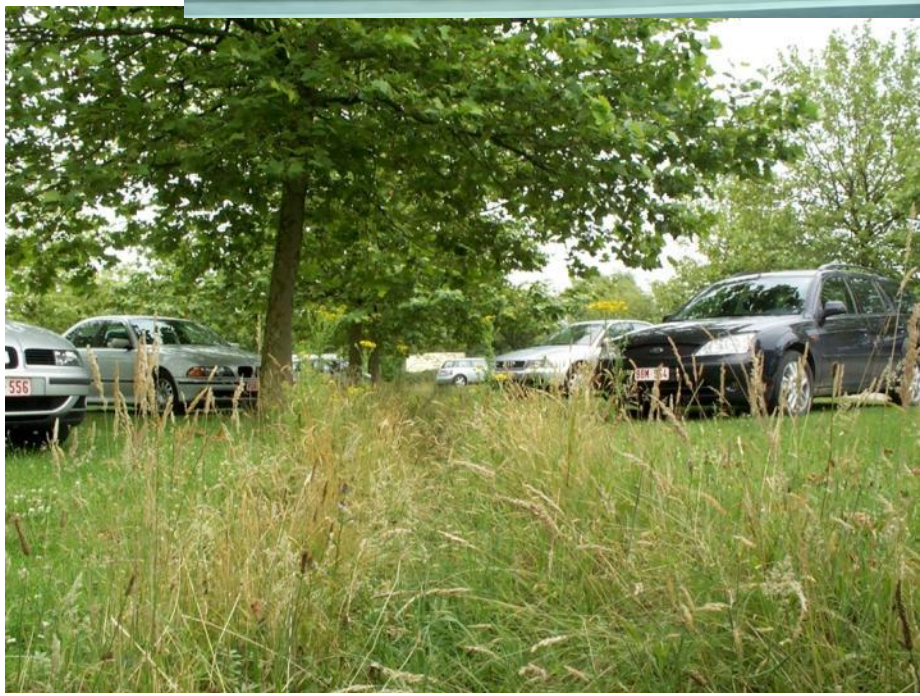
Bad examples: non-permeable seal. Additionally, the parking areas significantly contribute to the **urban heat island effect.**

Sint-Gillis Waas (B).

New parking areas for super markets GB en Aldi.

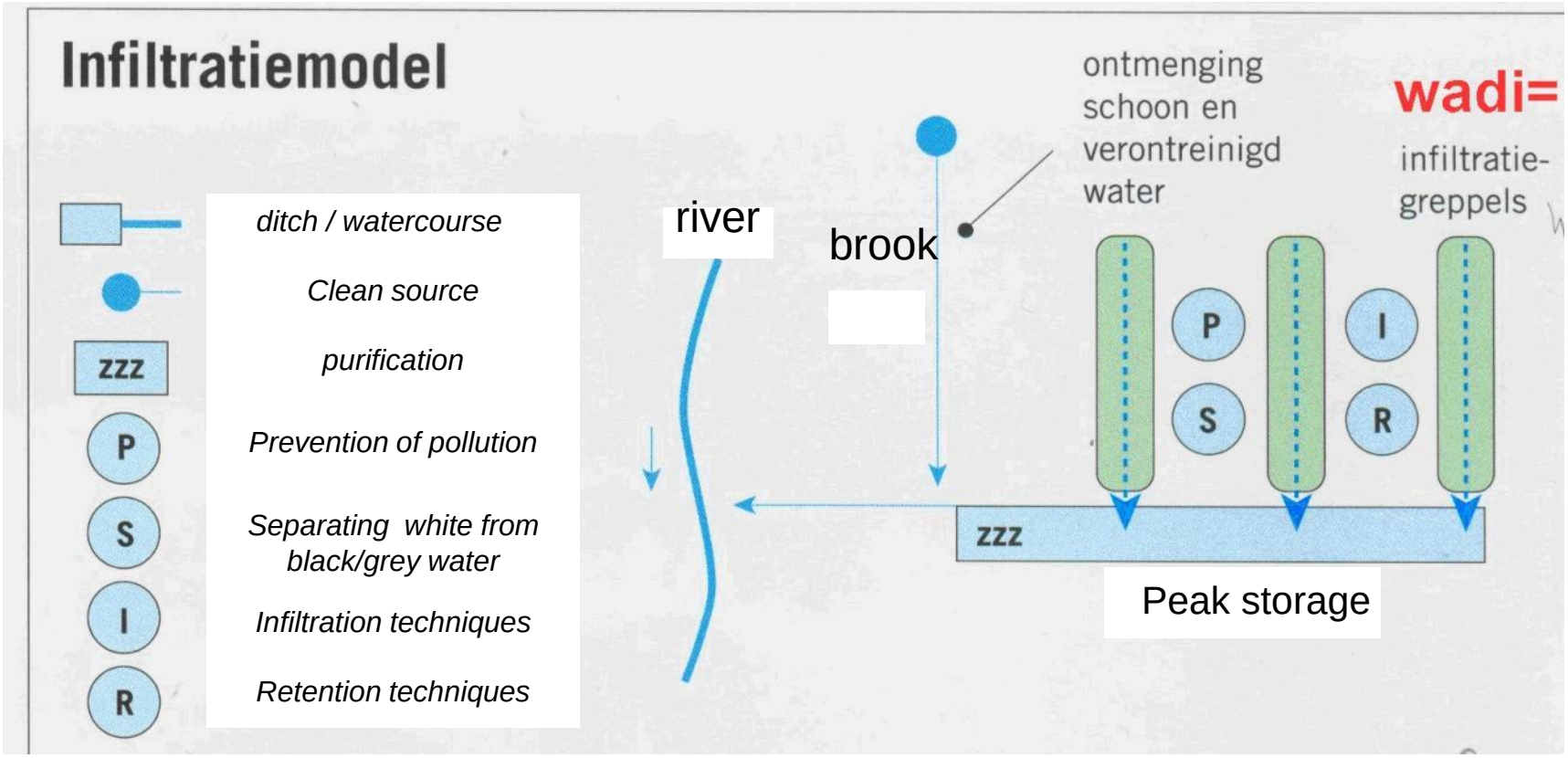
Good examples: permeable parkings.

Mechelen (B). Parking
Planckendael (Muizen)



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

THE INFILTRATION MODEL is a guideline for residential areas. Do not discharge rainwater in sewage systems. The aim is **retention** and **infiltration** of clear rainwater in urban areas. This is also important for the creation of wet conditions for plants and animals, while the groundwater level in urban areas often is very low.

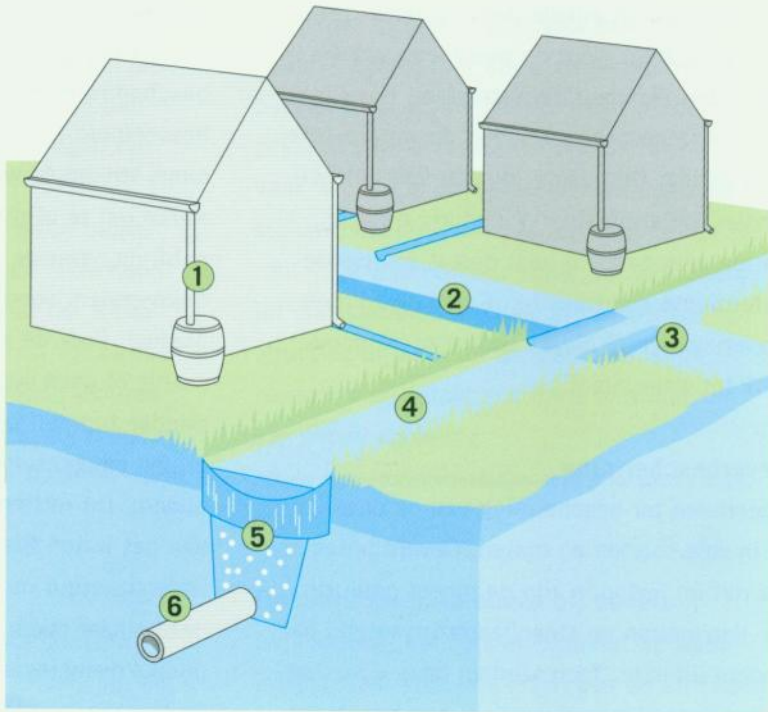


STOWA. STICHTING TOEGEPAST ONDERZOEK WATERBEHEER. 2001. Levende stadswateren: werken aan water in de stad. STOWA, ill. ISBN 90 5773 096 3. www.stowa.nl

WADI technique.

Werking van een wadi

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



WADI: a natural regulation of rainwater

Enschede (NL): eco quarters

Oikos and Ruwenbosch

Enschede (NL): eco quarters

Oikos and Ruwenbosch

‘SLOKOP’

The ‘slokop’ is connected with the sewage system and prevents flooding.

Wadi's in the eco quarters !

Culemborg (NL)

Malmö (S)

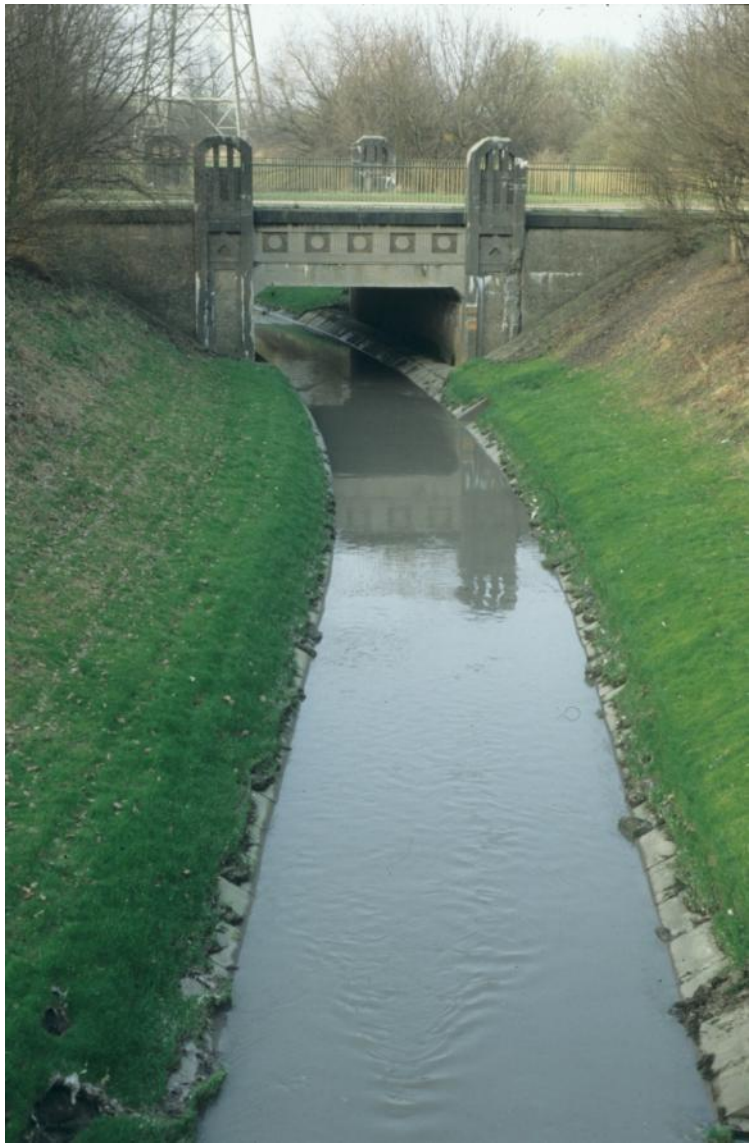
Malmö (Sweden): ecoquarter *Västra Hamnen (western Harbour)*

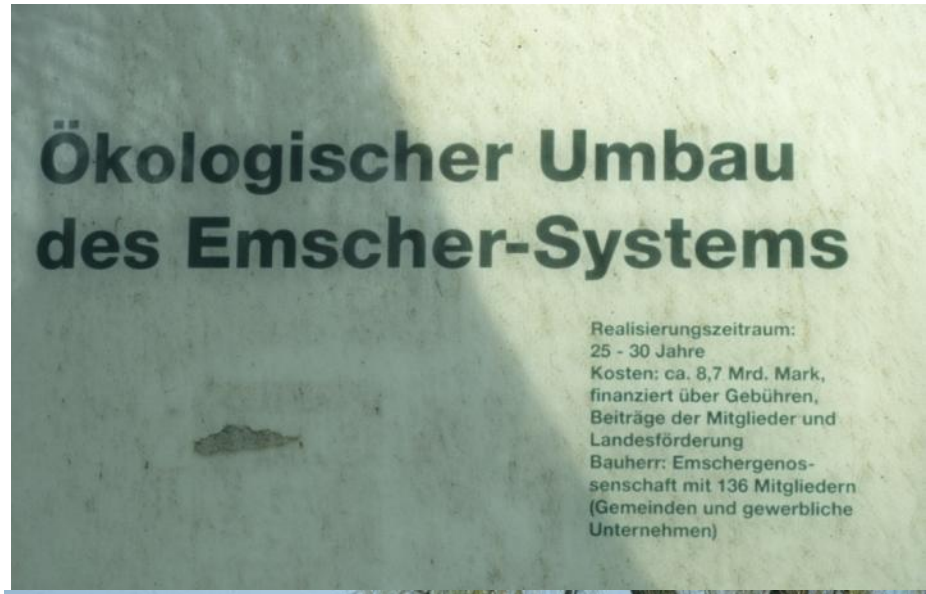
Infiltration zone in Gelsenkirchen (D).

Infiltration zone in the ecoquarter *Kuppersbusch.*

Gelsenkirchen (D) eco quarter *Schüngelberg.*

Germany: Ruhr area





Before and…

…after ‘re-naturierung’

Add to all this measures at the level of the building: Green façades and green roofs can also strengthen connectivity in the stony town centres.

Paris (F): Quai Branly

Green wall in Thailand (Pak Chong) in the All Green Learning Center (AGLC),

http://www.allgreenleaningcenter.org

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

Eidfjord (N). Hardangervidda national park

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

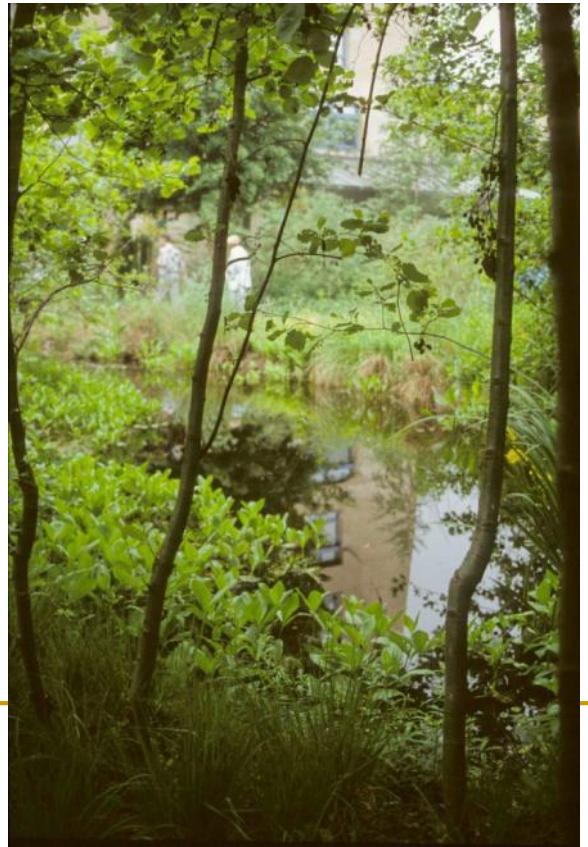
Boxtel (NL). De Kleine Aarde

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

Westerlo (B). Kamp C

Hovden (N): water neutral ecoquarter.

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



Water neutral retirement home (Pelgromshof Zevenaar ,NL)

Green roof and infiltration pond.

View from inside a room

Base the design principles on the following scientific basic laws and guidelines from **ecology science.**

- 1. Abiotic conditions are dominant over biotic conditions. Plants and animals need the right abiotic environment, but also human activities depend on appropriate abiotic conditions. (SCHROEVERS, 1982).
- 2. Abiotic conditions: weak or dominant ? Sustainable gentle gradients provide a wide variety of organisms (blurred borders). (VAN LEEUWEN, 1966b).
- 3.Time is dominating over space, Process (time) is the cause; pattern (space) is the consequence. (Relation theory, VAN LEEUWEN, 1966)
- 4. Design blue green infrastructure, connecting corridors and stepping stones as much as possible within (urban) landscapes and avoid creating borders, fences and obstructions. (Island theory, MC ARTHUR & WILSON, 1967).
- 5. Consider cities as ecosystems and approach them with the tools and insights from ecology science. (BREUSTE ET AL., 2008). Designing a well-thought public-private gradient within a lobe-city framework is a key success factor towards an increasing contribution of urban green and gardens to typical local biodiversity. That is because such a gradient contributes to increasing horizontal ecological relations and connectivity between isolated blue-green urban islands. (ROMBAUT, 2008, 2011).

CONCLUSION: Municipal gardens and urban green could mean a very important contribution for the local biodiversity in urban areas if …

- …If the important **basic laws from the ecology** science are respected and applied. We discussed 5 of themin this presentation.
- …If they are connected through a **well-designed public-private gradient** in a blue green network, within the framework of a lobe-city.
- …If **ecologically sound green management** is deployed with the aim of achieving, restoring and maintaining a biodivers pattern.