LIVING WITH LIFE

in ecotope city
Prof.dr.ir. Taeke M. de Jong, 2002-11-07

1 INTRODUCTION

There are two environmental problems only: the decline of biodiversity and bad human health.
All other environmental problem definitions could be derived from this statement.
Depending on the definition of health[a] I estimate that roughly 80% of the human population is unhealthy, while some 100 000 species are lost since Linnaeus. The extinction rate is estimated 1000 per year now; the growth in evolution as 1 successful species per year. There are many estimates on biodiversity described much better than I can do by Van Zoest (1998).[b] We know some 1.7 million well-described species but much more are unknown. Though we now know the genome of some, we do not know yet how they work let alone we know their mutual relations. Even how our own species works is nearly completely unknown to us, though we already studied 3000 years on this topic. Having some success in medicine, we seldom understand exactly why. Compared with the combinatory explosion of unanswered questions we understand almost nothing. Possible principals punish researchers admitting that honestly and modestly. Mythmakers win. However, myths may be useful for survival.

Nevertheless, every state bears its own responsibility in this multitude of species like a modern Noach. Though The Netherlands occupies less than 0.01% of the earth's surface it entails approximately 35000 (2%) of the earth's number of known species. Our responsibility is proportional to their global, continental (blue list), national (red list) or local rareness.
The concept of rareness and thus responsibility is scale-sensitive.

There are positive and negative relations between human health and biodiversity. The impact of biodiversity on human health is unknown. Perhaps a small organism in some square kilometres of the remaining rainforests is on the long term a necessary condition for our life by producing tiny quantities of chemical compounds conditioning processes in our body and mind as catalysts, but we do not know. How to calculate the risk of loosing them?
The reverse impact of human health and growth on biodiversity is better known but not certain.

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[a] Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. Preamble to the Constitution of the World Health Organization as adopted by the International Health Conference, New York, 19-22 June 1946; signed on 22 July 1946 by the representatives of 61 States (Official Records of the World Health Organization, no. 2, p. 100) and entered into force on 7 April 1948. The Definition has not been amended since 1948. See http://www.who.int/about/definition/en/
[b] (Zoest 1989)

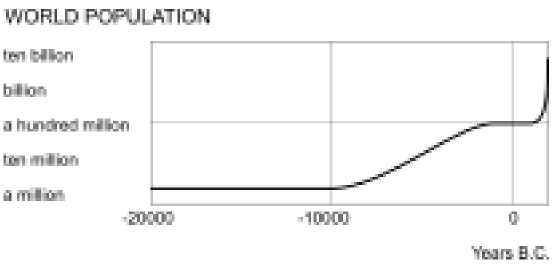


Figure 1 Estimated growth of world population

Health is a scale dependent concept in time. Though world population is not healthy on an individual level, in the long term we are a healthy species growing in numbers exponentially ousting other species, living twice as long as some centuries ago.
And we are not only expanding in number. Per person we need more and more living space in our homes and neighbourhoods. In a wider context we reduced the space we need for agriculture reducing biodiversity in rural areas at the same time.

However, the *intensity* of urban use in The Netherlands some 20 years ago was highest in shops (135 hours/m^2year). After shops came offices, social-cultural facilities, schools, home and garden (48 hours/m^2year).[a] The other hours of the year (counting 8760 hours) in the urban surface may be available for other species depending on the conditions we leave them by design and use (distinguished by time scale). Some species accept or even welcome our presence like that in step vegetation (for example greater plantain, rats, mosquito's, sparrows). Could we welcome more rare species in our towns by creating ecological conditions[b], ecotope cities? How does it interfere with our health?

2 THE IMPORTANCE OF DIVERSITY FOR LIFE

Diversity is a risk-cover for life[c]. In the diversity of life there was always a species to survive or within a species a specimen that survived. Survival of the fittest presupposes diversity from which can be 'chosen' in changed circumstances. Diminishing biodiversity means undermining the resistance against catastrophes. From the 1.7 million species we know, we probably lost some 100 000. So, we not only introduce ecological disasters, but we also undermine the resistance of life against these disasters.

[a] (Jong 1985)
[b] (Tjallingii 1996)
[c] (Londo 1997)

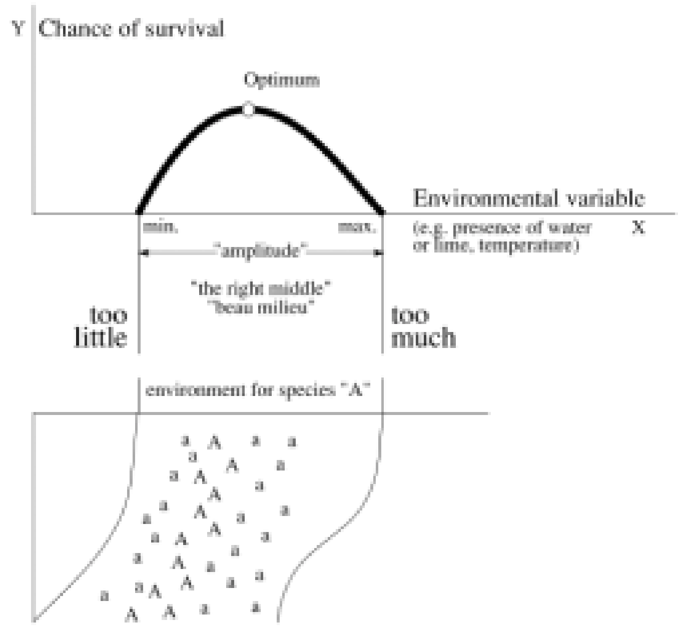


Figure 2 Ecological tolerance in theory and reality.

The curve of *ecological tolerance* relates the chance of survival of a species or ecosystem to any environmental variable, for instance the presence of water. In that special case survival runs between drying out and drowning (*Figure 2*).

Imagine the bottom picture as a slope from high and dry to low and wet. Species A will survive best in its optimum. Therefore we see flourishing specimens on the optimum line of moisture (A). Higher or lower there are marginally growing specimens (a). The marginal specimens however are important for survival of the species as a whole. Suppose for instance long-lasting showers: the lower, too wet standing marginal specimens die, the flourishing specimens become marginal, but the high and dry standing specimens start to flourish! Long-lasting dry weather results in the same in a reversed sense.

Levelling the surface and water-supply for agricultural purposes in favour of one useful species means loss of other species and increased risk for the remaining species.

But there is a less friendly ecological lesson hidden within this scheme. Marginal specimens are important for survival of the species as a whole. A reservoir of unhealthy specimens favours species. Death regulates life. Health is also spatially scale-sensitive.

3 THE IMPORTANCE OF DIVERSITY FOR HUMAN LIVING

Biodiversity in mankind is a crucial value in our quality of life. As we are here we are all different and the very last comfort you can give a depressed person is 'But you are unique'. Medicine hardly discovered that evaluating medicines[a]. It hinders generalizing science using concepts as average and standard deviation. Ecology[b], organization theory[c] and design study[d] are aware of that difficulty. Evolutionary ecology is only comprehensible considering exceptions outside the limits of a normal test population (3*standard deviation)[e].

Diversity is also a precondition for trade and communication. If production and consumption would be the same everywhere, there would be no economical life. If we would have all the same perceptions and ideas, there would be no communication. It is an important misconception to believe that communication only helps *bridging* differences. Communication also *produces* diversity by compensating each other and coordinating behaviour by specialization.

Brundtland[f] summarizes the environmental challenge by stating sustainability as leaving next generations at least as much possibilities as we found ourselves. But what are possibilities? 'Possibilities' is not the same as economical supply. If our parents would have left us the same supplies as they found in their childhood, we would be far from satisfied. 'Possibilities' has to do with

[a] (Philp 2001)
[b] (Dieckmann, Law et al. 2000)
[c] (Riemsdijk and NOBO 1999)
[d] (Jong and Voordt 2002)
[e] (Philp 2001)
[f.] (Brundtland 1987)

freedom of choice and thus variety. Our converging Schumpeter-economy[a] and Fukuyama-culture[b] leaves no choice. In our search for the alternative we find everywhere in the world the same hotels, the same dinners, the same language. This century, the last 'primitive' cultures are lost and with them an experience of life that no western language can express. After looking at their dancers in the afternoon on our rain forest holyday we find them back in the disco in the evening.

The most extreme consequence of this levelling out would be a world without economy and even communication. That is the ultimate consequence of local autarky. If there were no longer any differences in production factors, exchanging goods and services would no longer be necessary. If total worldwide distribution of knowledge and consensus would be the result of our communication age, there would no longer be anything worthwhile to communicate. These thought experiments show clearly that 'difference' is also a hidden presupposition in communication and economy. The question remains on what level of scale self-sufficiency is desired: global, continental, national, local?[c]

Quality can be measured in terms of possibilities of use, experience and expectation for future generations. The way design can sustain a sustainable development in the sense of Brundtland is to produce more ‘choices’ for man, animal and plant. If there were one best solution for all problems of architecture and urban planning, it would be the worst in the sense of choices for future generations! This paradox pleads more for diversity than for uniform solutions. Moreover, if there were a uniform solution, the designer would have no task. Quality is always a function of variation.

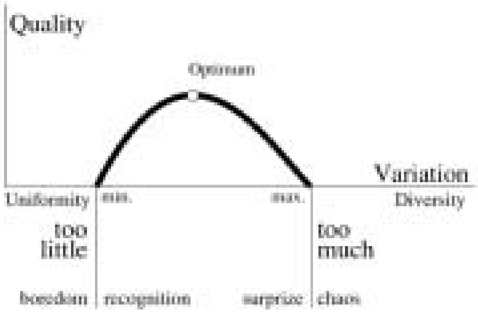


Figure 3 Quality = f(Variation)

Quality of possible experience moves between diversity and uniformity, surprise and recognition. One step too far into both sides brings us in the area of boredom or confusion.

This is a simple conception, already recognized by *Birkhoff*[d] and *Bense*[e], but why did it not succeed, why is quality always posed as an unsolvable question? Because the concept of diversity is scale sensitive and so is our experience. When on one level of scale we experience chaos, in the same time on an other level of scale we could experience boredom.

4 SCALE-SENSITIVE CONCEPTS

As I mentioned in the introduction, rareness, responsibility for rare species and even health are scale sensitive concepts. So is quality. But any discussion on variety and thus variables can fall prey to confusion of scale. That means that even logic and science as forms of communication are prey to a scale paradox. The paradox of *Achilles and the turtle* is a beautiful example of a scale-paradox in time. The turtle says: 'Achilles cannot outrun me when I get a head start, because when he is where I was at the moment he started I'm already further, when he reaches that point I am again further and so on!' This conclusion is only incorrect by changing the time-scale during the reasoning. Russell finds something similar on set theory. *Russell*[f] bans sets containing themselves and reflexive judgements, as 'I lie’. This sentence is not only a object statement, but in the same time a meta-linguistic statement about itself producing a paradox. When I lie I speak the truth and the reverse.

a. (Krupp and Helmar 1995; Krupp 1996)

b. (Fukuyama 1992)

c (Steekelenburg 2001)

d. (Birkhoff 1933)

e. (Bense 1954)

f. (Russell 1919)

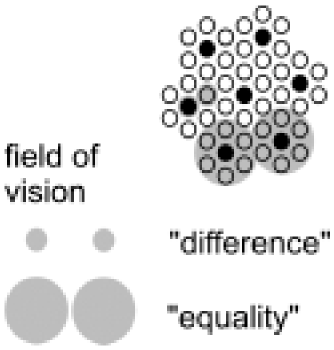


Figure 4 The scale paradox

The *scale paradox* means an important scientific ban on applying conclusions drawn on one level of scale to another without any concern. The picture shows the possibility of changing conclusions on a change of scale by a factor 3. There are 7 decimals between a grain of sand and the earth. That gives approximately 15 possibilities of turning conclusions. Between a molecule and a grain of sand applies the same. This ban is violated so many times, that this should be an important criterion on the validity of scientific judgements.

The scale-paradox is not limited on concepts of diversity. An important example of turning conceptions into their opposite by scale is the duality of aim and means. For the government subsidizing a municipality the subsidy is a means, for the municipality it is an aim. So the conception of means changes in a conception of aim by crossing levels of scale. The turning of '*Zweckbegriff*' into '*Systemrationalität*'[a] may be a turning conception of the same scale-sensitive character. In growing organizations *integration* on the level of the organization as a whole means often *disintegration* of the subsystems and perhaps a new form of integration in the sub-sub-systems. This process is called '*differentiation*'!

In *Figure 4* confusion of scale is already possible by a linear factor 3 difference in level of scale. That is why in spatial planning we articulate orders of size by a factor of approximately 3.

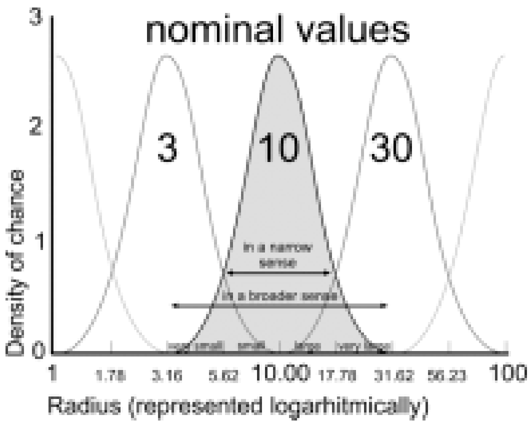


Figure 5 Names and boundaries of urban categories

An element from the nearly logarithmical series {1, 3, 10, 30, 100 …} is the name (nominal value) of an 'elastic' urban category ranging until those of the nearest categories (scale range).
The name giving 'nominal' radius r=10 then is the median of a chance density distribution of the logarithm of radiuses between (rounded off) r=3 and r=30, with a standard deviation of 0.15. We chose a series of radiuses (and not diameters) because an area with a radius of {0.3, 1, 3, 10km} fits well with {neighbourhood, district, quarter, conurbation} or loose {hamlet, village, town, conurbation} in every day parlance.

Then also the system of dry and wet connections could be named in this semi logarithmical sequence according to average mesh widths.

a. (Luhmann 1973)

5 SPATIAL STATE OF DISPERSION AS A CONDITION OF DIVERSITY

Form as a primary object of design presupposes state of dispersion.

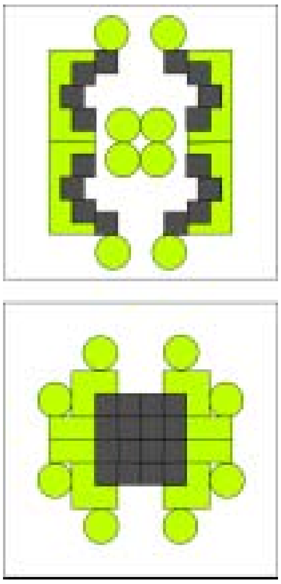


Figure 6 States of dispersion r=100m

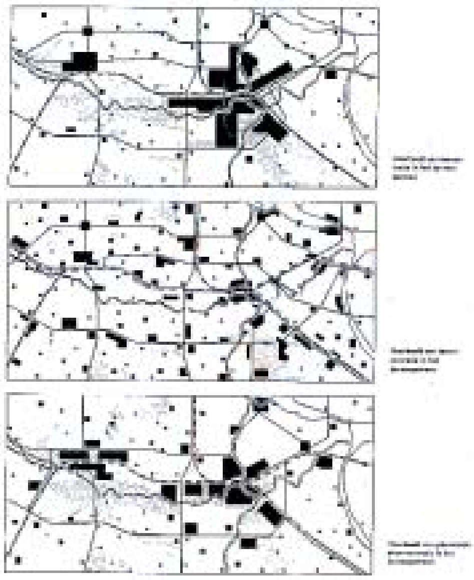


Figure 7 Accumulation, Sprawl, Bundled Deconcentration r=30km[a]

Scale articulation is especially important distinguishing states of dispersion. State of dispersion is not the same as density. Considering the same density different states of dispersion are possible (*Figure 8*) and that is the case on every level of scale again (*Figure 9*).

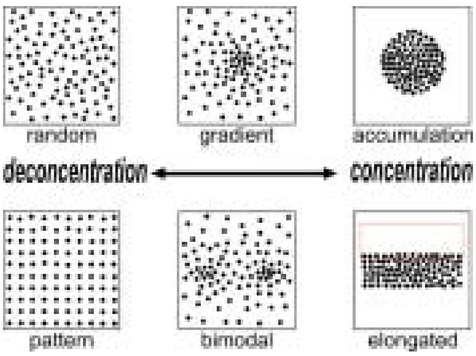


Figure 8 States of dispersion in the same density on one level of scale

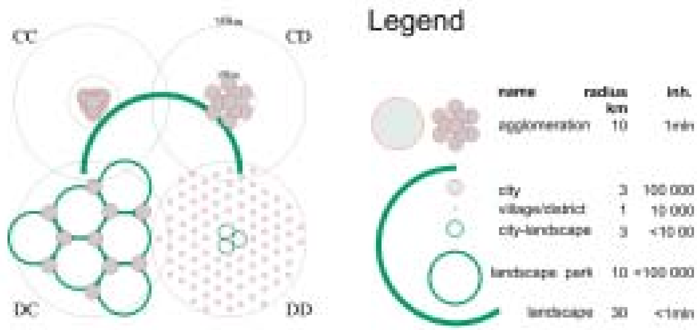


Figure 9 One million people in two states of distribution on two levels of scale (accords CC, CD, DC and DD).

Figure 8 shows the use of the words concentration (C) and deconcentration (D) for processes into states of more or less accumulation respectively. Applied on design strategies in different levels of scale we speak about 'accords' (*Figure 9*).
In Figure 9 the *regional density* is equal in all cases: approx. 300inh./km^2. However, in case CC the built-up area is concentrated on both levels ($C_{30km}C_{10km}$) in a high *conurbation density*: (approx. 6000inh./km^2).
In the case CD people are deconcentrated only within a radius of 10km ($C_{30km}D_{10km}$) into an average conurbation density of approx. 3000 inh./km^2.
In the case $D_{30km}C_{10km}$ the inhabitants are concentrated in towns (concentrations of 3km radius within a radius of 10km), but deconcentrated over the region. The *urban density* remains approx. 3000 inh./km^2.
In the case $D_{30km}D_{10km}$ they are dispersed on both levels.

[a] (Tweede_Nota 1966)

Urban sprawl in a radius of 10km hardly influences the surrounding landscape when the inhabitants are concentrated in a radius of 30 (the two variants above in *Figure 9*).
However, the urban sprawl in a radius of 30km breaks up the surrounding landscape in landscape parks. By that condition the sprawl within a radius of 10km is important again: the landscape parks are broken up further into town landscapes. In The Netherlands until 1983[a] DC was the national strategy ('Bundled deconcentration', 'Gebundelde Deconcentratie'), after 1983[b] the policy changed into CC (Compact town', 'Compacte Stad'), but turned out in practice as CD and even DD.
The result of both strategies was disappointing.

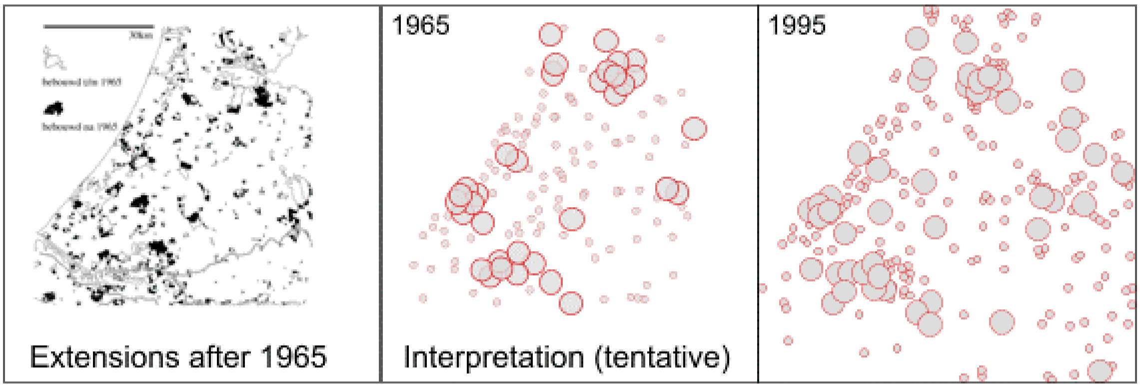


Figure 10 Urban sprawl in Randstad, The Netherlands

In prominent ecology textbooks there are several definitions of ecology emphasising dispersion or with an increasing awareness of scale (in that case we will speak about spatial distribution):

•Andrewartha (1961), cited by Krebs (1994):Ecology is the scientific study of the *distribution and abundance* of organisms.
•Krebs, C.J. (1994)[c]: Ecology is the scientific study of the *interactions* that determine the distribution and abundance of organisms.
•Pianka (1994)[d]: Ecology is the study of the *relationships between organisms* and the totality of the *physical and biological factors* affecting them or influenced by them.
•Begon, Harper and Townsend (1996)[e]: Ecology is the scientific study of the interactions that determine the distribution and abundance of *organisms, populations and communities.*

Kolasa[f] seems to be the only ecologist aware of scale articulation.

[a] (Tweede_Nota 1966)
[b] (Structuurschets 1983)
[c] (Krebs 1994)
[d] (Pianka 1994)
[e] (Begon 1996)
[f] (Kolasa and Pickett 1991)

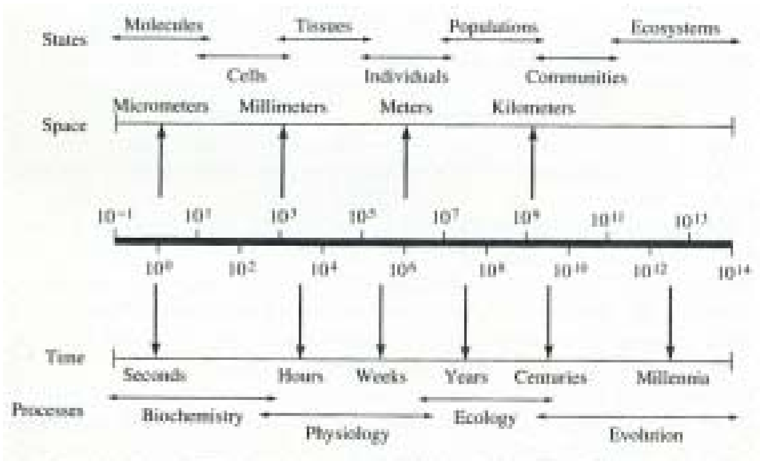


Figure 11 Diagrammatic representation of the time-space scaling of various biological phenomena.

Pianka stresses relationships in a broader sense than spatial relationships, but he adds a scheme stressing scale in space and time. 'Community and ecosystem phenomena occur over longer time spans and more vast areas than suborganismal and organismal-level process and entities. (after Anderson (1986) after Osmund et al.)'

Begon, Harper and Townsend distinguish organisms, populations and communities. That distinction looks like a distinction of scale, but is primarily a distinction between different kinds of ecology:

- autecology concerning populations of one species at a time and
- synecology concerning the community of different species in the same 'biotope'.

On the level of organisms one could speak about 'ecological behaviour' as for instance Grime[a] elaborated as plant species bound 'strategies for survival' like 'competitors', 'ruderals' and 'stress tolerators' as rôles in a play concerned less predictable than communities reaching a well described 'climax'.

6 ECOLOGIES

Besides autecology and synecology we know environmental science emphasising human society and health, cybernetic ecology emphasising space-time relationships, system dynamics ecology stressing abiotic points of departure and chaos ecology stressing unpredictability from minor earlier events. Their approach and terminology differ substantially:

	naming abiotics	**naming biotics**
environmental science	environment	human society
autecology	habitat	population
synecology	biotope	life community
cybernetic ecology	abiotic variation	biotic variation
system dynamics ecology	ecotope	biosphere
chaos ecology	opportunities	individual strategies for survival

Figure 12 Ecologies

The sequence in this summary may reflect a decreasing human centred approach as we ask from urbanists on their way from environmental scientists into designers of biotope cities or even further. In that perspective of urban ecology it is important to understand the differences to avoid debates that paralysed thinking about nature policy in the Netherlands for years.

Mechtild de Jong describes in her thesis[b] the strikingly separated Dutch development of the last four categories in *Figure 12* during the 20th century. The clearest controversy - between the 'holistic-vitalistic' synecology and the 'dynamical' systems ecology - represents a beautiful example of spatial dispersion in one species causing scientific diversity. Synecology primarily developed in the Catholic University of Nijmegen (Westhoff) extending to Wageningen University of Agriculture in the higher

[a] (Grime, Hodgson et al. 1988)
[b] (Jong 2002)

East of The Netherlands while 'dynamic' ecology originated from the National University of Leiden (Baas Becking) in the wet lower West area. The 'cybernetic ecology' originated from my teacher and predecessor in Delft Van Leeuwen commuting between East and West. In his lectures he stressed variation in space running from equality into difference and in time from stability into change.

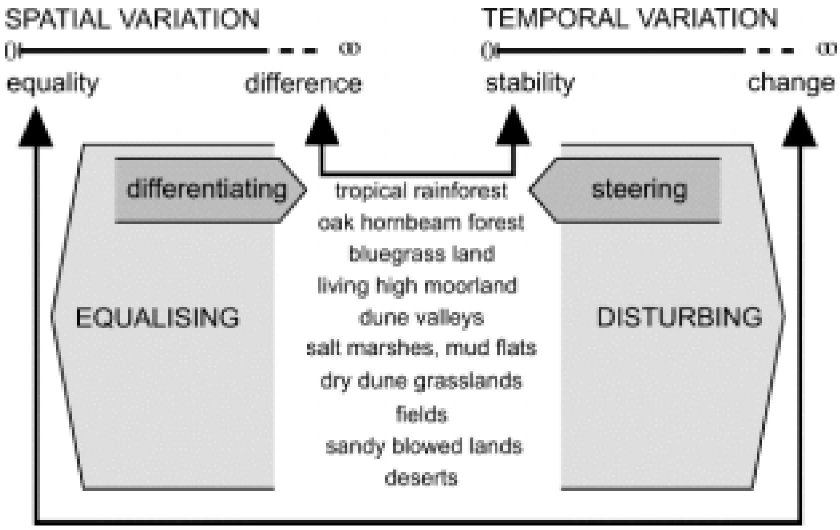


Figure 13 Spatial and temporal variation in the theories of Van Leeuwen[a]

The practical implications of his 'relation theory' made him popular amongst architectural and urban designers in Delft and amongst managers of nature reserves. They recognised steering devices, 'selectors' like basin, lid and gutter stressing rather boundaries and conditions we can draw then the surrounded systems developing inside after realisation of a design. Selectors determine the openness and closedness of systems[b], especially when they are bordered vaguely (gradients). Van Leeuwen's botanical field knowledge was generally recognised as 'phenomenal'. Both theoretical and practical qualities got him a honorary doctorate in the University of Groningen (1974). However, some ten years later in the same University a mathematically oriented thesis[c] showed methodological weaknesses in his theories (to be found in other ecological theories as well). After decades of means directed and *conditional* relation theoretical applications in national planning[d] the more aim-directed and *operational* holistic-vitalistic approach with predictable states of synecology became dominant. The general nature policy in The Netherlands now is based on aimed nature types. The 'completeness' of a natural reserve determines its support by government.
Nevertheless, Van Leeuwen's boundary-oriented conditionality rather than operational causality in systems supposed by aim-directed managers keeps the designer fascinated. A house should not cause a household, it should make many households possible, whatever household may come.

I was fascinated by the difference in logical mode between possible and probable futures. Anything that is probable is per definition in the same time possible, but not anything possible is also probable. Designers are asked to study improbable possibilities, probable futures after all can be opened up by classical forecasting research. This controversy between designing and forecasting in Faculties of Architecture meets the difference between conditional and operational thinking Van Leeuwen often mentioned. The city creates conditions (possibilities) for different societies, it should not cause a (probable) community. So, a nature reserve should offer conditions for different kinds of nature. After all we appreciate nature by its own dynamics not influenced or even planned by man. Nature offers an escape from planned space and time. The Dutch word for cinema, 'bioscoop' means 'looking life' (bios), an escape from our own living. We have to live without loosing life going by itself.

The methodological problems of relation theory can be solved by scale-articulation of concepts like variation in space and time. They become scientifically operational by naming their scale. Perhaps

[a] (Leeuwen 1973)
[b] (Leeuwen 1964)
[c] (Sloep 1983)
[d] (Tweede_Nota 1966)

scale-articulation even solves the controversies of Dutch ecology. By that I can live with different ecologies as long as they do not create myths like not comprehended chaos theory sometimes did.

nominally	**abiotic**	**biotic**
kilometres radius		
10000	earth	biomen
1000	continent	areas of vegetation
100	geomorphological unit	flora-counties
10	landscape	formations
metres		
1000	hydrological unit, biotope	ecological groups
100	soil complex, ecotope	communities
10	soil unit	symbiosis
millimetres		
1000	soil structure and ~profile	individual survival strategies
100	coarse gravel	specialisation
10	gravel	integration
1	coarse sand 0,21-2	differentiation
micrometres (μ)		
100	fine sand 50-210	multi-celled organisms
10	silt 2-50	single-celled organisms
1	clay parts < 2	bacteria
0,1	molecule	virus

Figure 14 Ecological units

Figure 14 is a preliminary and rough attempt to name abiotic and biotic components by scale. Any level of scale has its own nameable diversity and dynamics. It has to be discussed, elaborated and renamed by ecologists more precise. Perhaps different approaches in ecology appear to have their own level of scale, accessible to designers giving measure to the urban context on that scale. On different levels of scale we could need different approaches; for example:

- R=300m Ecological groups in ecotopes
- R=30m Communities in biotopes
- R=3m Symbiosis and competition
- R=30cm Individual survival strategies

7 THE CONDITION OF MEASURE

Open space in the Netherlands is reduced by 12.5% urban and rural built area for 16 000 000 inhabitants with ample 300 m2 average built area per person. When these inhabitants were concentrated in 16 conurbations of 1 000 000 inhabitants each within 10km radius (see *Figure 9*) - regularly dispersed over the country - 10 open landscapes with a free horizon of 30km radius would be available as open space. They would be accessible within 10km from everybody's house. In empty spaces of that measure bears and eagles could find their habitat and the weekends could be filled by survival journeys we now look for in other countries once a year.

However, agriculture and urban sprawl have filled these potentially open landscapes. If we name an area of 30km radius still a landscape as long as there are less then 1 000 000 inhabitants, The Netherlands still have 10 landscapes (see *Figure 15*). But not for long, because there are landscapes with nearly 1 000 000 inhabitants and great pressure of urban sprawl. The size of spots in *Figure 15* meets the average urban density in The Netherlands. So, where they overlap the density is higher than average.

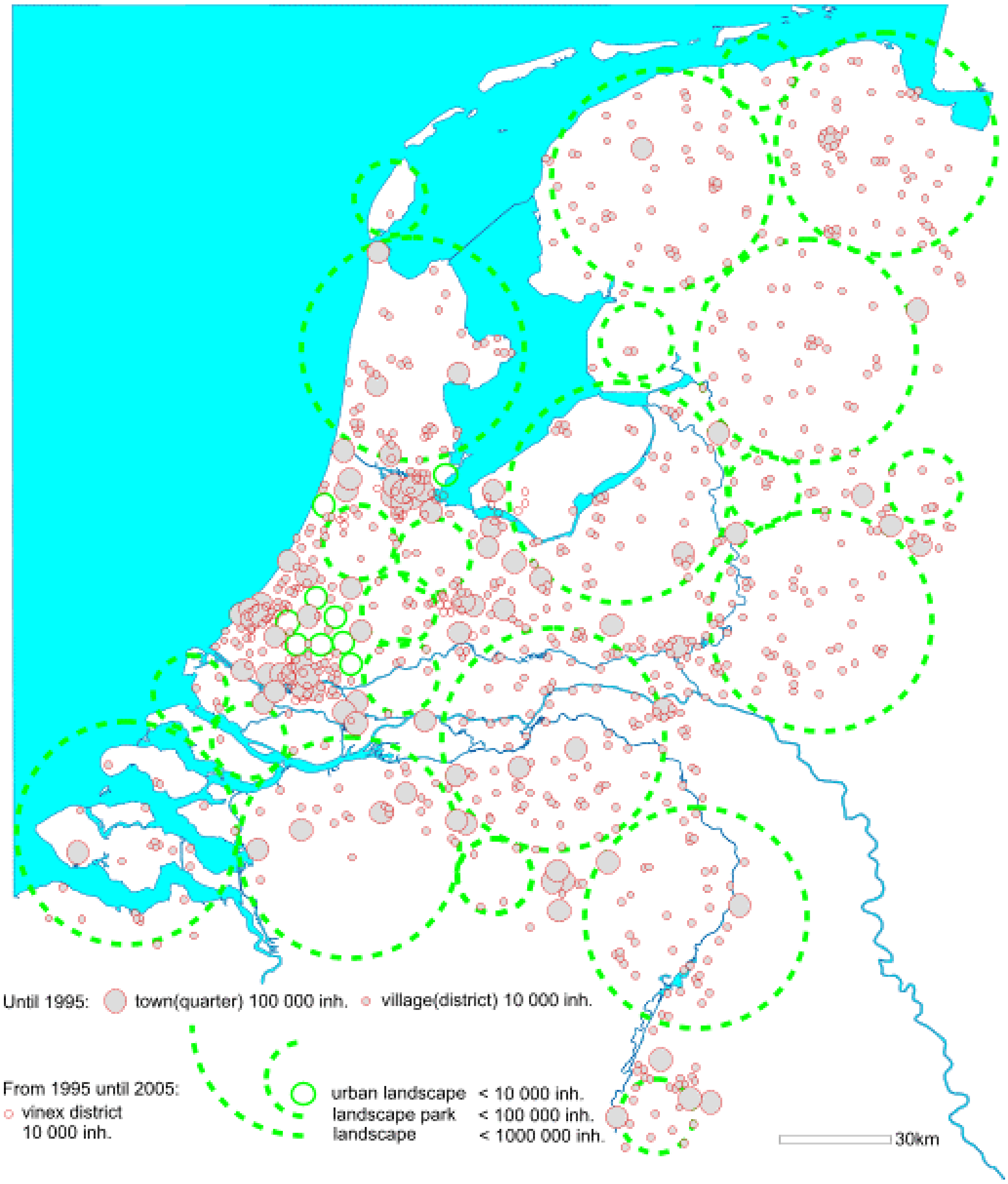


Figure 15 Built and open space in The Netherlands

From *Figure 15* we can conclude that concentration within conurbations (r=10km) does not help much in keeping landscapes open. Regional concentration (r=30km) does. Regional deconcentration breaks landscapes up into landscape parks or urban landscapes like happened in the Green Heart of Randstad (recently named green metropolis or Deltametropolis). However, deconcentration within conurbations (r=10km) could help making biotope cities. What kind of biotopes are they?

Form, size and structure of components are conditions for the function of open areas though urban functions on their turn can be the historical cause of form and structure. The landscape consultancy H+N+S in Utrecht visualised the functional charge for nature as a function of size and altitude in *Figure 16*.

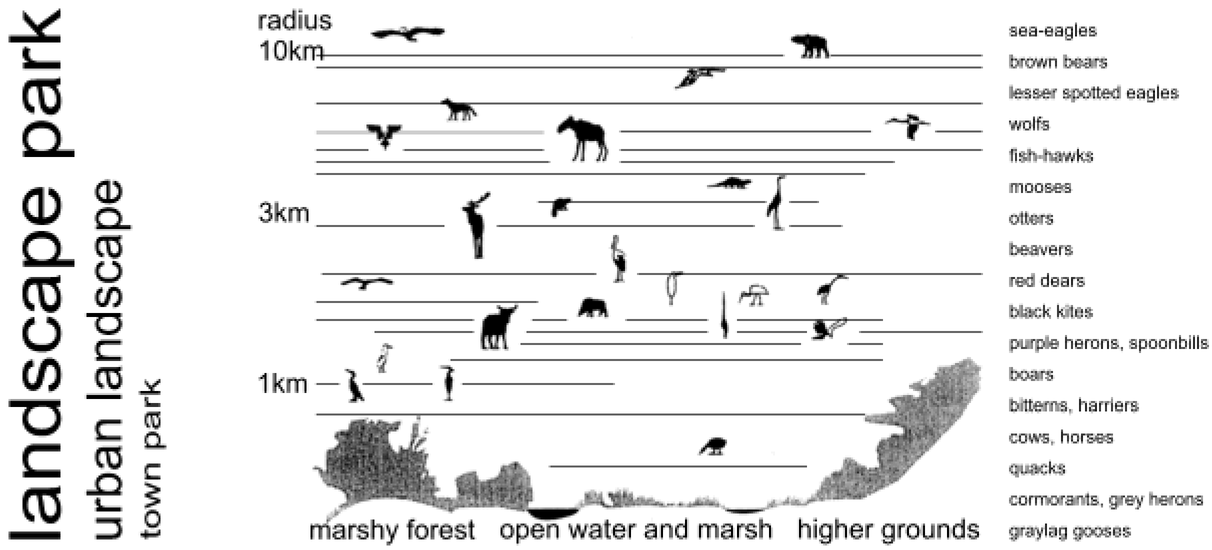


Figure 16 Possibilities for nature by size and altitude

In *Figure 17* they summarised possibilities of human recreation.

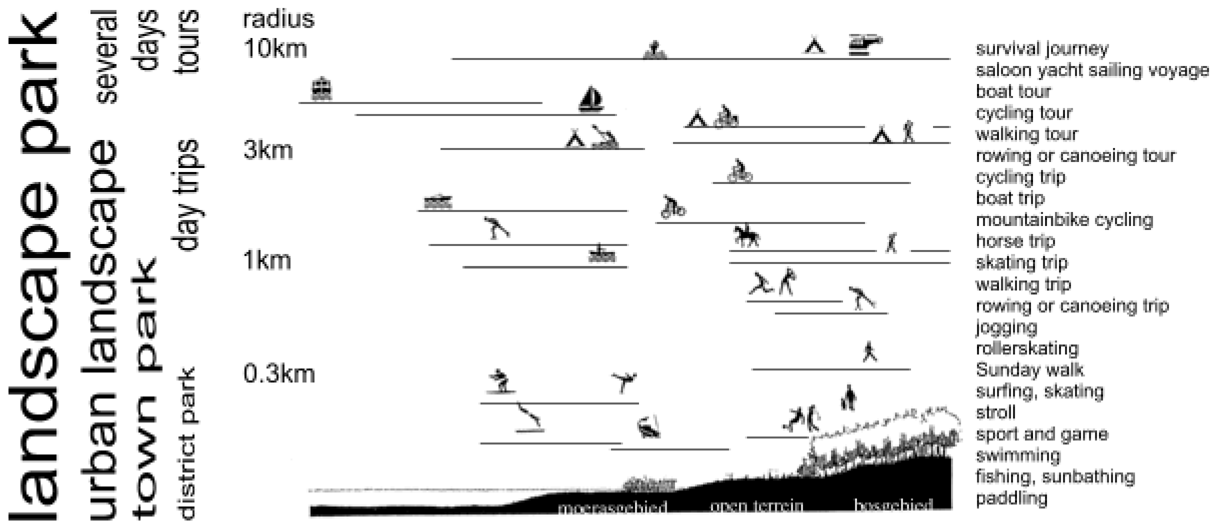


Figure 17 Possibilities for recreation by size and altitude

The smaller the area the less animals could find a habitat, but that is not the case for botanical biodiversity as far as their distribution is not dependent on animals.

Open area	within	radius
• Landscape	100km	30km
• Landscape park	30km	10km
• Urban landscape	10km	3km
Town park	3km	1km
District park	1km	300m
Neighbourhood park	300m	100m
Ensemble green	100m	30m

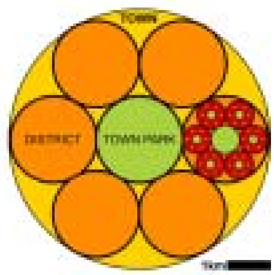


Figure 18 25% Central green area equally dispersed on 7 levels of scale

A crucial space-time dilemma of urban planning is priority for either small open spaces nearby residential areas or remote larger ones with more travel time and a small profit of species.
If on 7 levels of scale from r=30m until r=30km any built area should be adjacent to at least one central open area of the same size (see *Figure 18*), approximately 75% of total surface would be occupied by built space and 25% by open space. The largest open space would occupy 10 of that 25%, the 6 next smaller ones together 6 of the 25%, the 36 even smaller ones 3% and so on. The relative large amount of space token by the largest one is an economic argument for more small ones near by home. However this strategy would stress botanical rather then zoological biodiversity. Moreover, a priority for smaller green spaces nearby home with a smaller emphasis on animals brings nature closer to the inhabitants, especially the young ones.

Ecological infrastructure could be important for distribution of animals with a larger feeding ground or reproduction area then the same areas not connected. However its effectiveness is species specific and not convincingly proven. Their surface could be at the expense of larger concentrated areas.

Open area concentrated but isolated The same area connecting but deconcentrated

Figure 19 The surface dilemma of concentrating or connecting

Tummers and Tummers-Zuurmond[a] defend central open areas instead of peripheral dispersion.

8 URBAN ECOLOGY

Since 19th century's hygienic developments in the urban area[b] - the very source of public housing policy and urban design - biodiversity in spaced towns outruns rural biodiversity.

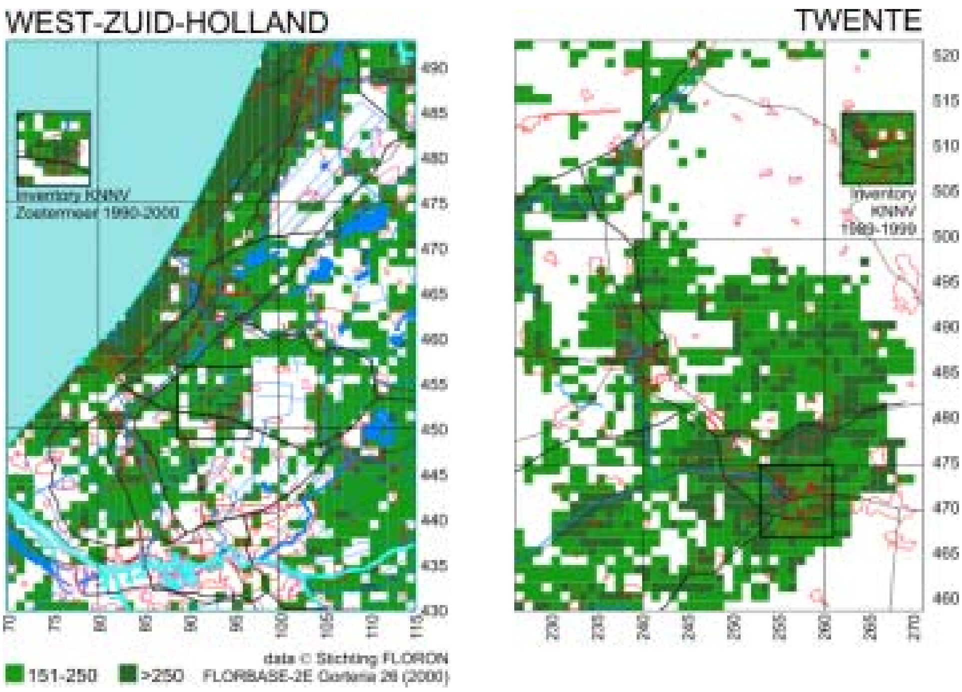


Figure 20 Number of wild plant species per km2 in the lower and higher part of The Netherlands

[a] (Tummers and Tummers-Zuurmond 1997)
[b] (Ali Cohen 1872), (Houwaart 1991)

Figure 20 shows that some square kilometres in the urban area of Zoetermeer indicated in the left picture have more that 250 wild plant species per km^2. Local observers (inset KNNV)[a] counted even more then national ones (FLORON). The urban area of Zoetermeer is more in contrast with the rural environment characterised by cattle breeding then Enschede (indicated in the right picture) surrounded by more natural equally rich areas. *Figure 21* shows both in more detail. Here we can see that infrastructure and industrial areas contribute more then we would expect by intuition. Their verges, slopes and rough grounds are less visited and disturbed by man and pet.

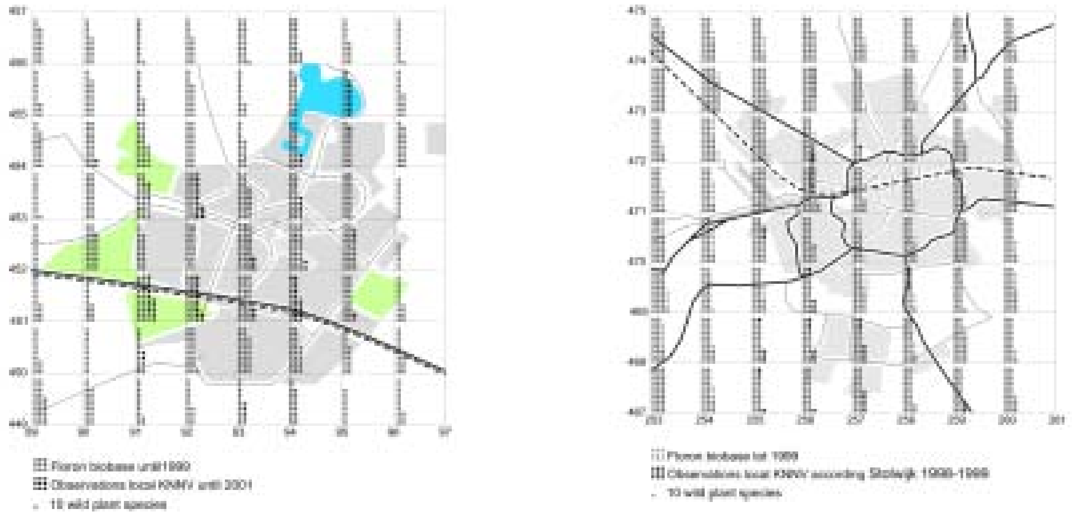
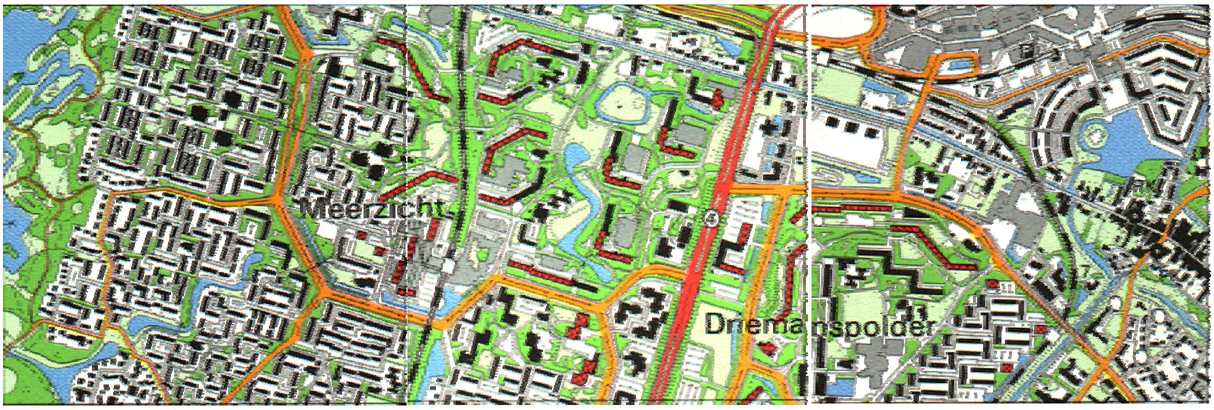


Figure 21 Number of plant species per km2 in Zoetermeer and Enschede

The number of species per km2 is added up over several years. So, many species could have been disappeared, they then only show the urban potential. Moreover, some square kilometres could have been observed better then other ones, for example the outskirts.



180	200	330 wild plant species
low-rise outskirts	high-rise	centre

Figure 22 Number of wild plant species in 3 km^2 of Zoetermeer

Even when in the centre the plant observations were better then in the outskirts, *Figure 22* warns us for the intuitive view that biodiversity always decreases from the outskirts into the centre. The large number of observed species in the central km^2 could also be explained by urban age, abiotic variation like seepage, drainage, water level or intersection by infrastructure with verges and slopes, less influence of adjacent agriculture and manure of cattle breeding dispersed by water or wind.
So, some of these possible causes could be varied as means of design aiming urban biodiversity.

Effective variation for botanical biodiversity	**in a radius of approx.**
altitude, ground	30km

[a] (Jong and Vos 2000; Jong and Vos 2003)

Effective variation for botanical biodiversity	**in a radius of approx.**
soil, water management	10km
seepage, drainage, water level, urban opening up	3km
The next levels are still hidden for botanical observation usually sampled per square km.	
urban lay-out	1km
parcelling (distribution of greenery)	300m
pavement, tread, pet manuring, minerals	100m
altitude differences, mow management, disturbance	30m
sun lighting	10m

Figure 23 Scale-articulated hypotheses of effective abiotic variation producing botanical biodiversity

Figure 23 shows possible working factors in urban design per level of scale. These hypotheses should be examined and evaluated yet. Accepting that the character of botanical diversity can not be predicted, one could question whether urban biotopes are valuable at all compared with rural nature. *Figure 24* arranges some 500 urban plant species from the 1500 known in The Netherlands in a sequence of national rareness, naming 50 of them only. Their national presence in % of the 5x5km observation squares is recognisable in the rising line. The spots show the urban presence in % of 1x1km observation squares in Zoetermeer. So, the spots above the line are more common in Zoetermeer than in The Netherlands, the spots below less so.

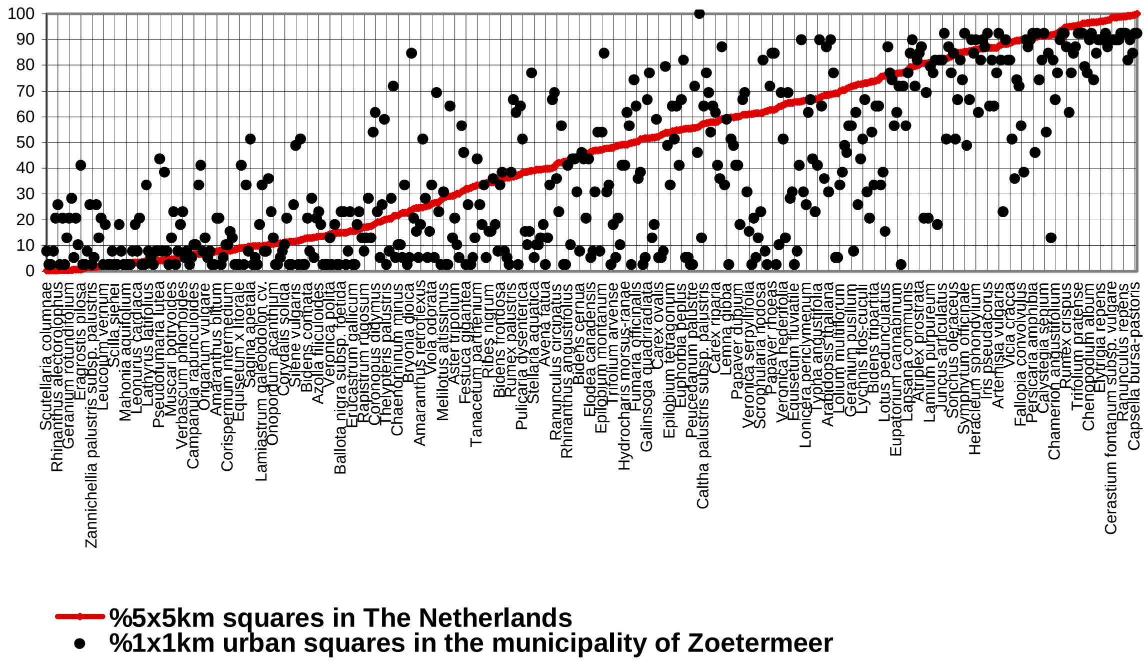


Figure 24 Local rareness of approximately 500 plant species in a sequence of national rareness

A number of nationally rare plant species in the left side of the graph evidently found their place in urban ecotopes. In the wake of urban plants and ecotopes rare insects and fungi have been observed in Zoetermeer[a], but seldom nationally rare vertebrates.

[a] (Jong and Vos 1995; Jong and Vos 1998; Jong and Vos 2000; Jong and Vos 2003)

9 TYPING URBAN BIOTOPES OR ECOTOPES

Ecological typology is scale-sensitive. On a global level (r=10 000km) year average temperature and precipitation determine so-called 'biomen'[a]. On a continental level (r=3 000km) areas of vegetation like estuaries, salt vegetations, reed marsh, river accompanying, Atlantic heather, birch forest, oak-beach forest, pine-spruce forest, dunes, warm oak forest and high moor land are distinguished[b]. On a map types in a typology appears like legend-units in a legend (see *Figure 25*).

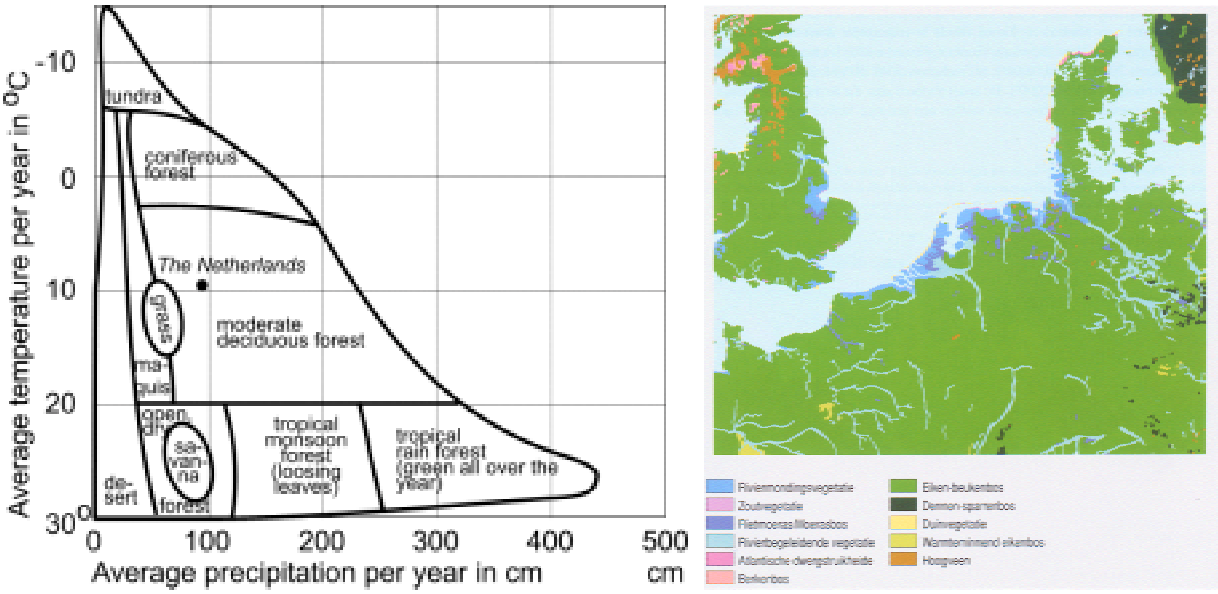
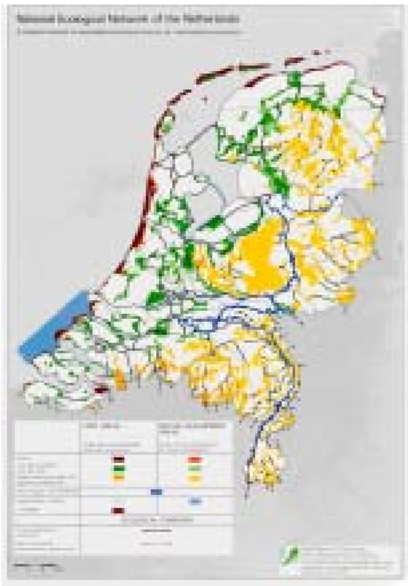


Figure 25 Global and continental[c] ecological typology

On a national level in The Netherlands Holocene and Pleistocene are the most enclosing categories approximately separated by the 5m altitude or clay (with peat and dunes) versus sand (intersected by river clay or locally filled by high moor land). The most urbanised Holocene estuary area, botanically indicated as 'lagoon county' is highly influenced by man and in the same time an internationally rare cultural-natural monument of polders. It is ecologically divided further in many ways representing its dynamic and unpredictable wet ecological diversity.

[a] (Myers 1985)
[b] (Bohn 2001)
[c] (RIVM 2001)



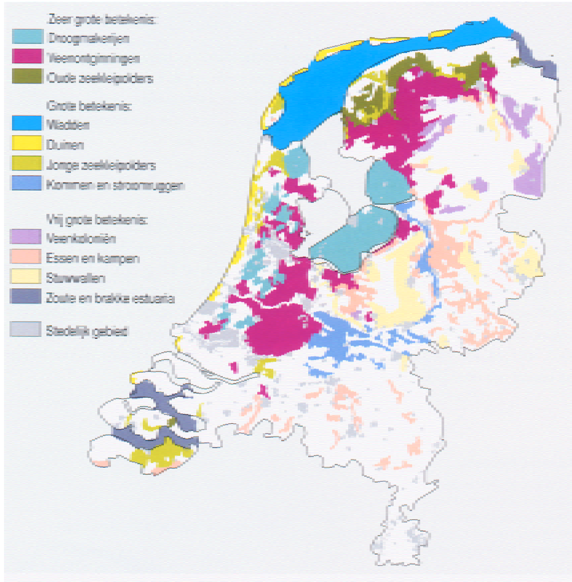


Figure 26 Planning Ecological Infrastructure[a] *Figure 27 International rareness of landscapes*[b]

The synecological typology by which the 132 national aimed nature types of the ecological infrastructure (EHS) are defined[c] proved to be inadequate earlier for the Holocene Zuid-Holland area[d]. Too many transitional stages between sand, clay and peat, influenced by a historical local diversity of cutting peat and water management produced a variety of nature types nearly equalling the number of grounds itself.

Regional ecological units in the Holocene are based on soil characteristics, highly influenced by altitude in 'formations', causing dynamic local communities.

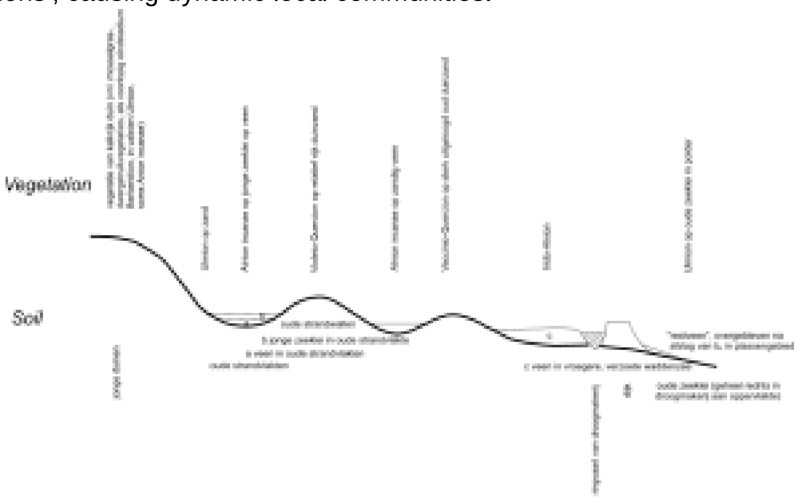


Figure 28 Formations mid-west of The Netherlands

Within these ecological contexts the urban area has to find its own ecological typology. Its unpredictable ecological riches and potential urges to a more conditional approach like ecotopes and ecological groups[e] rather then a causal one by biotopes and communities being 'complete' or not. A more conditional typology (see *Figure 31*) based on moist, sun lighting by vegetation height and nutritional value of the soil does not predict aimed communities but rareness. It stresses conditions to be influenced by urban design. Rareness is also culturally useful because it makes cultural values

[a] (LNV 2002), the image is from an earlier version.
[b] (RIVM 2001)
[c] (Bal 1995; Bal, Beije et al. 1995), elaborated in (Schaminee and Jansen 2001)
[d] (Held and Clausman 1985)
[e] (Runhaar, Groen et al. 1987; Meijden 1992; Meijden 1993)

comparable with ecological ones (*Figure 29*). Conditionality represented by tanks filled with liquids of different specific gravity clarifies a possibility evaluating categories of nature and culture (*Figure 30*).

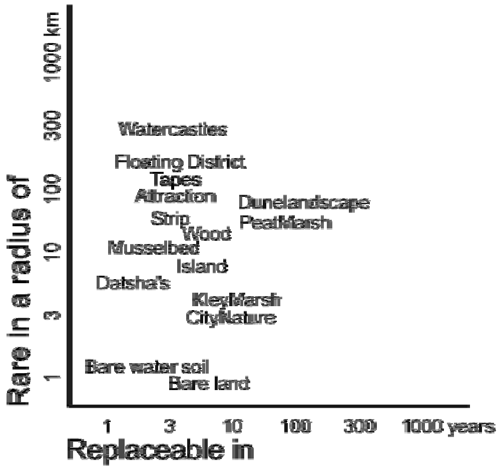


Figure 29 Comparing ecological and urban objects[a]

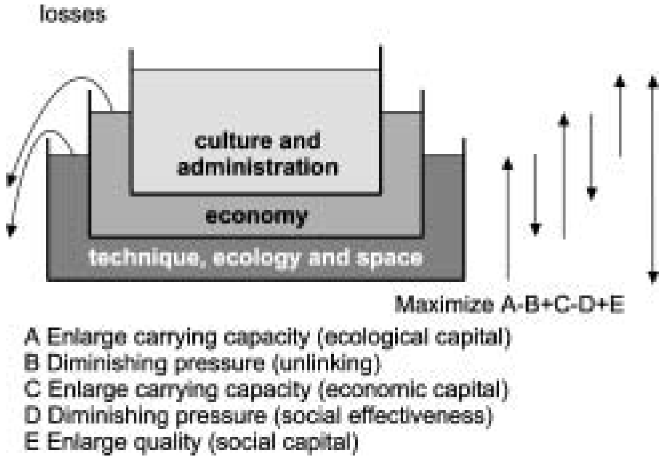


Figure 30 Evaluating the incomparable[b]

[a] (Jong 2001)
[b] (Jong and Priemus 2002)

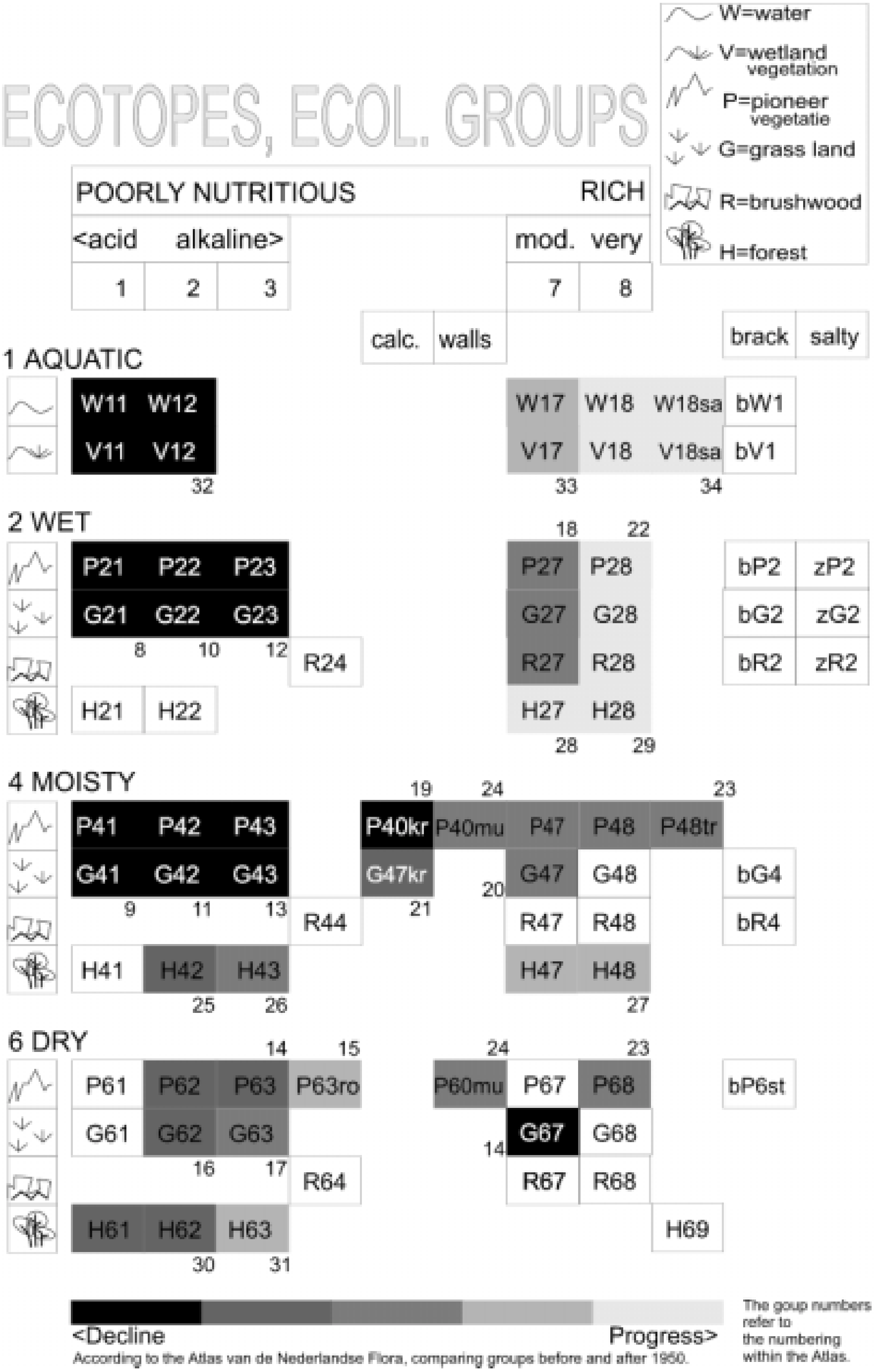


Figure 31 Ecotopes or ecological groups

10 URBAN PERSPECTIVES

The urban growth since the industrial revolution culminates, especially in the developing countries where the European hygienic history of towns repeats itself. Restricting ourselves to the present Dutch situation claims on Randstad are bigger then ever and the idea of an open Green Heart fades away by urban sprawl.

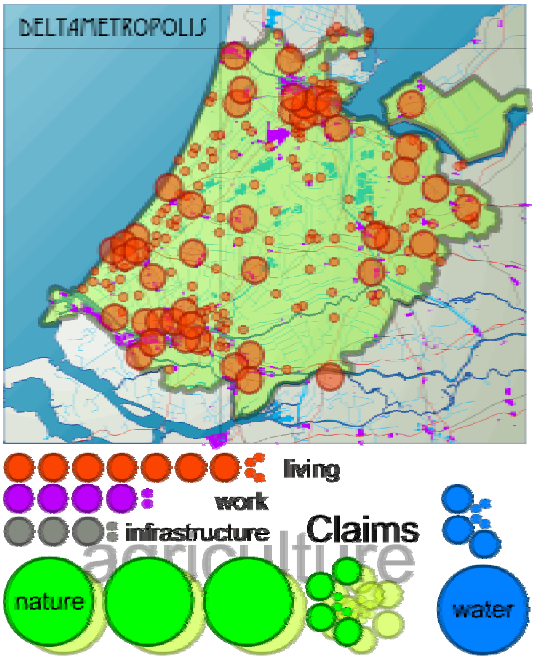


Figure 32 Claims on Detametropolis area

Figure 33 The supposed Green Heart

The 30 years old idea of high density conurbations have not been successful in spite of national strategies like bundled concentration or compact cities. And if so, they would have been not effective (see *Figure 9*) in saving surrounding landscape. It is an example of ideas like high tech transportation solutions that have big metropolises as a reference. However, Randstad does not yet reach the capacity of a real metropolis making fast underground systems possible.

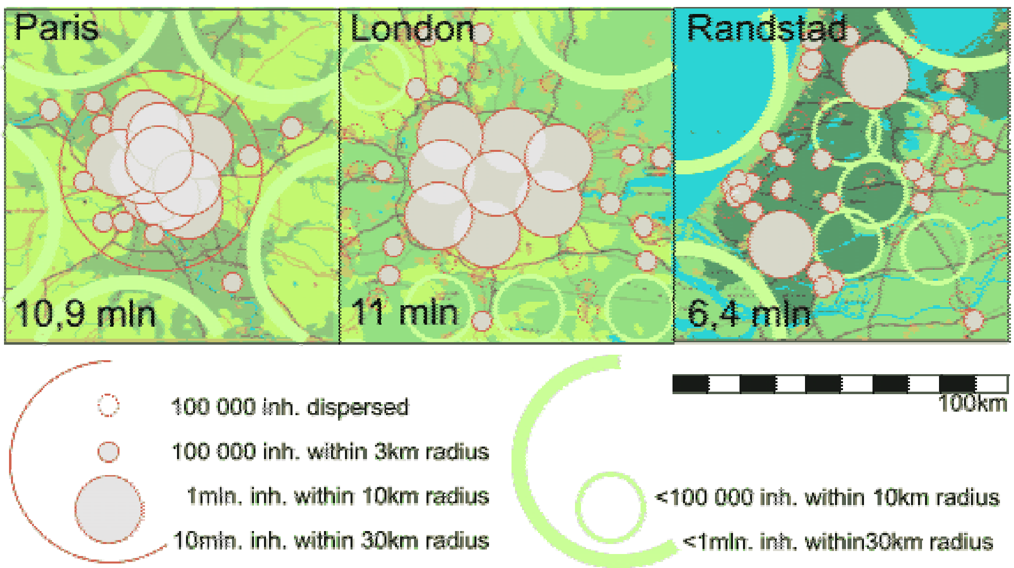


Figure 34 The capacity of metro poles

From an ecological point of view the condition of measure (see paragraph 7 on page 10) is less important when we concentrate on vegetation rather than on big animals. From a human point of view we should bring nature closer to home (see page 13). That pleads for openness within the agglomeration and not for accumulation on every level of scale.

11 HUMAN HEALTH IN THE URBAN ENVIRONMENT

Being no expert on human health the most extensive overview I know in the joint field of medicine and urbanism is edited by Vogler and Kuhn[a] some 50 years ago. They discuss many kinds of 'civilisation damage' in the urban environment from different medical specialist's points of view. I never found a reference into this comprehensive work and I can understand it considering its size and age. So, I recoil from reviewing it as well, the more so while I am not read up on more recent medical literature. Apart from the disadvantages of living in high densities Vogler and Kuhn emphasise, its benefits Jane Jacobs[b] some years later referred to were partly confirmed in a psychological sense. Freedman[c] discussed research on crowding and behaviour concluding no other impact of increasing density than intensifying existing negative or positive social-psychological processes. However, by human biodiversity or social diversity - stage in the lifecycle, income or life style - some people like to live in high densities, others do not. People with children mostly like low densities of quiet suburbs. So, forced to live in high densities the impact could be primarily negative. However, learning to live in high densities with children might turn out positive by discovering advantages, adapting, compensating shortages and accommodating new functions.

Adapting to an environment and compensating shortages by new accommodations are essential characteristics of life. Life would never have developed without these capacities. The possibility of adaptation and compensation are often forgotten by researchers only interested in forecasting. 'Arsenic is poisonous', they predict. The prediction is based on 3x standard deviation from the average (99.7% of the cases) and if arsenic poison would be ever a global problem their solution would be removing the cause only. But in Austria a village population of so called 'arsenic eaters' (source unknown) since centuries got used to it. That is the way evolution solved problems by adaptation and compensation increasing diversity, not by global rules reducing diversity. Oxygen was once a global poison, now it is a prerequisite for aerobic life. Adapting, compensating and accommodating are also ways designers study. When low temperature is a problem of living in higher latitudes we compensate (accommodate) by building acclimatised houses. It is unnatural because it disturbs the natural distribution and abundance of homo sapiens. But since we make houses more than 3000 years it appears natural to us. What we call 'natural' apparently is time scale sensitive as well.

Epidemiological research seldom succeeds in convincingly separating causal physical context factors like the urban environment from other coinciding influences affecting health. Death rates in the big towns in the nineties were 11% higher than elsewhere in The Netherlands and there are substantial health differences between and within towns (*Figure 35*) [d]. However, they correlate highly with income differences causing different (un)healthy lifestyles. For example they indicate that in a low-income district the chance to die before the age of 65 is 50% higher than in a high-income district. And rich people move from low-income wet peat and clay districts into high-income sandy districts leaving a less healthy population behind. A recent survey into medicine use shows that the most well-to-do sandy region 'Gooi' has the lowest use of medicines in The Netherlands[e] (*Figure 36*). Insurance companies could decrease their rates for these groups in the same time increasing their wealth (and health). But to which extend Gooi-people owe their health to wealth and life style, to lower housing density, to green area in their direct neighbourhood, dry sandy soil or climate we do not know. The surveyors did not try to explain either comparing regions of The Netherlands because epidemiological research is one of the most tricky disciplines urging expensive longitudinal research extending decades to be convincing. That is a great pity, because as long as statistical evidence fails an even more tricky branch of statistics wins: risk calculation. Risk calculation seems rational, but often it is also the calculation of fears and myths motivated by little more then sharing them in collective fear.

[a] (Vogler and Kuhn 1957)
[b] (Jacobs 1961)
[c] (Freedman 1975)
[d] (Garretsen and Raat 1989; Lucht and Verkleij 2002)
[e] (Batenburg-Eddes and Berg-Jeths 2002)

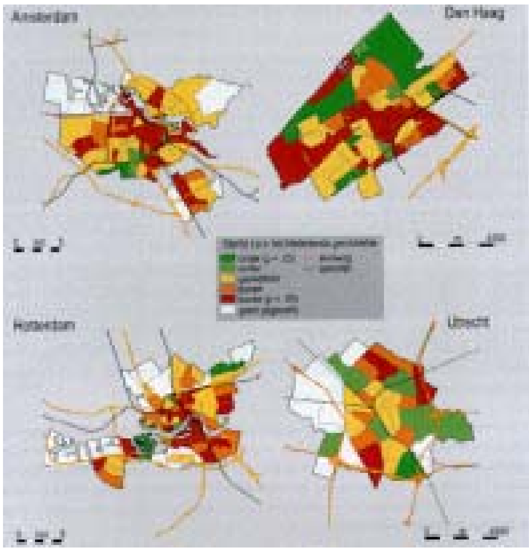


Figure 35 Differences in death rates

Figure 36 Use of medicines

The more we know, the more possible threads we become aware of to be calculated. That raises fear and fear raises stress. Stress is suspect in raising or stimulating diseases like cancer. Fear for cancer is so well-known a medical symptom that it got its own name in medical vocabularies: 'carcinophobia'. Designers in the wake of this uncertainty already try to make solutions for possible problems. That is their task, but they seldom evaluate the effectiveness and possible side-effects of their solutions. Urban design is not always the most effective solution in environmental problems remaining after the great positive health effect of housing itself. Barton and Tsourou[a] advise 12 key health objectives for urban planners in the context of WHO healthy city project in which Eindhoven participates: healthy lifestyles, social cohesion, housing quality, access to work, accessibility, local low-input food production, safety, equity, air quality and aesthetics, water and sanitation quality, quality of land and mineral resources, climate stability. Evaluating their effectiveness again would urge expensive longitudinal research extending decades to be scientifically convincing.

There is something wrong in the state of medicine. King Average rules the kingdom of exceptions human species comprises, but in the same time exceptional occurrences are magnified by television and newspapers. Television and newspapers bomb us by statistical exceptions, distorting our perception of chance and magnifying impact. Risk is popularly defined by chance times impact. The public shame of few physicians involved intimidates the profession as a whole. And we still know little about our body, our own nature yet. Honest physicians remain silent but that is what frightens more. Avoiding any risk physicians prescribe too many medicines, order too many physical examinations increasing the costs of medical care, increasing slowly appearing side effects. Avoiding any risk raises new risks on other levels of scale. Always avoiding to catch a cold may result in high susceptibility for flu any time we leave a building or a car. Our hygiene drove life out and nature in exile. Our biological resistance fades, the number of immunity deficiency diseases increases. We do not get injuries enough to become vaccinated by nature itself. We like dangerous holydays to flee from our unnatural and boring safety, but we do not know real danger anymore and fall ill by foreign food.

A secret medical survey I heard of by a medical student in the seventies revealed that half of our diseases at that time were iatrogeneous (caused by physicians). I do not know whether that was true or not and what the present state of medicine is in this respect. That is why I fear the worst case. Insurance companies sell fear. We pay more for safety than for anything else: insurance, police, army, preventing fire, burglary and catching a cold. We fear we can not pay all and we double our work until we die from the impacts of stress. The life time we spend on worry is lost well-being, lost health and life time. Our fear for exceptional possibilities raises new diseases of the mind and we fear them as well. In reality our life is safer then ever, but we do not dare to live with life: the risk to die. Life became strange to us and death as well, we fear the unfamiliar because it could be unhygienic.

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[a] (Barton and Tsournou 2000)

In the mean time numerous other organisms are going their own way, not fearing for anything that is not actual and mostly without any apparent fearing at all. They live from very slow to very fast.
I prefer the slow living plants surrounded by their very fast pairing messengers of life-experience, the insects. Plants are the basis of life's pyramid. Added animal life only selects and regulates like man does as well by harvesting, preserving, mowing and gardening. Sometimes we visit them and walk in something totally else we belong to historically but do not have to understand, something we should not try to plan.
I think it stimulates human health when we bring life close to everybody's home and living, but nobody knows, it is a hypothesis. Berg et al. give an excellent overview in their essay about the relation between nature and health[a] concerning history, possible impacts on stress, fear, physical resistance and personal growth. Nature puts the stressing concept of our own importance into a relative perspective of one species between 1 700 000 ones or more. They differ more from us than any people we tend to reject in social conflict. Nature tempers forced choice as architecture should do as well[b].

The intellectual challenge of this century is to handle diversity instead of generalising it by statistical reduction. Generalising research has diminishing returns, on the other hand design is promising, generating study. Evolution and ecological succession is its model. Studying nature heals social disappointment by disappointing presuppositions, prejudices. It stimulates an active form of modesty. The more we know about nature the more we appear to know not, and the more we want to know, to see, to experience. In any town of The Netherlands specialised study groups of nature associations contribute to atlases of birds[c], butterflies[d], bats[e], amphibians and reptiles[f], mammals[g], fishes[h], plants[i] and mushrooms[j] multiplying our shrinking world of holiday destinations by growing local universes we tended to overlook. In any town nature writes a history of war and peace far more thrilling than television and newspapers could do.
Nature looks for its journalists because it only exists by the grace of those seeing it.

12 CONCLUSIONS CONCERNING SPATIAL HUMAN RIGHTS

A. Any human has a right on 300m2 residential area in a radius of 10km, work and services included.
B. Any human has a right on all necessary sources of living within a radius of 30km. These sources have to give access to products of 2000m2 agricultural land per person. This land should be accessible within a radius of 1000km concerning the risk of stagnating logistics.
C. Agriculture has to be located in areas with highest supply of water, minerals and sunlight. Towns and untilled natural areas have to be located in areas with less minerals.
D. Any human has a right on untilled natural ground uninhabited by man within a radius of x from her or his place of residence measuring at least a radius of x/3; x being {0.3, 1, 3 … 100 000 metre}.
E. Dutch cities belong to the most healthy in the world. So, any attention given to health in Dutch cities is distressing in a perspective of the hygienic condition of cities in the second and third world.

[a] (Berg, Berg et al. 2001)
[b] (Eyck, Parin et al. 1968)
[c] (Hagemeijer and Blair ; Bekhuis, Bijlsma et al. 1987; Beintema, Moedt et al. 1995)
[d] (Tax 1989; Bink 1992)
[e] (Limpens, Mostert et al. 1997)
[f] (Bohemen, Buizer et al. 1986)
[g] (Broekhuizen, Hoekstra et al. 1992)
[h] (Nie 1996)
[i] (Mennema, Quene-Boterenbrood et al. 1980; Weeda, Schaminée et al. 2000)
[j] (Nauta and Vellinga 1995)

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