

Sun wind water earth **life** living legends for design

AR1U130 SUETerritory (design) 4ECTS

AR0112 Civil engineering for dummies (calculations) 2ECTS

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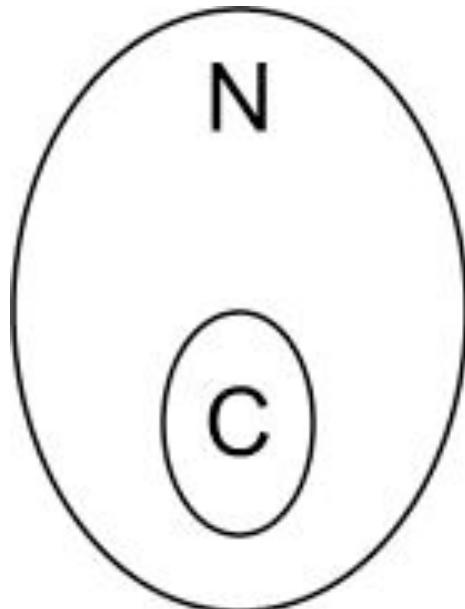
Ir. D. de Bruin

Drs. M.J. Moens

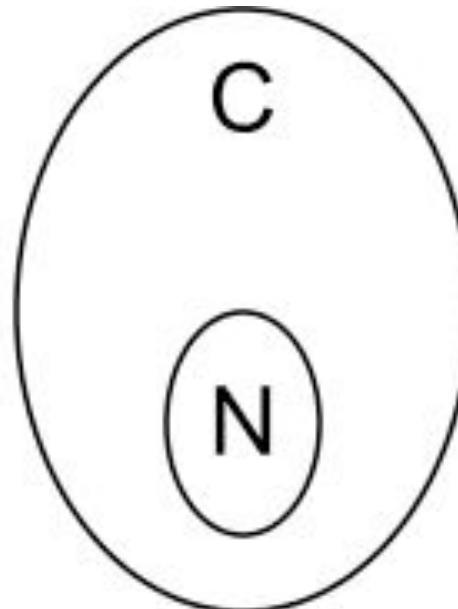
Prof.dr.ir. C.M. Steenbergen

Ir. M.W.M. van den Toorn

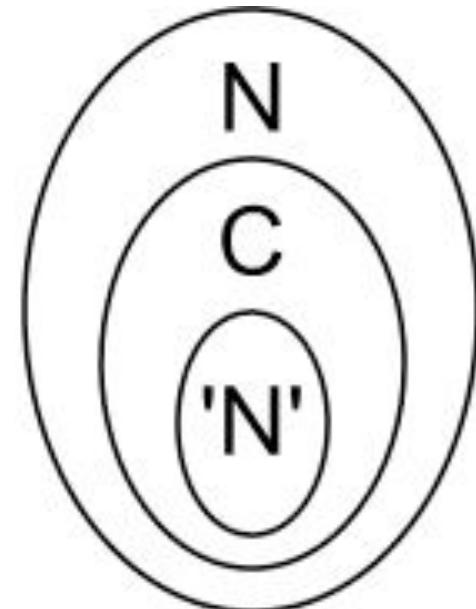
The nature of culture



Ecocentric



Anthropocentric



Conditional

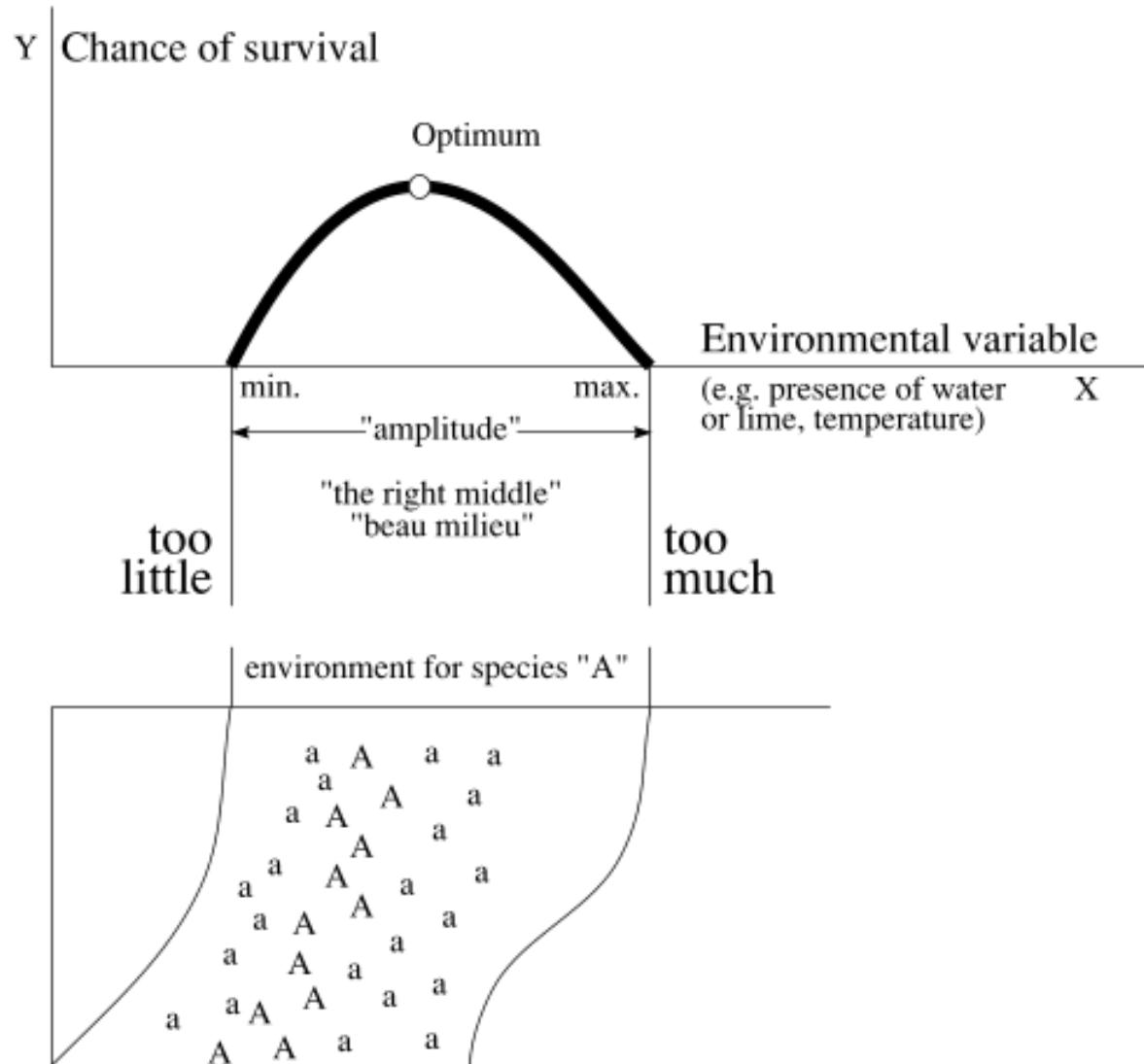
Conditional or operational



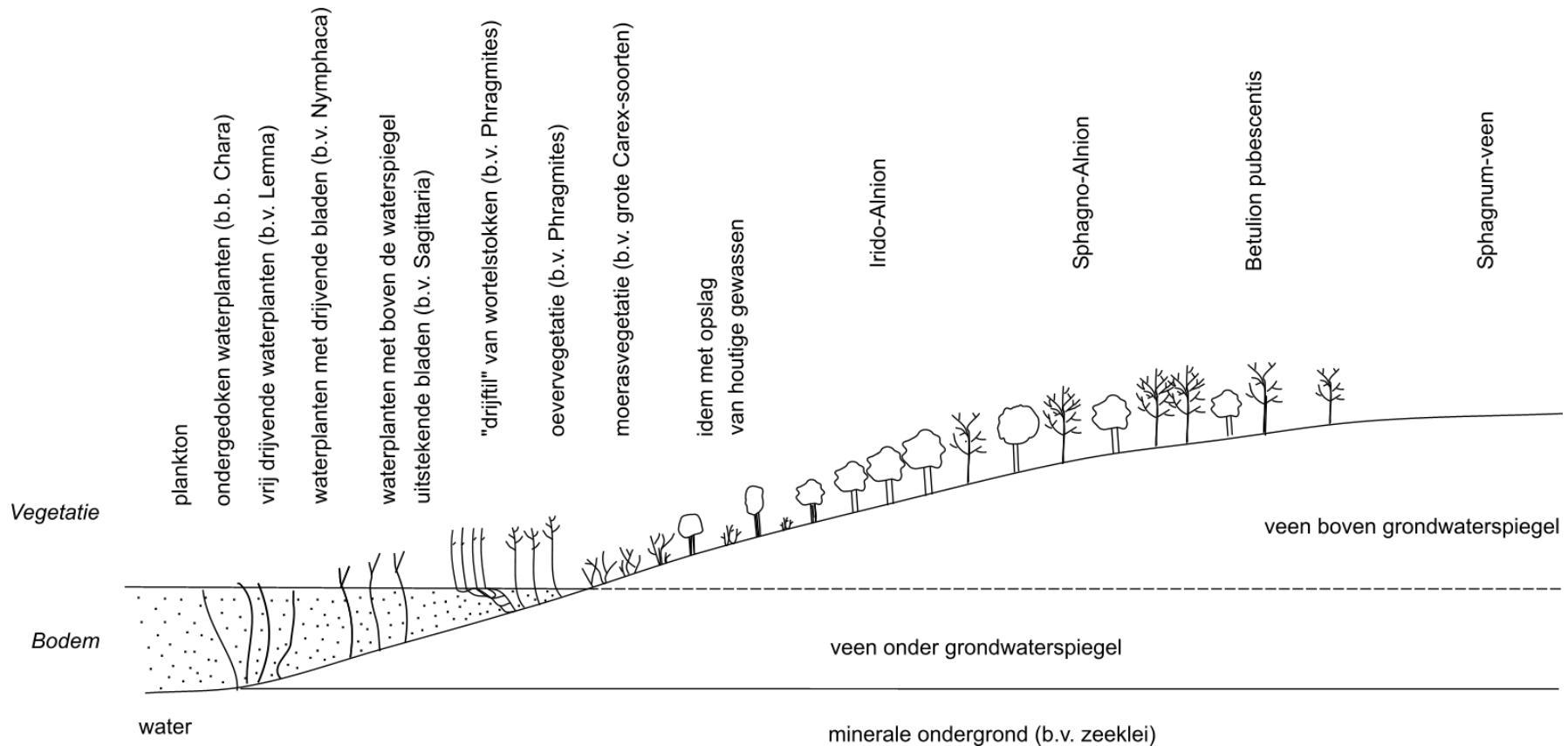
Abiotic conditions

Diversity as a condition for life

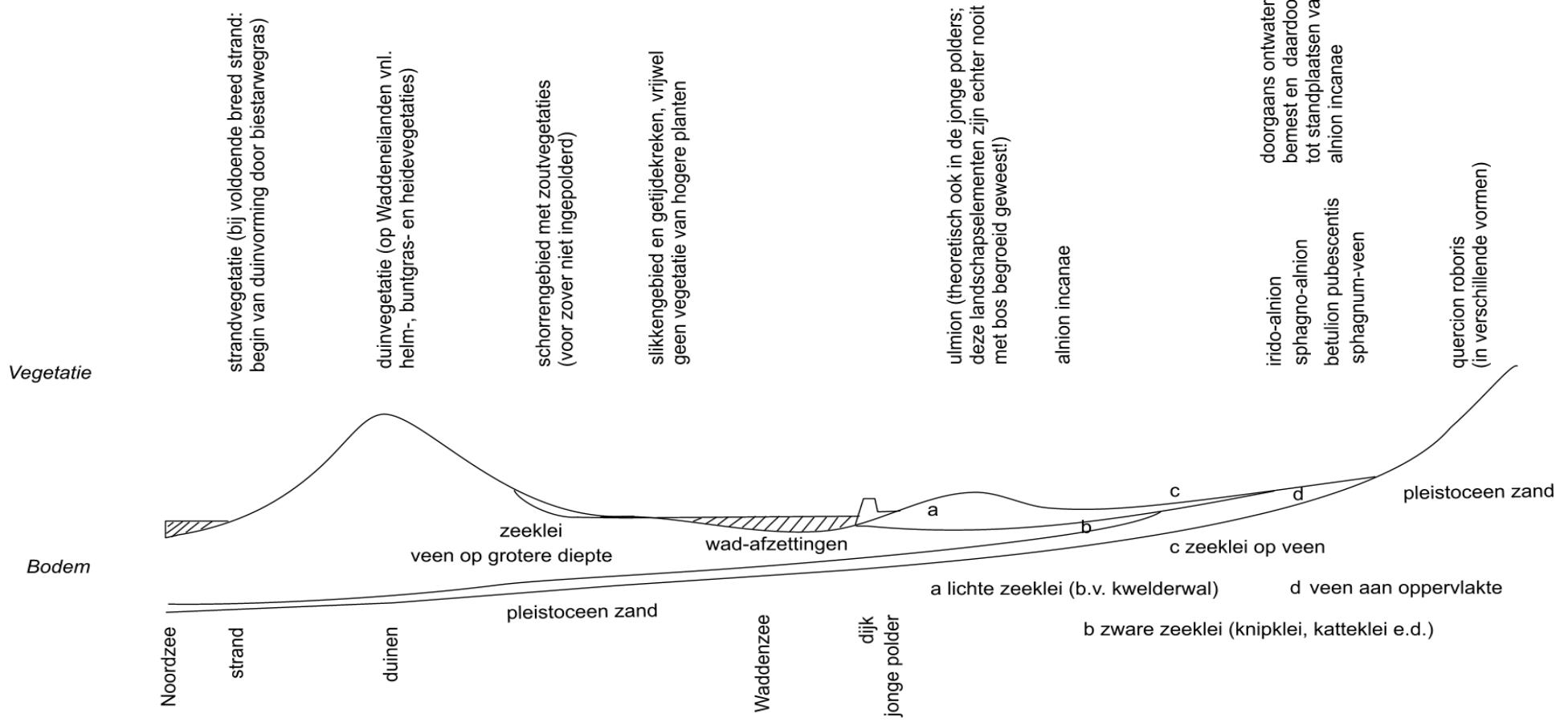
This kind of graph
is called
'Ecological
tolerance'



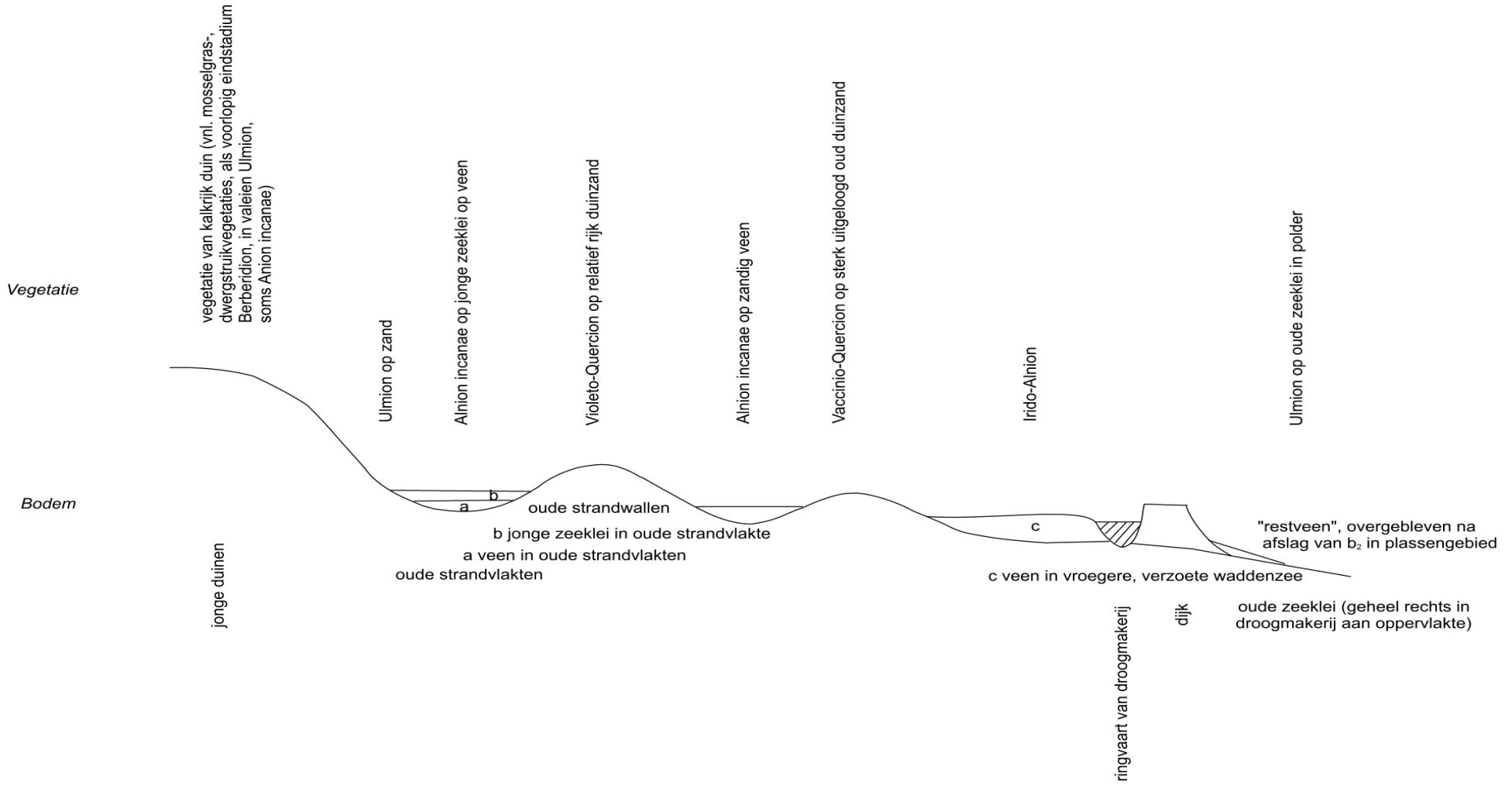
Verlanding



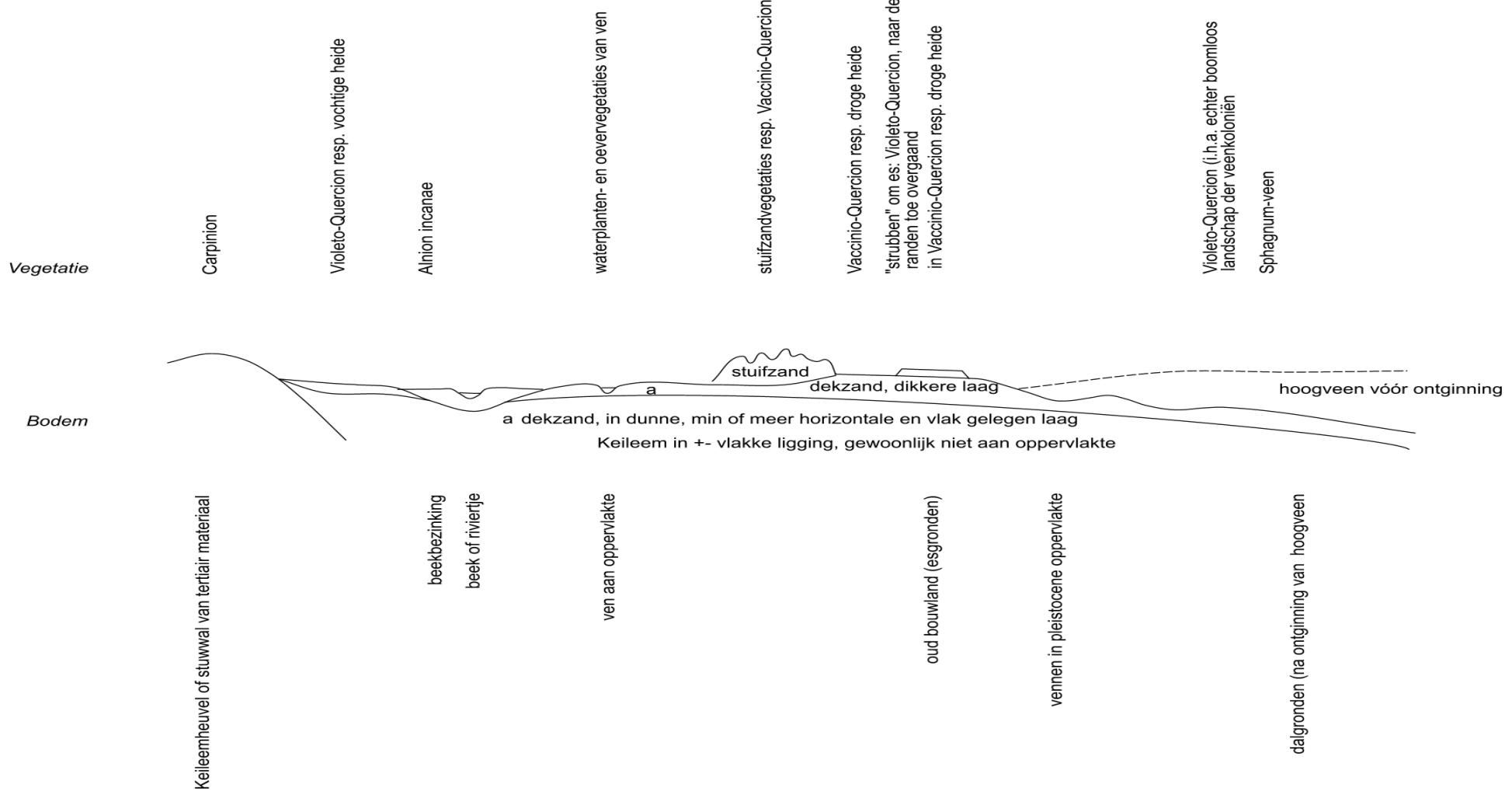
Northern coast formation



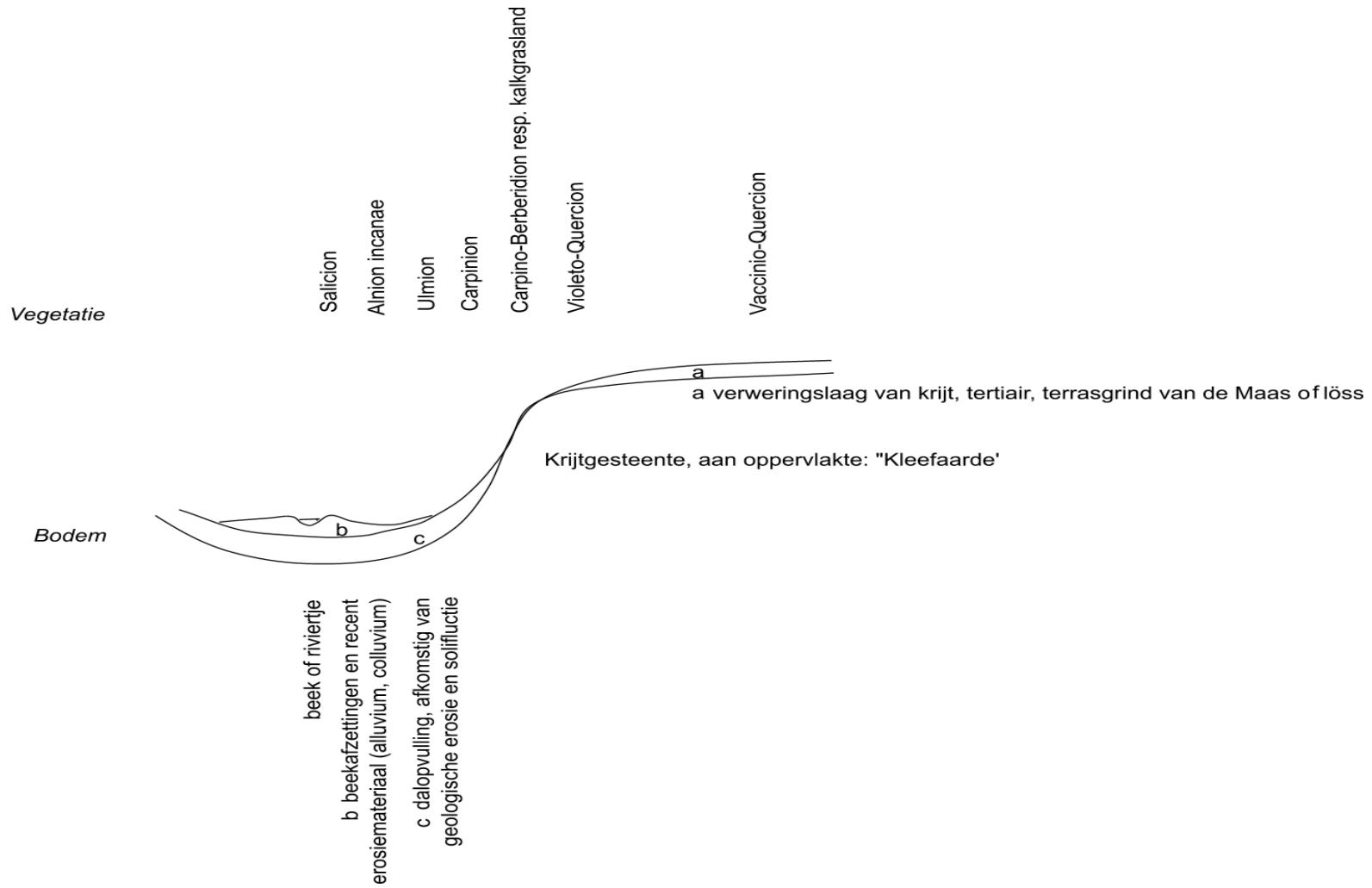
Mid-West coast formation



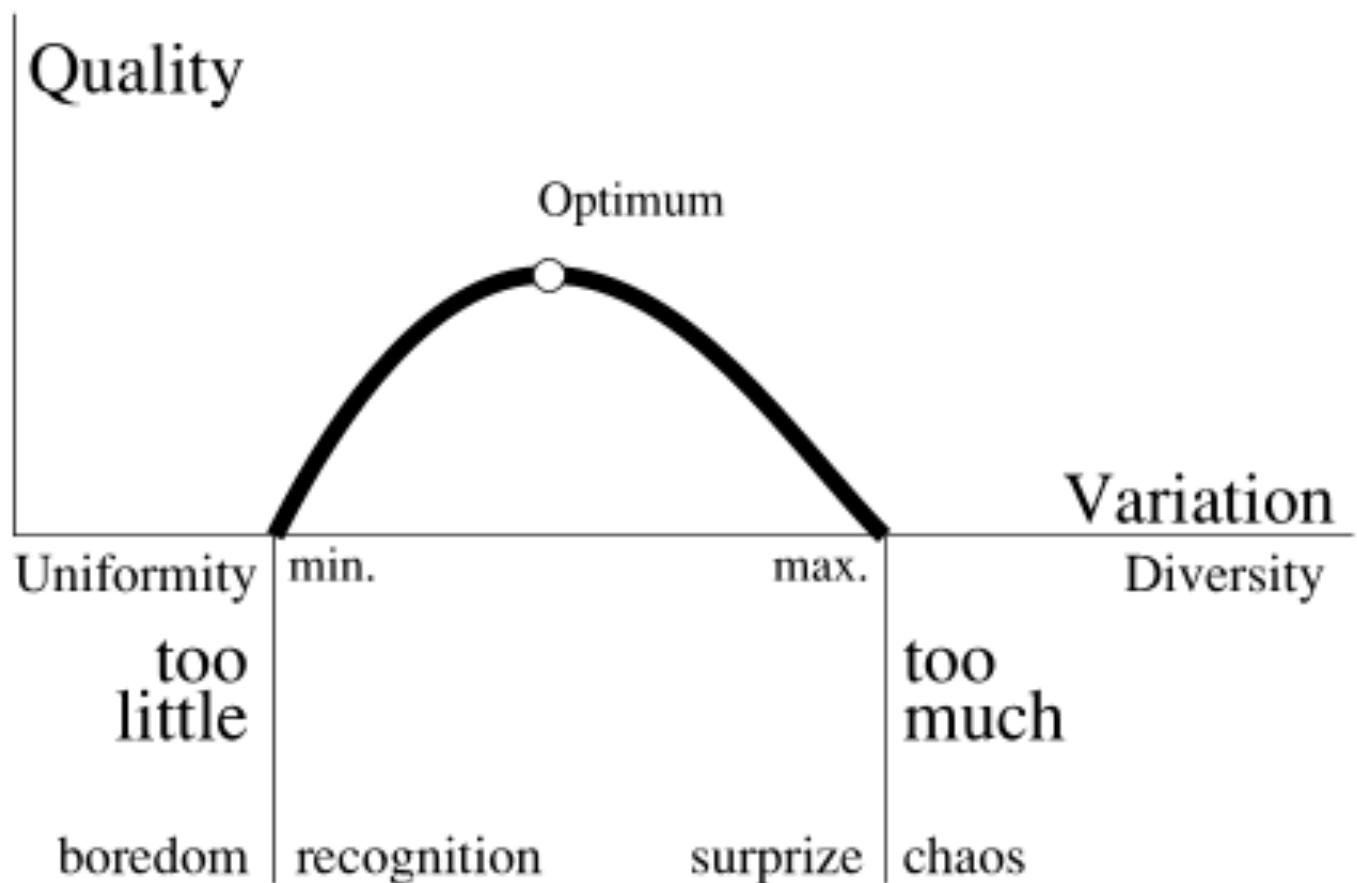
Boulder clay formation



South Limburg

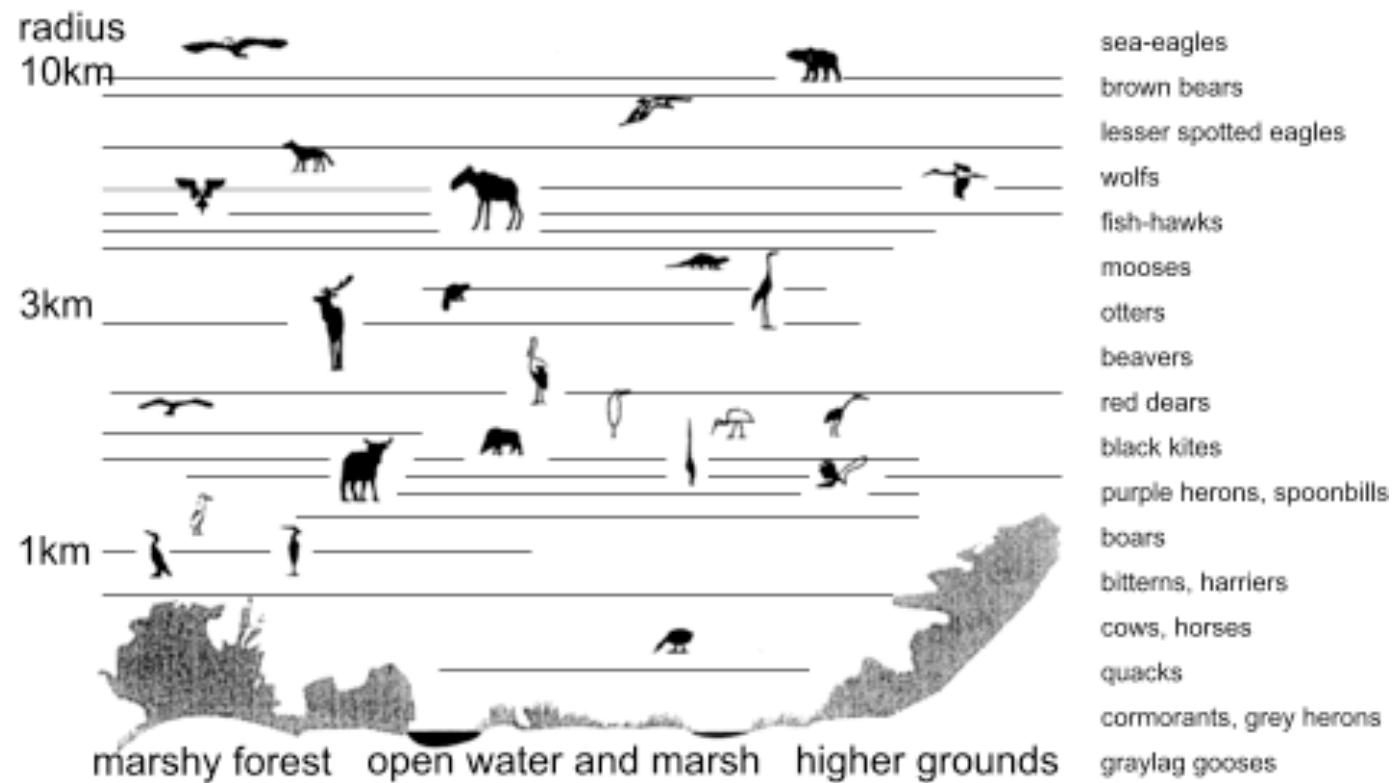


Quality = f(variation)

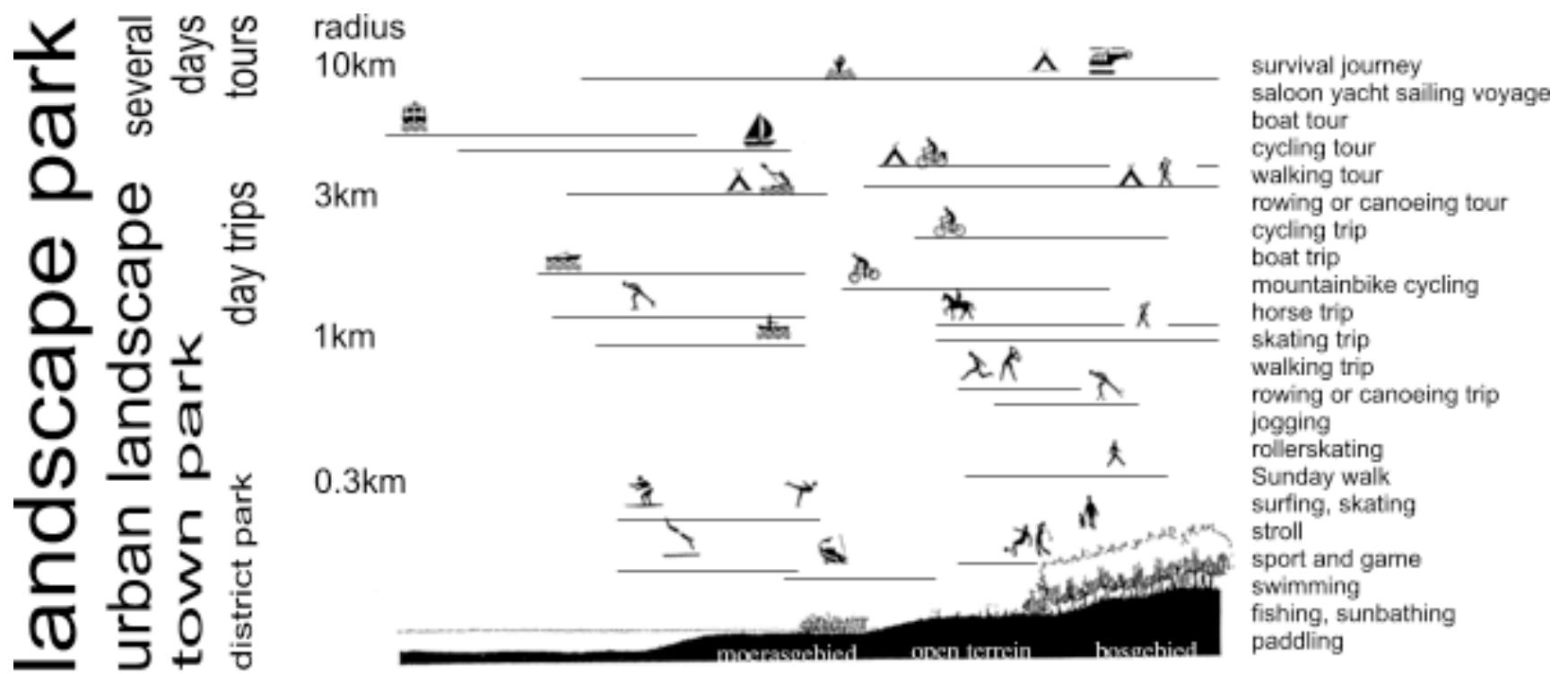


Possibilities for nature (H+N+S)

landscape park
urban landscape
town park



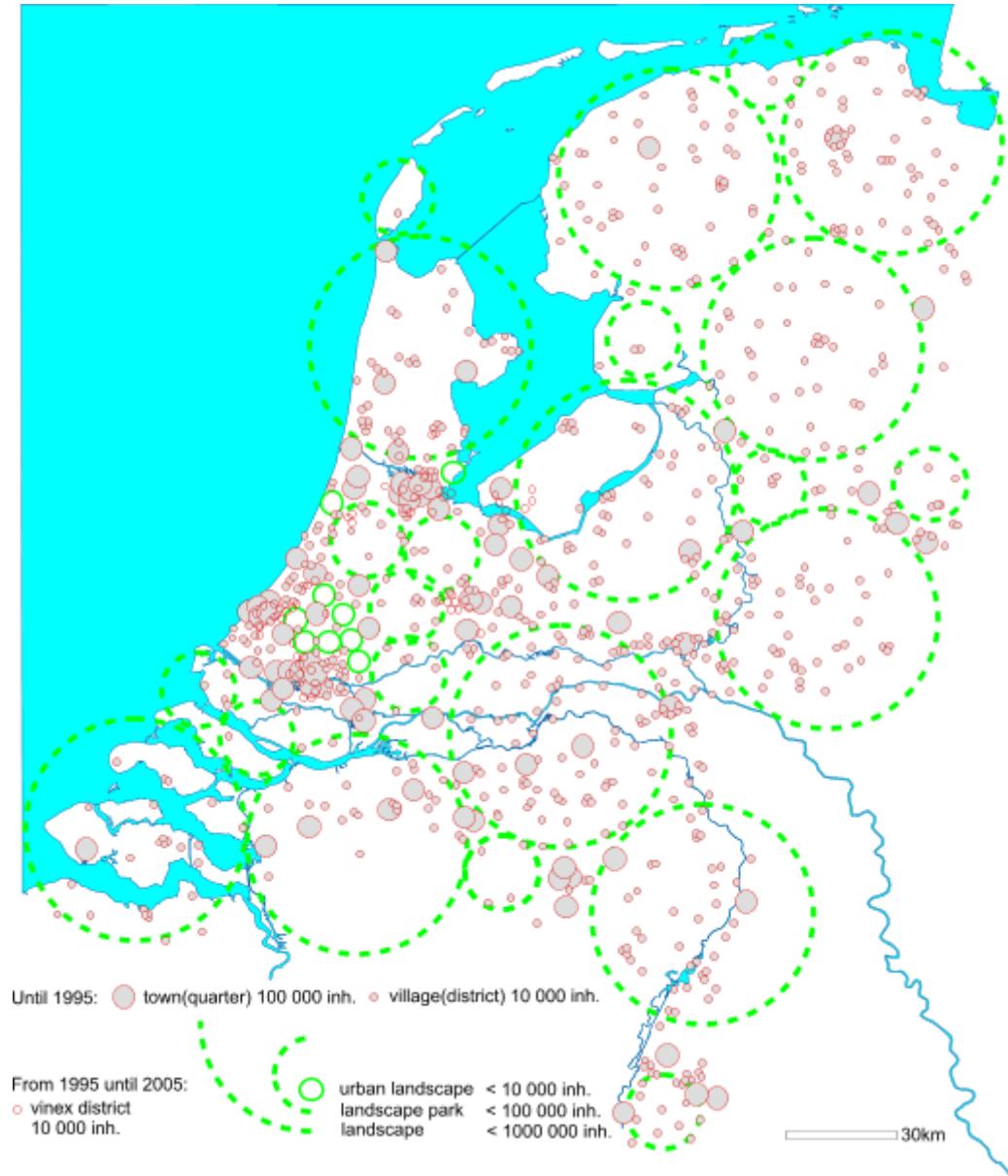
Possibilities for recreation (H+N+S)



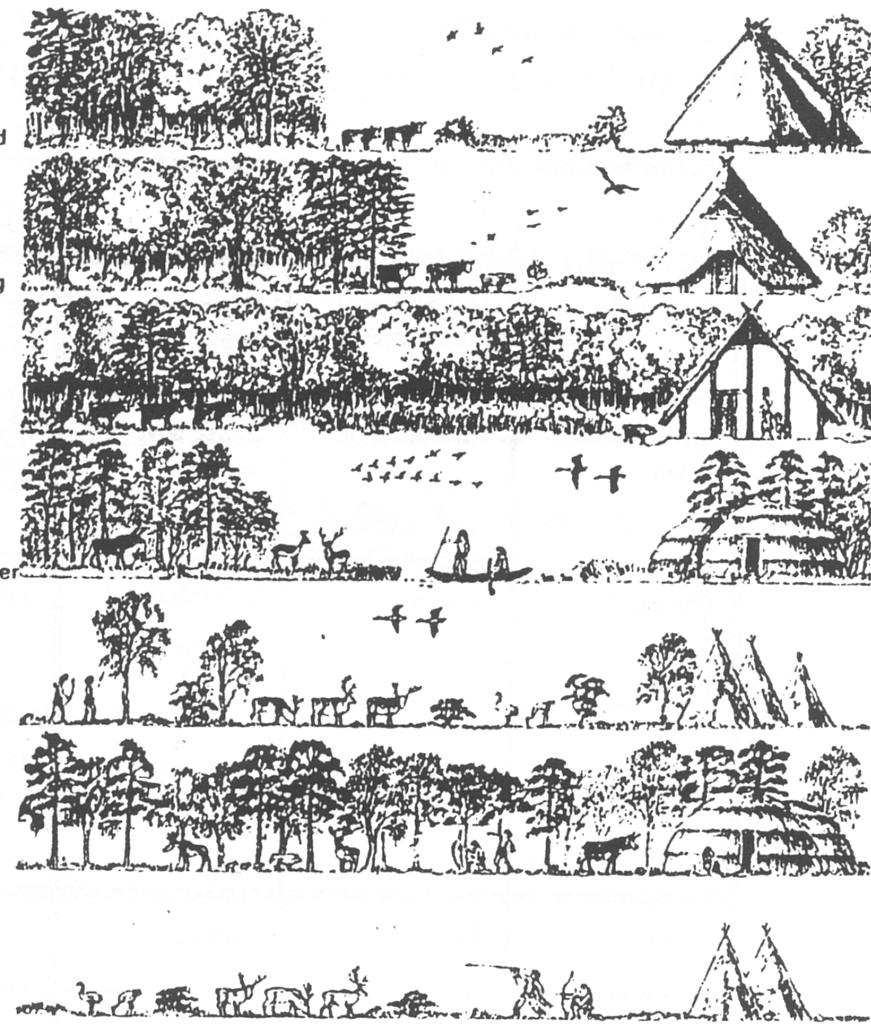
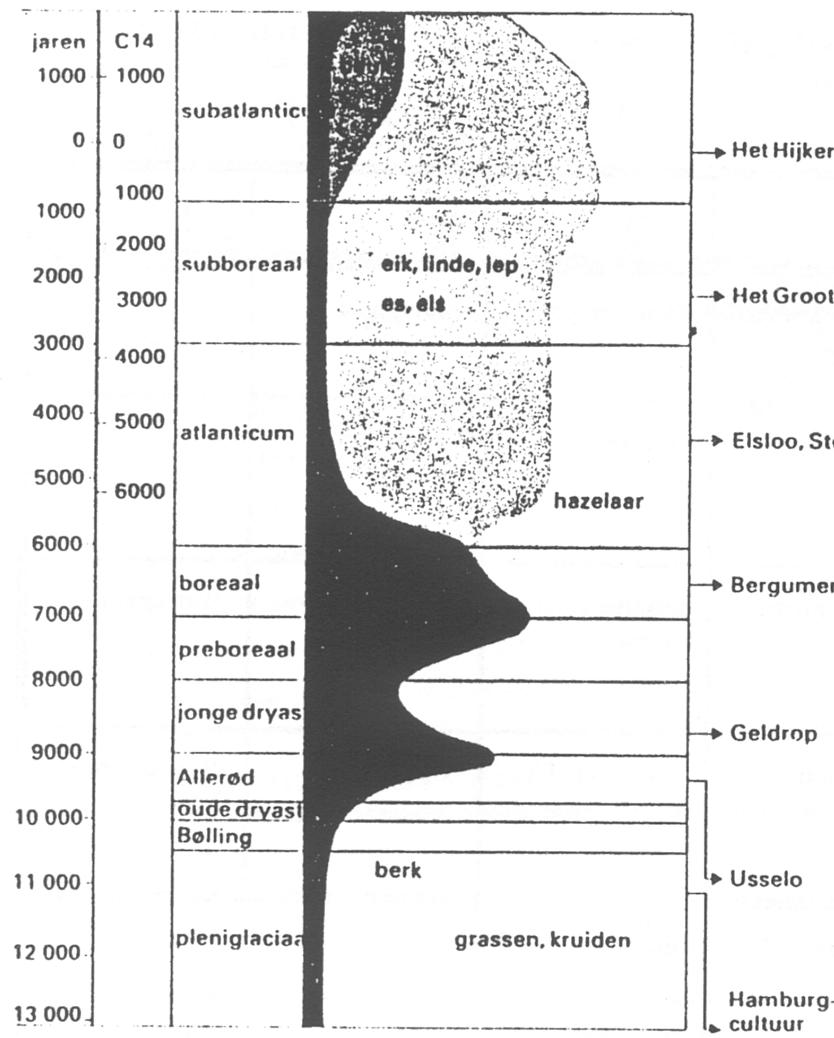
The condition of space

The smaller the open area the less animals could find a habitat.

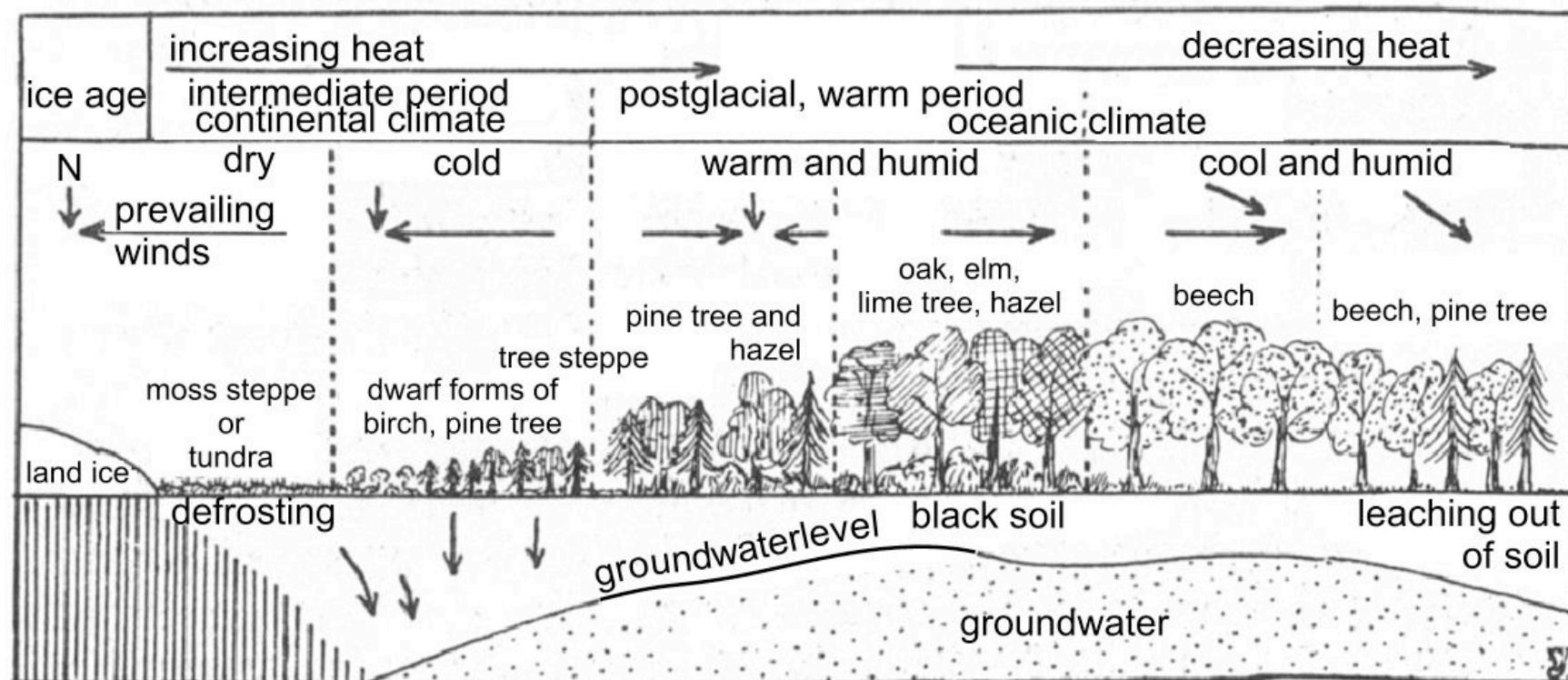
But that is not the case for botanical biodiversity as far as their dispersion is not dependent on big animals.



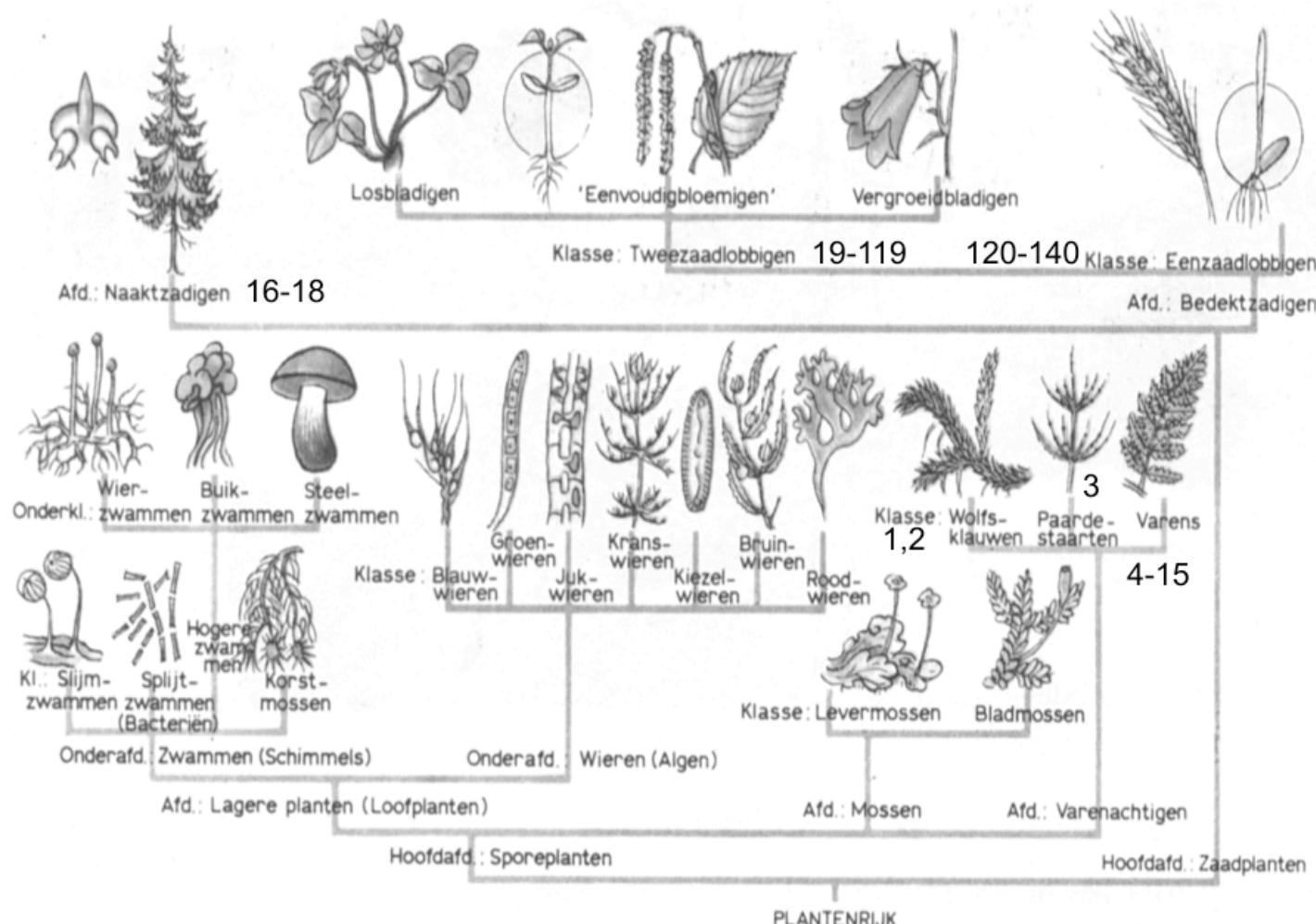
The condition of time



The influence of climate changes on vegetation



Plants as a basic condition



Biodiversity according to the CBS Biobase

BIOBASE CBS Duuren (1997) }.		Species world-wide	Species in the Netherlands	% in the Netherlands	plants or animals	rough 10% estimate
Name						
arthropoda	1130000	21000	2	a		
moulds and fungi	100000	3500	4	p		
'yellow algae'	9200	2200	24	p		
threadworms or elvers	12500	1700	14	a		
green seaweeds	7000	1600	23	p		
the angiosperms	250000	1400	1	p		
lichens	20000	633	3	p		
mosses	23000	533	2	p		
Chordata	52000	470	1	a		
ringworms	8000	350	4	a		
flatworms	14000	330	2	a		
wheel animals	1800	300	17	a		
molluscs	53000	300	1	a		
eye seaweeds	500	250	50	p		
bacteria	1500	150	10	p	*	
blue algae	1500	150	10	p	*	
coelenterata	8000	140	2	a		
virus	1200	120	10	p	*	
red seaweeds	3500	78	2	p		

Kinds of responsibility

- B Very threatened
- BA Very threatened, important internationally
- BD Very threatened, vulnerable
- C Threatened
- CA Threatened, important internationally
- D Vulnerable
- DA Vulnerable, important internationally

Habitat responsibility

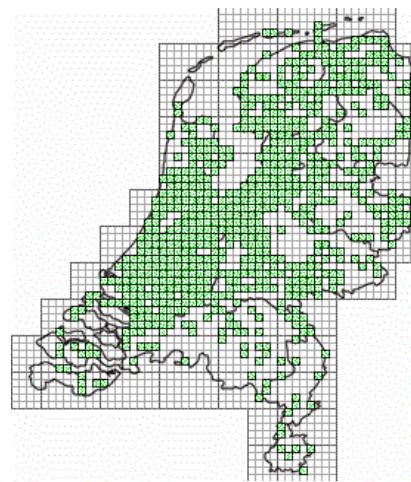
A=internat.important B=very threatened		NEST	FOOD	mainly insects
Black Tern	BA	open water	open water	+
Little Grebe	C	open water	open water	+
Garganey duck	C	open water	open water	
Bittern	BD	reed vegetation	reed vegetation	
Sedge Warbler	C	reed vegetation	reed vegetation	+
Savi's Warbler	C	reed vegetation	reed vegetation	+
Spotted Crake	D	reed vegetation	reed vegetation	+
Bearded Tit	DA	reed vegetation	reed vegetation	+
Spoonbill	DA	reed vegetation	reed vegetation	+
Great Reed Warbler	BD	reed vegetation	brushwood	+
Ruff	B	brushwood	grassland	+
Common Tern	C	sandy, open brushwood, pioneer	open water	
Avocet	DA	sandy, open brushwood, pioneer	open water	+
Kentish Plover	BD	sandy, open brushwood, pioneer	sandy, open brushwood, pioneer	
Ringed Plover	D	sandy, open brushwood, pioneer	sandy, open brushwood, pioneer	+
Redshank	C	grassland	grassland	+
Black-tailed Godwit	CA	grassland	grassland	+

The distribution of two world-wide rare but Dutch common species

marsh fleawort
(moerasandijvie)



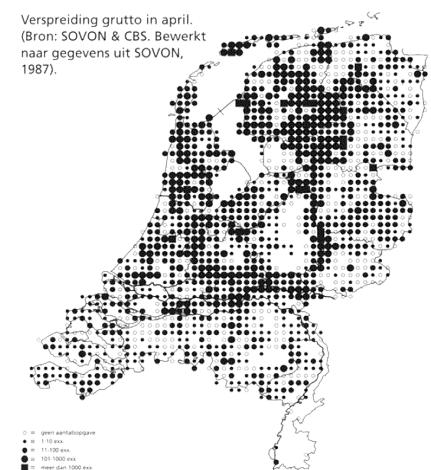
E. Hallier, 1887



black-tailed godwit
(grutto)



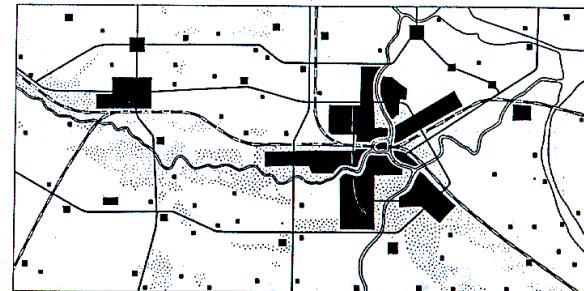
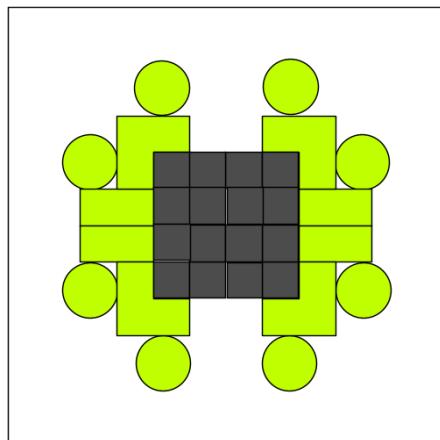
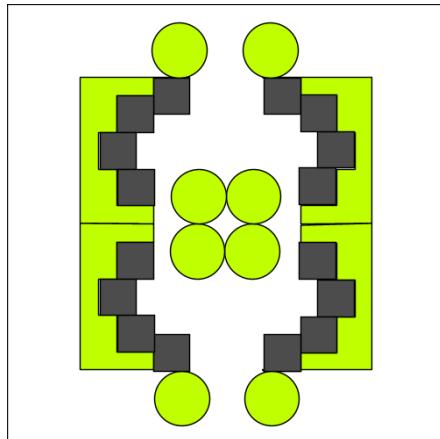
Verspreiding grutto in april.
(Bron: SOVON & CBS. Bewerkt naar gegevens uit SOVON, 1987).



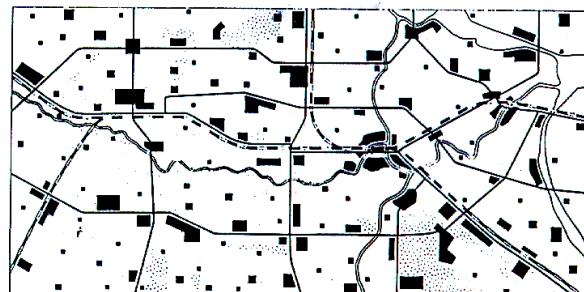
The ecologist's view

- Andrewartha (1961): Ecology is the scientific study of the ***distribution and abundance*** of organisms.
- Krebs, C.J. (1972, 1992): Ecology is the scientific study of the *interactions* that determine the ***distribution and abundance*** of organisms.
- Begon; Harper; Townsend (1996): Ecology is the scientific study of the *interactions* that determine the ***distribution and abundance*** of organisms, *populations and communities*.

The designer's view: state of dispersion(form)



Voorbeeld van concentratie in het kernpatroon

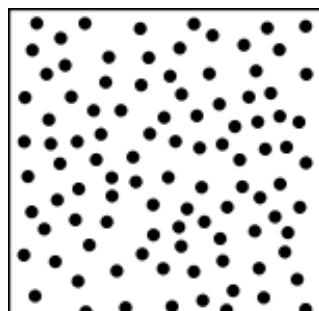


Voorbeeld van deconcentratie in het kernpatroon

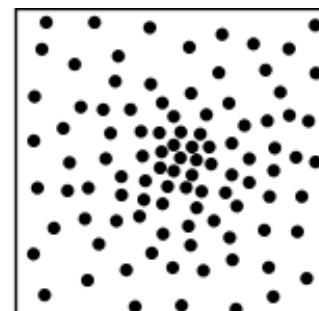


Voorbeeld van gebundelde deconcentratie in het kernpatroon

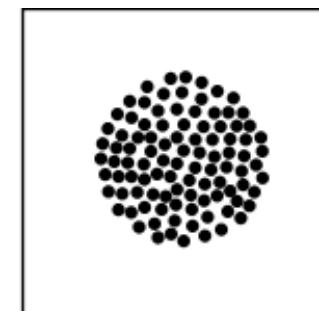
Alternatives of form: states of dispersion at one level of scale



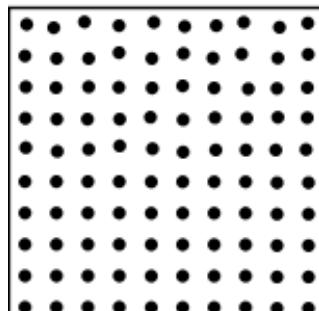
random



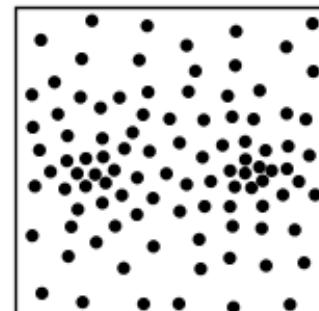
gradient



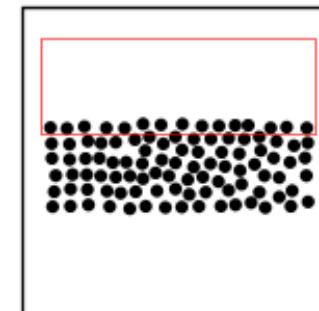
accumulation



pattern



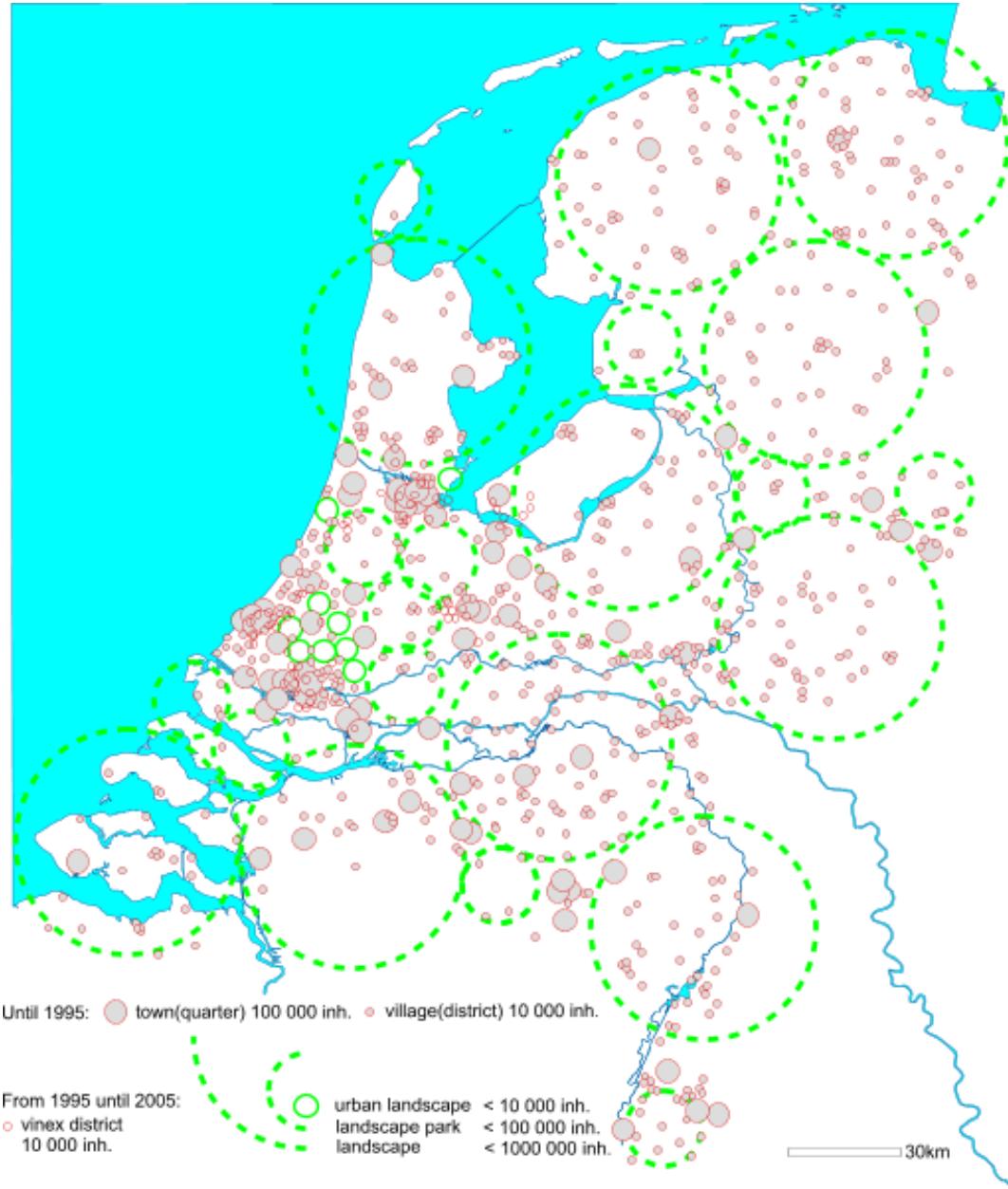
bimodal



elongated

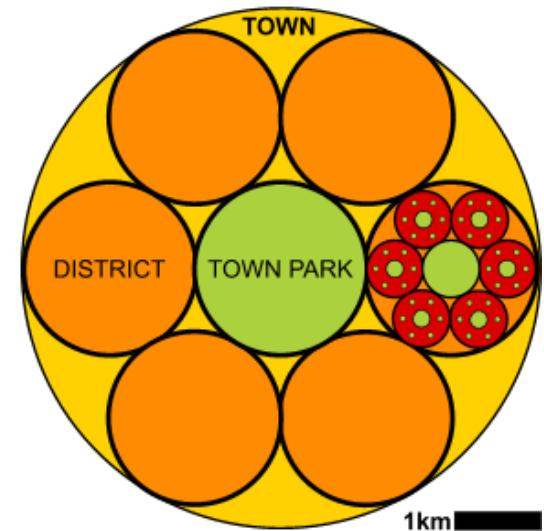
deconcentration ← → *concentration*

Built and open space

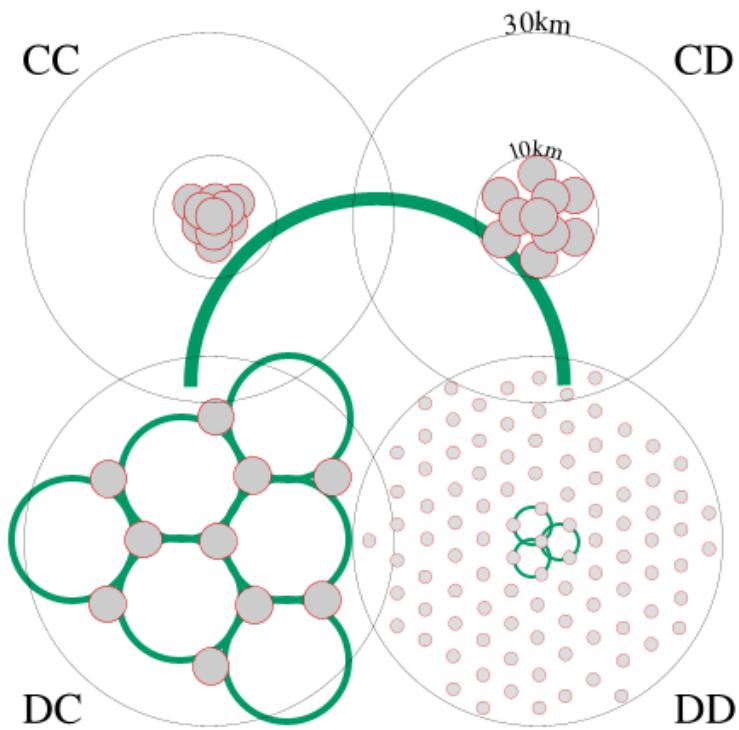


Open space

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



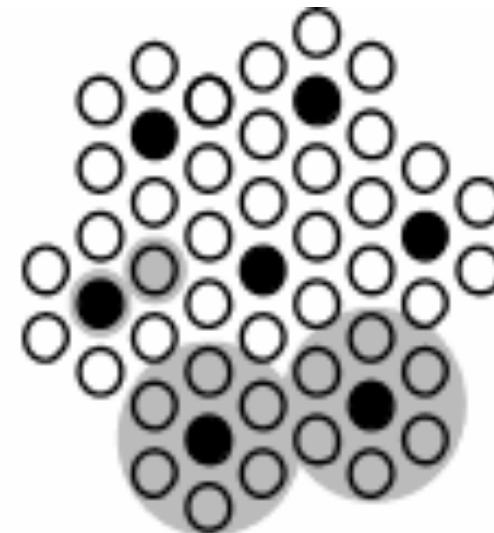
States of dispersion at different levels of scale



Legend

name	radius km	inh.
agglomeration	10	1mln
city	3	100 000
village/district	1	10 000
city-landscape	3	<10 000
landscape park	10	<100 000
landscape	30	<1mln

Schale paradox



field
of
vision



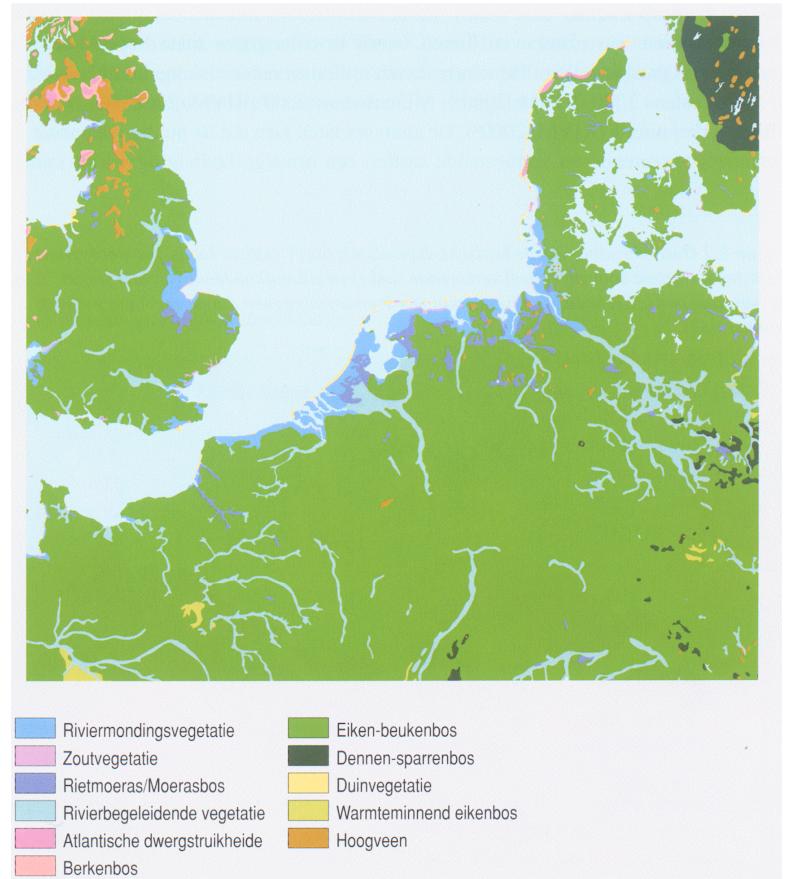
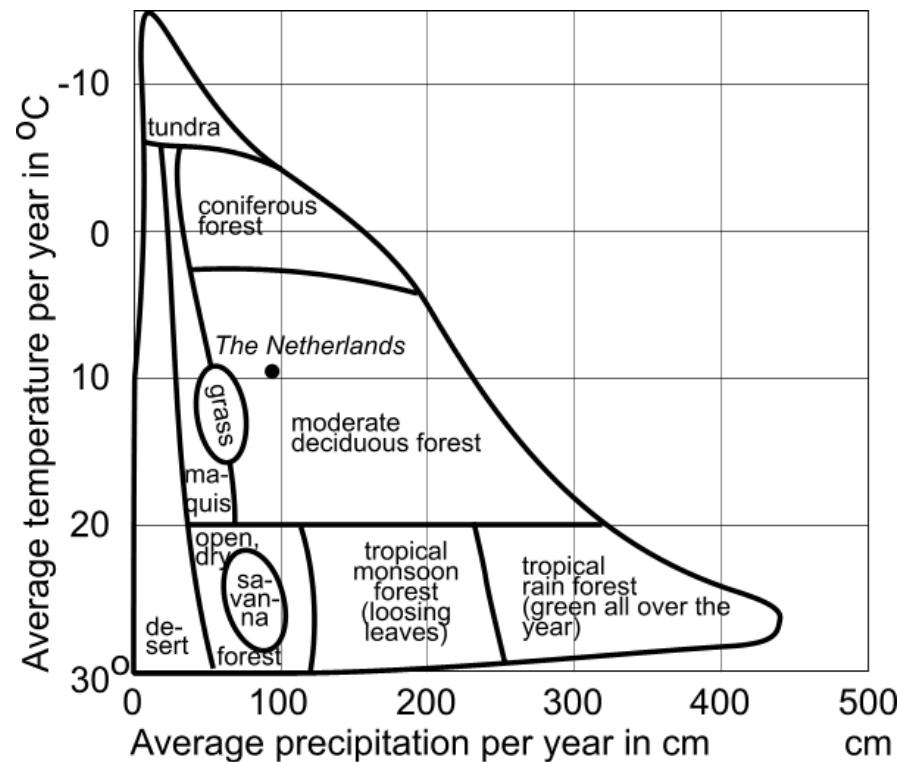
"difference"

"equality"

Scale sensitive legend units

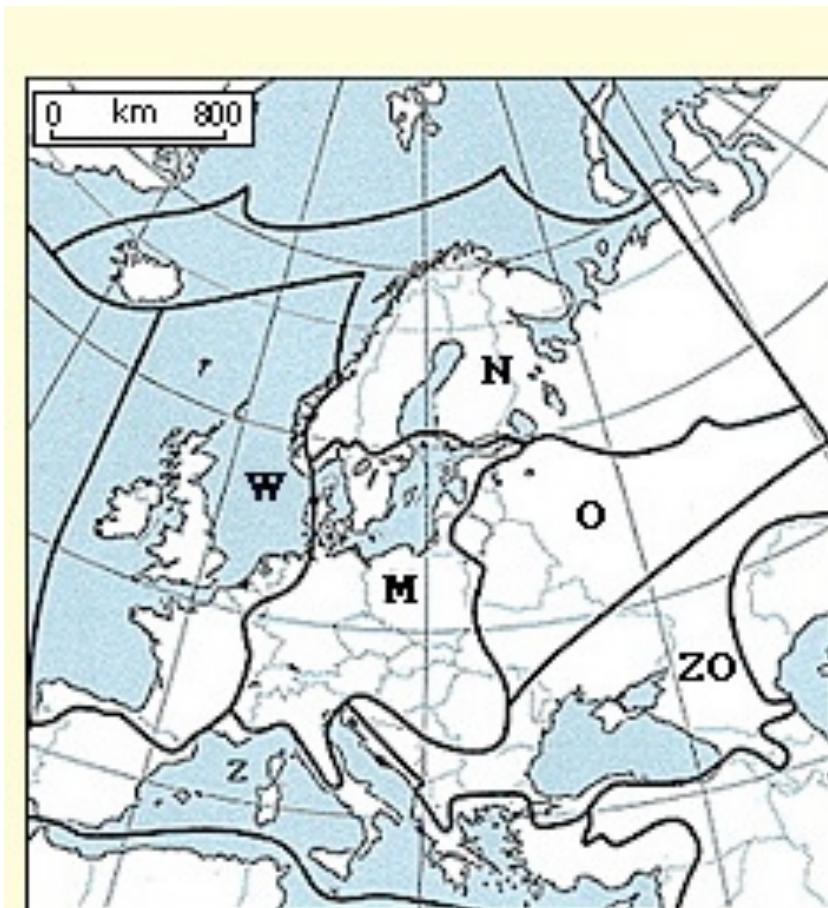
- Global
- Continental
- National
- Regional

Gobal and continental types



R=1000km

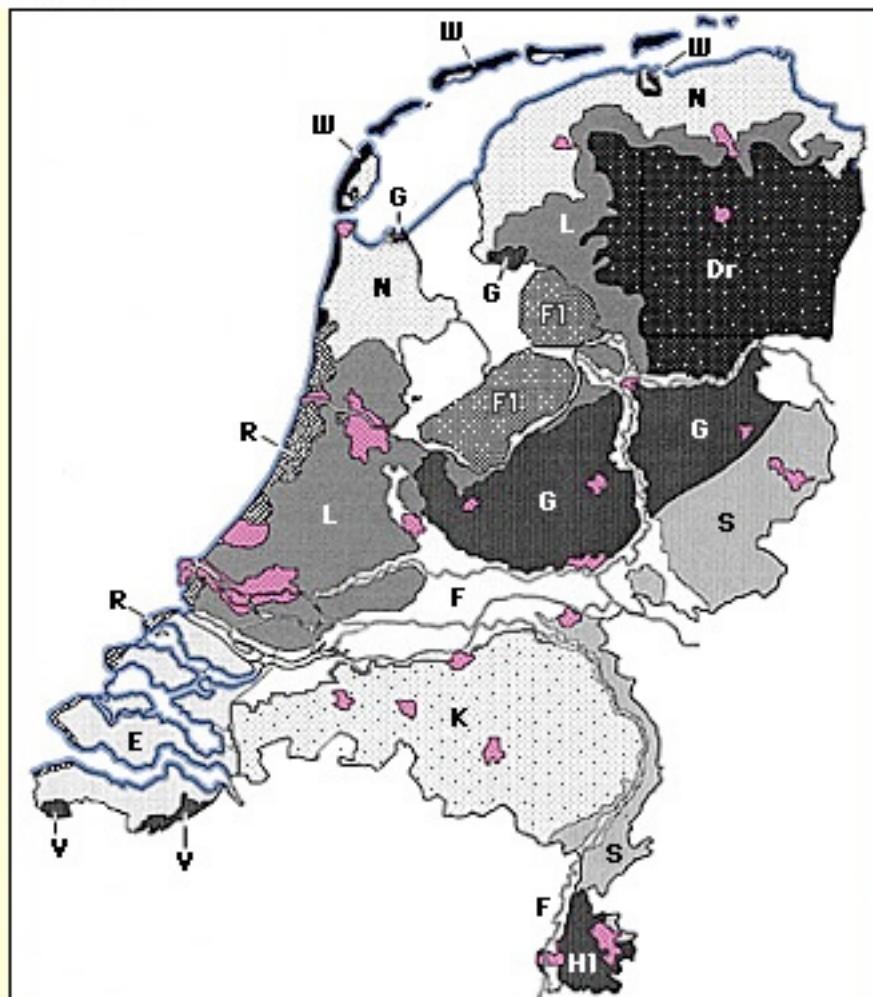
Continental types of vegetation



L. van Duuren & J.H.J. Schaminée

R=100km: National types of flora

ETI • HIFN

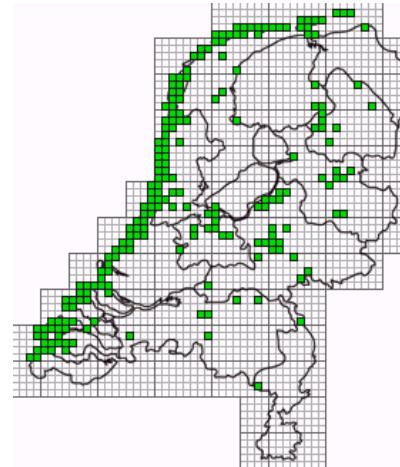


- Dr = Drents district
 - Du = Duindistricten R, W
 - E = Estuariëndistrict
 - F = Fluviatiel district
 - F1 = Flevoland
 - G = Gelders district
 - H = Hafdistricten E, L, N
 - H1 = Heuvelland district
 - K = Kempens district
 - L = Laagveendistrict
 - N = Noordelijk kleidistrict
 - P = Pleistocene districten Dr, G, K, S, V
 - R = Renodunaal district
 - S = Subcentreurop district
 - V = Vlaams district
 - W = Waddendistrict
- Maritiem district
Urbane gebieden

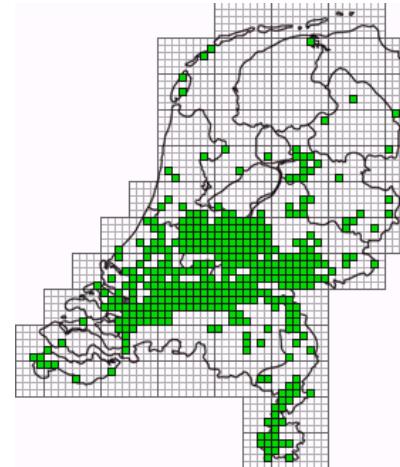
Dunes and rivers



L. Reichenbach, 1846



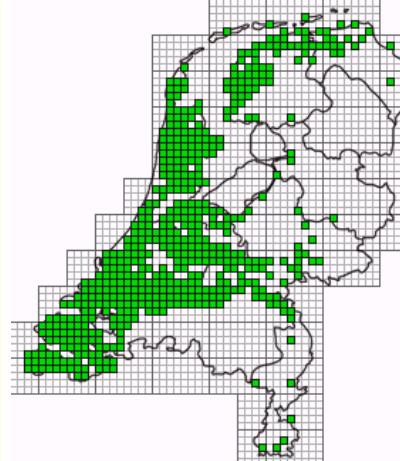
E. Hallier, 1887



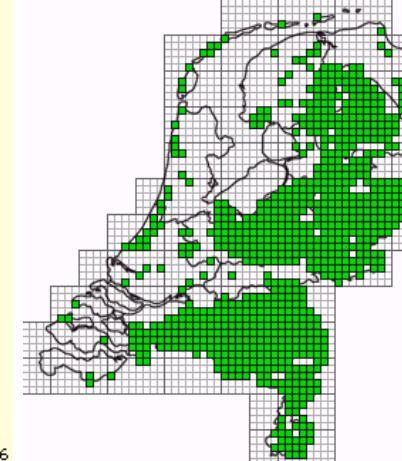
Dispersion of marram (helm)

Dispersion of greater burdock (grote klis)

Holocene and Pleistocene



*Dispersion of meadow
barley (veldgerst)*

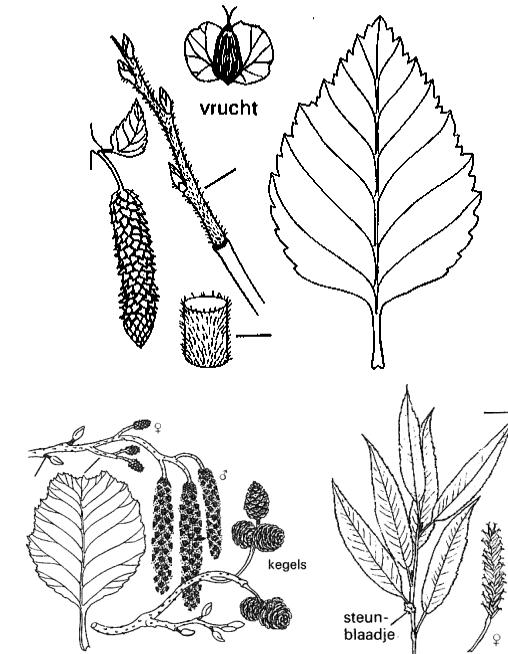


*Dispersion of wavy hair-grass
(bochtige smele)*

Peat forests

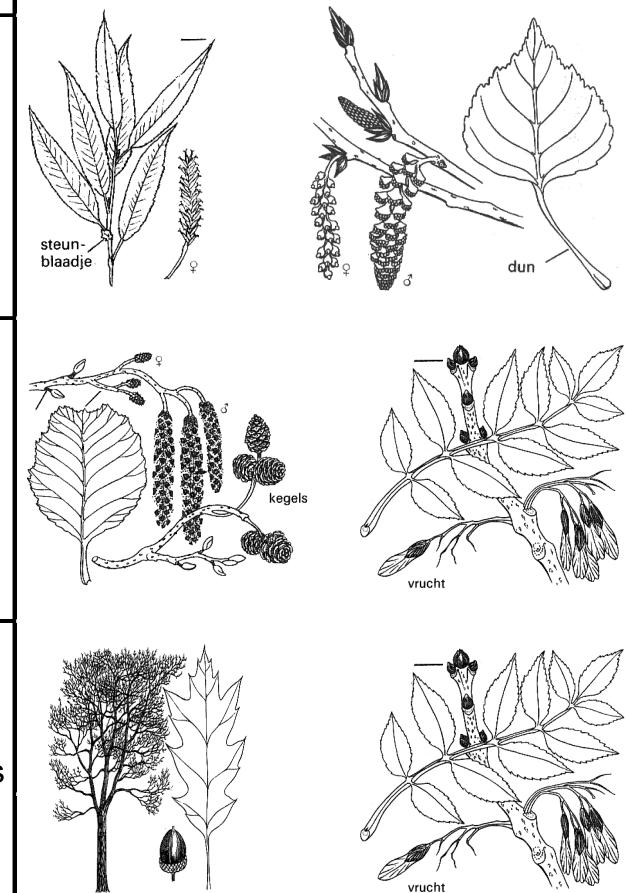
Forest	Natural	Reclaimed
Betulon Pubescentis	Rarefied birch forests on somewhat dehydrated peat grounds (very rare).	Dug out or drained and manured meadows sometimes planted as <i>Alnion incanae</i> .
Sphagno-Alnion.	Birch (sometimes alder) forests with shrubs of alder buckthorn, willows, bog myrtle on acid peat grounds (rare).	Bluegrass lands, later usually drained and manured, sometimes planted as <i>Alnion incanae</i> .
Irido-Alnion.	Alder or willow (mostly coppice wood) in peat areas with very high, stagnating not too poor ground water, usually with rarified shrubs .	Moist grass land, dug out or drained and manured meadows mostly planted as <i>Alnion incanae</i> .

Leeuwen and Kraft (1959)



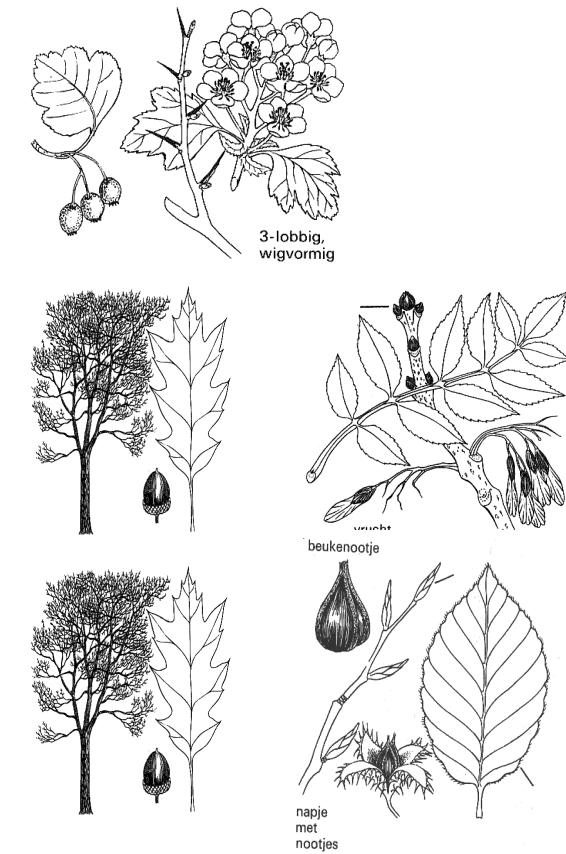
Holocene forests

Forest	Natural	Reclaimed
	Holocene	
Salicion	Willow and poplar forests, often found on <i>nutritious flooded areas like river forelands</i> . As coppice wood and wickers, willows are planted on 'grienden'. Temporarily you will find these woods on other nutritious grounds as pioneer vegetation.	Grass land on river forelands and 'grienden'.
Alnion incanae	Alder and ash forests with densely shrubs on <i>clay or sandy nutritious grounds with high and often somewhat changing ground water level or in the neighbourhood of streaming water</i> . These forests often contain some oaks and poplars as well.	Moisty grass land (meadows) sometimes with hedges (Rubion, alder), pollard willows or poplars.
Ulmion	Oak , ash (sometimes elm or maple) forests on <i>moist, nutritious sandy and not too heavy clay grounds with ground water level in reach of roots</i> .	Settlements, horticulture, orchards, fields, grass land, elm lanes, country estates and dune woods.
Sambuco-Berberidion	Hedges and thickets on <i>most limy grounds</i> of Ulmion .	

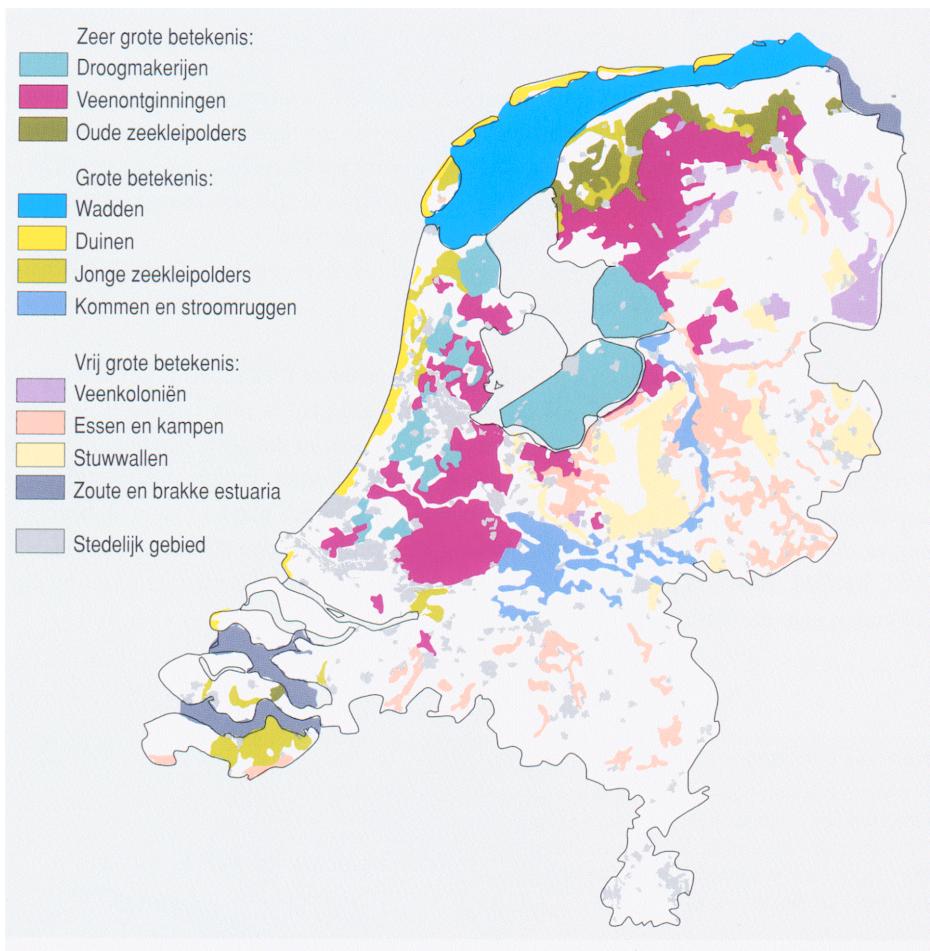
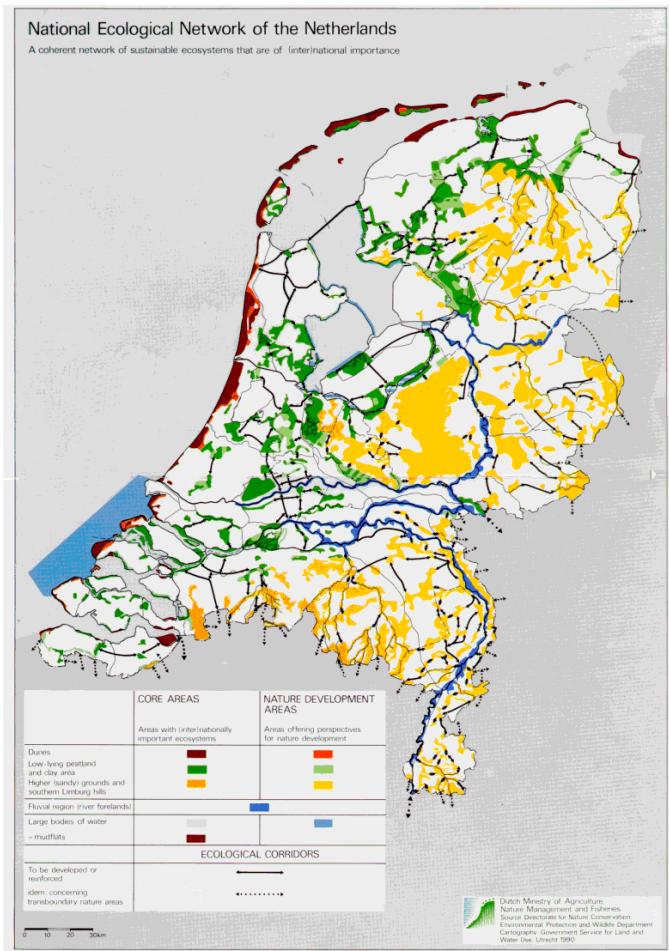


Pleistocene forests

Forest	Natural	Reclaimed
Rubion	Hedges and thickets (hawthorn , sloe, roses, blackberries) on <i>nutritious, but not explicitly limy grounds</i> .	Settlements, orchards and fields on rather dry grounds; grass land on more moisty or very limy grounds.
Carpinion	Oak, ash (sometimes maple or beech) forests on <i>nutritious, not too wet loam grounds</i> . In coppice wood thickets you wil find hazel and hornbeam.	
Carpino-Berberidion	Hedges and thickets on <i>most limy grounds</i> of Carpinion .	
Violeto-Quercion	Oak (seldom birch or beech) forests or coppice wood on <i>acid but not</i>	Fields
Vaccinio-Quercion	Oak (sometimes birch or beech) forests or coppice wood on <i>acid extremely poor, sandy (sometimes loamy) grounds</i> .	Prehistoric (neolithic) settlements, heath often later planted with coniferous wood (drifting sand) or crops (if dry) or meadows (if wet).



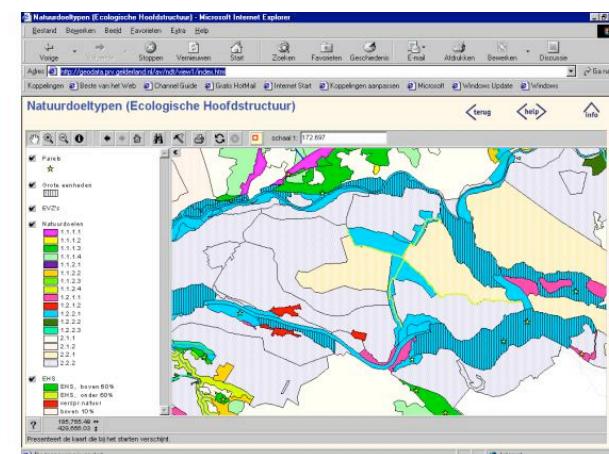
Other national typologies



The EHS for the Netherlands

Begrenende EHS

- [Yellow square] In 1990 bestaande natuur
- [Light blue square] Beheersgebied vanaf 1990
- [Green square] Natuurontwikkelingsgebied en reservatsgebied vanaf 1990



The EHS worked out on Internet for the province of South Holland and the Gelderse poort

Nature target groups

	Main group 1	Main group 2	Main group 3	Main group 4 ¹⁾
Name	almost-naturally	supervised-naturally	half-naturally	multifunctional
Radius	3km	>1km	300m	100m
Future picture	global	global	fixed	fixed
STRATEGY				
spacial scale	Landscape > thousands of ha.	Landscape > 500 ha.	ecotope/mosaic to approx. 100 ha.	ecotope mostly a few ha.
· location	mostly process-determined	process and pattern-determined	process-, pattern- and species-determined	pattern- and species-determined
· processes	not directed	directed integrally	directed in detail	directed in detail
· patterns	not established	not established	established, perhaps a cyclical succession	established
directing variables	non	process-focused on landscape level	process- and pattern-focused up to ecotope level	process- and especially pattern-focused up to ecotope level

Lay-out, conservancy, development

	Main group 1	Main group 2	Main group 3	Main group 4 ¹⁾
Name	almost-naturally	supervised-naturally	half-naturally	multifunctional
LAY-OUT				
nature-technical	only in the beginning phase	only in the beginning phase	perhaps repeated	perhaps repeated
· environmentally specialistic	only in the beginning phase	only in the beginning phase	permanent, if necessary	non
CONSERVANCY				
internal nature conservancy	non	non	partly necessary	necessary
compartmentalising	non	non	possibly in mosaic	possible
· shared use	(very) extensive	(very) extensive	(fairly) extensive	characteristic
DEVELOPMENT				
succession-stage	mostly diverse stages	diverse stages	a stage/mosaic	a stage
extent of development	on average long	on average long	rather short	short
predictability	on average, limited in the long run	on average, rather limited in the long term	quite large	large

Nature-target types per physical-geographical region

Physical-geographical region	Main group				total	
	Landscape scale		ecotope level			
	1	2	3	4		
	3km	>1km	300m	100m		
hl	Hilly land	1	2	12	2	17
hz	Higher sandy soils	2	3	19	2	26
ri	Fluvial area	0	2	12	2	16
lv	Laagveen area	1	3	10	2	16
zk	Marine clay area	0	3	13	2	18
du	Dunes	1	1	16	2	20
az	Estuaries	0	3	8	1	12
gg	Tidal zone	2	2	2	0	6
nz	North Sea	1	0	0	0	1
	Total	8	19	92	13	132

Nature-targets higher sandy soils

	>1km	300m	100m
1.1: zand-natuurbos - dschap	hz-2.2: zandverstuivingsland-schap	hz-3.1: laaglandbeek	hz-4.1: akker
1.2: hoogveenland-ap		hz-3.2: zoetwatergemeenschap	
		hz-3.3: rietland en ruigte	
	hz-2.3: boslandschap van bron en beek	hz-3.4: ven	hz-4.2: grasland
		hz-3.5: droog grasland	
		hz-3.6: bloemrijk grasland	
		hz-3.7: vochtig schraalgrasland	
		hz-3.8: open zand	
		hz-3.9: droge heide	
		hz-3.10: vochtige heide en levend hoogveen	
2.1: boslandschap arme en leemige gronden		hz-3.11: struweel, mantel- en zoombegroeiing	hz-4.8: afgeleide doeltype uit hoofdgroepen 1-4
		hz-3.12: hak hout	hz-4.8.3: inheemse bos cultuur
		hz-3.13: bosgemeenschappen van arme zandgrond	hz-4.8.4: bos cultuur met inheemse soorten
		hz-3.14: bosgemeenschappen van leemgrond	
		hz-3.15: bosgemeenschappen van bron en beek	
		hz-3.16: bosgemeenschappen van hoogveen	
		hz-3.17: middenbos	
		hz-3.18: boombos	
		hz-3.19: park-stinzenbos	

Elaborated targets 300m.

300m

hz-3.1: laaglandbeek



hz-3.2: zoet watergemeenschap

hz-3.3: rietland en ruigte



hz-3.4: ven

hz-3.5: droog grasland

hz-3.6: bloemrijk grasland

hz-3.7: vochtig schraalgrasland



hz-3.8: open zand

hz-3.9: droge heide

hz-3.10: vochtige heide en levend hoogveen

hz-3.11: struweel, mantel- en zoombegroeiing

hz-3.12: hakhout

hz-3.13: bosgemeenschappen van arme zandgrond

hz-3.14: bosgemeenschappen van leemgrond

hz-3.15: bosgemeenschappen van bron en beek

hz-3.16: bosgemeenschappen van hoogveen

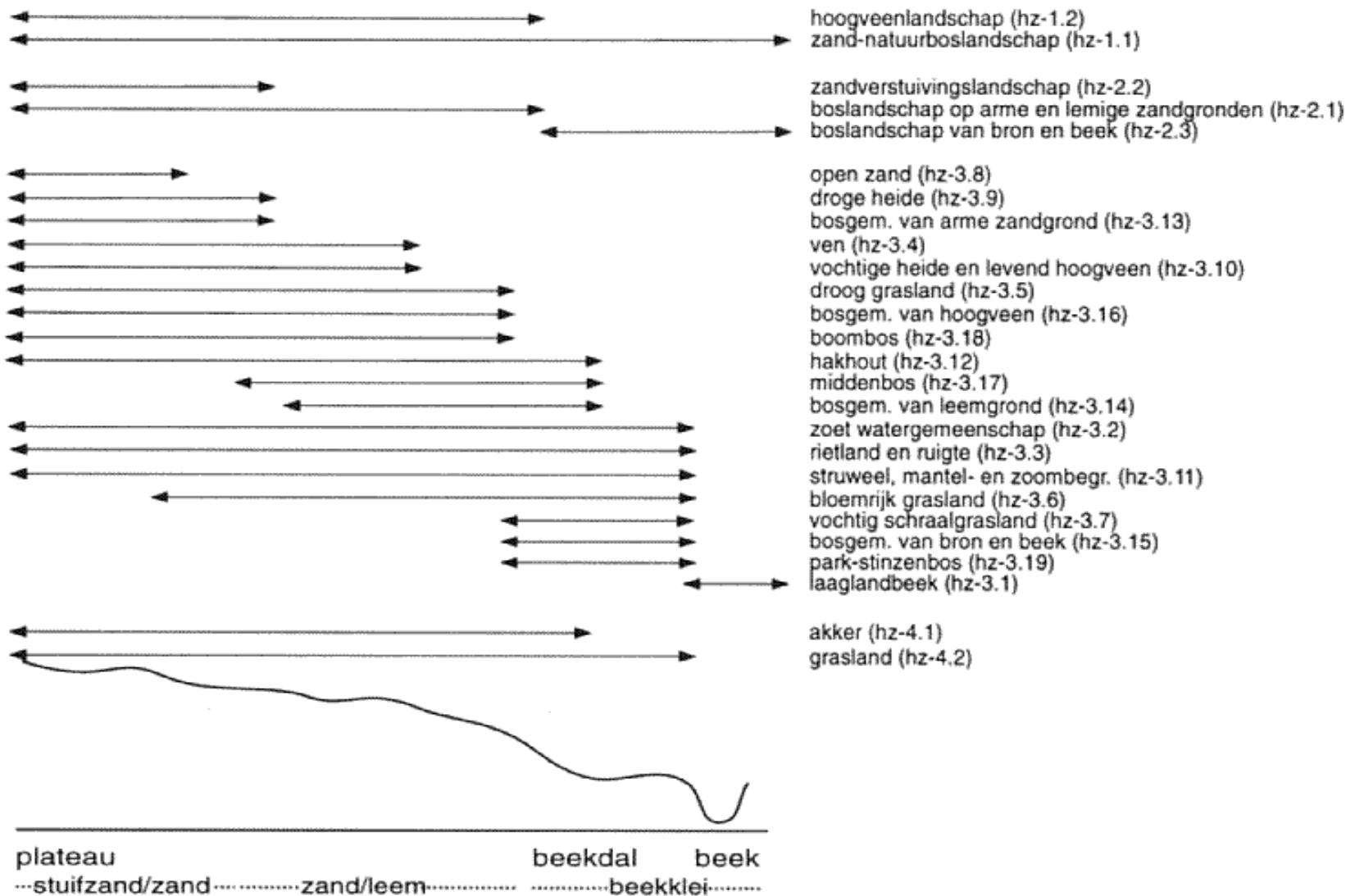
hz-3.17: middenbos

hz-3.18: boombos

hz-3.19: park-stinzenbos



Higher sandy formations

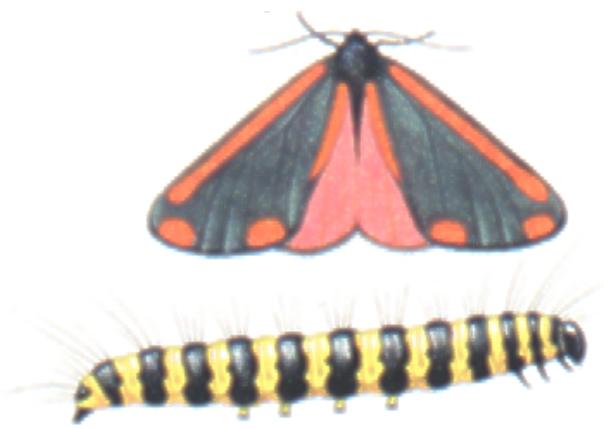


Types of ecology

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chaos ecology	opportunities	individual strategies	

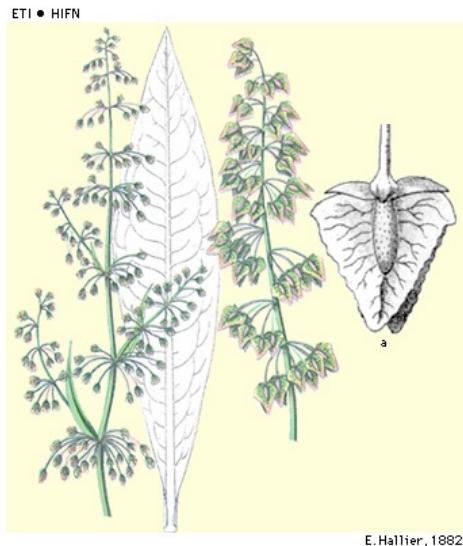
decreasing human centred approach

Symbiosis

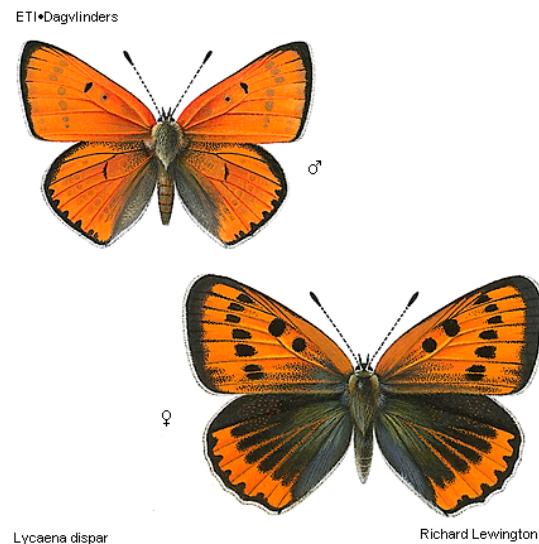


Tyria jacobaeae and common ragwort

Breeding and host plant



water dock (waterzuring)
V18, V19



large copper butterfly
(grote vuurvlinder)



loosestrife (kattestaart)
R27, R28, H27, H28, V17

Survival strategies



Vogelmuur P48, P68
("ruderal")



Wilgenroosje R47, R67,
H47, H62
("competitor")



Grote sleutelbloem
G43, G47kr, H43, H47
("stress-tolerator")

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decreasing human centred approach

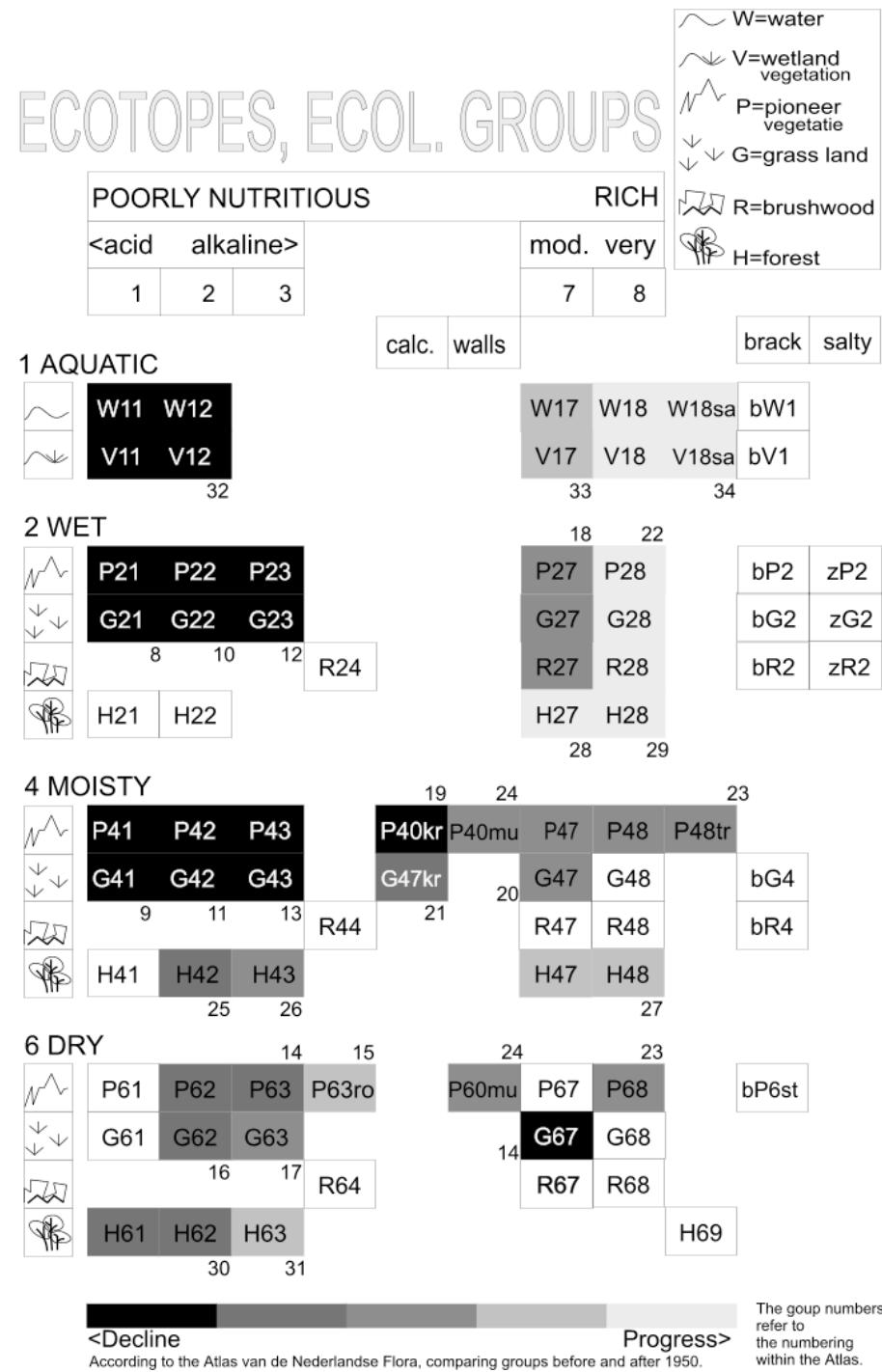
System dynamics

Odum(1971)

Ecological group and biotope

	PIONEER	CLIMAX
Energy	high	low
Net production	linear	web
Food chains		
Community structure	small	large
Total amount of organic material	extrabiotic	interbiotic
Inorganic nutrients	low	high
Species diversity	low	high
Spatial diversity		
Life characteristics	wide	
Niche specialisation	small	narrow
Sizes of organisms	short, simple	large
Life cycles		long, complex
Nutrient cycles	open	
Mineral cycles	fast	closed
Nutrient exchanges	unimportant	slow
Reuse		substantial
Selection pressure	fast	controlled
Growth strategy	quantity	quality
Production		
Homeostasis	undeveloped	developed
Symbiosis	small	substantial
Nutrient conservation	high	low
Coincidence	little	much
Information		

Local ecotopes, ecological groups

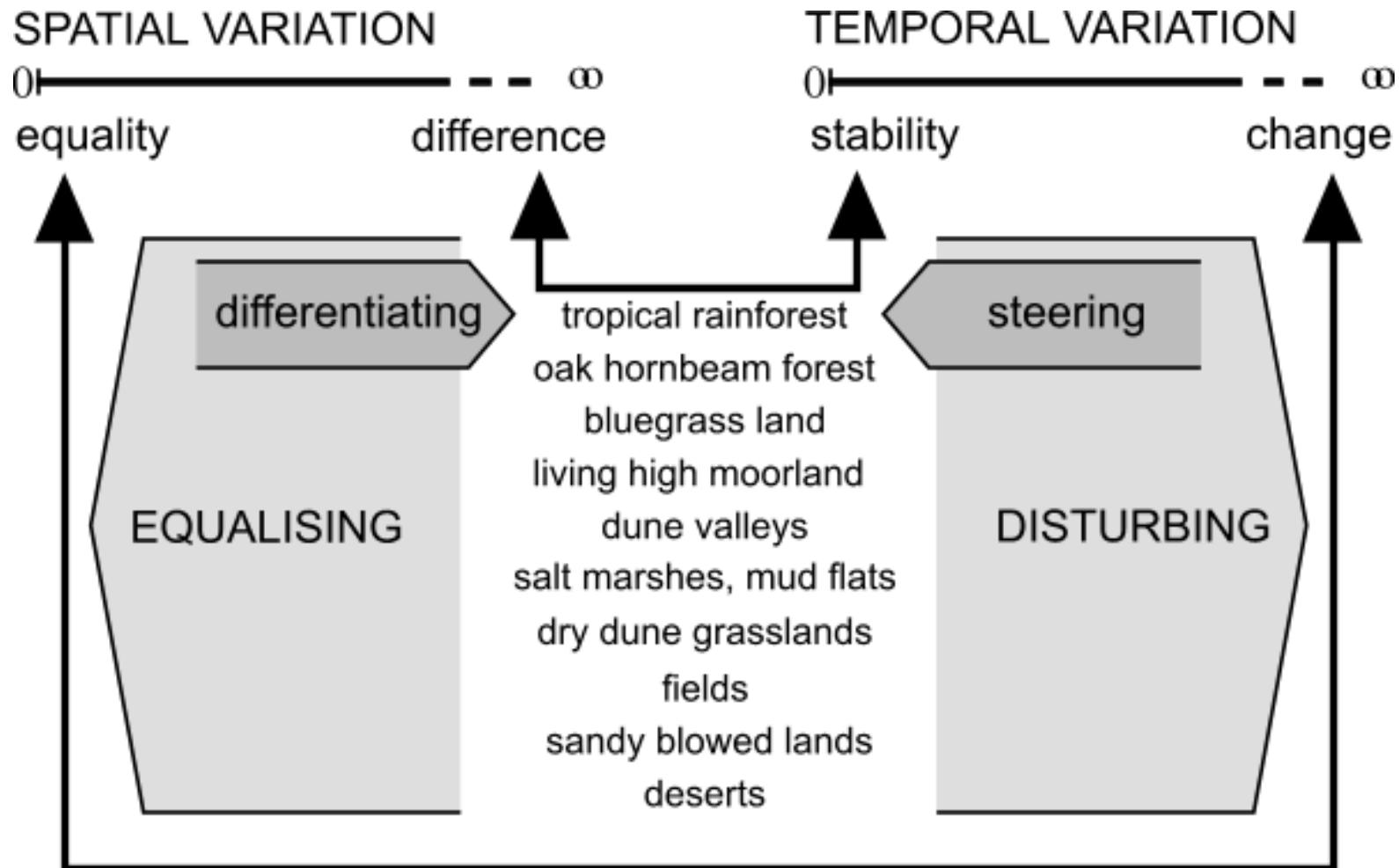


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Cybernetic variation

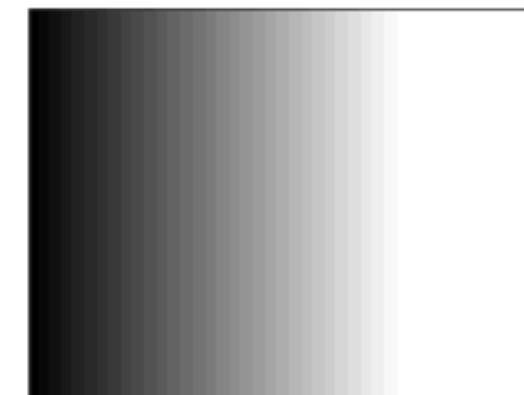
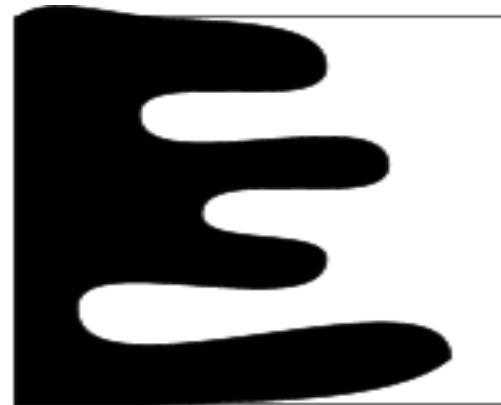


Gradients (Van Leeuwen)

Disturbance (limes convergens)	alkaline, nutricious	>>	acid, malnutritious	Mineralisation, strong dynamics, poor pattern, little ordinary
	mineral	>>	organic, humus, peat	
	wet	>>	dry	
Gradient (limes divergens)	acid, malnutritious	>>	alkaline, nutricious	Humification, weak dynamics, rich pattern, many
	organic, humus, peat	>>	mineral	
	dry	>>	wet	



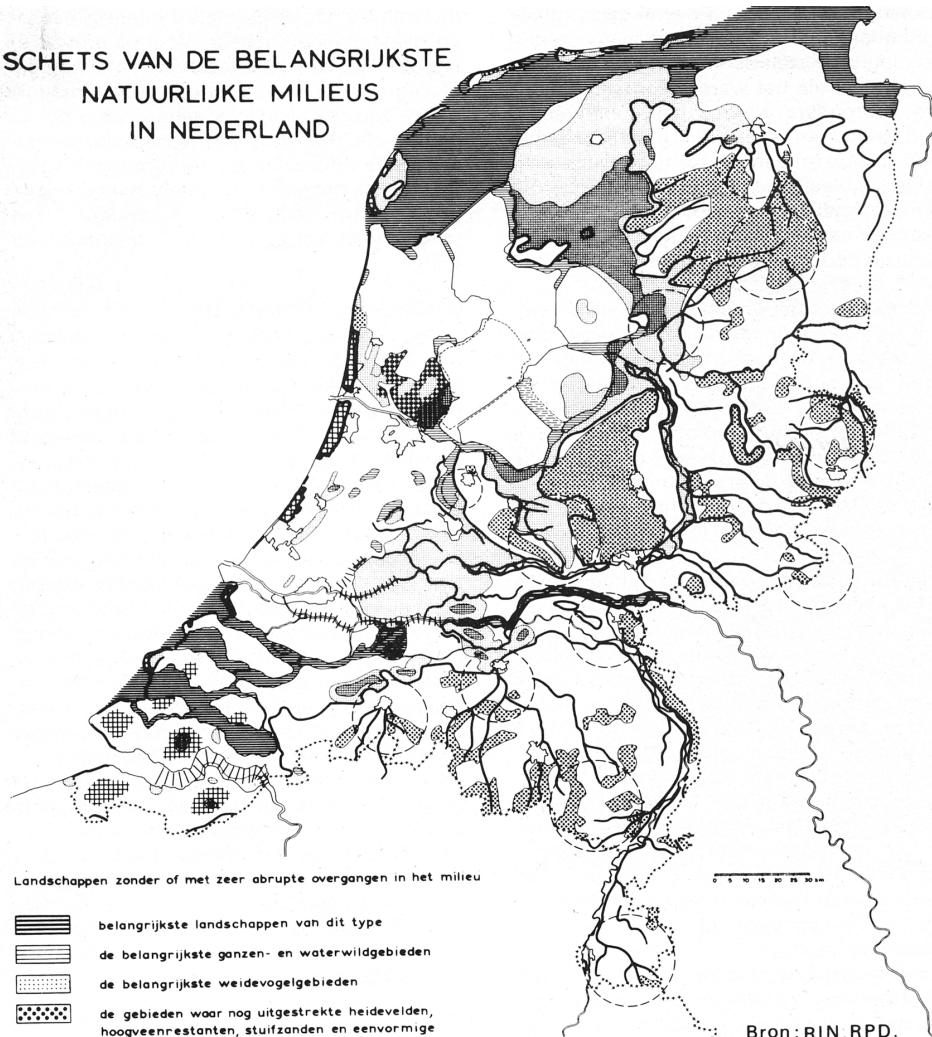
Disturbance (limes convergens)



Gradient (limes divergens)

Gradient map

SCHETS VAN DE BELANGRIJKSTE
NATUURLIJKE MILIEUS
IN NEDERLAND



Landschappen zonder of met zeer abrupte overgangen in het milieu

- [Solid horizontal lines] belangrijkste landschappen van dit type
- [Horizontal lines with dots] de belangrijkste ganzen- en waterwildgebieden
- [Dotted pattern] de belangrijkste weidevogelgebieden
- [Dots with diagonal lines] gebieden waar nog uitgestrekte heidevelden, hoogveenrestanten, stuifzanden en eenvormige boscomplexen voorkomen, o.a. van belang voor roofvogels, wulpens, korhoenders en kraanvogels

Landschappen met geleidelijke overgangen of milieugradienten

- [Wavy line pattern] smalle zones waar zich geleidelijke overgangen bevinden tussen landschappen met onderling sterk verschillende levensomstandigheden
- [Vertical lines pattern] de benedenloop van onze grote rivieren waar, behalve gradiënten van zout naar zoet water in het westen, ook overgangen worden aangetroffen met een afnemende invloed van de eb- en vloedbeweging in oostelijke richting

gebieden in het westen van Nederland van kleiner formaat waarbinnen zich relatief veel overgangsstroken tussen zout en zoet milieu bevinden

delen van ons land waar de rijkdom aan bijzondere plantensoorten eertijds zeer groot was en ten dele nog is. Het hoogtepunt hierbij werd gevormd door het landschap tussen Eindhoven en Weert

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decreasing human centred approach

Synecology: life community and biotope

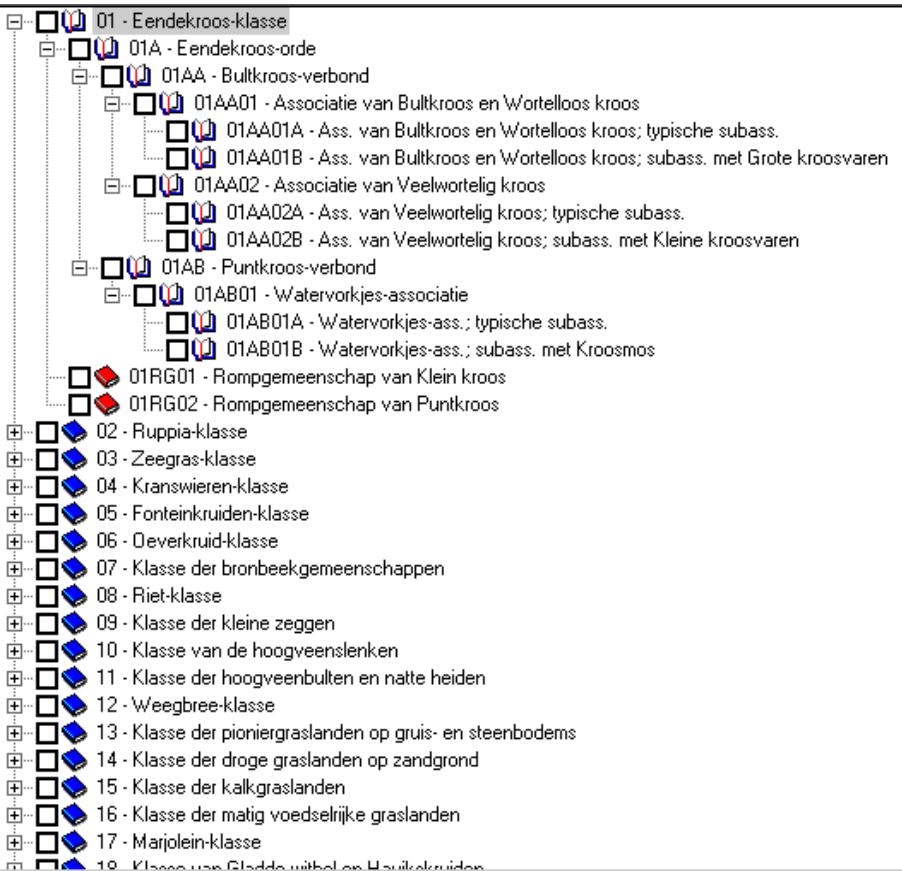
Klasse

Orde

Verbond

Associatie

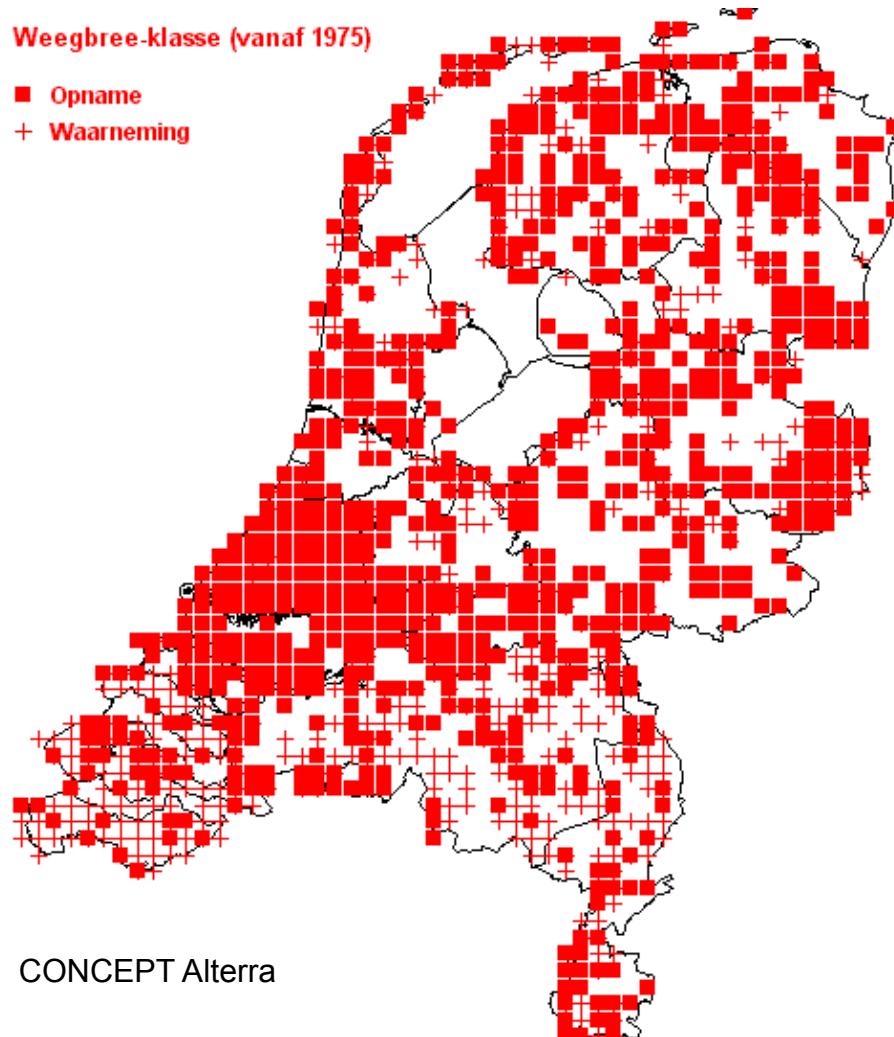
Subassociatie



12 Weegbree-klasse

Weegbree-klasse (vanaf 1975)

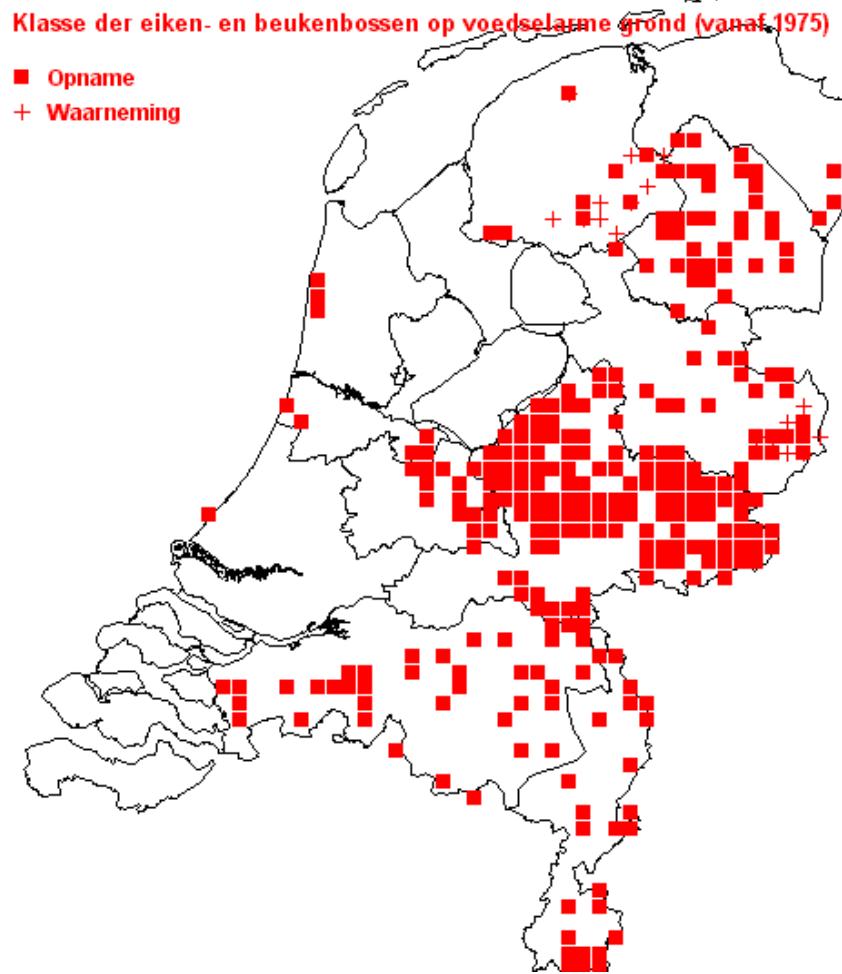
- Opname
- + Waarneming



Alterra

CONCEPT Alterra

42 Voedselarme eiken-beukenbossen-klasse

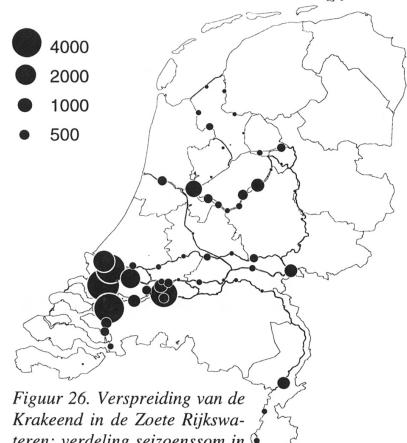


Types of ecology

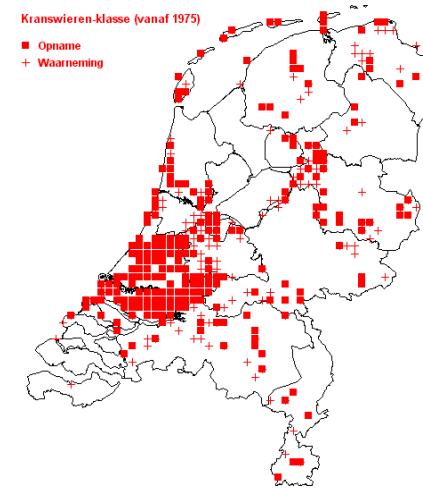
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decreasing human centred approach

Autecology: population and habitat



Gadwall duck
(krakeend)



04 Garland Weed
Class
(eendekroosklasse)

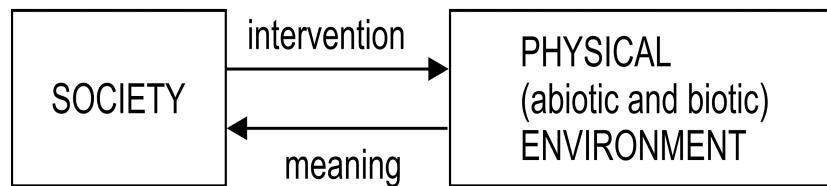
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decreasing human centred approach

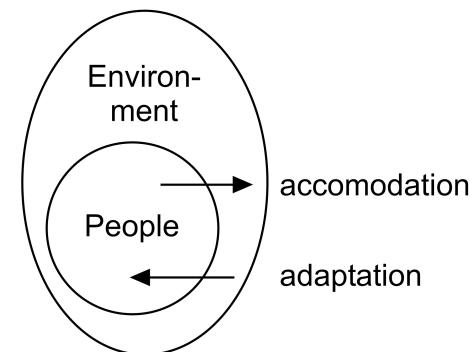
Environmental science: society and environment

Environment is the physical, non-living surroundings of society in reciprocal relationship



Environment according to Udo de Haes

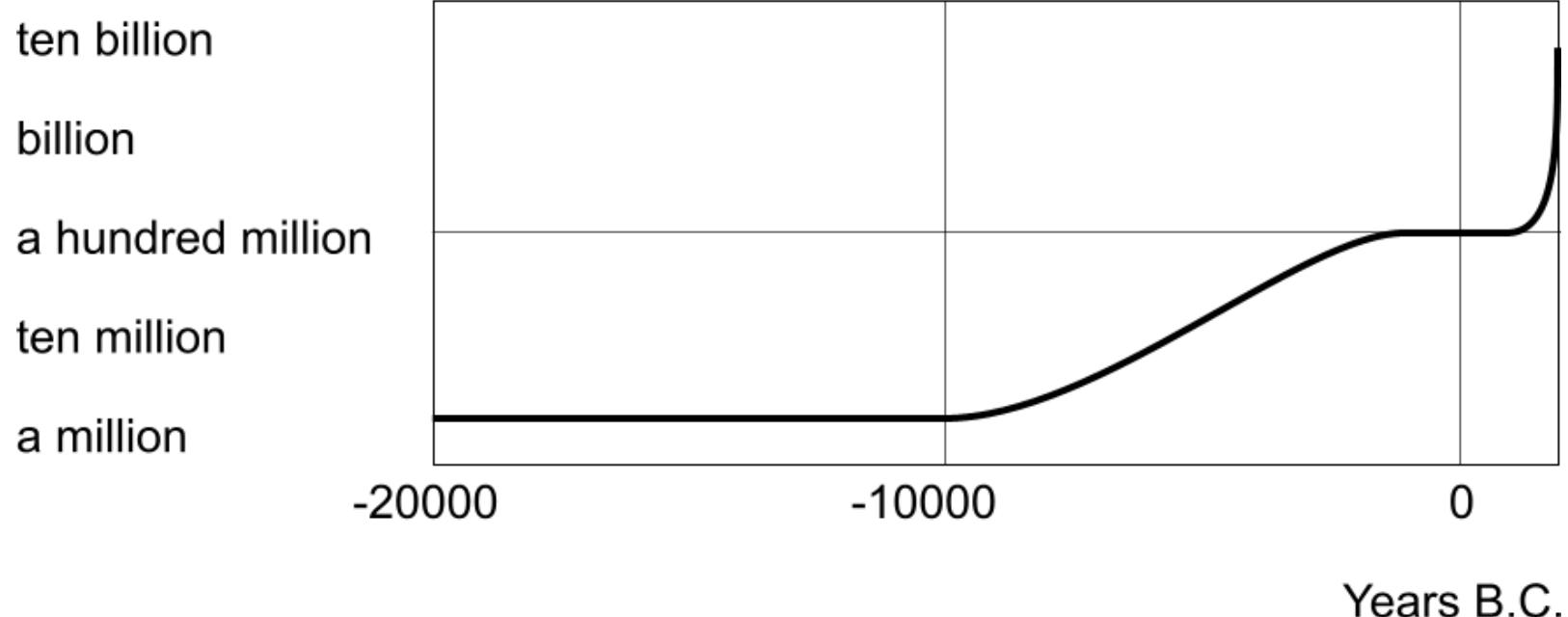
Environment is the set of conditions for life



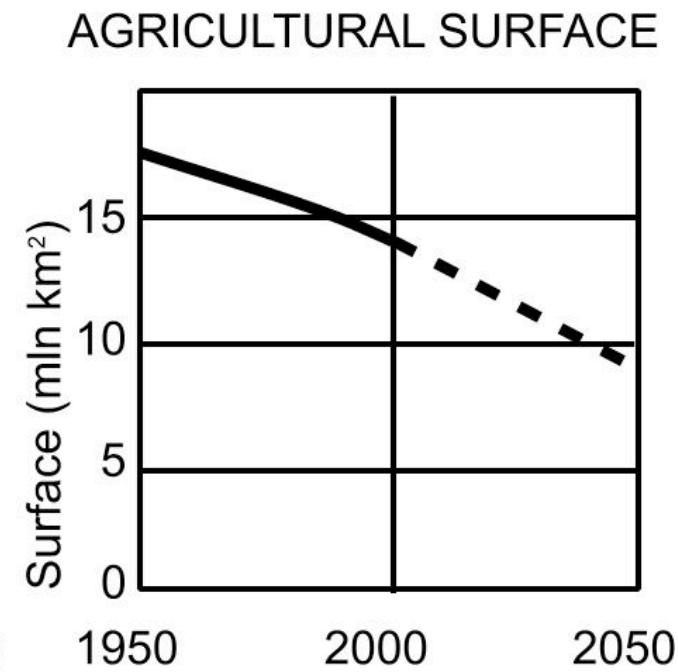
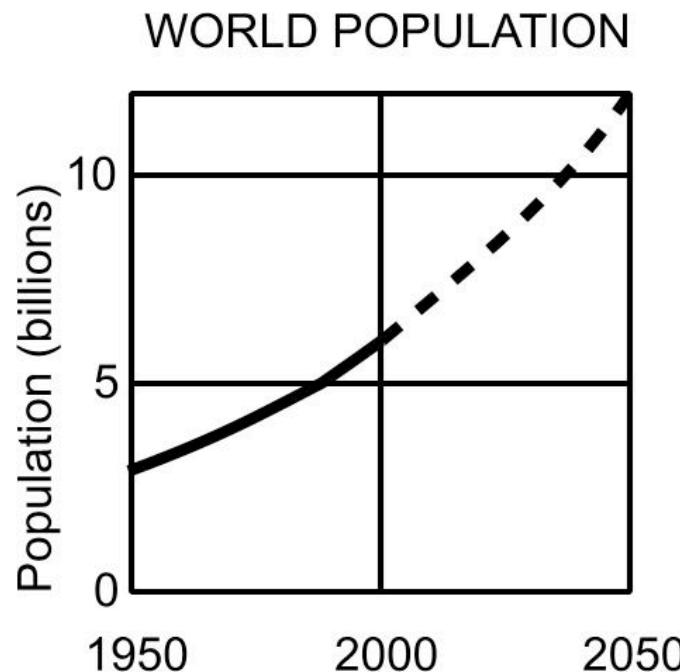
Environment in technical sense

World population

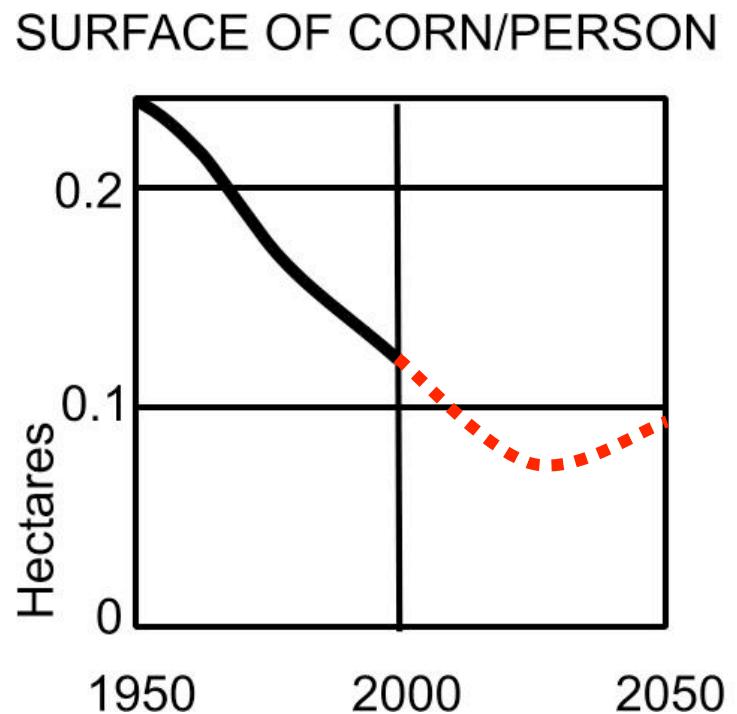
WORLD POPULATION



Agricultural surface



Agricultural surface/person

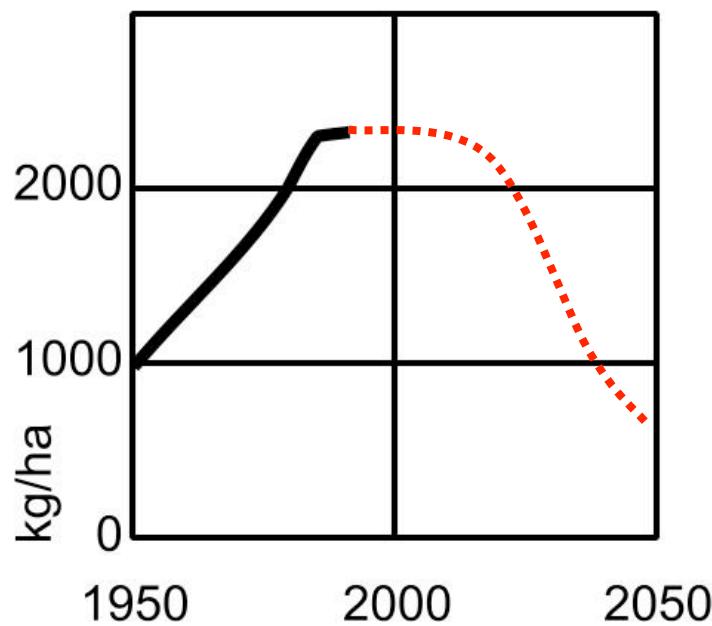


decrease:
60% desertification
20% erosion
20% pollution

increase:
at the cost of forest
New area by climate change?

Yield per hectare

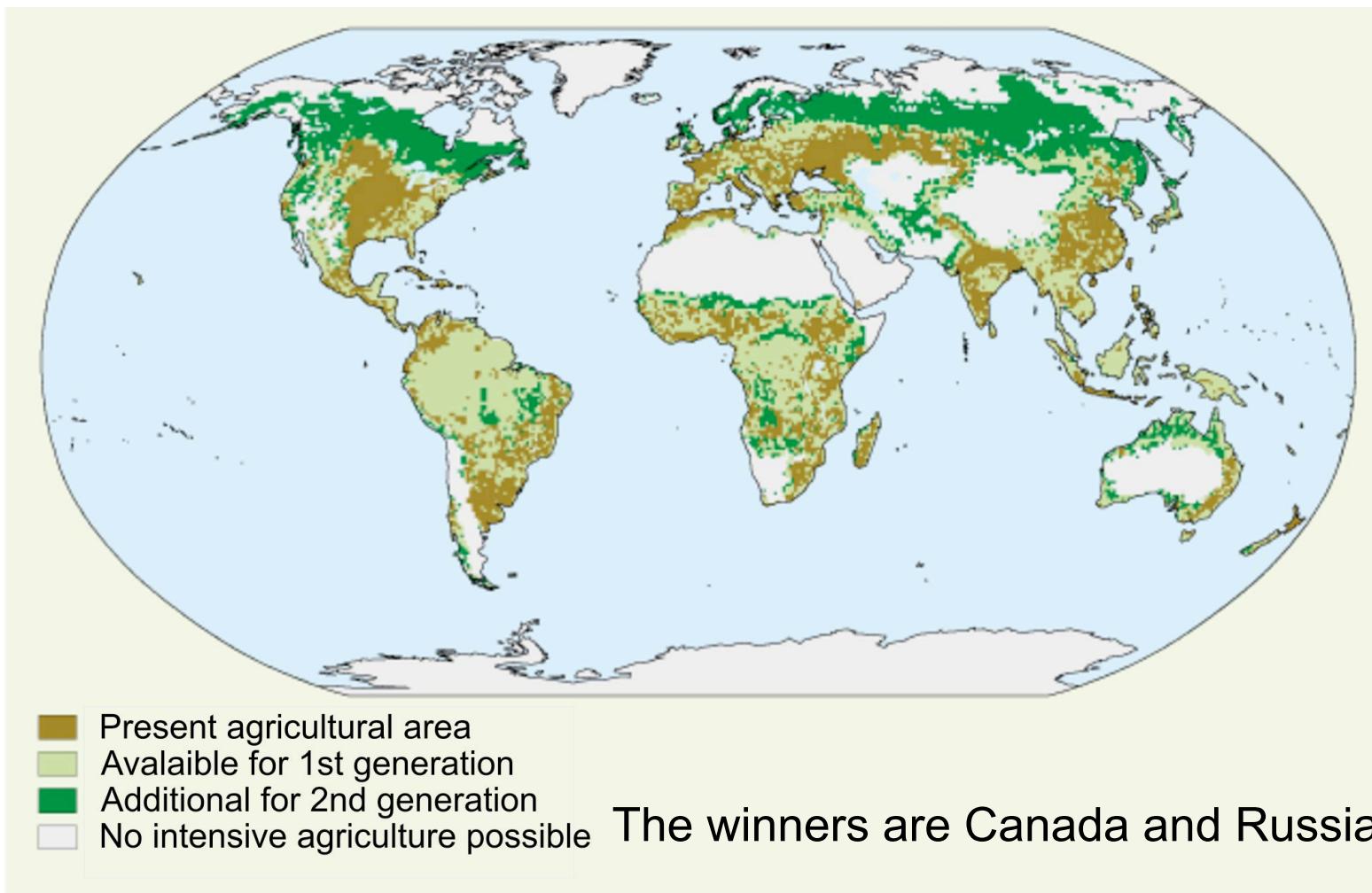
YIELD OF CORN/HA



CONSEQUENCES
INCREASE OF
PRODUCTION:
erosion
desertification
pollution

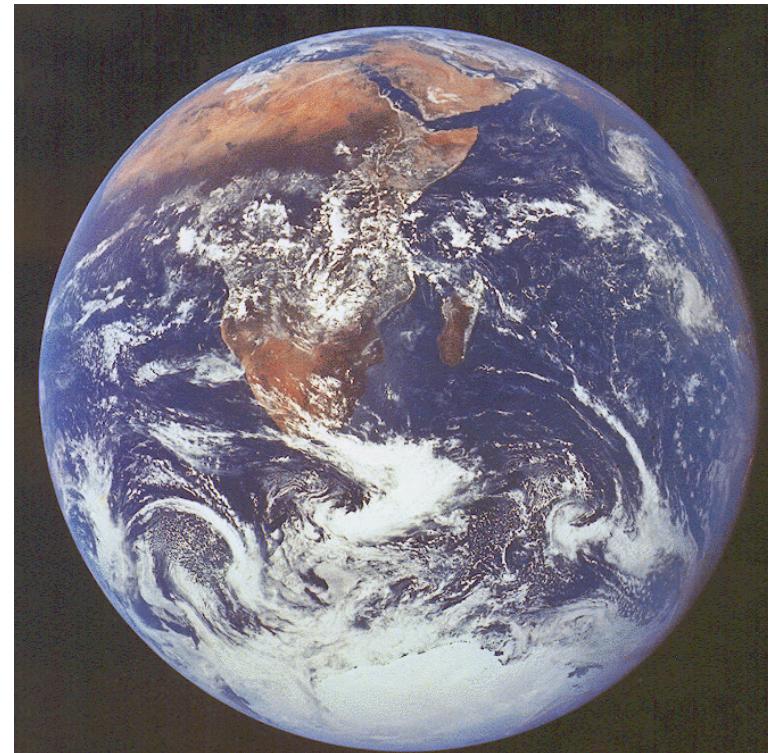
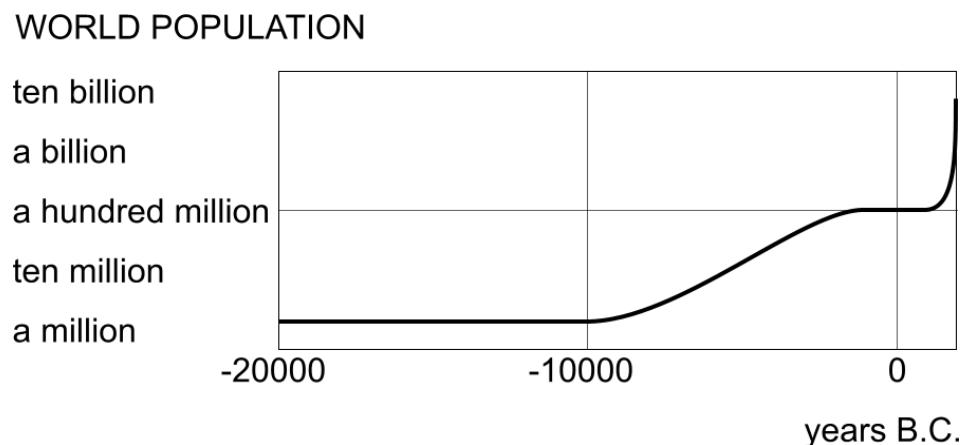
phosphate shortage?

Climate change



A paradox of scale

One species, perhaps counting 80% ‘unhealthy’ specimens, is healthy enough to oust 1000 other species on 1 new species by evolution per year.



Which risk do we count?

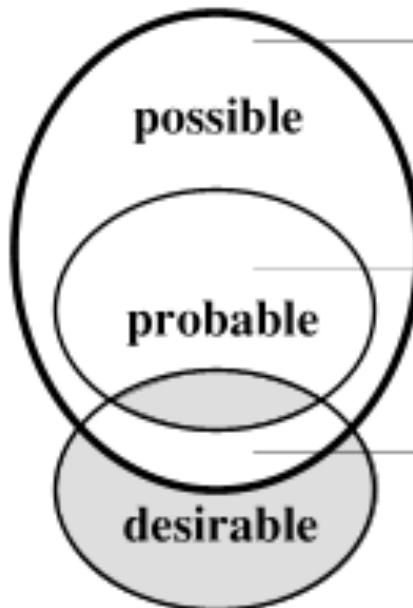
Possible futures

FUTURES

designing

predicting

governing



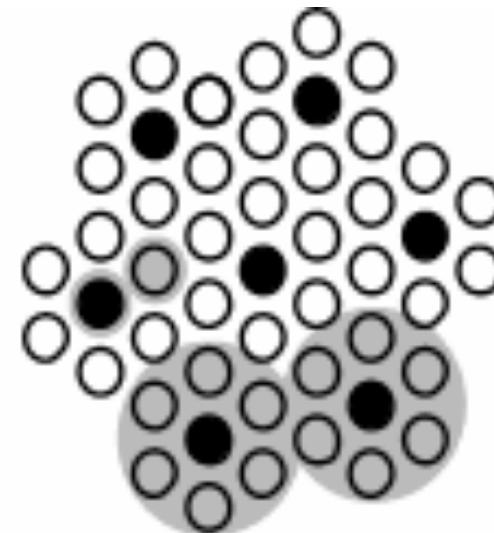
From a viewpoint of planning not relevant

Experiments, design propositions
possible but not (yet) probable or not (yet)
made collectively desirable in a political program

Problems, problem indicating survey;
probable, but not yet desirable

Aims, political programs
desirable and possible, but not (yet) probable

Schale paradox



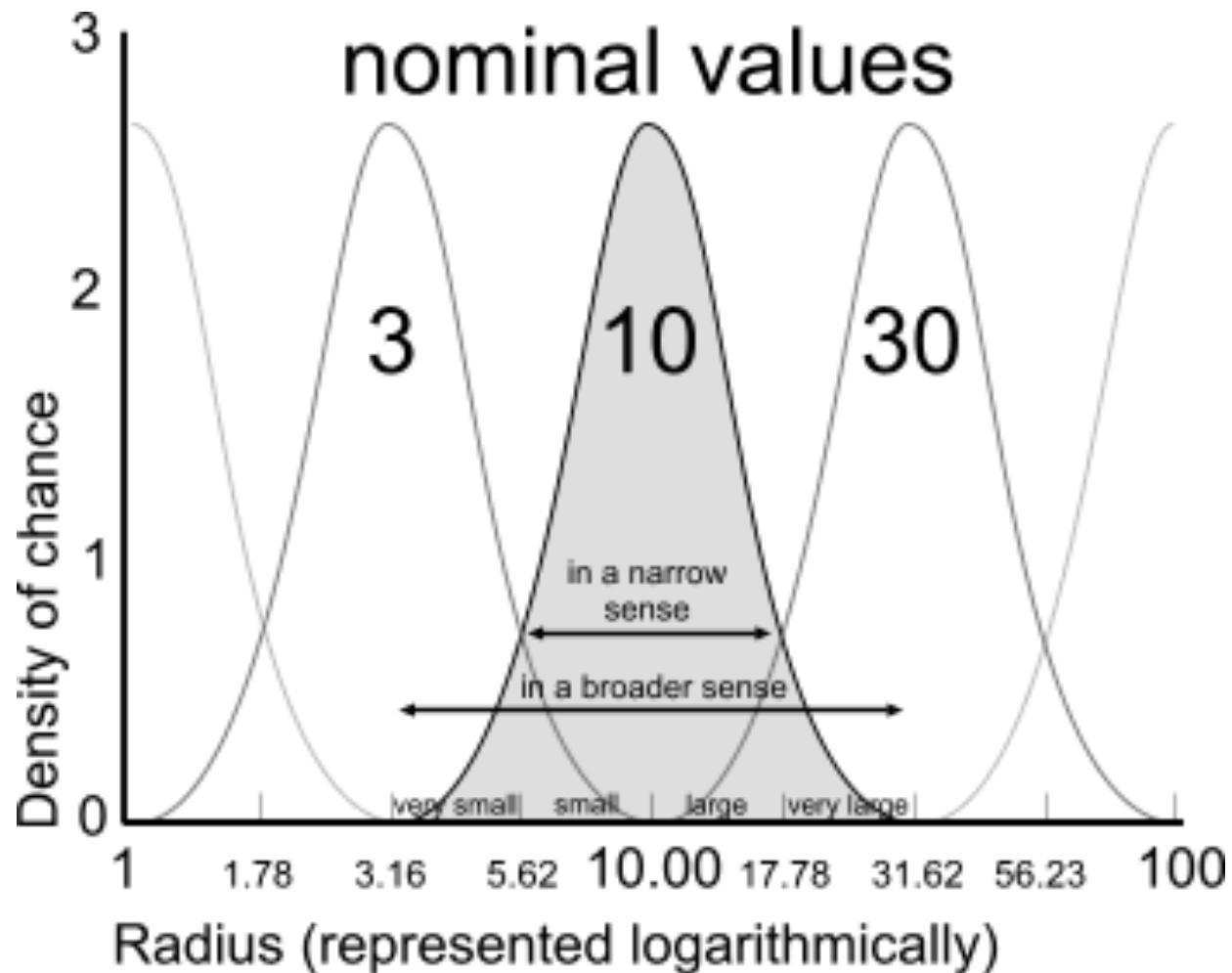
field
of
vision



"difference"

"equality"

Scale articulation



Binary legend of man's habitat

	nominal		binary legend	
Name frame	frame in m	grain in m	net residential area	tare
Global	10 000 000	1 000 000	continents	oceans
Continental	3 000 000	300 000	habitable lands	seas and waste lands
Subcontinental	1 000 000	100 000	urbanised areas	lake and rural areas
National	300 000	30 000	urban networks	landscapes
Subnational	100 000	10 000	urban regions	landscape park
Regional	30 000	3 000	conurbations	town landscapes
Subregional	10 000	1 000	towns, quarters	town parks
Urban, local	3 000	300	districts, villages	district parks
District	1 000	100	neighbourhoods, hamlets	neighbourhood parks
Neighbourhood	300	30	ensembles	greenery
Ensemble	100	10	lots	opening up area
Lot	30	3	houses	gardens, patios
Dwelling	10	1	living rooms, studies, bedrooms	wet rooms, circulation spaces, stogares
Room	3	0.3	sitting areas, dinettes, beds	walking area, cupboards, closets, window sills
Place	1	0.1	action-surrounding space	commodities

Ecological units

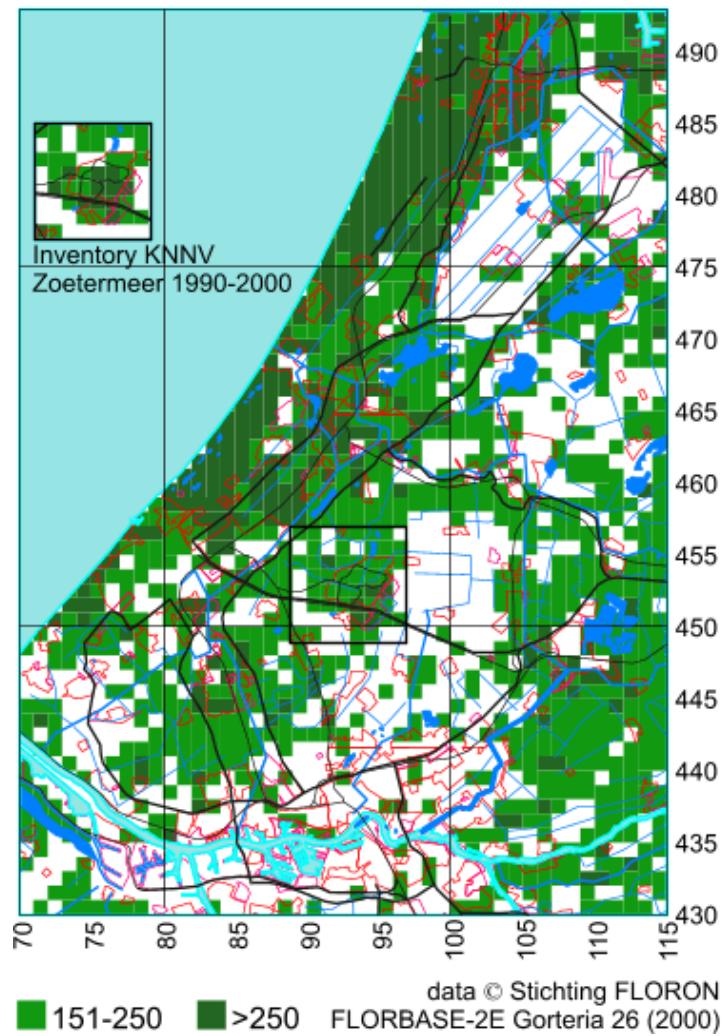
Nominally	abiotic frame	nominally	biotic components
<i>kilometres radius</i>			
10000	earth	3000	biomen
1000	continent	300	areas of vegetation
100	geomorphological unit	30	flora-counties
10	formations	3	landscape
<i>metres</i>			
1000	hydrological unit, biotope	300	communities
100	soil complex, ecotope	30	ecological groups
10	soil unit	3	symbiosis and competition
<i>millimetres</i>			
1000	soil structure and ~profile	300	individual survival strategies
100	coarse gravel	30	
10	gravel	3	
1	coarse sand 0,21-2	0.3	
<i>micrometres (μ)</i>			
100	fine sand 50-210	30	multi-celled organisms
10	silt 2-50	3	single-celled organisms
1	clay parts < 2	0.3	bacteria
0,1	molecule	0.30	virus

Ecological elaboration

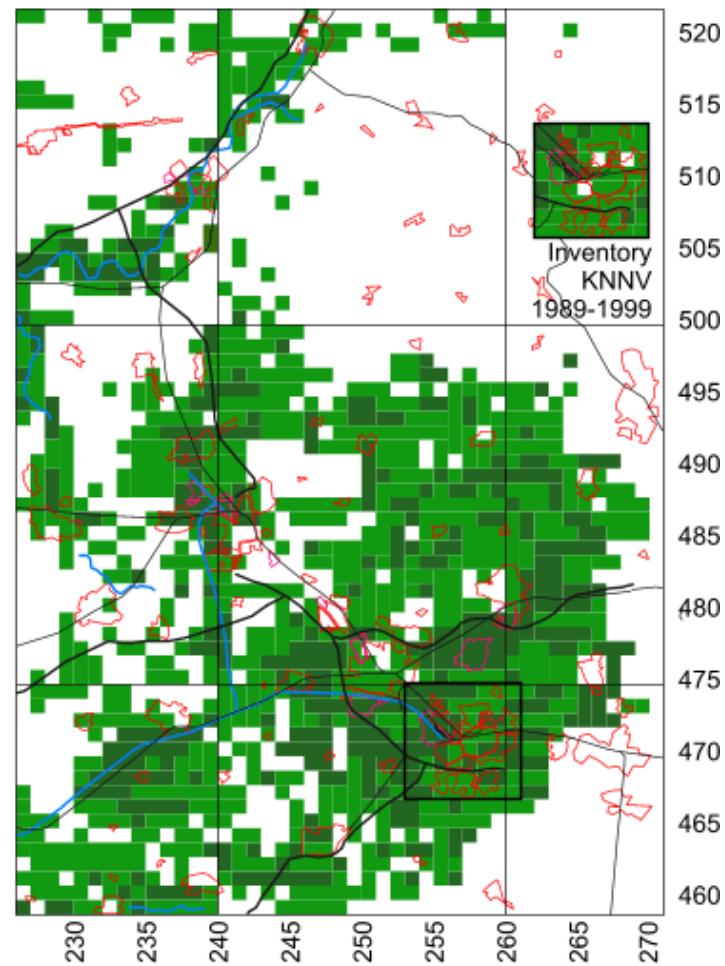
- R=300m Communities in biotopes
- R=30m Ecological groups in ecotopes
- R=3m Symbiosis and competition
- R=30cm Individual survival strategies

Vegetation biodiversity

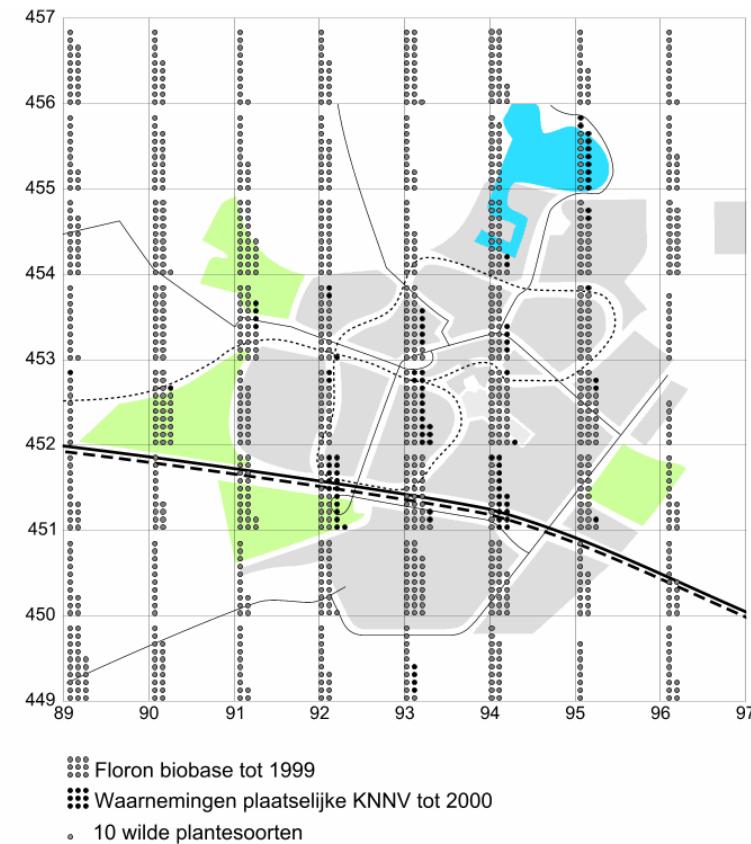
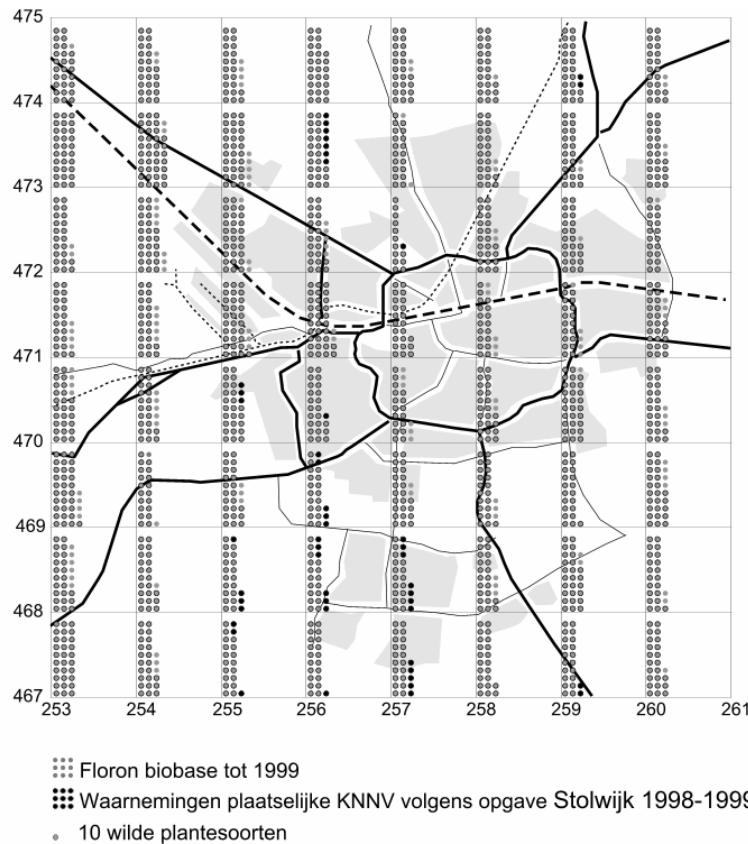
WEST-ZUID-HOLLAND



TWENTE



R=3km

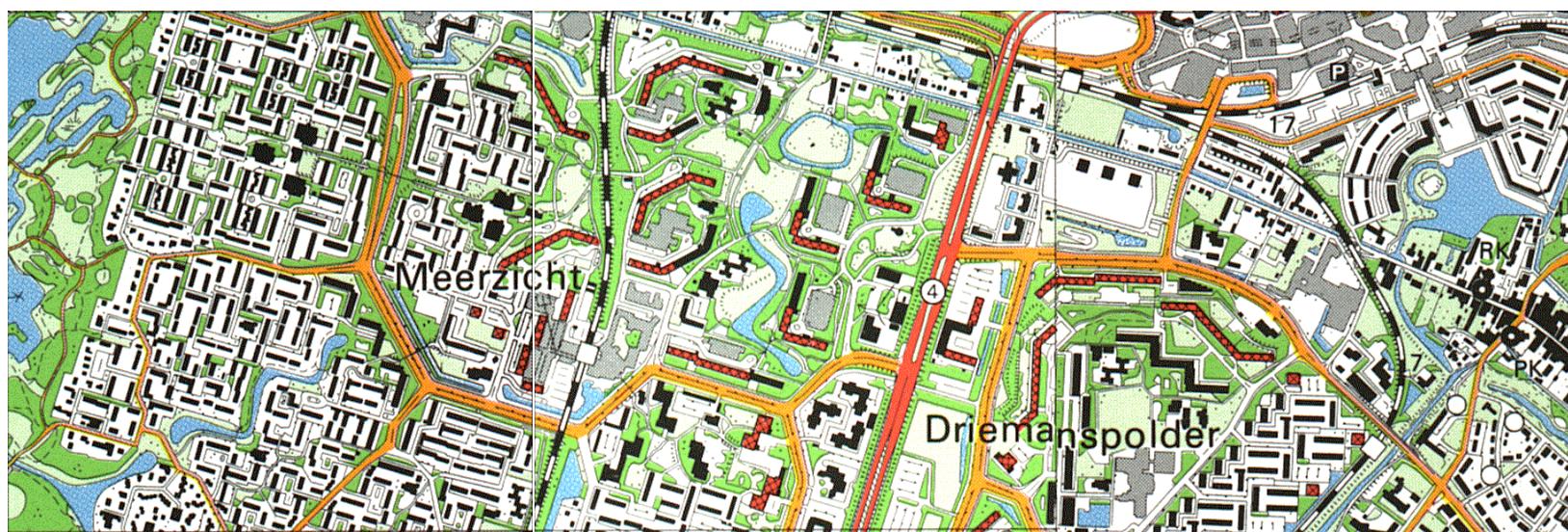


$R=1\text{ km}$

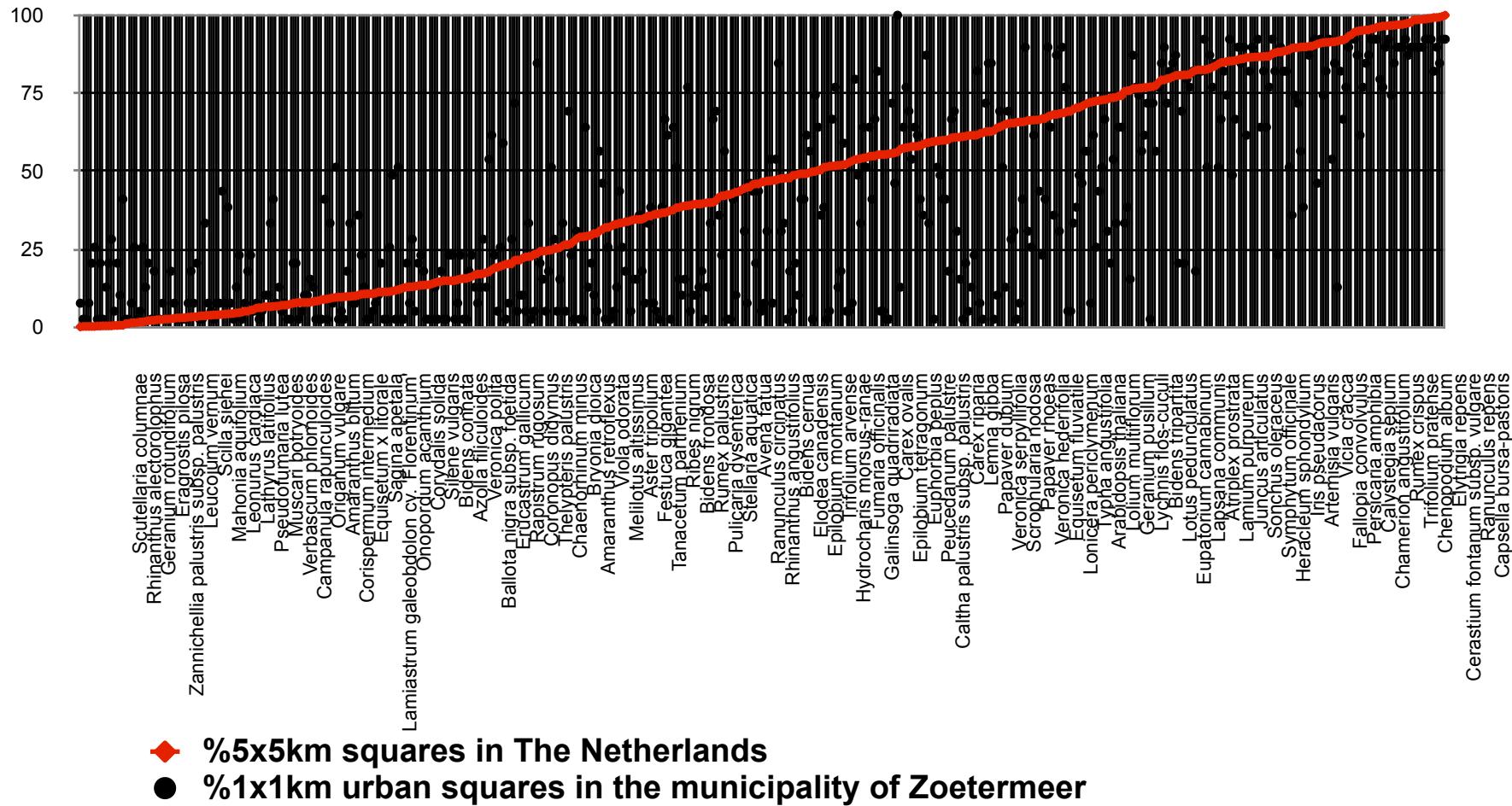
180 species

200 species

330 species



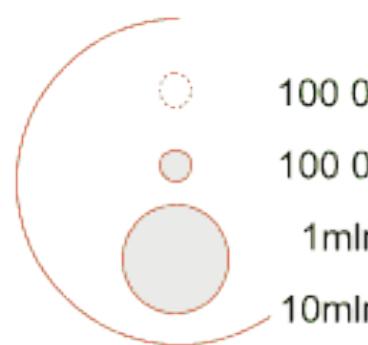
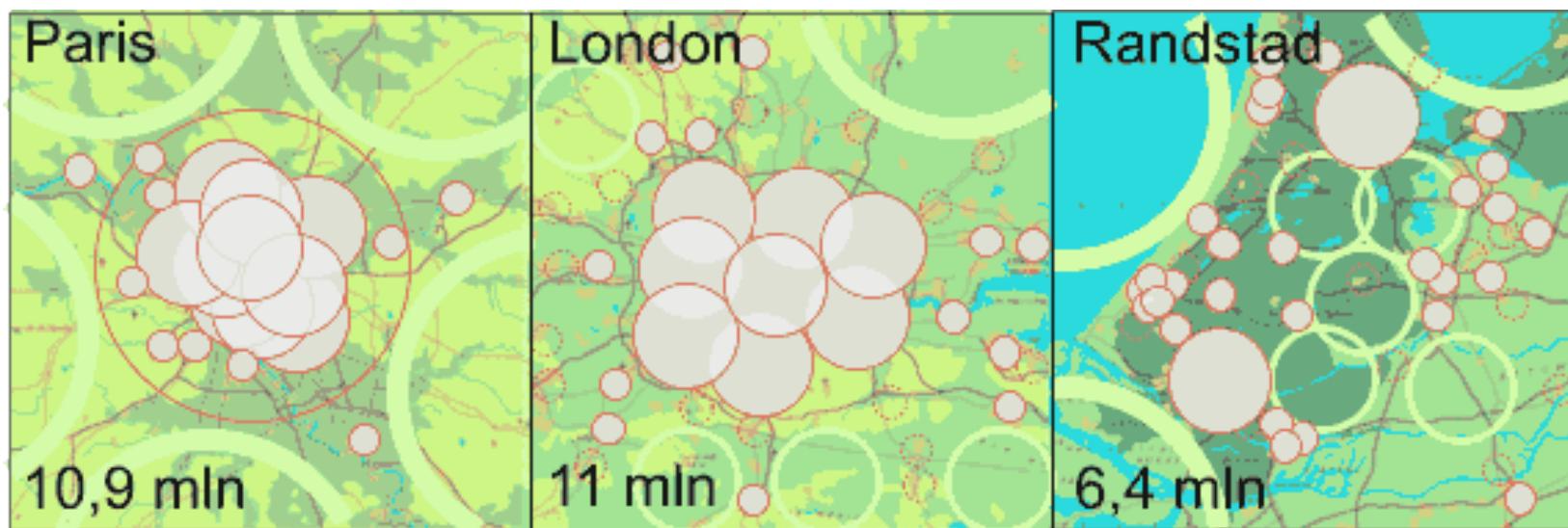
National rareness of 500 urban plant species in Zoetermeer



Urban ecology hypotheses

Effective variation for botanical biodiversity	in a radius of approx.
altitude, ground	30km
soil, watermanagement	10km
seepage, drainage, water level, urban opening up	3km
<i>The next levels are still hidden from usual botanical observation per square km.</i>	
urban lay-out	1km
parcelling (distribution of greenery)	300m
pavement, tread, pet manuring, minerals	100m
altitude differences, mow management, disturbance	30m
sunlighting	10m

Metropolitan ambitions

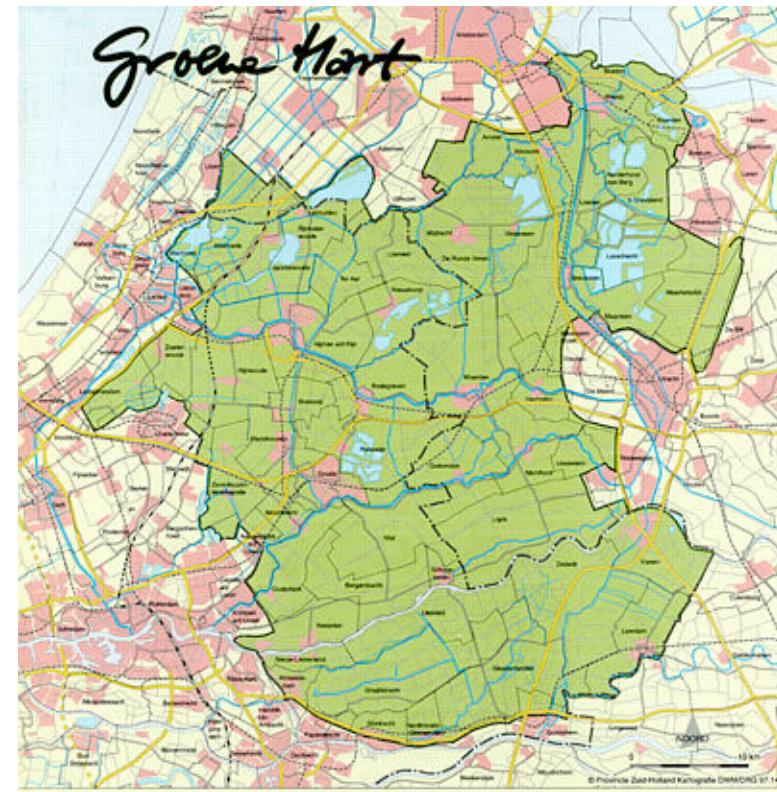
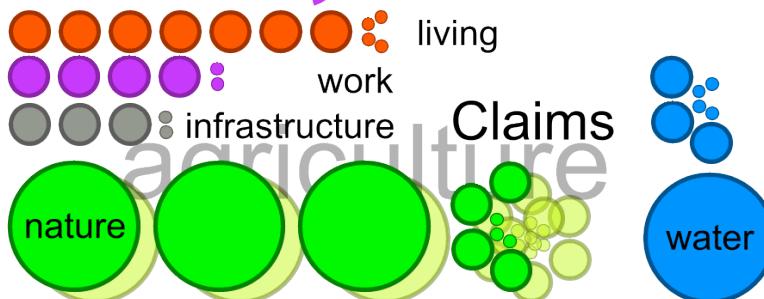
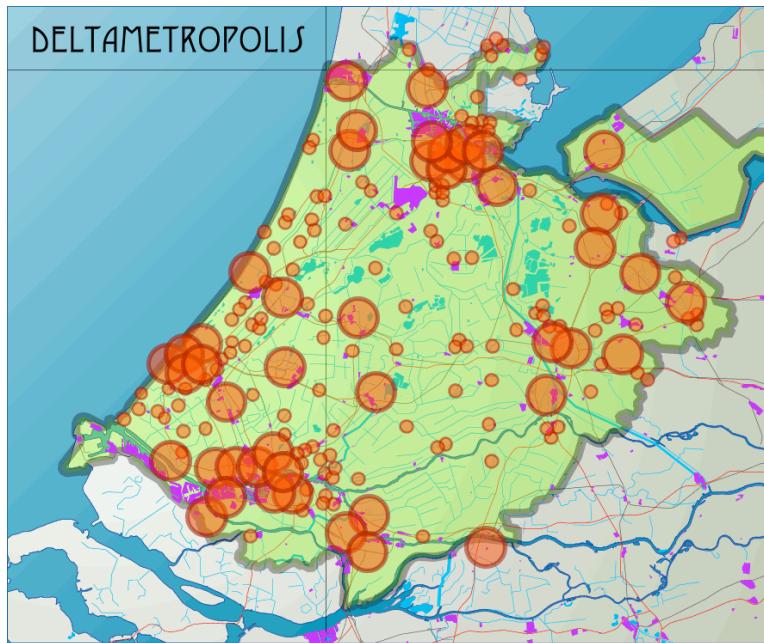


- 100 000 inh. dispersed
- 100 000 inh. within 3km radius
- 1mln. inh. within 10km radius
- 10mln. inh. within 30km radius



- <100 000 inh. within 10km radius
- <1mln. inh. within30km radius

Urban perspective



Wall and tread plants urban areas



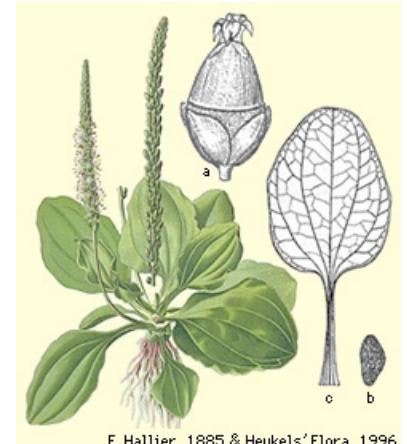
E. Hallier, 1883
procumbent pearlwort
liggend vetmuur P40mu



E. Hallier, 1883
yellow corydalis
gele helmbloem P40mu



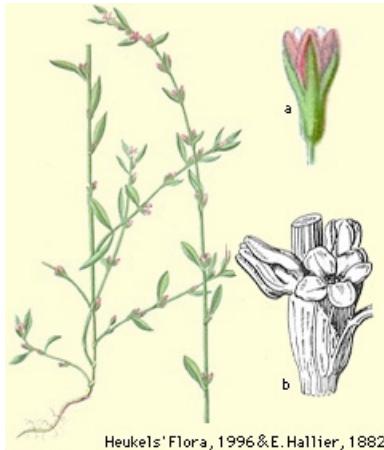
E. Hallier, 1884
ivy-leaved toadflax
muurleeuwebek P40mu



E. Hallier, 1885 & Heukels' Flora, 1996
plantain
weegbree P48tr



E. Hallier, 1883
shepherd's-purse
herderstasje P48tr



Heukels' Flora, 1996 & E. Hallier, 1882
knotgrass
varkensgras P48tr

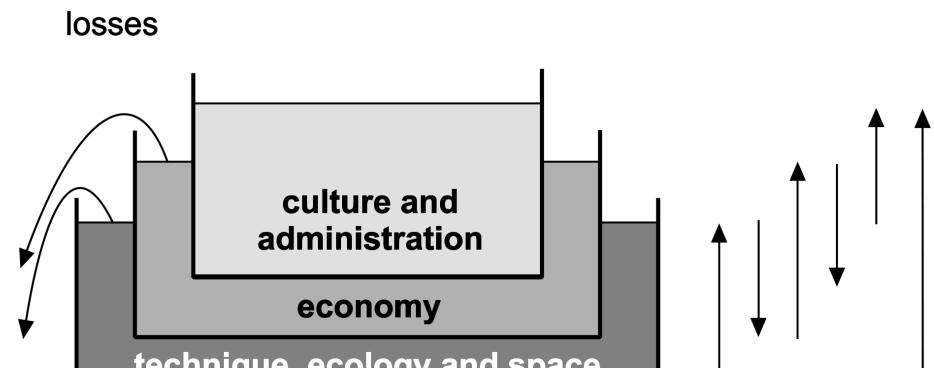
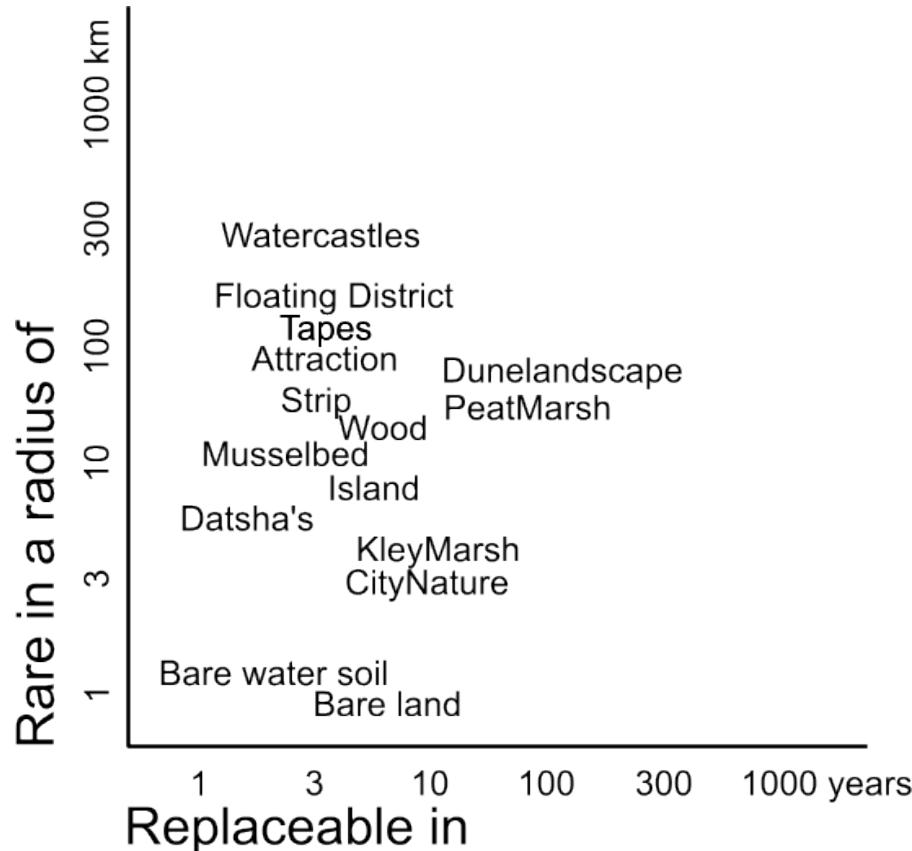


L. Reichenbach, 1846
annual meadow-grass
straatgras P48tr



E. Hallier, 1887
pineapple weed
schijfkamille P48tr

Comparing and evaluating



- A Enlarge carrying capacity (ecological capital)
- B Diminishing pressure (unlinking)
- C Enlarge carrying capacity (economic capital)
- D Diminishing pressure (social effectiveness)
- E Enlarge quality (social capital)