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

AR1U130 SUETerritory (design) 4ECTS
AR0112 Civil engineering for dummies (calculations) 2ECTS

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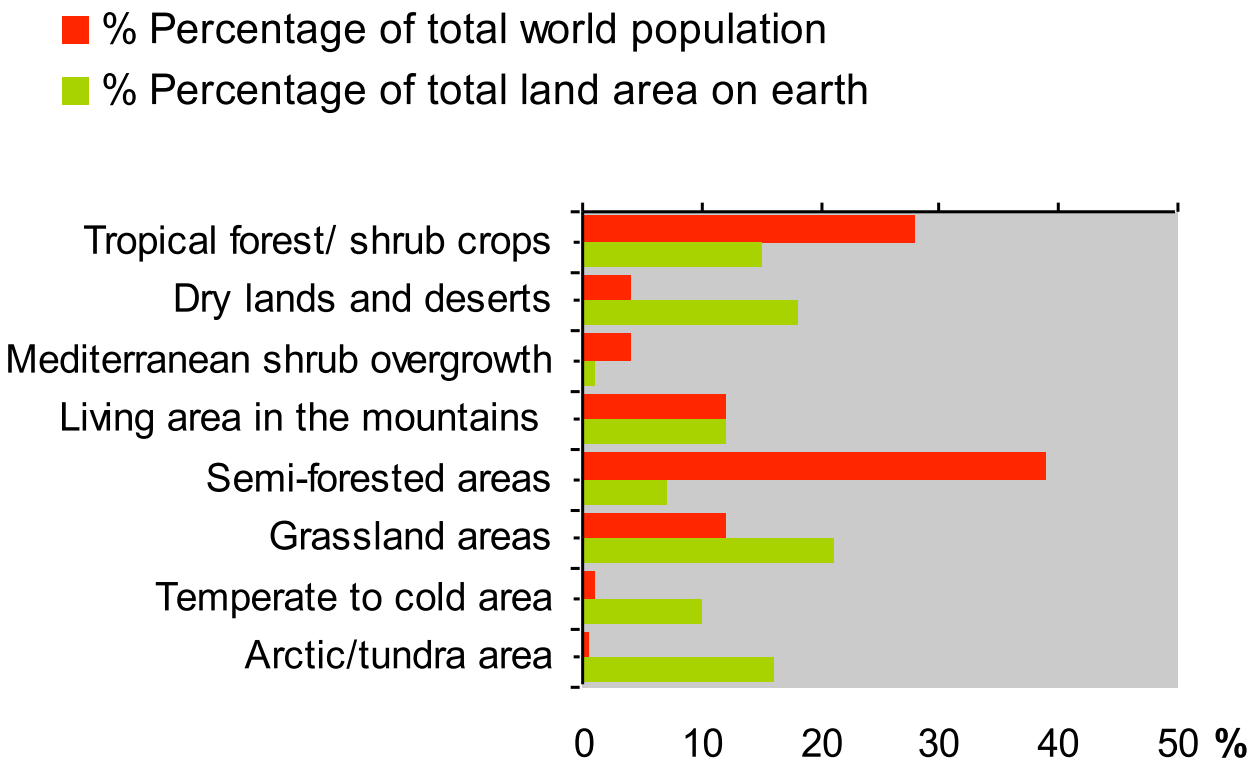
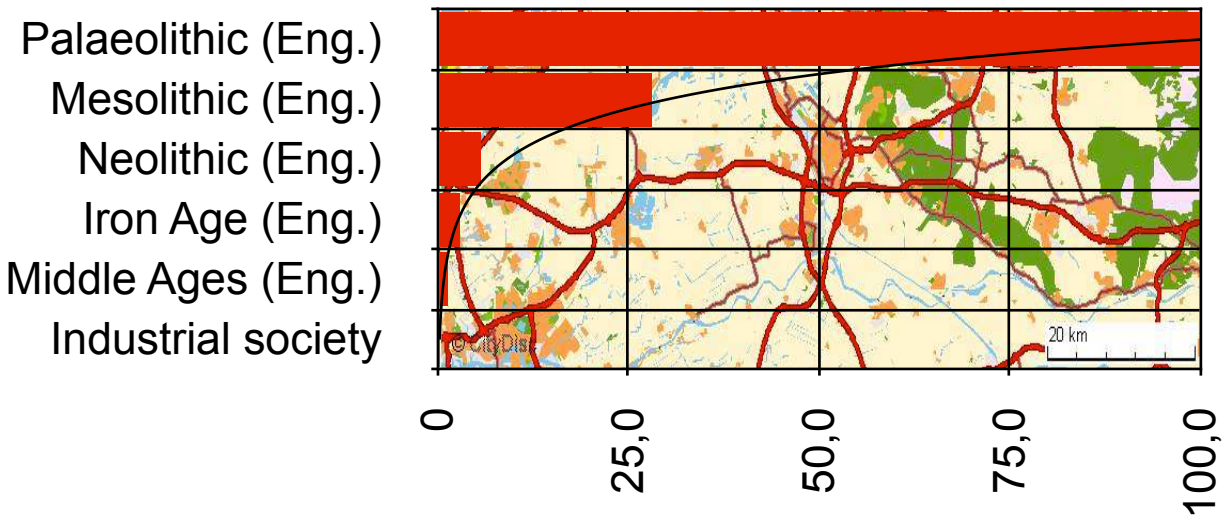
Habitat and Population



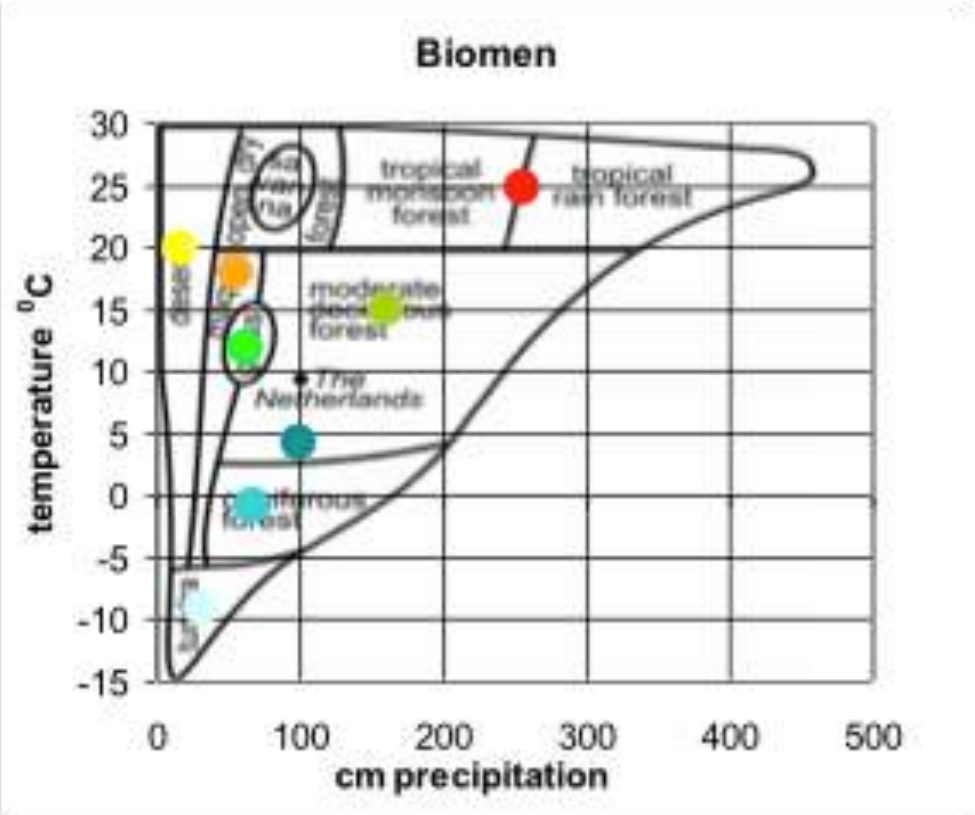
Economy and density

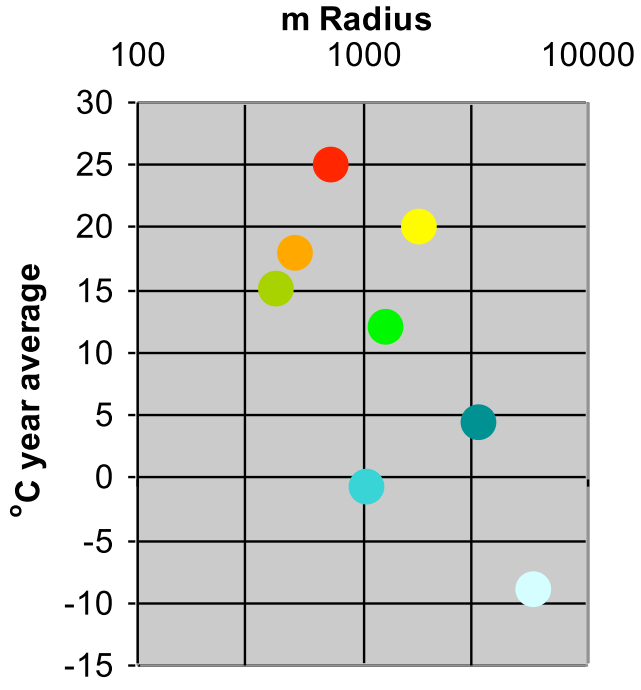
100 inhabitants	km. R ≈
Palaeolithic (Eng.)	100
Mesolithic (Eng.)	30
Neolithic (Eng.)	10
Iron Age (Eng.)	3
Middle Ages (Eng.)	1
Industrial society	0.1

km. radius required for survival of 100 inhabitants

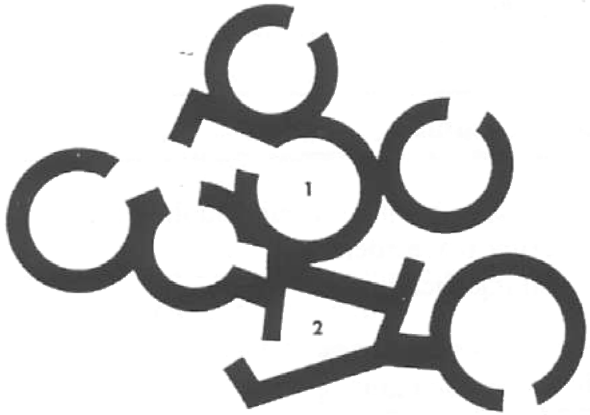


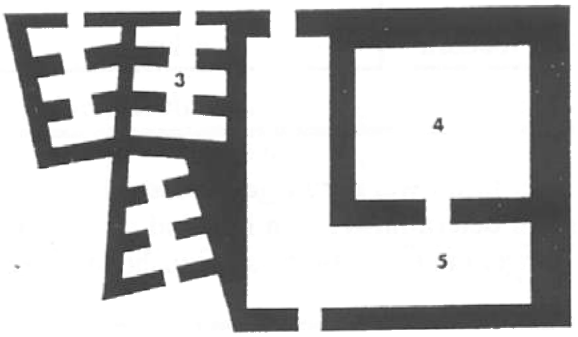
Habitat and density





Human living





1 Living room

2 Storage places in the neighbourhood

3 shops

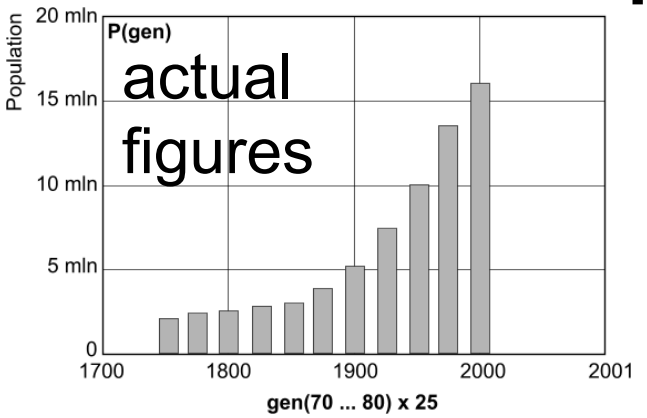
4 community building

5 inner courtyard

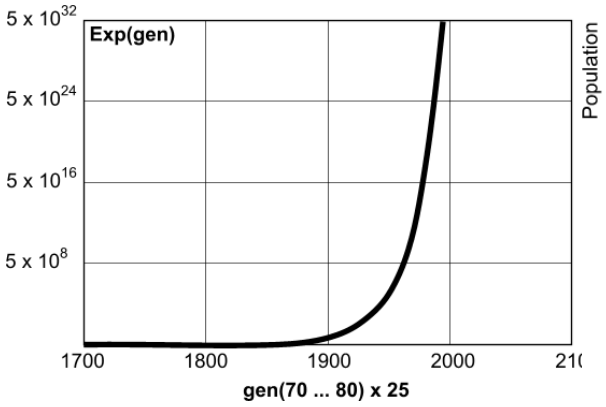
living in storeyed buildings

Historical floor plans of dwellings that reflect the transition from hunting into agriculture

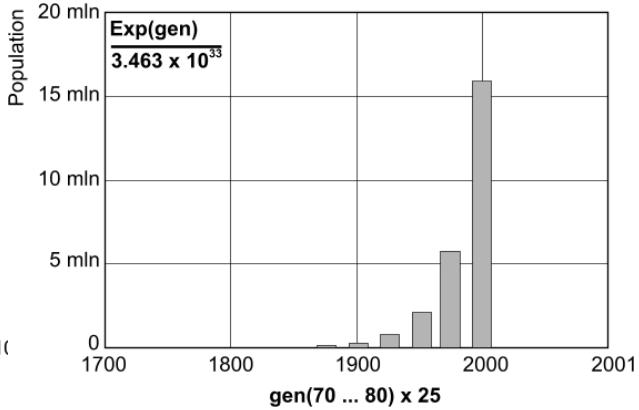
Population growth



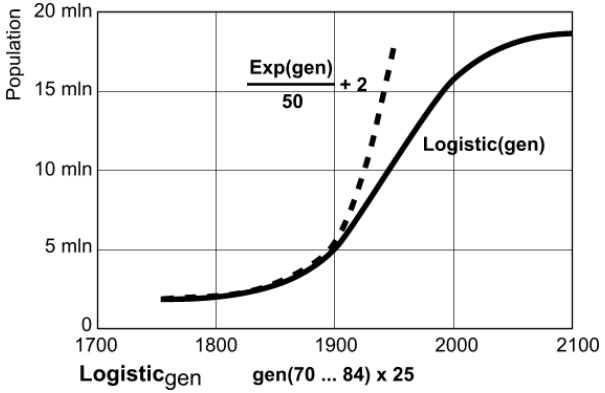
models



Unlimited growth



Adapted by parameter

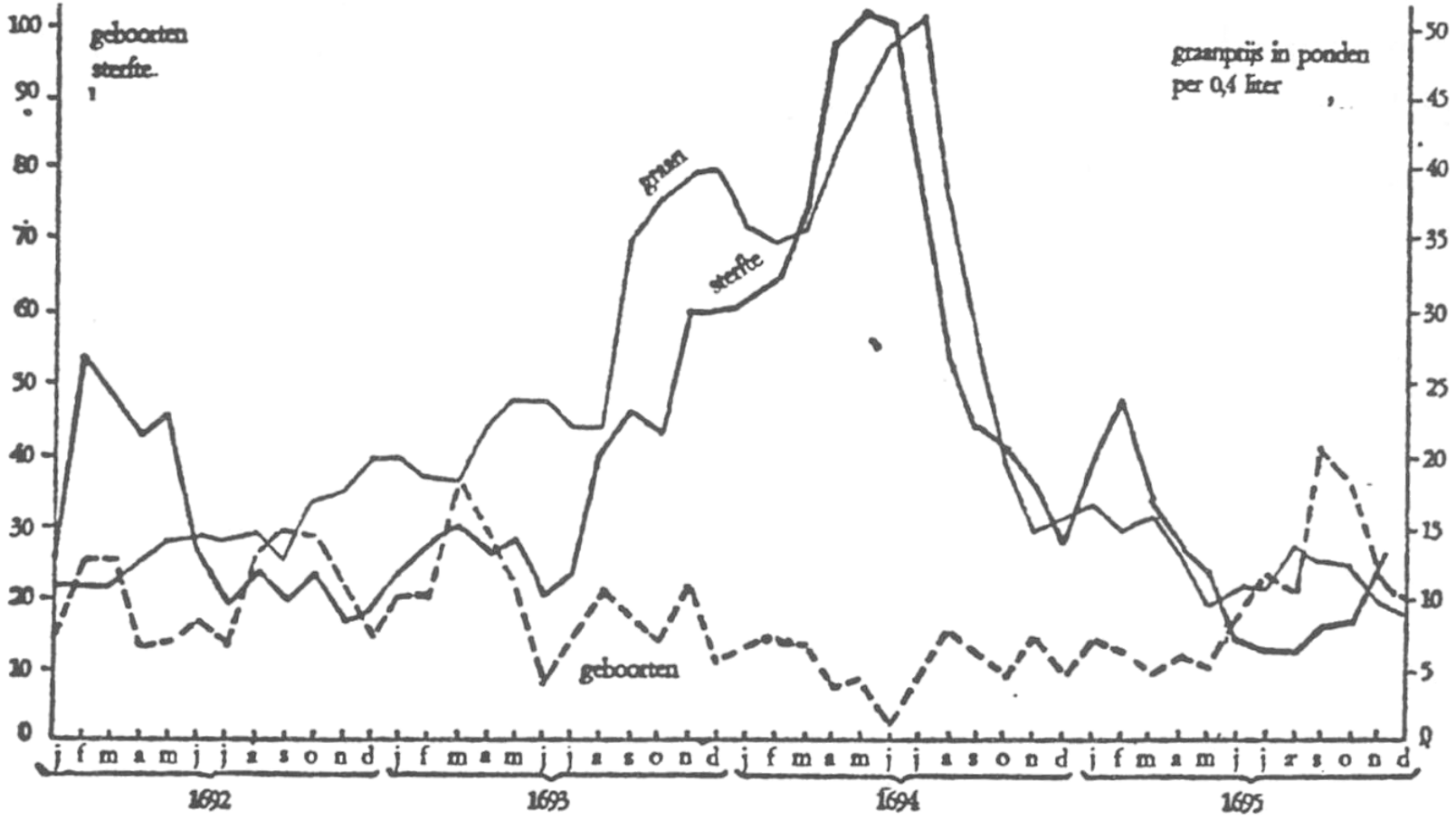


Limited growth because of carrying capacity

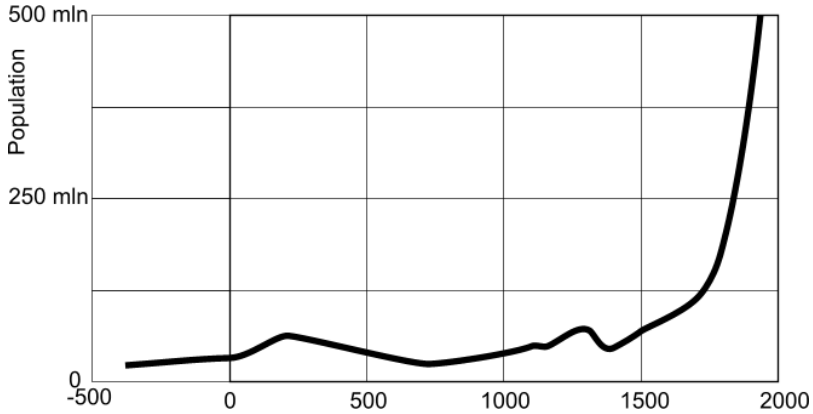
Methods of contraception

	infanticide	abortion	restricting coitus
Food gatherers and hunters			
Australian tribes (the Aborigine)	+	+	-
Tasmania	+	+	-
the Bushmen	+	-	-
Indians	+	+	+
Eskimos	+	+	-
Arable farmers			
Indians	+	+	+
Africa	+	+	+
Oceania	+	+	+
+ confirmed cases - no reported cases			

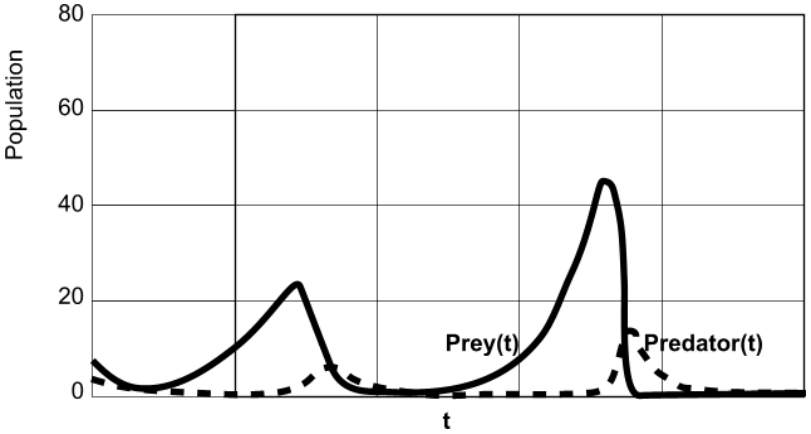
Demographic crisis in Meulan, near Paris 1693-1694



Population development

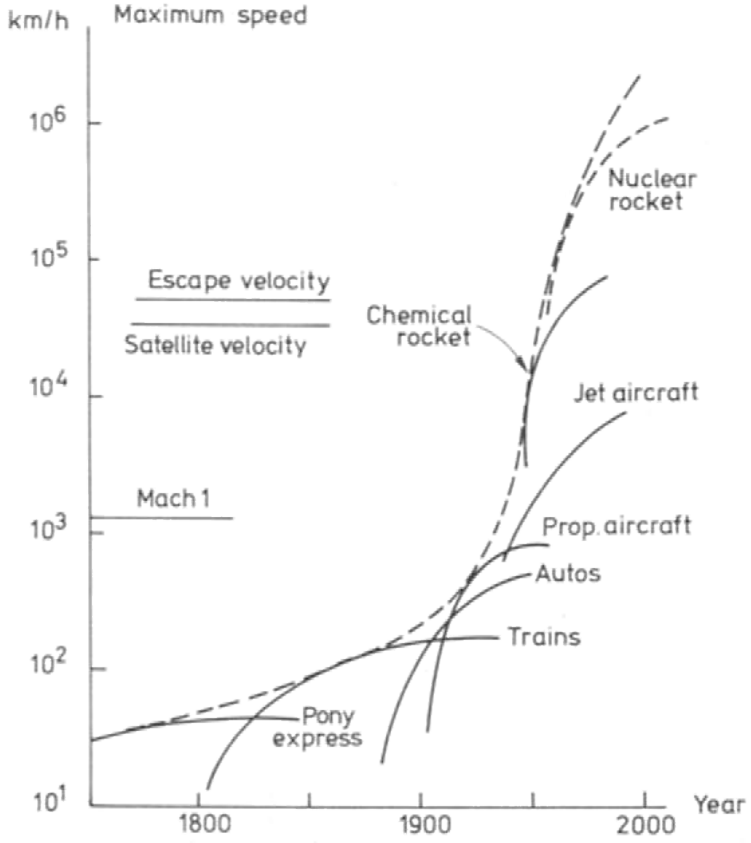


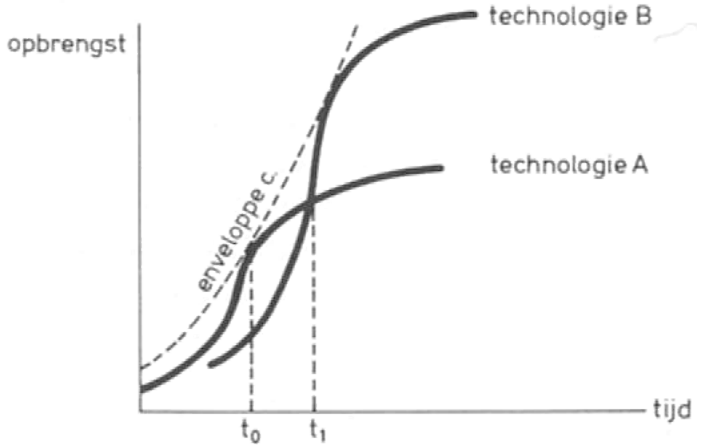
Population numbers in Europe.



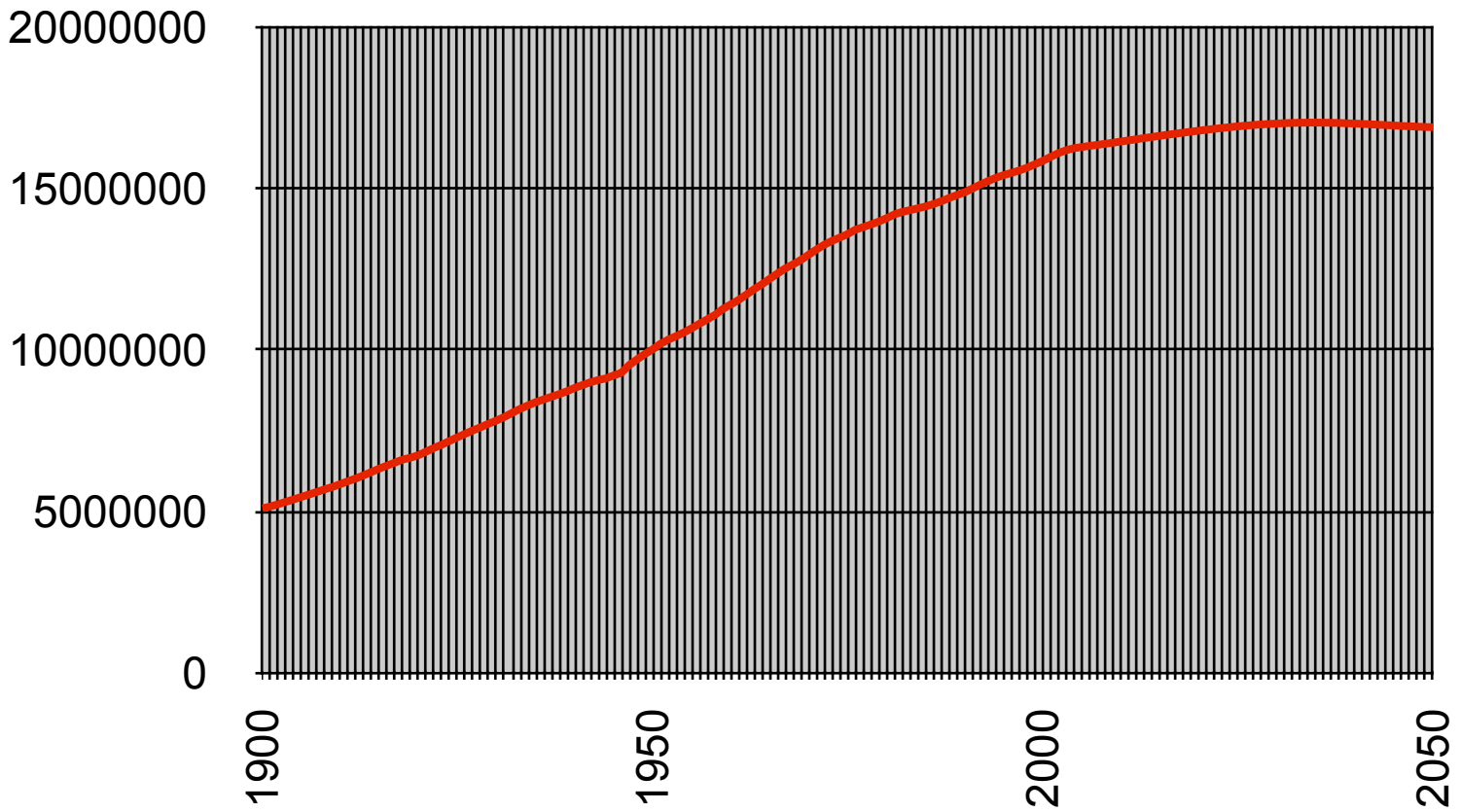
Predator and prey according to Lotke-Volterra

The envelope curve

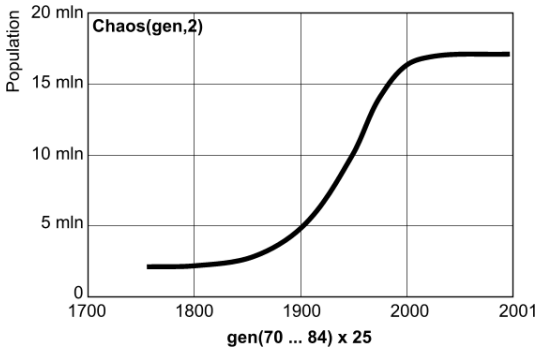




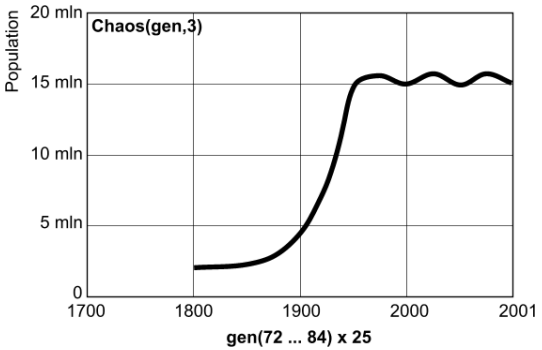
CBS prognosis



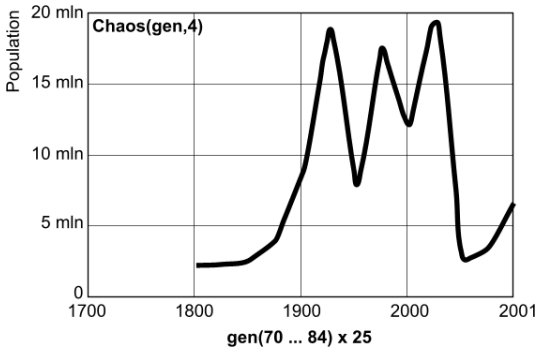
Uncertainty



Chaos using parameter *a* = 2

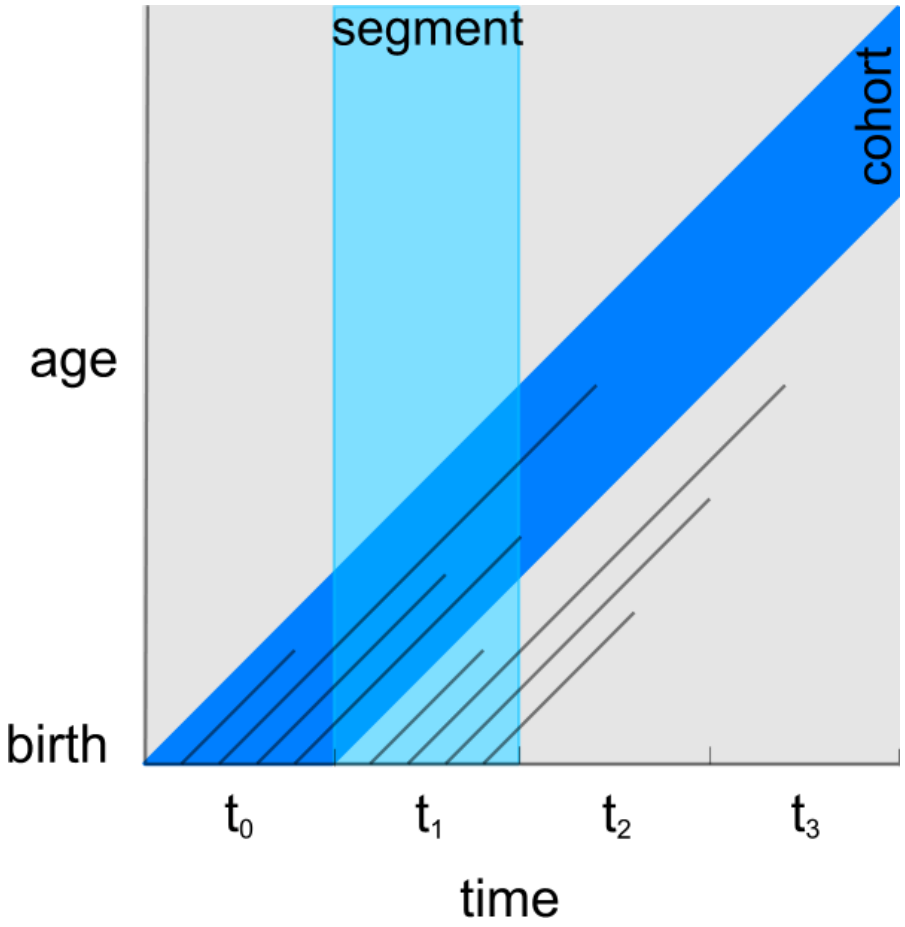


Chaos using parameter *a* = 3



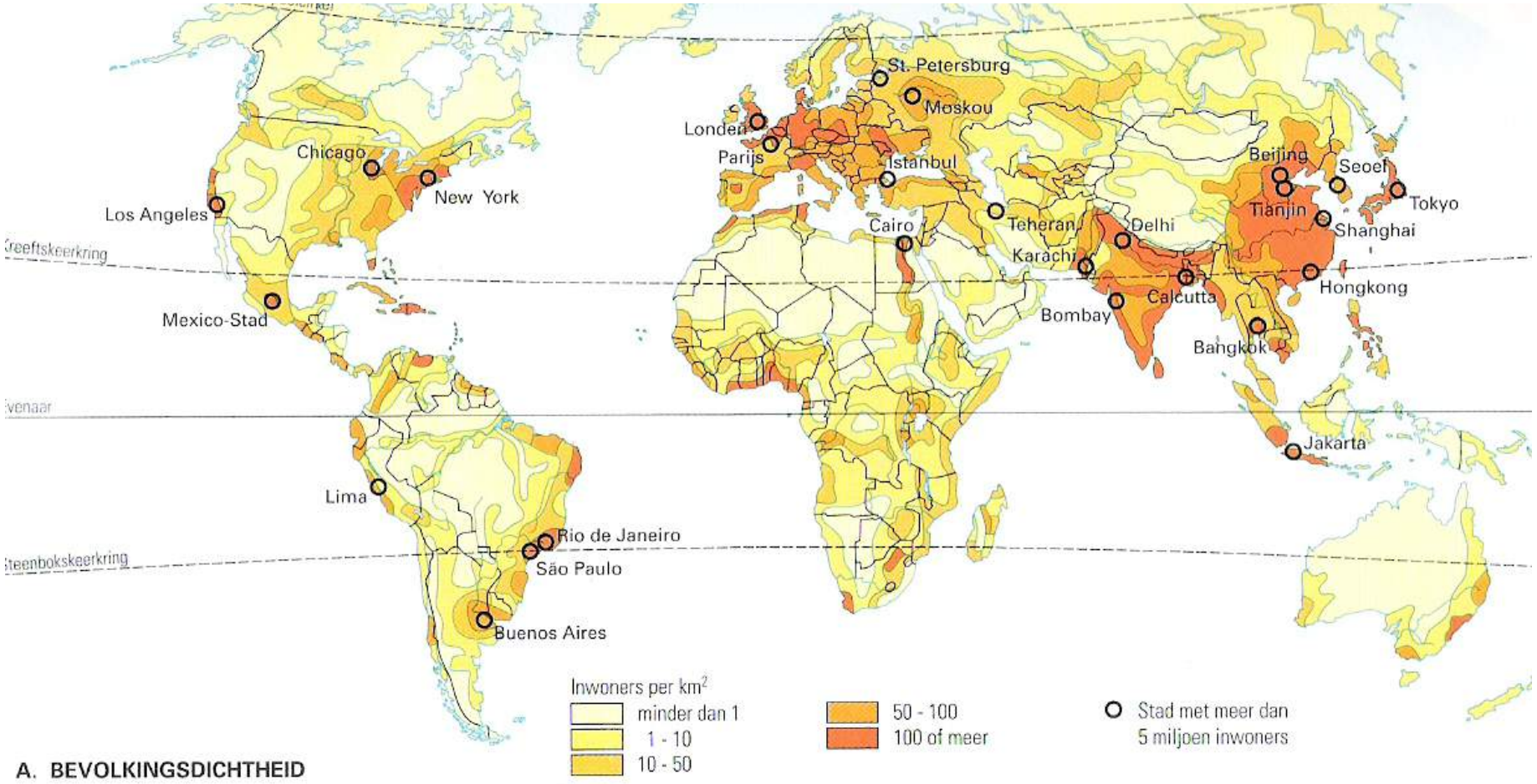
Chaos using parameter *a* = 4

Demography



Densities

World densities



A. BEVOLKINGSDICHTHEID

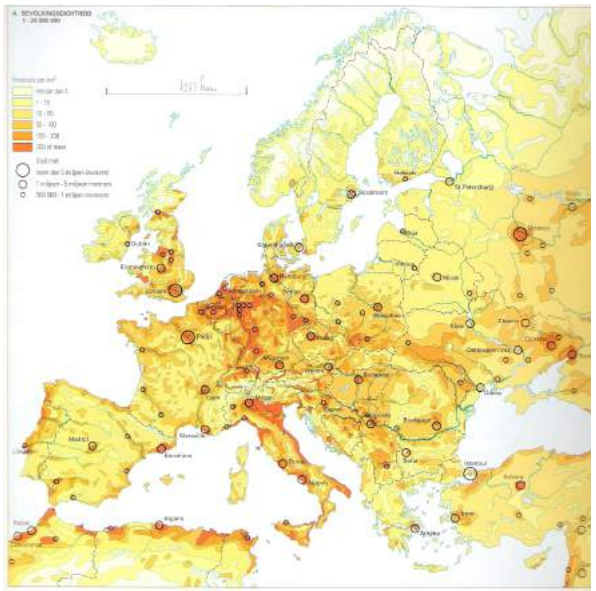
Gross, net and tare

Higher level	**gross**	
	net	**tare**
Lower level	gross	
	net	tare

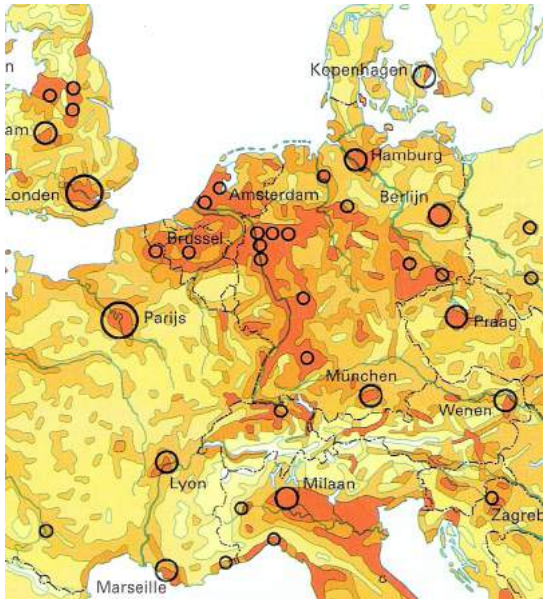
A binary legend

	m nominal radius		binary legend	
Name frame	**frame**	**grain**	**net**	**tare**
Global	10 000 000	1 000 000	continents	oceans
Continental	3 000 000	300 000	habitable lands	lakes and waste lands
Subcontinental	1 000 000	100 000	urbanised areas	rural areas
National	300 000	30 000	urban networks	landscapes
Subnationaal	100 000	10 000	urban regions	landscape parks
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	neigbourhood parks
Neighbourhood	300	30	ensembles	dispersed greenery
Ensemble	100	10	lots	opening up (access) area
Lot	30	3	houses	gardens, patios
Dwelling	10	1	living rooms, studies, bedrooms	inaccessible space, wet rooms, circulation and storage spaces
Room	3	0,3	sitting areas, dinettes, beds	walking area, cupboards, closets, window sills
Place	1	0,1	action-surrounding space	commodities

(Sub)continental densities



Continental densities



Subcontinental densities

Legend

The Netherlands

- The Netherlands as a whole counts more than 42000km^2 (sea excluded) and
- 16300000 inhabitants,
- that is about 390 inhabitants per km^2 (about 4 inhabitants per ha)
- with extremes ranging from 0 to 20 000 inhabitants per km^2 if you take smaller areas into account.

Land use

- The reciprocal of population density is land-use.
- The advantage of a land-use unit is that different destinations of use can be discerned.
- In the Netherlands, the land use is about 2700 m^2 per inhabitant, roughly divided as
- 1500 m^2 of agrarian land per inhabitant,
- 500m^2 of water,
- 300 m^2 of nature areas and forest,
- 300 m^2 of urban areas and infrastructure,
- 100m^2 industry and recreation.

Residential area

- Of this 300m2 urban area, only about 160m2 are ‘residential areas’.
- According to CBS’s definition of ground statistics, these are
  - homes with
  - green areas,
  - hardened surfaces and
  - primary facilities, such as shops, schools for pre-school and primary education, as well as other residential facilities such as caravan camps, house-boat harbours, service flats, etc.

160m^2 Residential area per person

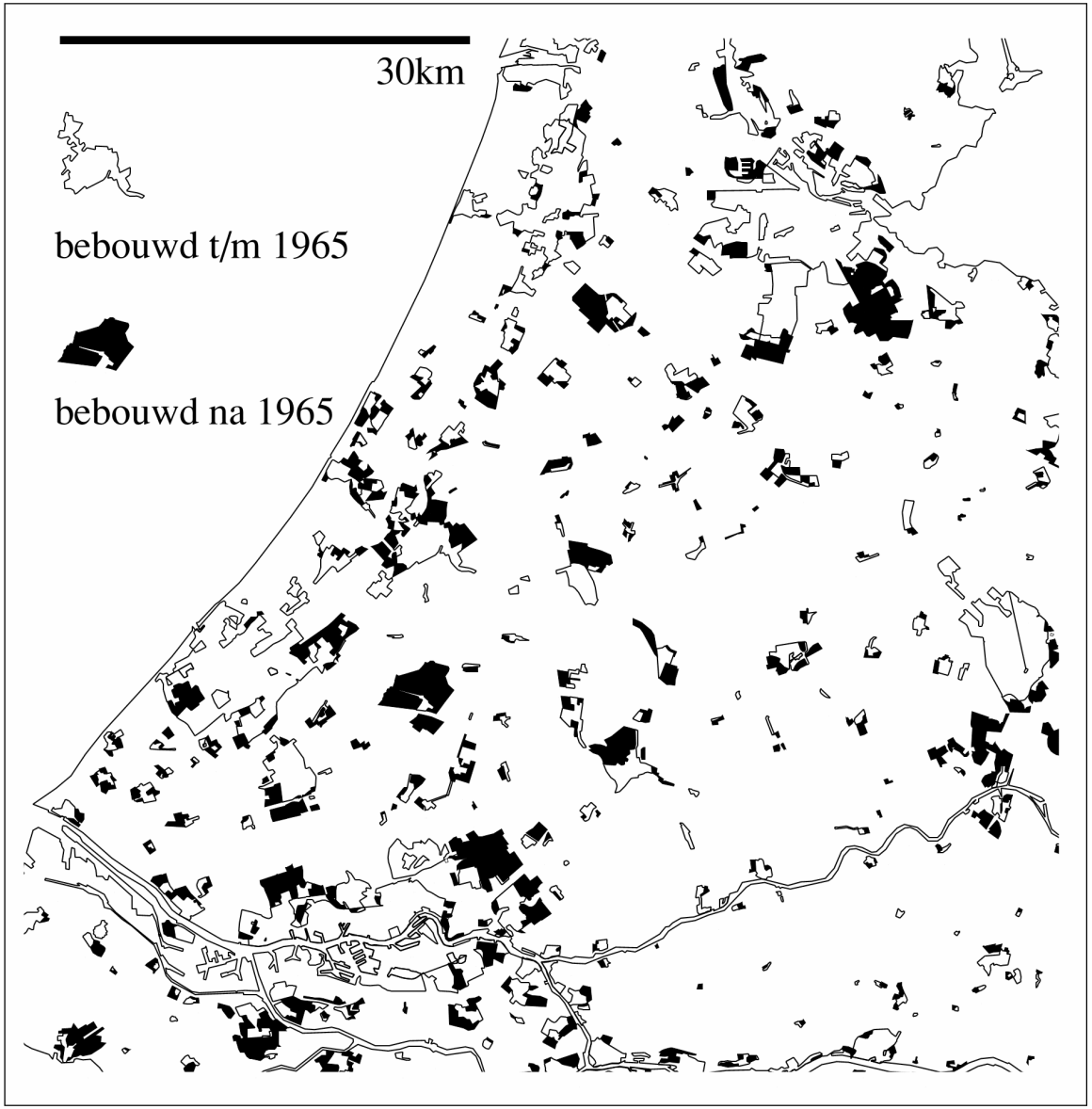
The residential area per inhabitant varies in space.

In the West of the Netherlands, an average of about 100 square metres of residential area is available per inhabitant;

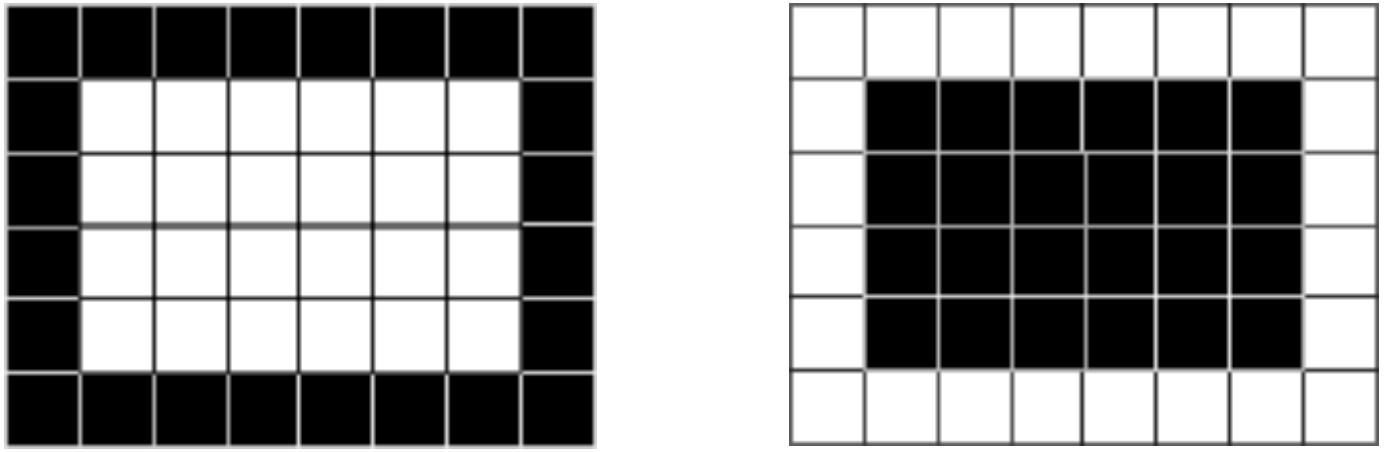
in East Groningen, about 300 m^2 ;

and in a number of other places between those two extremes, about approx. 200 m^2 per inhabitant.

1965
1995



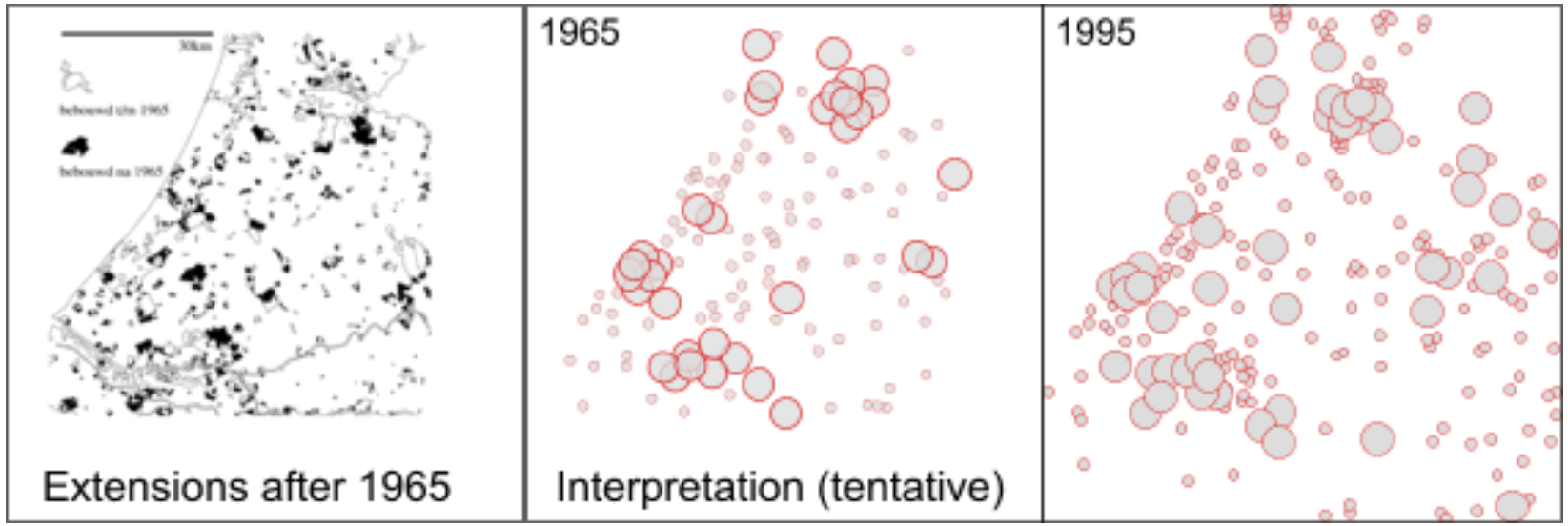
Linear versus compact



Same surface black and white (24 squares)

(Tummers-Zuurmond 1997)

Growing land use

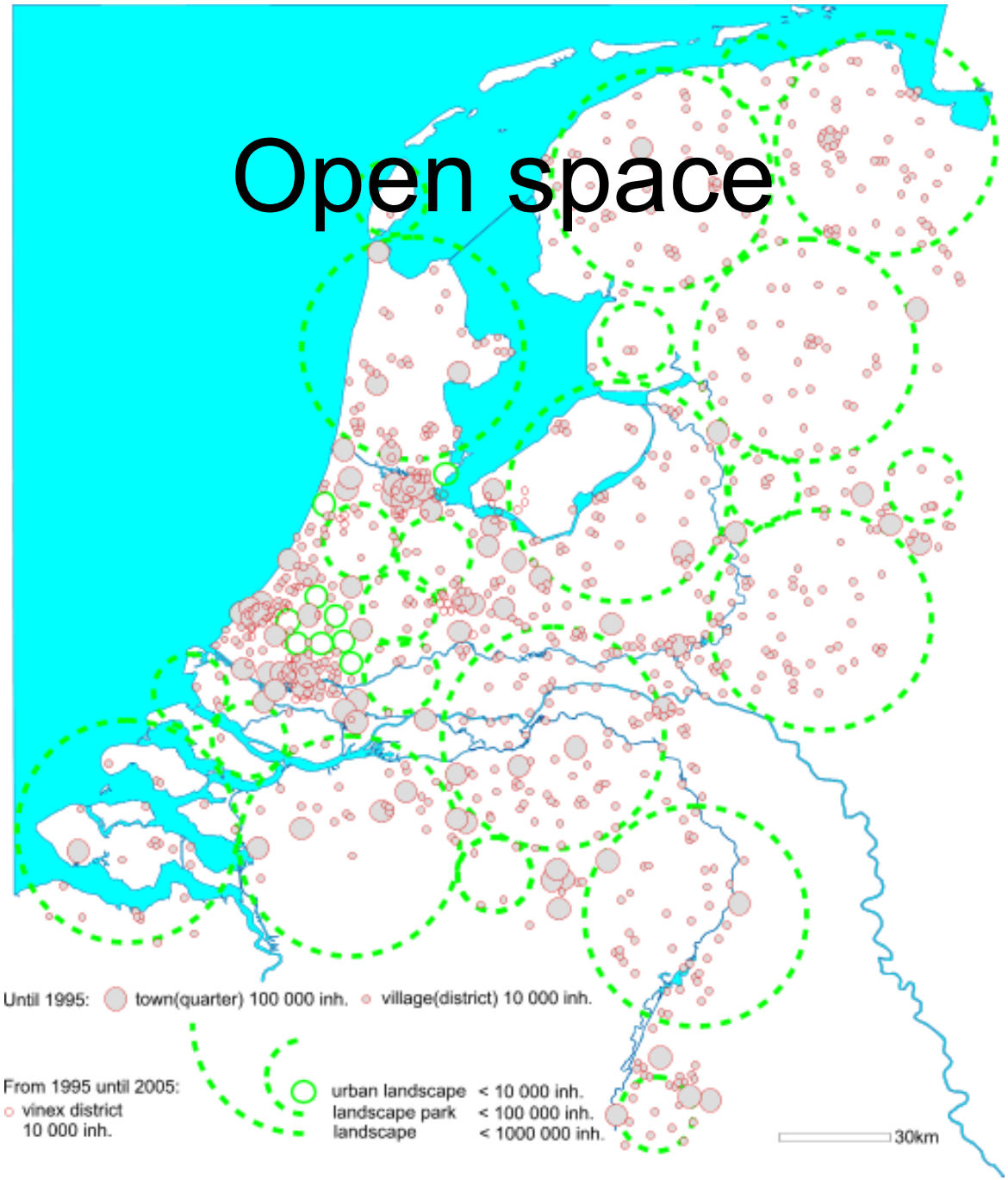


If one divides the density of inhabitants by the local number of occupants per household, then one arrives at the local density of homes.

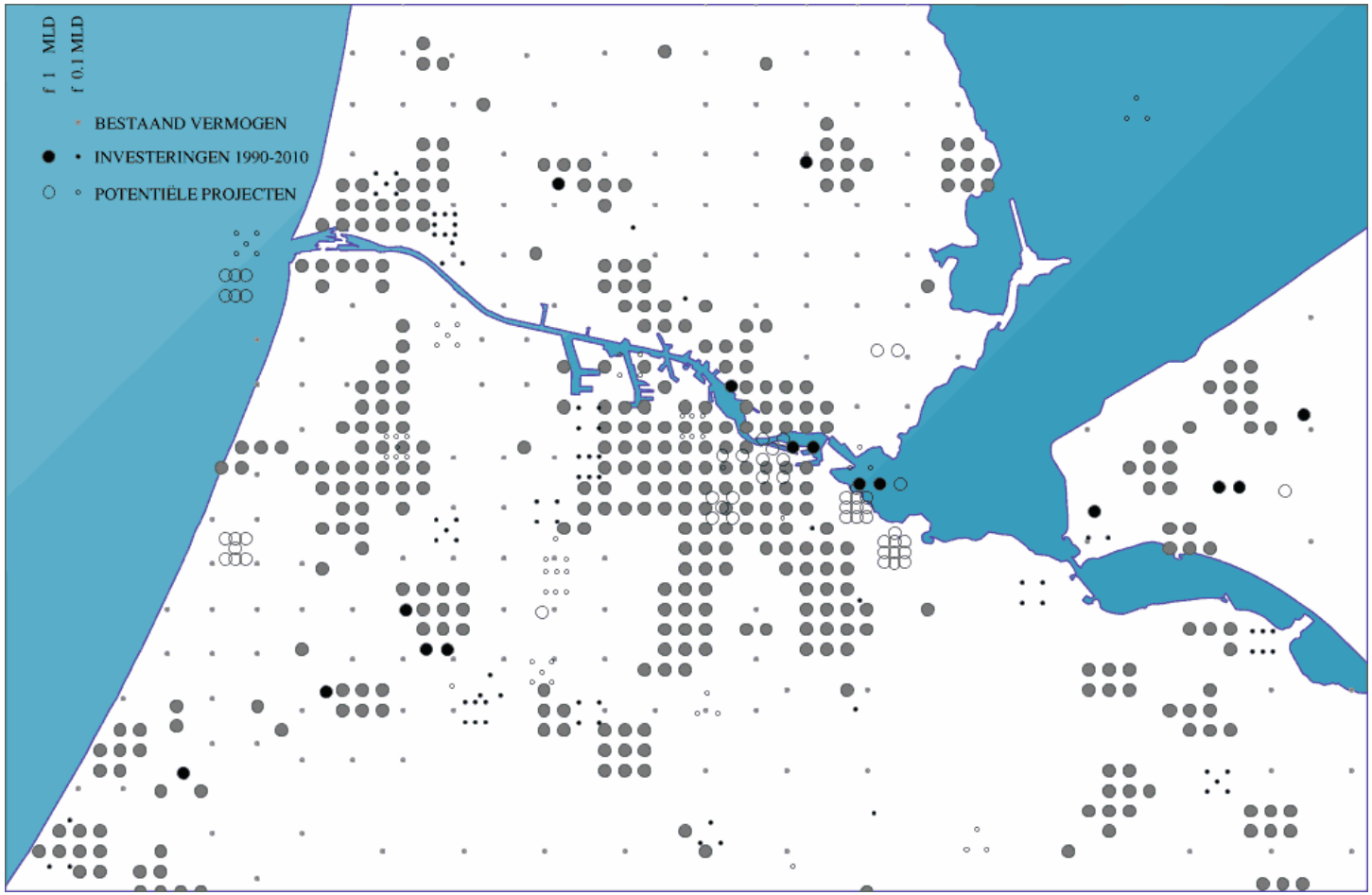
However, since WWII, the number of people per household, especially in the towns, has dropped from about 5 to 2.5; and this number continues to fall.

This, by the way, was the main reason for scarcity of housing in the later post-war period, and for the urban explosion after 1960.

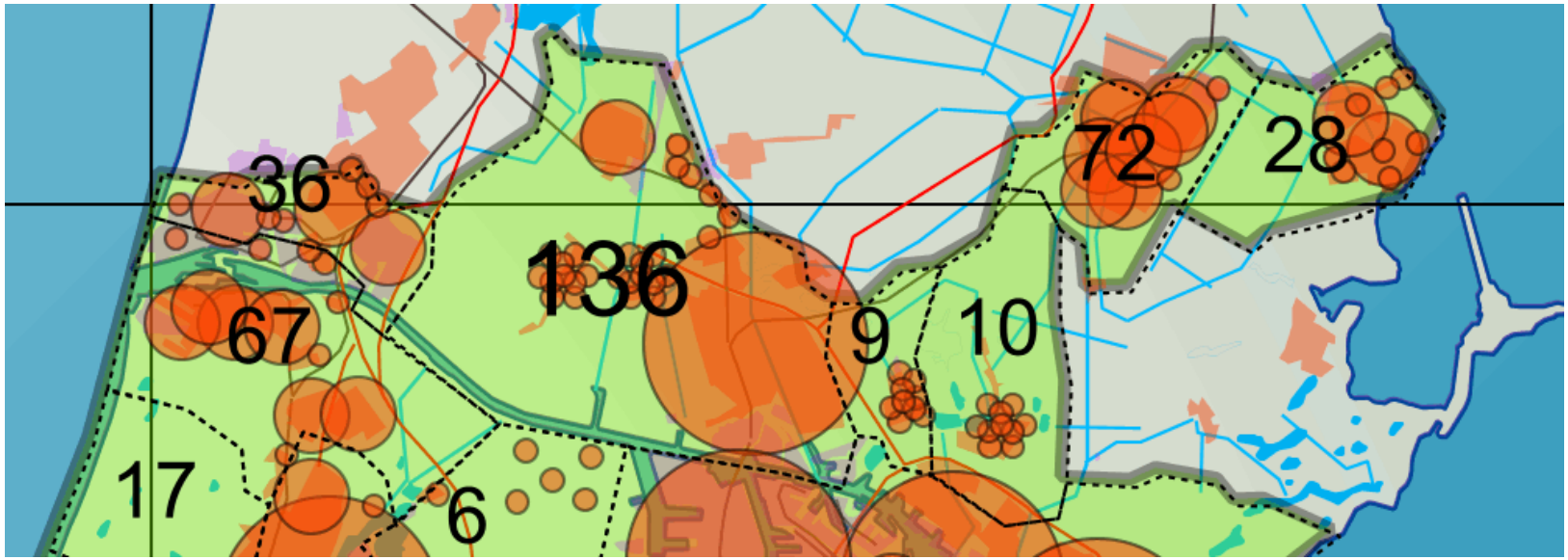
Open space


Until 1995:
town(quarter) 100 000 inh.
village(district) 10 000 inh.
From 1995 until 2005:
vinex district
10 000 inh.
urban landscape < 10 000 inh.
landscape park < 100 000 inh.
landscape < 1000 000 inh.
30km

Urban investments



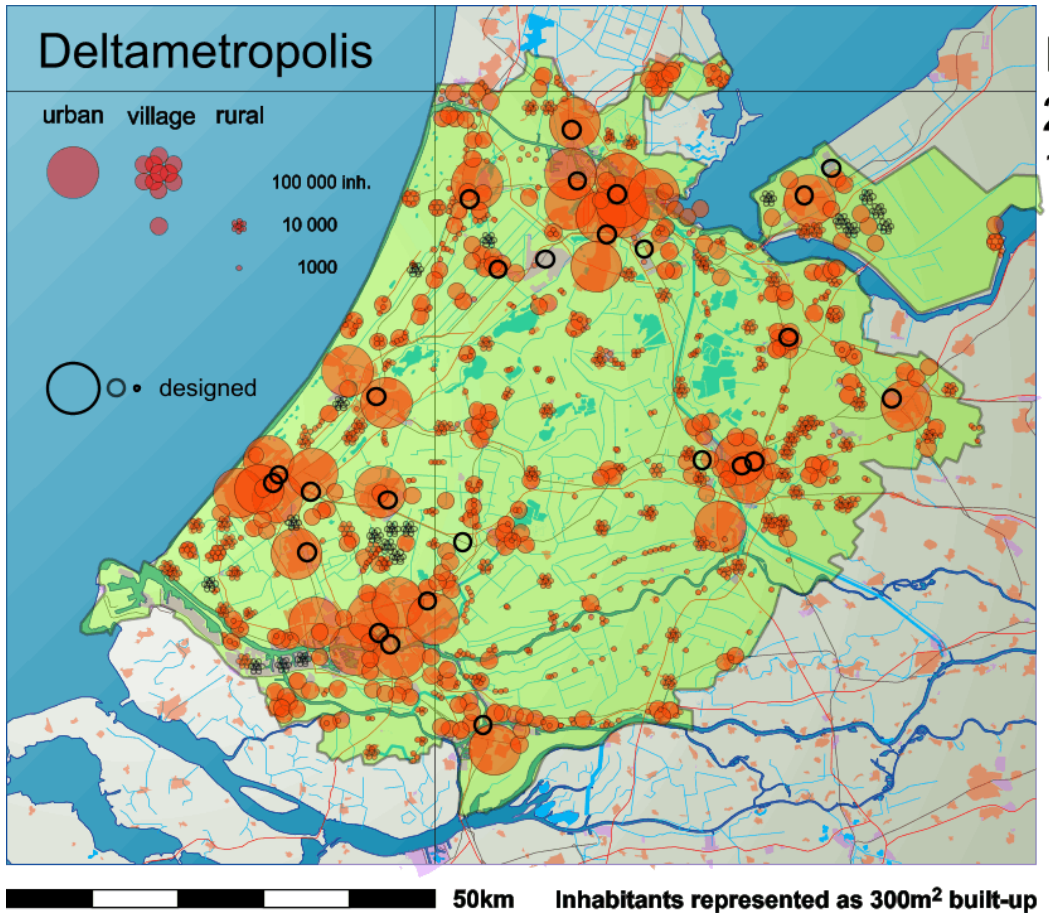
Drawing regional density



Population statistics per municipality, drawn as circles of 3, 1 and 0.3 km radius of 100 000, 10 000, and 1000 inhabitants (300m²/ inhabitant).

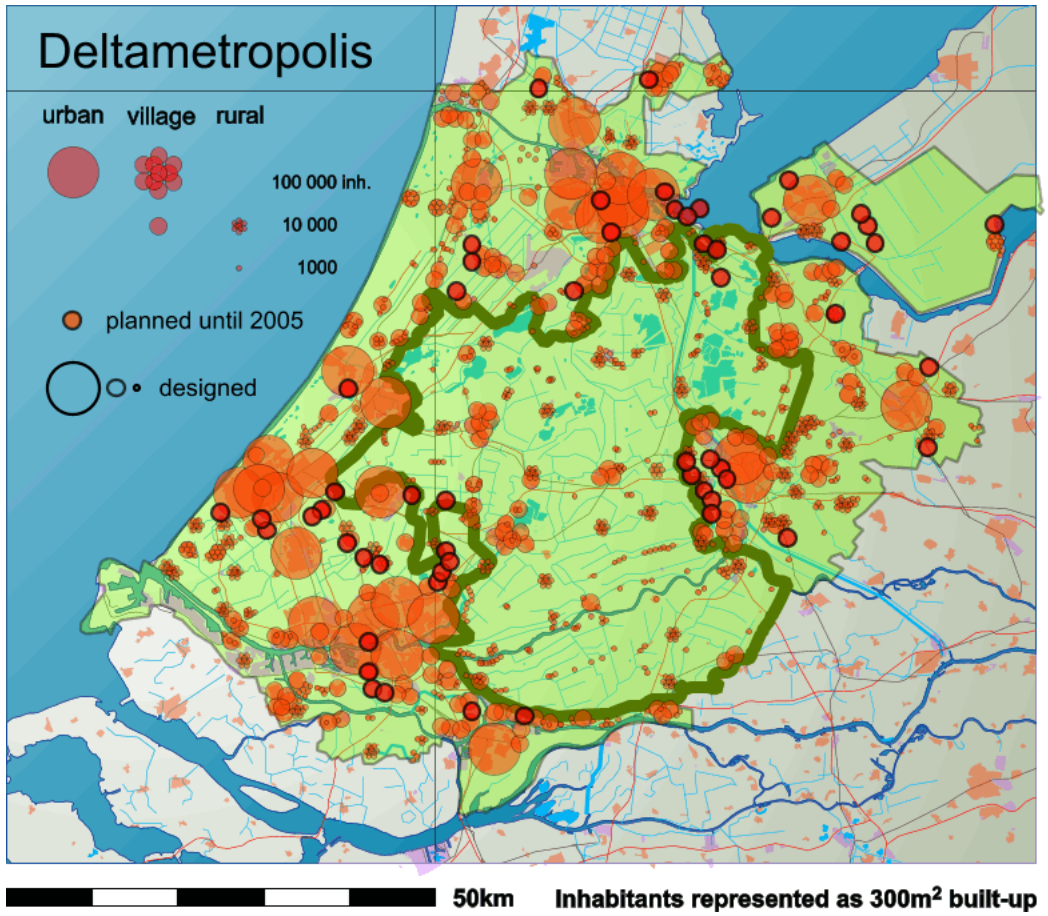
These circles represent the built-up area such a population needs at average in The Netherlands. Their location is roughly determined by the urban topography read from the map.

NRO5



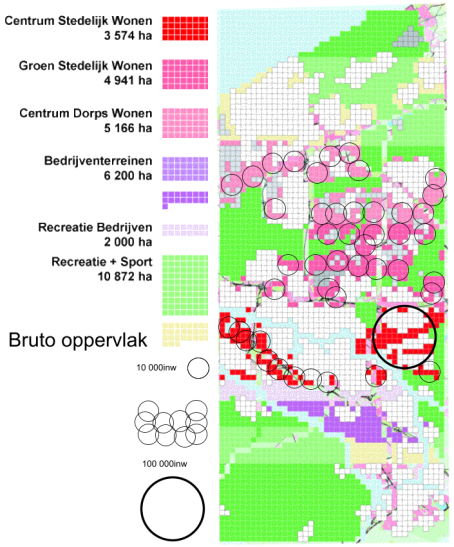
NRO5
26x10 000
187x1 000

Municipal plans

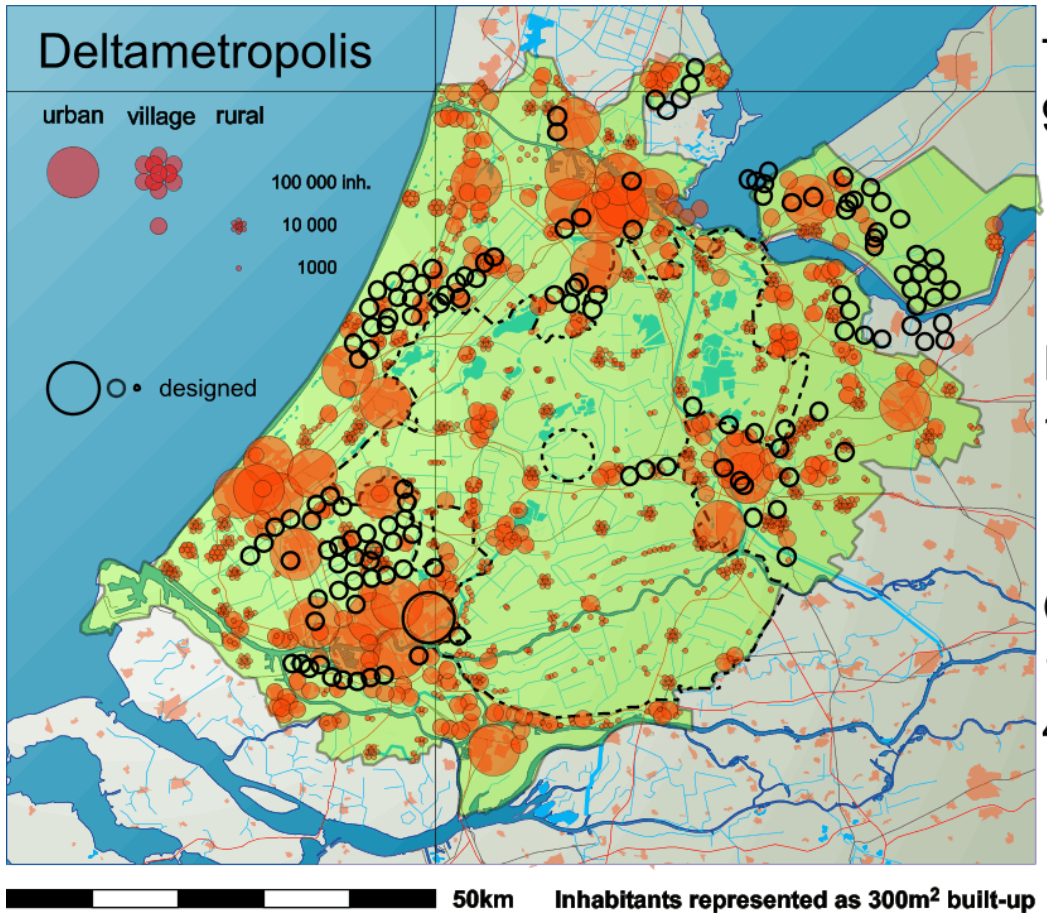


Nieuwe Kaart
57x10 000

Interpreting TKA, H+N+S, OMA



Contribution TKA, H+N+S, OMA

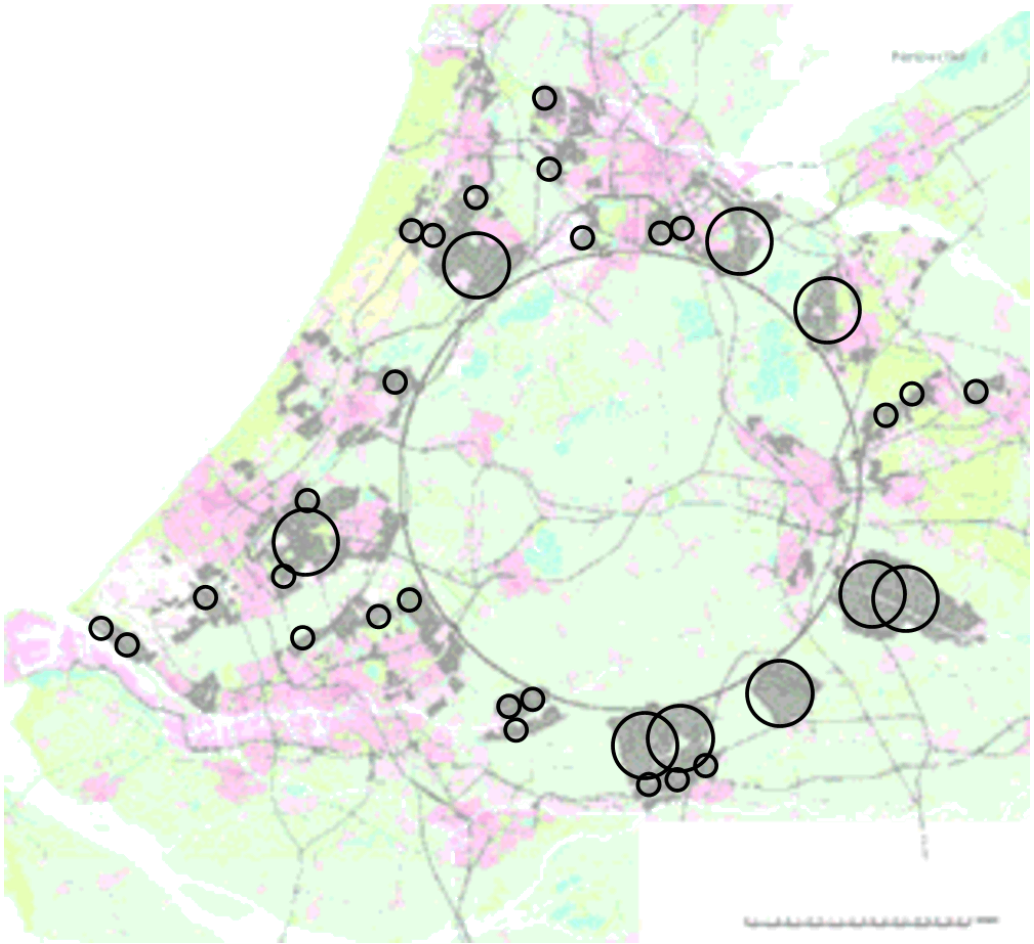


TKA
92x10 000

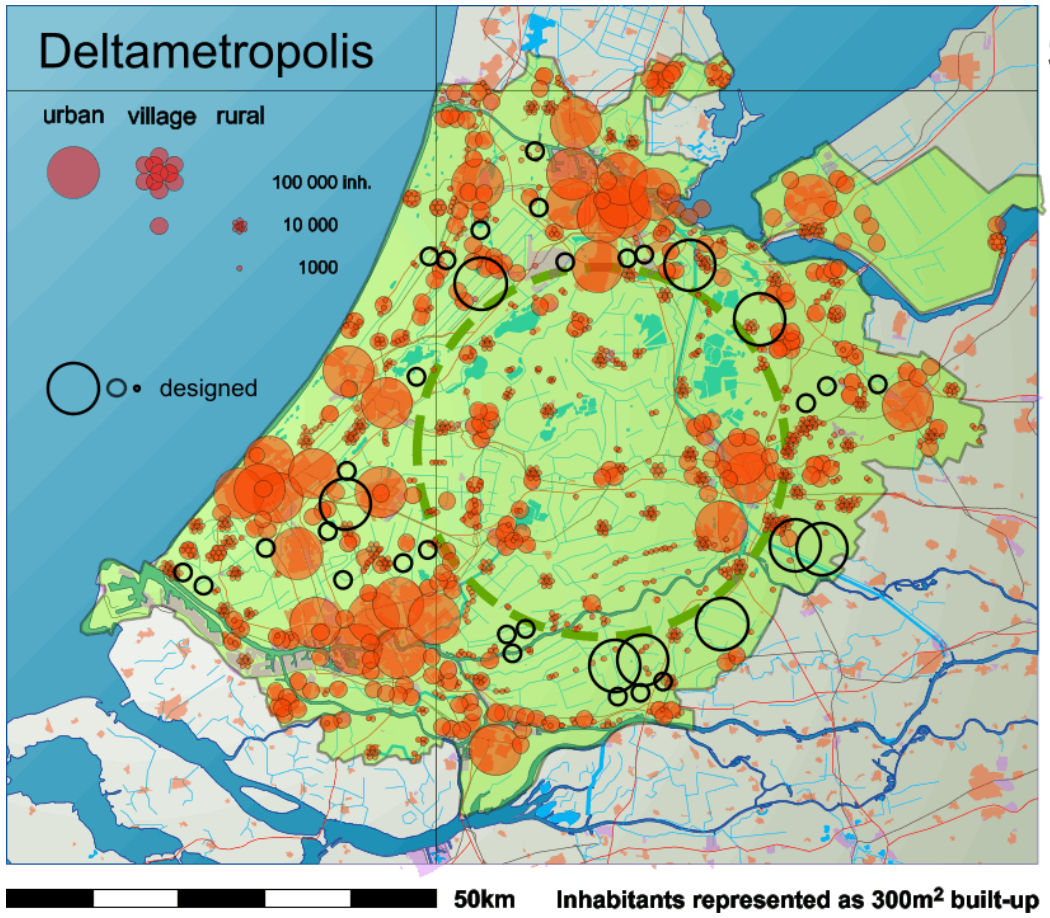
H+N+S
10 000x10

OMA
1x100 000
43x10 000

Interpreting Snozzi



Contribution Snozzi

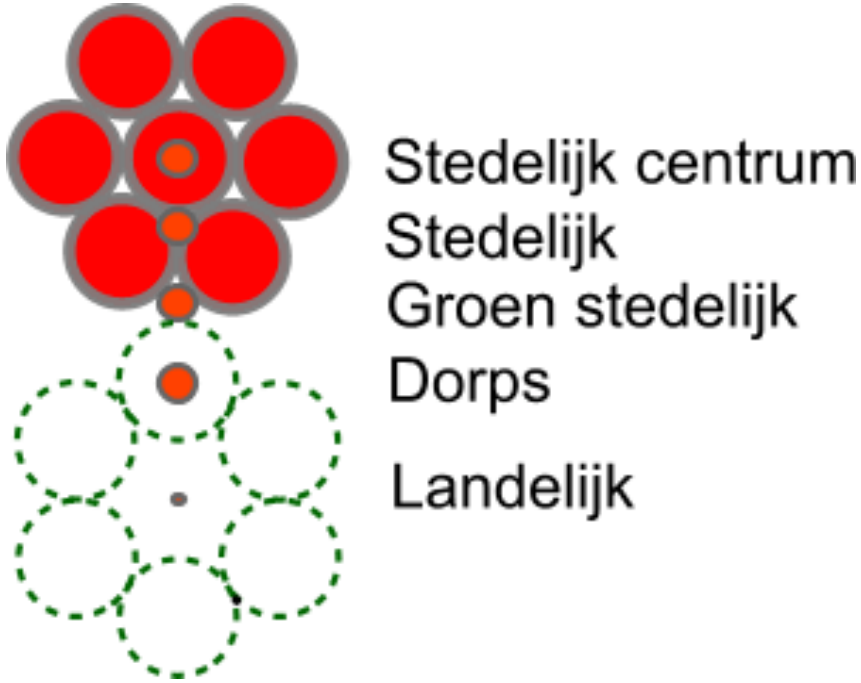


Snozzi

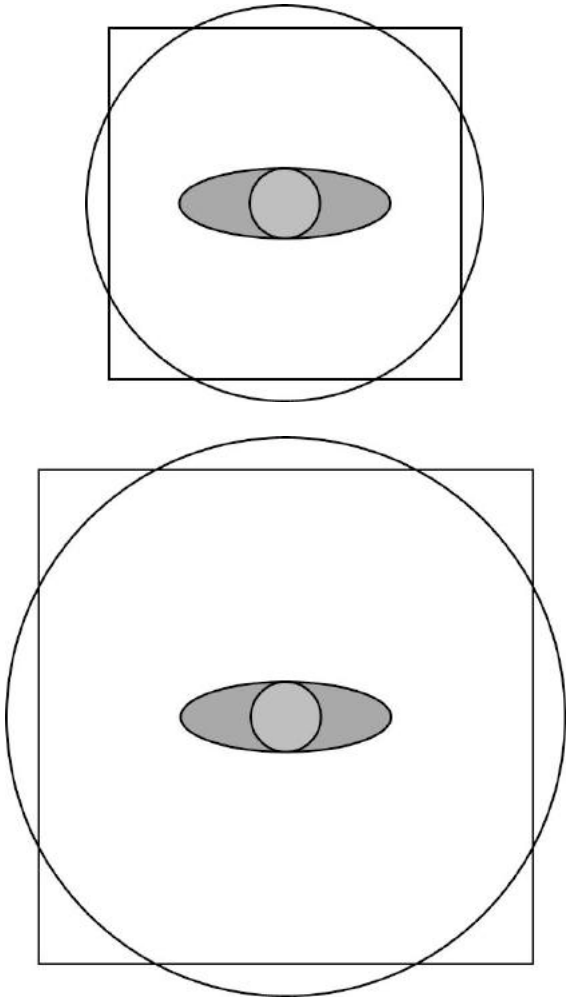
9x100 000

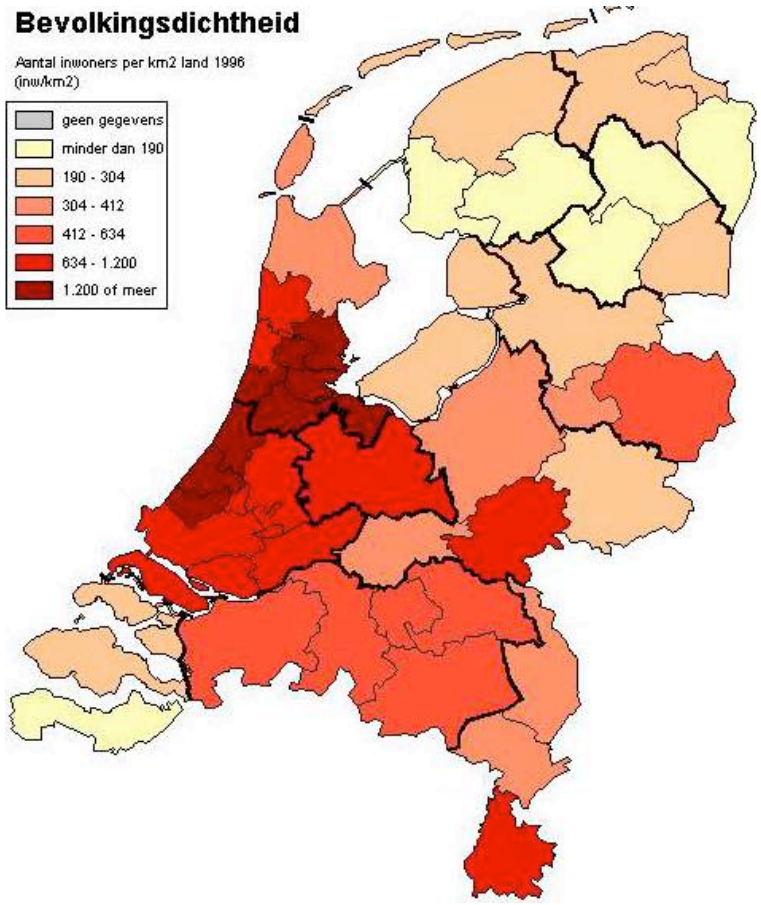
27x10 000

Location of dots from urban to rural

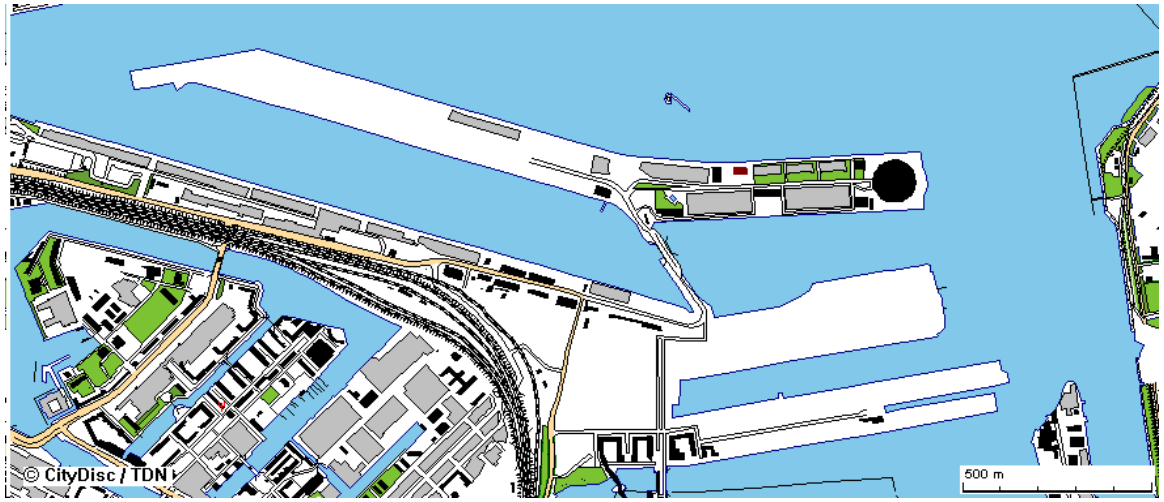


Misleading surface representations





Disappointing references

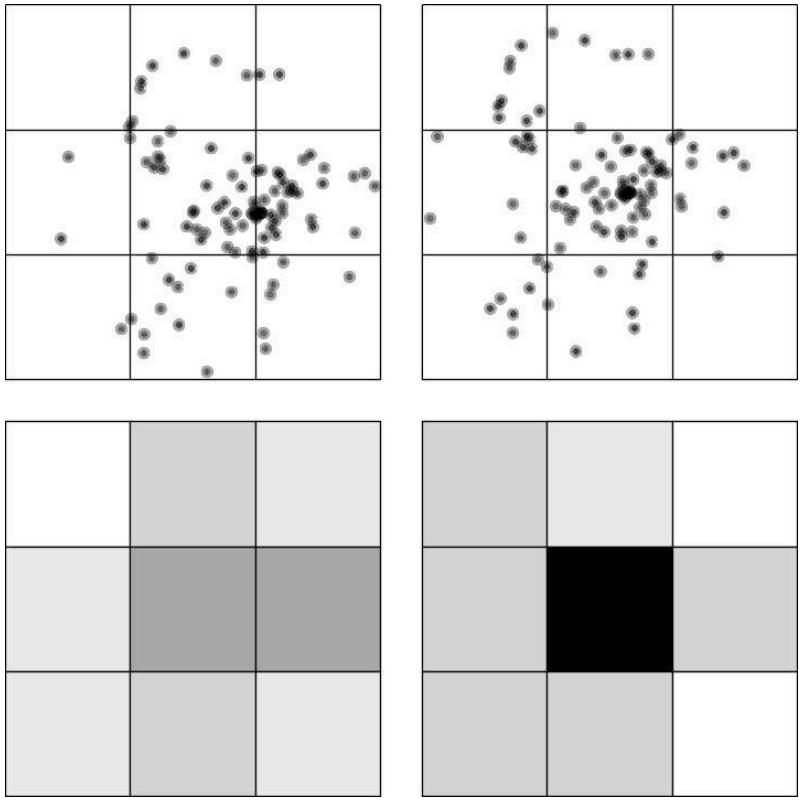


If high densities are reached and used as a reference elsewhere, the comparison could be very disappointing.

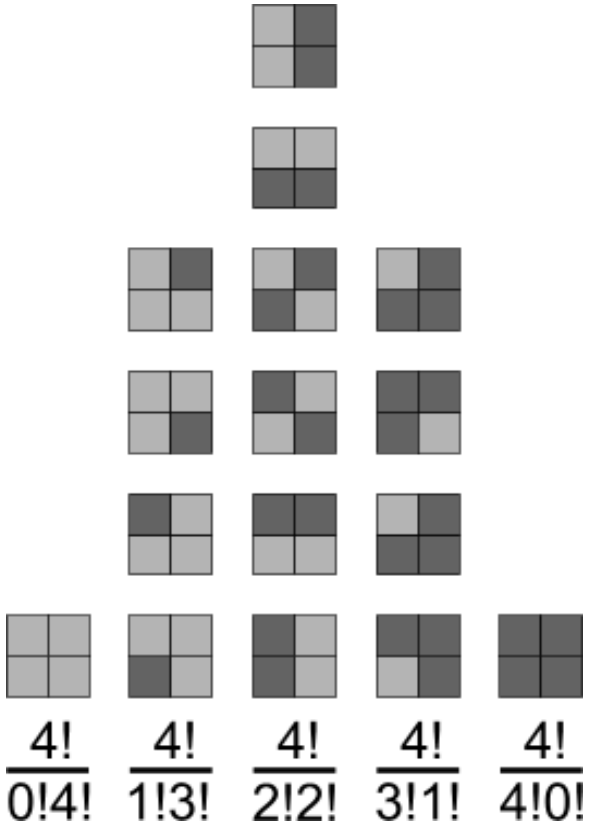
The residential plans for Amsterdam harbour islands reached very high densities, often used as reference that such densities can be reached without loss of quality.

However, when taking the surrounding water into account by measuring the reached densities, their value would be much lower.

Loss of design relevant qualities

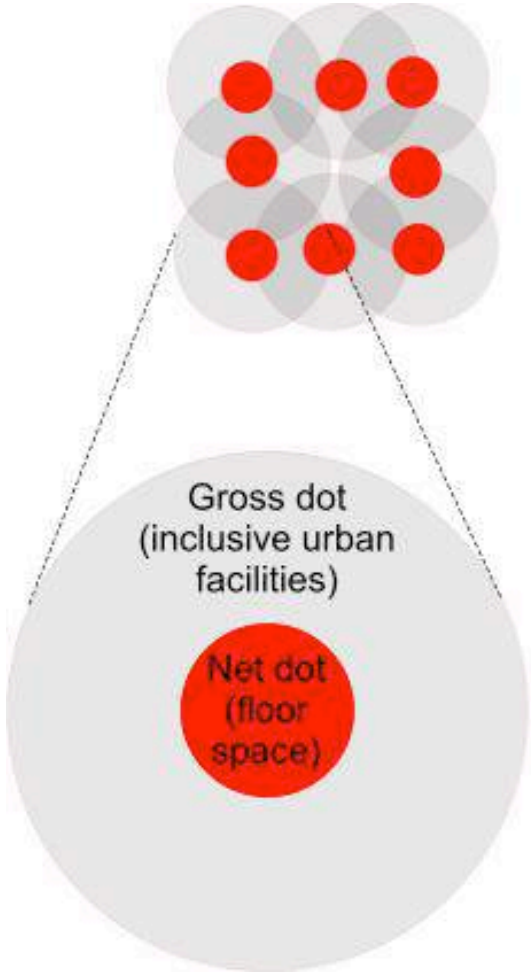


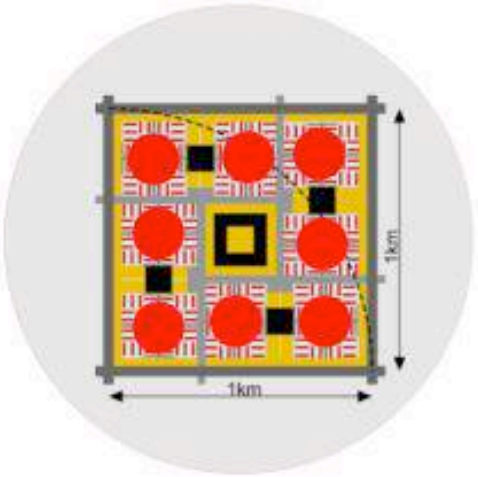
Two density interpretations of the same dispersion



Combinatorial possibilities of arrangement between emptyness and full coverage

Extreme gross and net dots

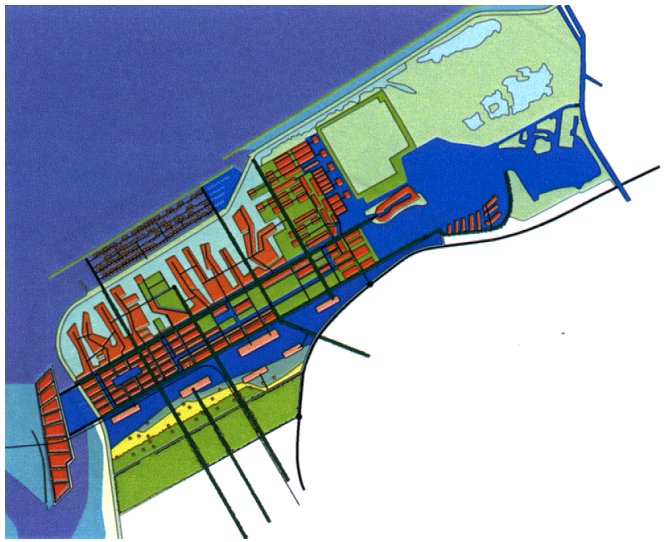




R=300m ~ 300 000m2 ~ urban area 1000 inhabitants with 300m2

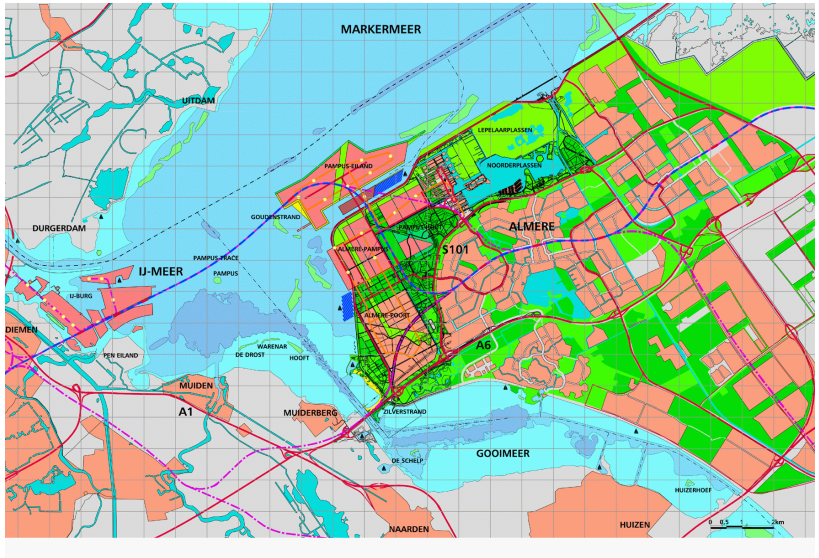
r=100m ~ 30 000m2 ~ floor space 1000 inhabitants with 30m2

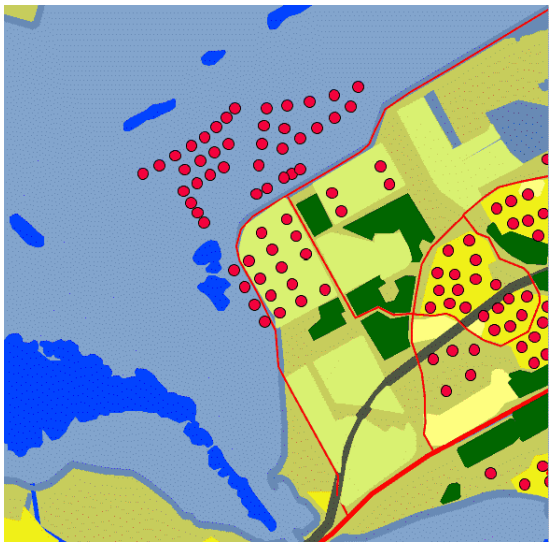
Interpreting H+N+S Pampus



Interpreting Hosper Pampus

Interpreting TKA Pampus





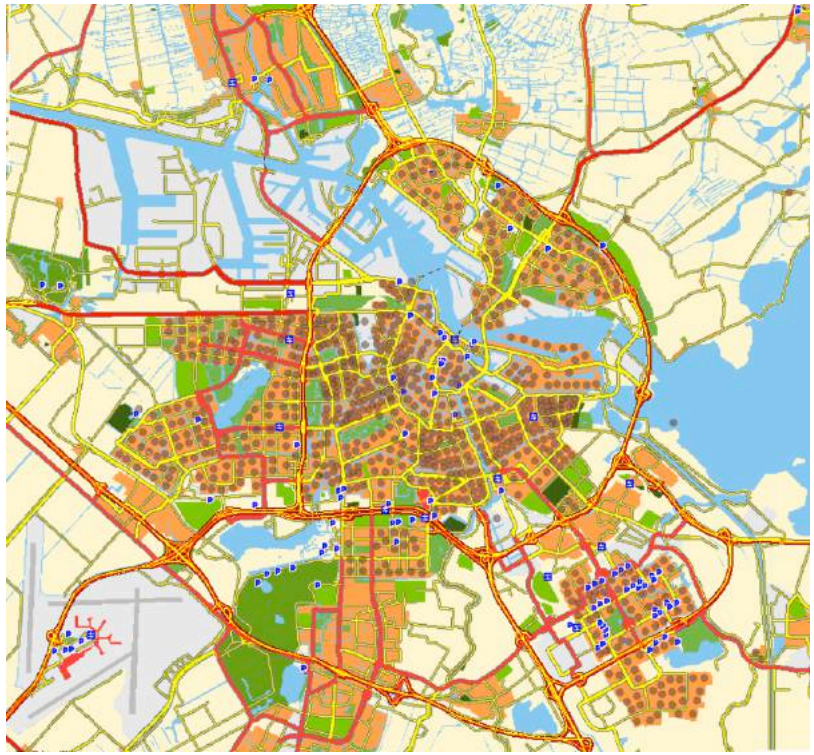
Interpolating plans to 50 000 inhabitants each

to compare states of dispersion (form)

Ten kinds of urban density

Digits	Min. area	Max. area	Min. radius	Max. radius	ominal radiu	Gross	Tare
	Smin	Smax	R_{min}	R_{max}	R_{nom}	name of area	including for example
	m^2	m^2	m	m	m		subtracted on lower level
10	1000000000	9999999999	17841	56419	**30000**	metropolis	landscape parks, metropolitan infrastructure and facilities
9	100000000	999999999	5642	17841	**10000**	conurbation	town landscapes, conurbarion infrastructure and facilities
8	10000000	99999999	1784	5642	**3000**	town, town quarter	town parks, town water, town infrastructure and facilities
7	1000000	9999999	564	1784	**1000**	district, district quarter, village	district parks, district water, district infrastructure and facilities
6	100000	999999	178	564	**300**	neigbourhood, hamlet	neighbourhood parks, small water, neighbourhood infrastructure and facilities
5	10000	99999	56	178	**100**	ensemble	small public green area residential public space
4	1000	9999	18	56	**30**	urban island, property, building complex	pavement directly opening up building complexes, open space in private parcels (lots, plots)
3	100	999	6	18	**10**	parcel, plot, lot or building	gardens, unbuilt places, patios
2	10	99	2	6	**3**	building segment,	rooms, unbuilt spots
1	1	9	1	2	**1**	building part	

Conurbation density$_{10km}$

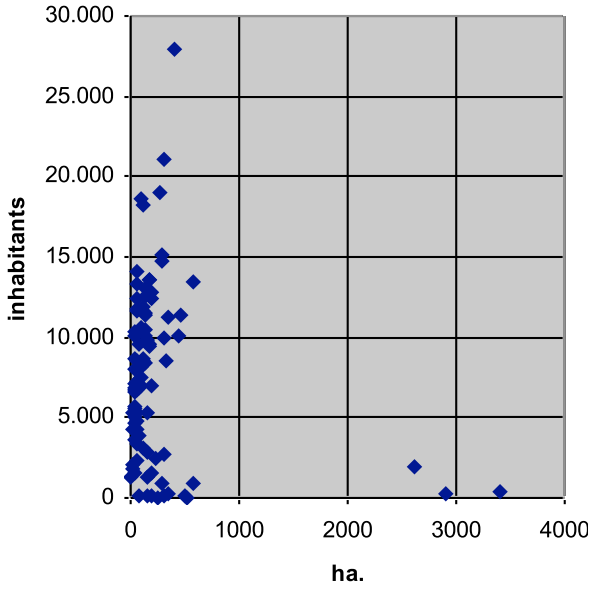


You can count the dots per grid cell to determine the local density per km^2. However, it is better to make a mask of 1km^2 and shovel that mask over the drawing to find the highest density. Multiplying that figure by 100 gives the density of inhabitants per ha. Dividing it by the average household size gives an estimate of the number of houses per ha.

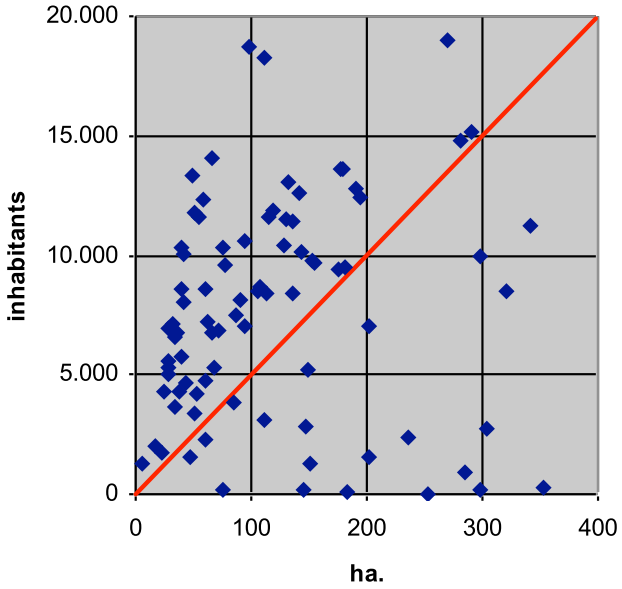
Town density$_{3km}$

- Town densities are incomparable if you do not precisely define the boundaries of the towns compared.
- To determine the main national subsidies for municipalities the distance between buildings has to be less than 100m to determine the ‘built-up area’ as a factor in subsidy calculation.
- That mainly means excluding ‘open area’ like agricultural areas, natural areas and parks larger than 100m in any direction as tare surface of higher order.
- The question if you have to include national or regional highways and waterways crossing the town and other facilities to calculate density has to be solved.

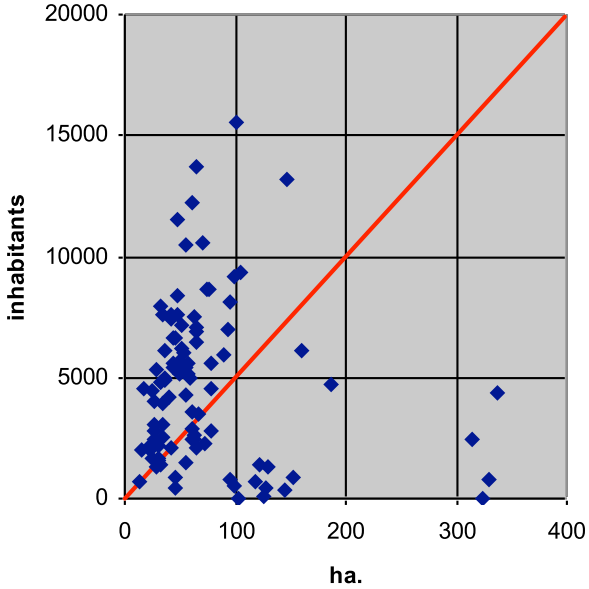
District density$_{1km}$



Inhabitants and surface of administrative districts in the municipality of Amsterdam

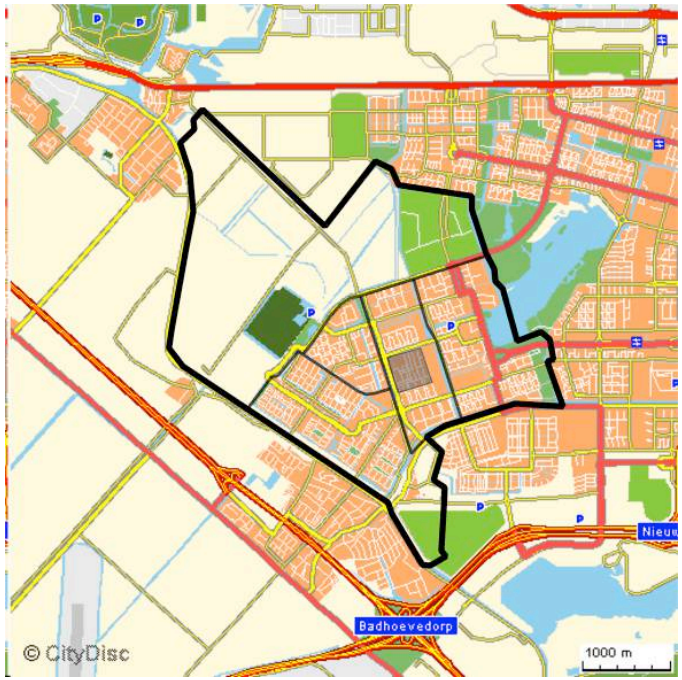


The same figures excluding districts of more than 999 ha and 20 000 inhabitants



The same figure concerning the municipality of The Hague

Neighbourhood density$_{300m}$



m2 Map cutting

- m2 Non district surface of higher order
- m2 Common district surface

= m2 **Gross neighbourhood** (a - b - c)

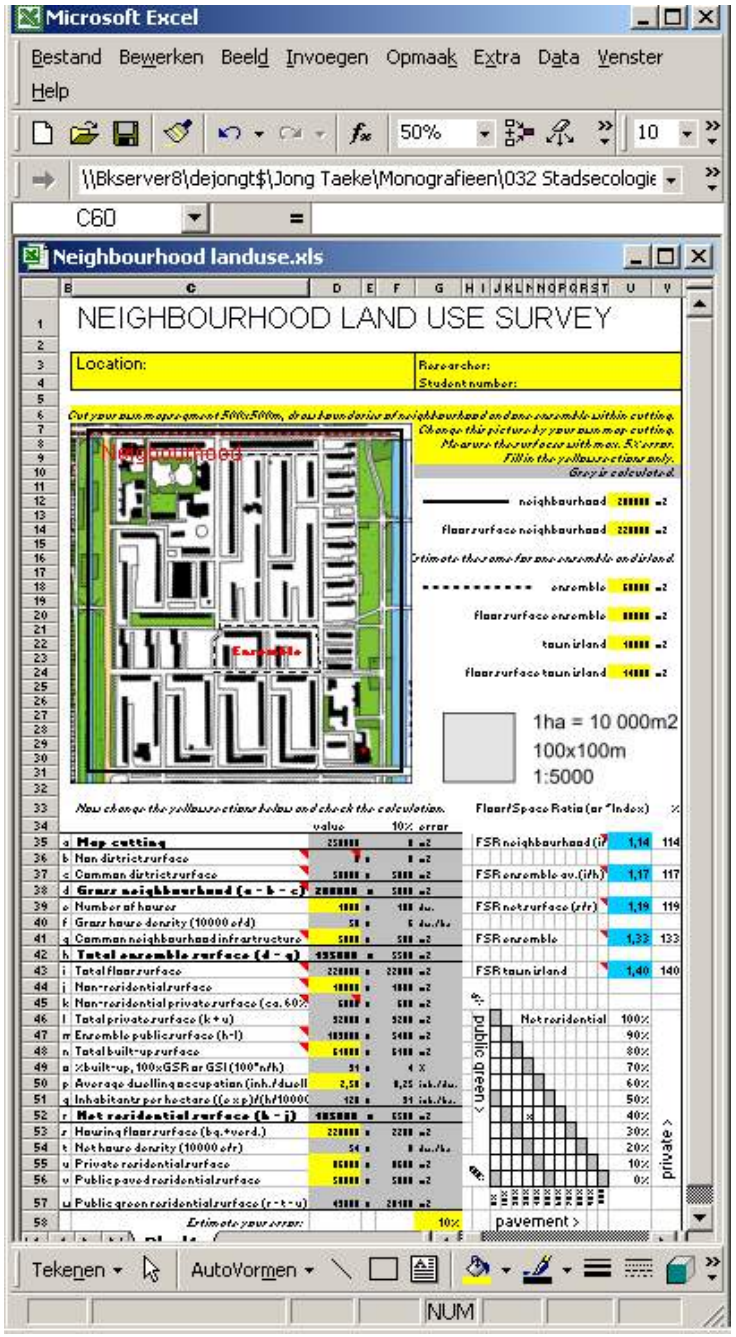
- m2 Neighbourhood infrastructure and facilities

= m2 **Net neigbourhood** (d - g)

Variables of Neighbourhood density

a	**m^2 Map cutting**	e	Number of houses
b	m^2 Non district surface of higher order	f	Gross house density per ha
c	m^2 Common district surface		(10 000 * e / d)
d	**m^2 Gross neighbourhood (a - b - c)**	g	m^2 Common neighbourhood infrastructure and facilities

h	**m^2 Gross Ensemble (d - g)**	p	Average dwelling occupation (inh./dwelling.)
i	m^2 Total floor surface	q	Inhabitants per hectare ((e x p)/(h/10000))
j	m^2 Non-residential surface	r	**Net residential surface (h - j)**
k	m^2 Non-residential private surface (ca. 60% j)	s	m^2 Housing floor surface (gf.+storeys.)
l	m^2 Total private surface (k + u)	t	Net house density (10000 e/r)
m	m^2 Ensemble public surface (h-l)	u	m^2 Private residential surface
n	m^2 Total built-up surface	v	m^2 Public paved residential surface
o	%built-up, 100xGSR or GSI (100*n/h)	w	m^2 Public green residential surface (r - u - v)

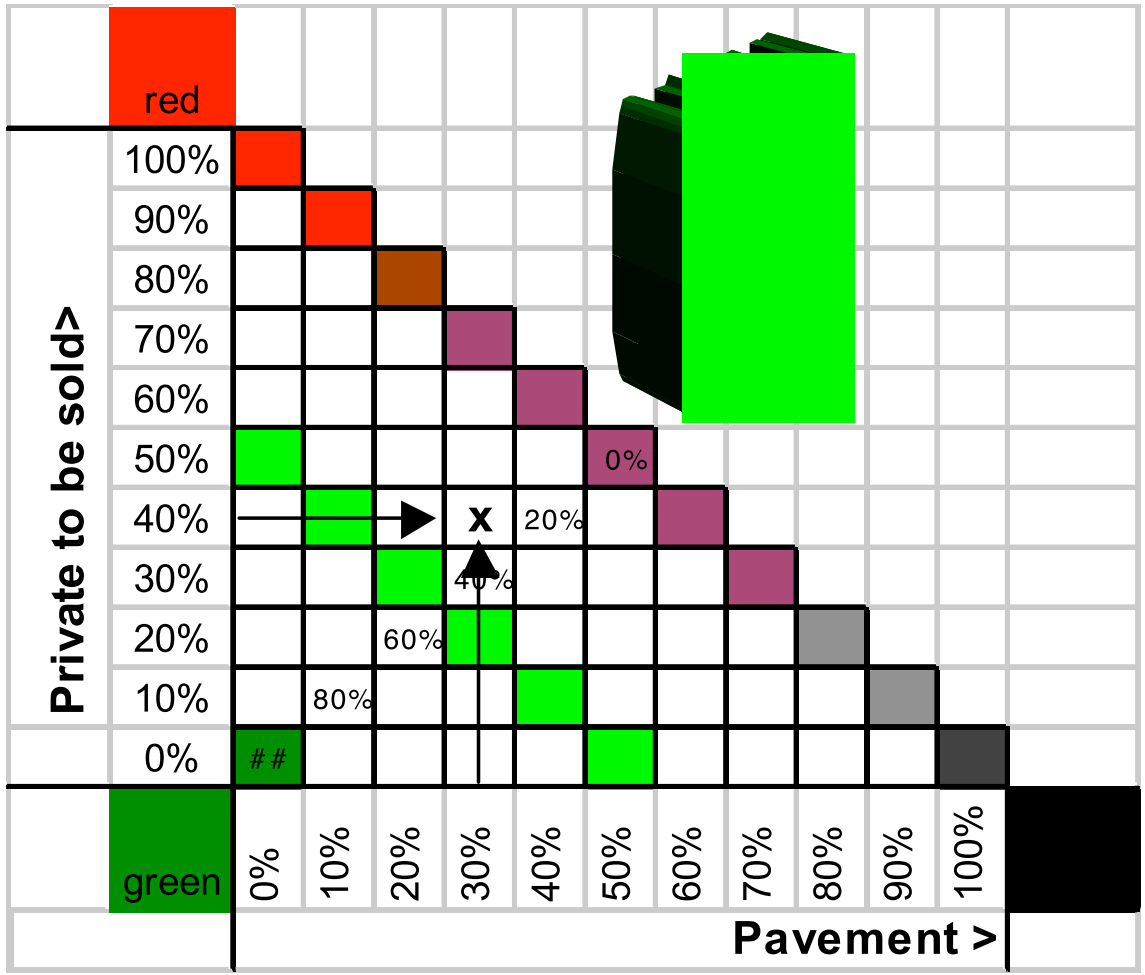


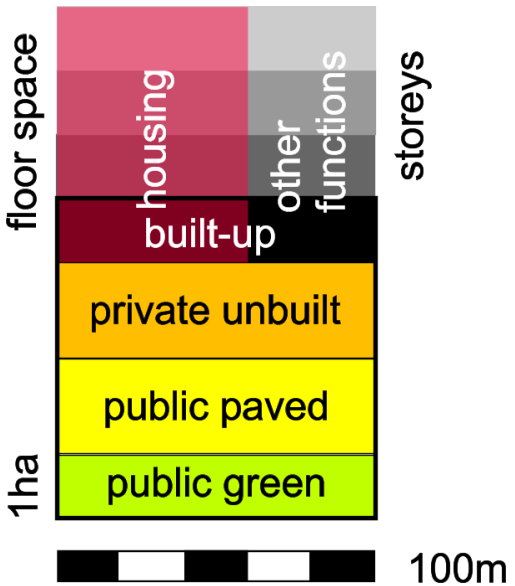
Calculating Neighbourhood densities

Five kinds of density

	for example	expressed as GSI
% floor space on gross neighbourhood (i/d)	114%	1.14
% floor space on net neighbourhood (i/h)	117%	1.17
% floor space on net residential surface (s/r)	119%	1.19
% floor space on a particular ensemble	133%	1.33
% floor space on a particular town island	140%	1.40

Private, pavement and green





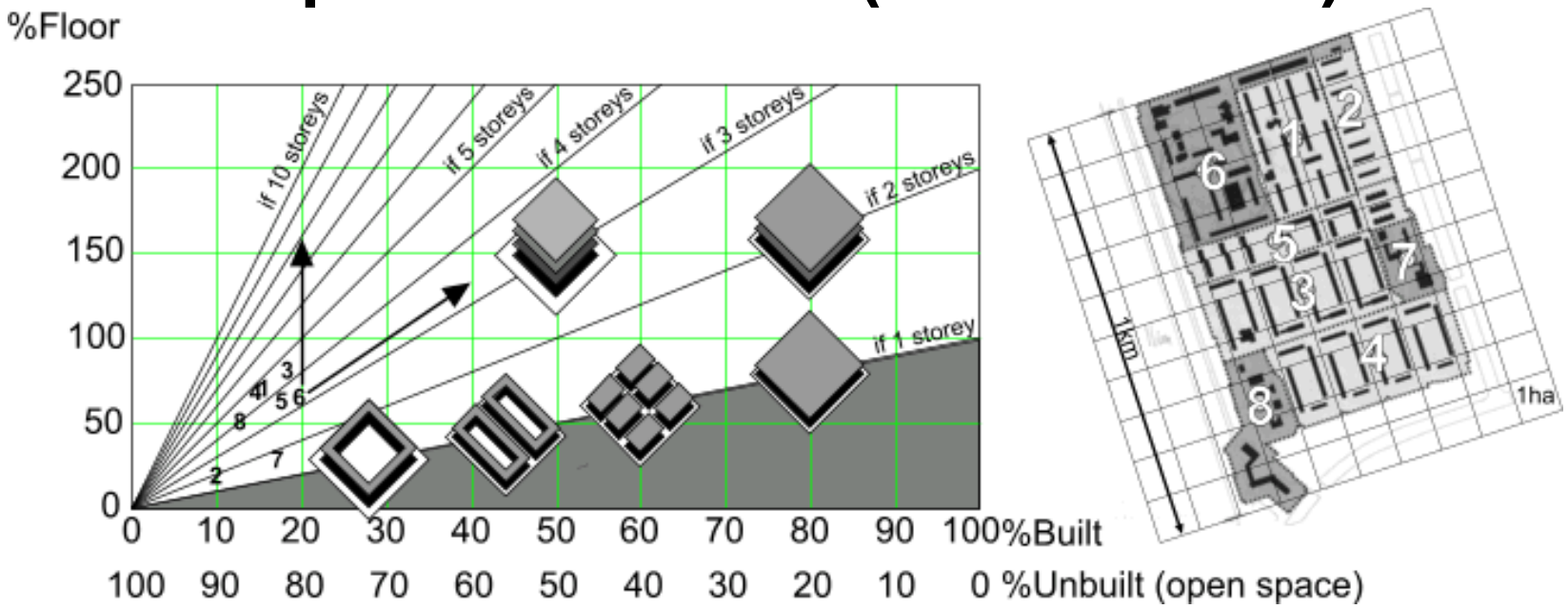
Ensemble density$_{100m}$

- The division of a neigbourhood in ensembles mostly results in homogeneous residential or non residential areas.
- So, on this level that functional distinction will no longer play an important role.
- We can concentrate on basic formal surfaces as
  - total area A,
  - built-up surface B,
  - floor surface F,
  - private surface P,
  - non-specified public surface A – P
  - and average building height or average number of storeys S.

Ensemble density$_{100m}$

- The gross ensemble surface A is equal to the net neighbourhood surface.
- So, neigbourhood infrastructure and ~facilities are excluded, and there is only one basis for density: F/A (FSI, or better FSR).
- The coverage of the total surface A by buildings B/A (GSI) is a primary variable.
- B multiplied by the average number of storeys S (if façades are vertical) produces the floor surface F.

Space mate (Permeta)



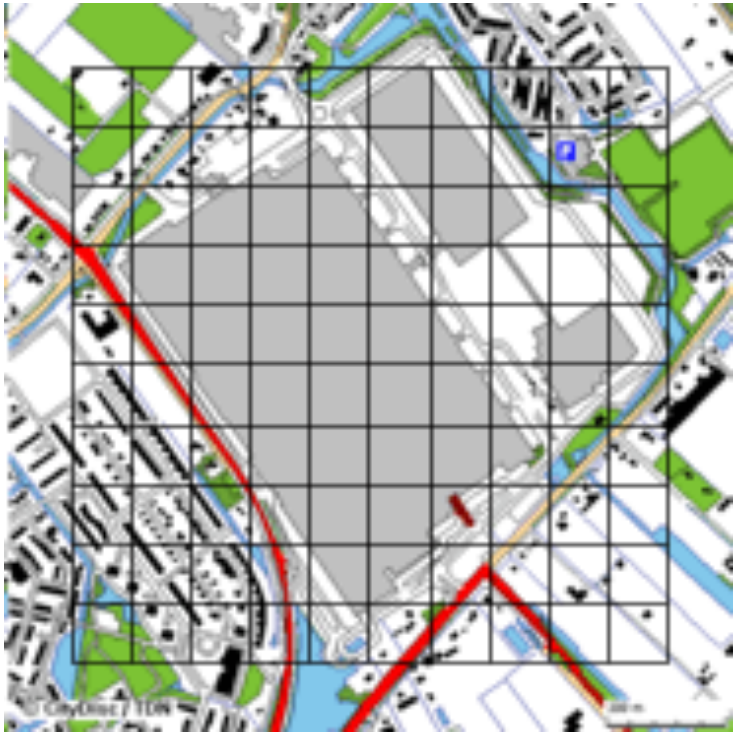
If F = S * B, then F/A = S * B/A.

To compare ensembles with different A, Permeta draws a diagram called Space Mate, plotting F/A against B/A. Both are given here as percentage of B and F from the total area A.

Moreover, the diagram is extended from 0 into 100%. So, B on the horizontal axis includes also unusual, mostly theoretical high densities.

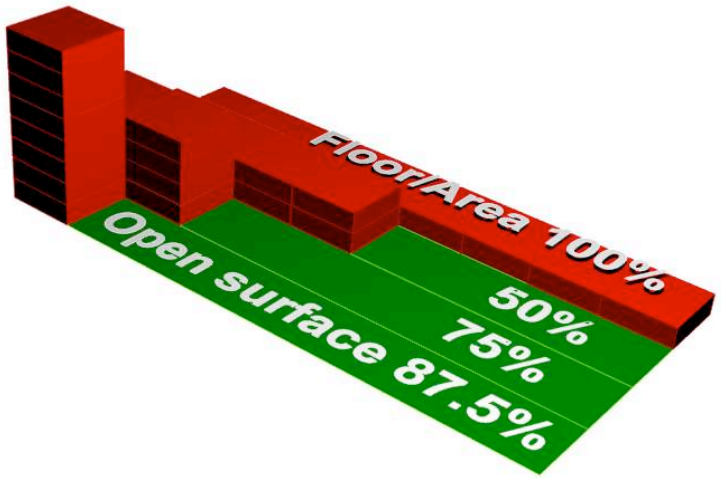
More than 50% built-up area

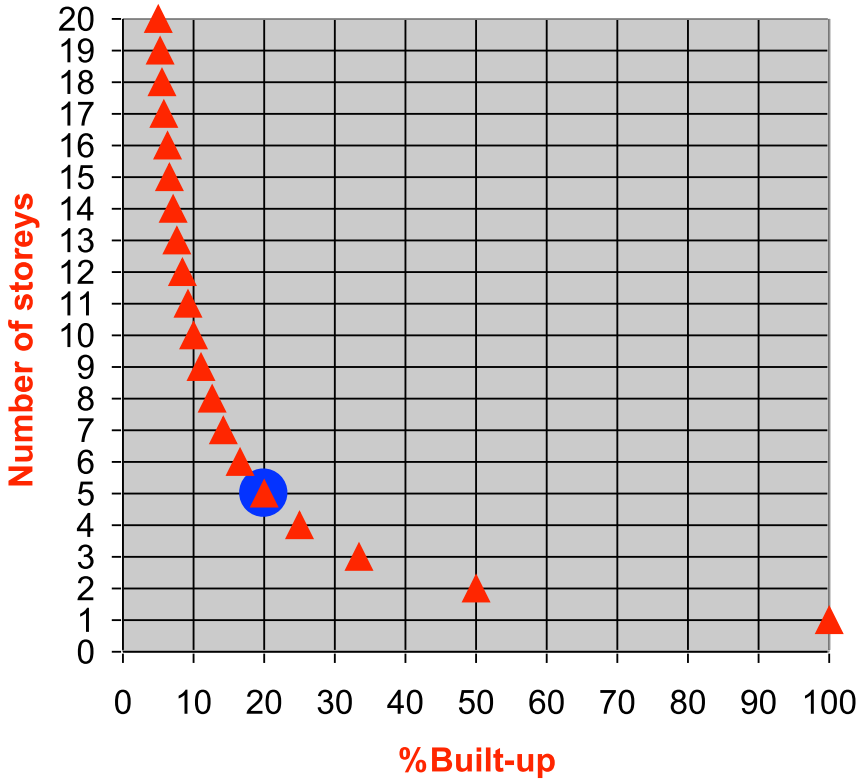
Ensemble in Venice 1: 5000; 200x200m



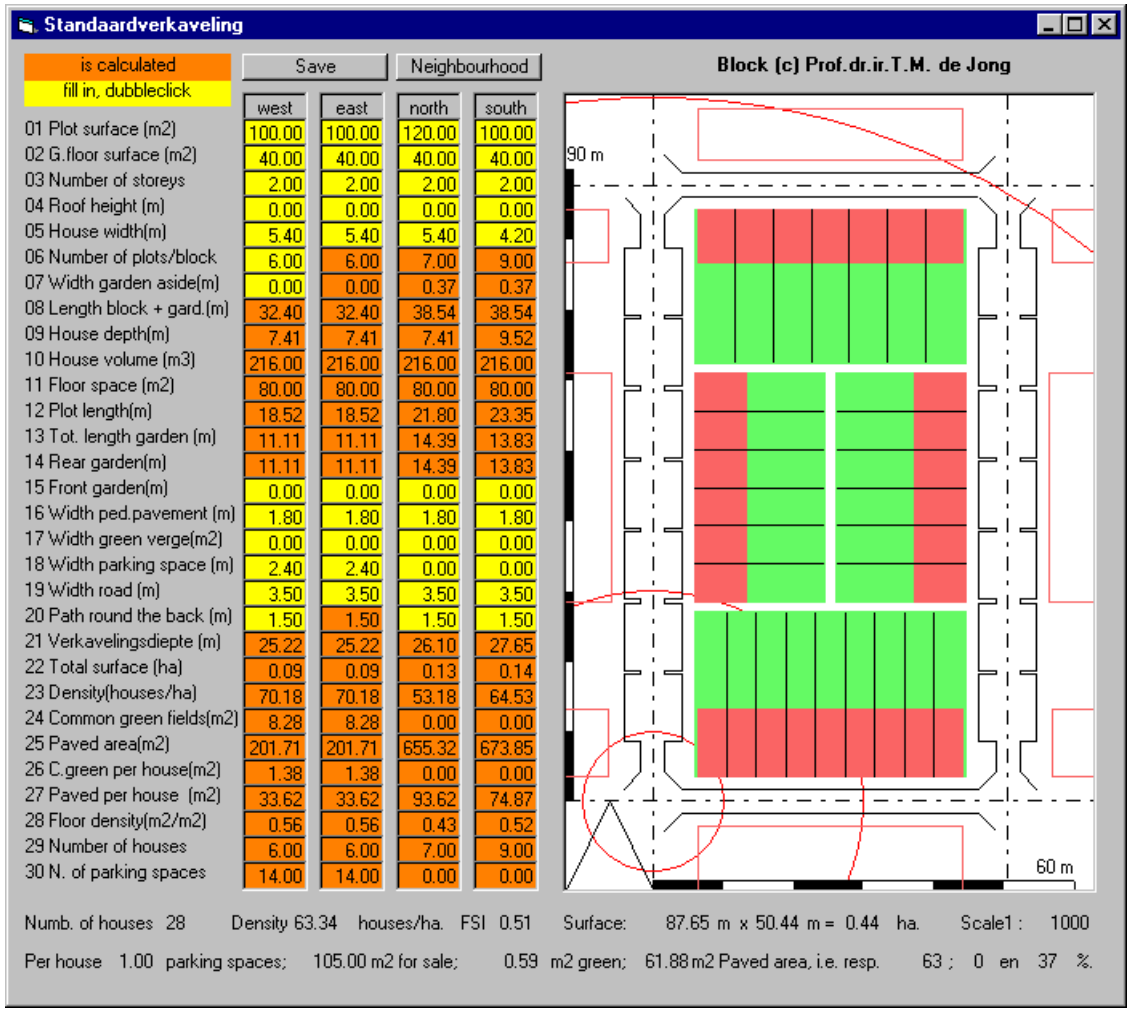
Auction Aalsmeer 1:25000; 1kmx1km

High rise

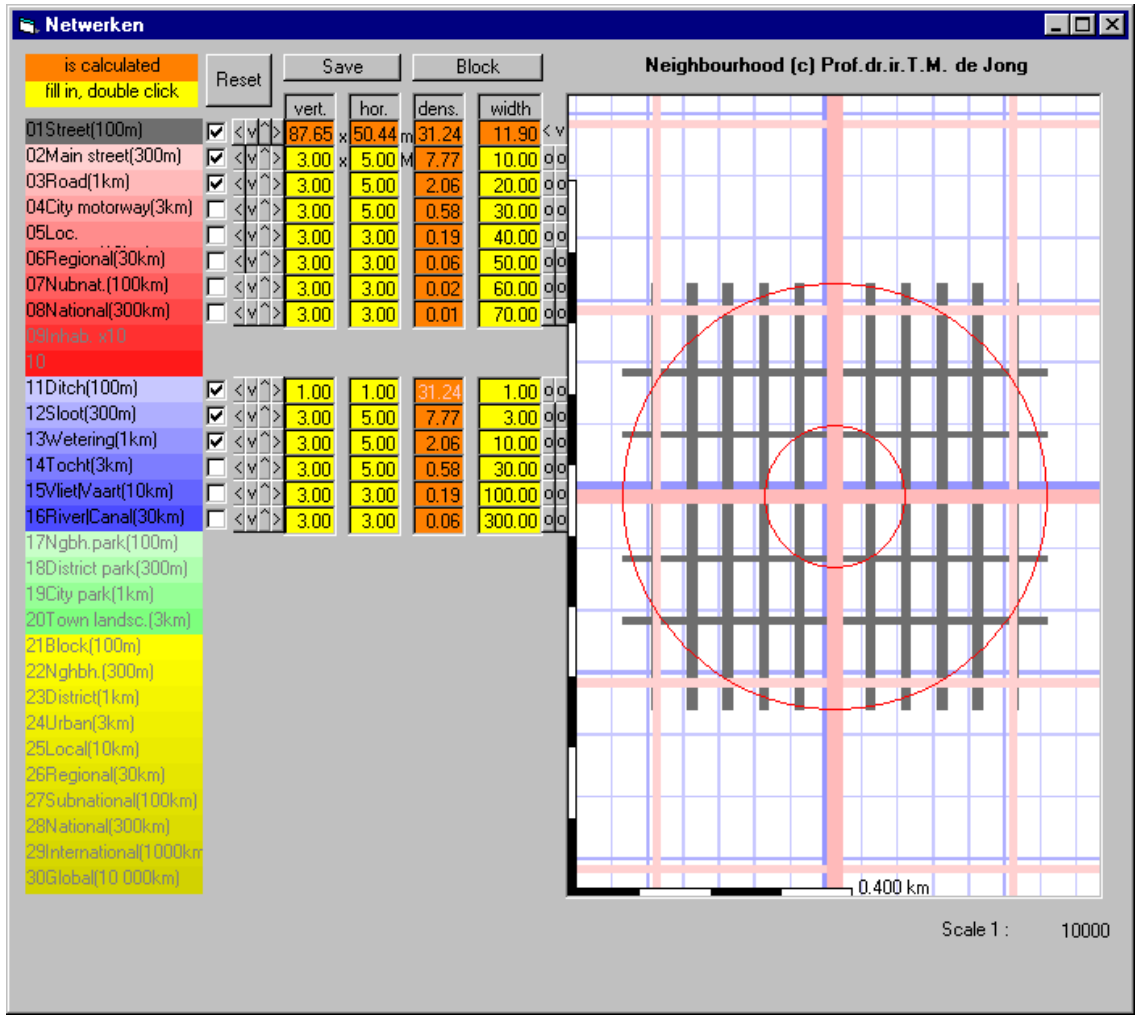

Floor/Area 100%
50%
75%
Open surface 87.5%


Number of storeys
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
0
10
20
30
40
50
60
70
80
90
100
%Built-up

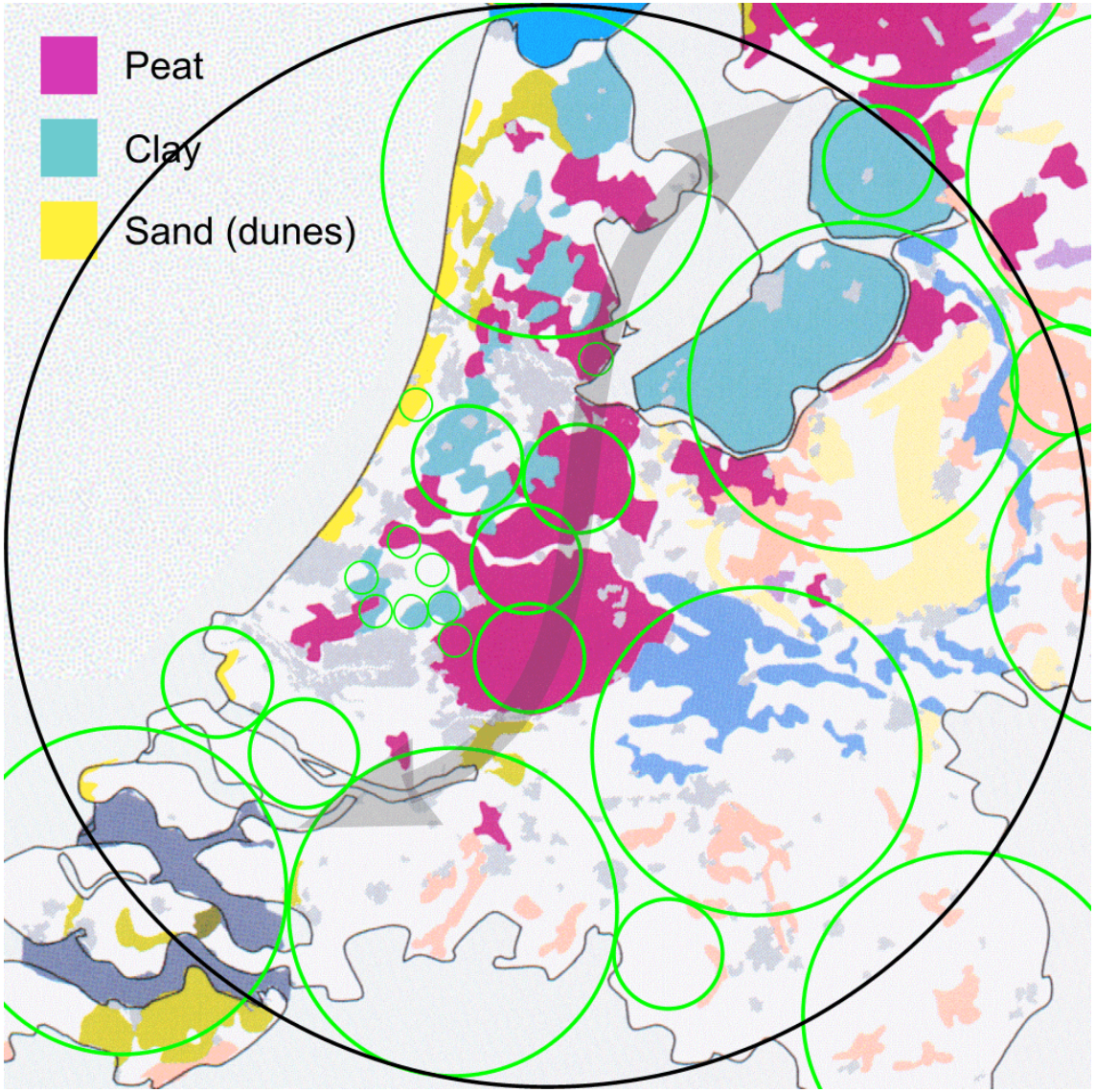
Urban island density$_{30m}$



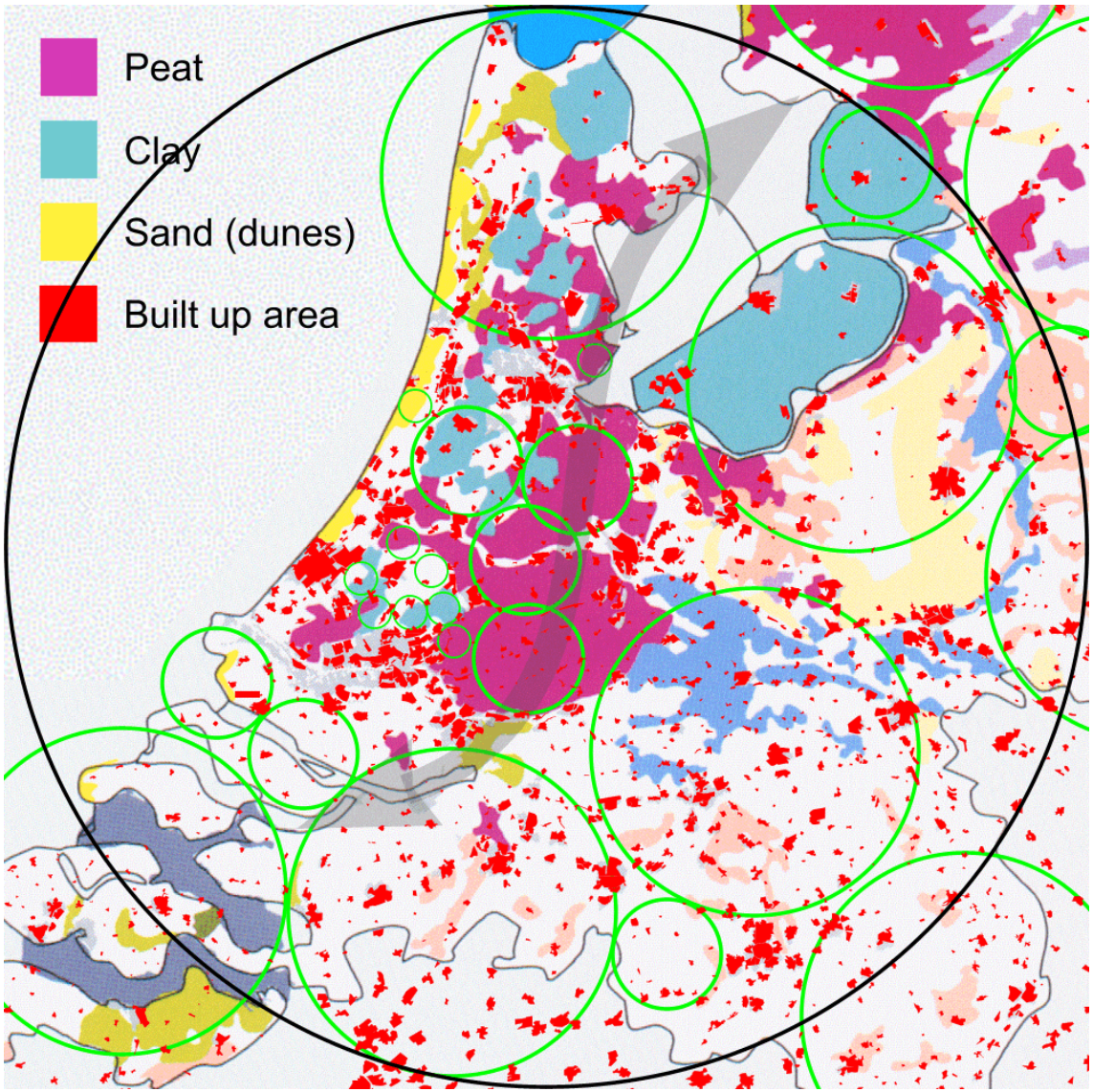
Multiplying urban islands



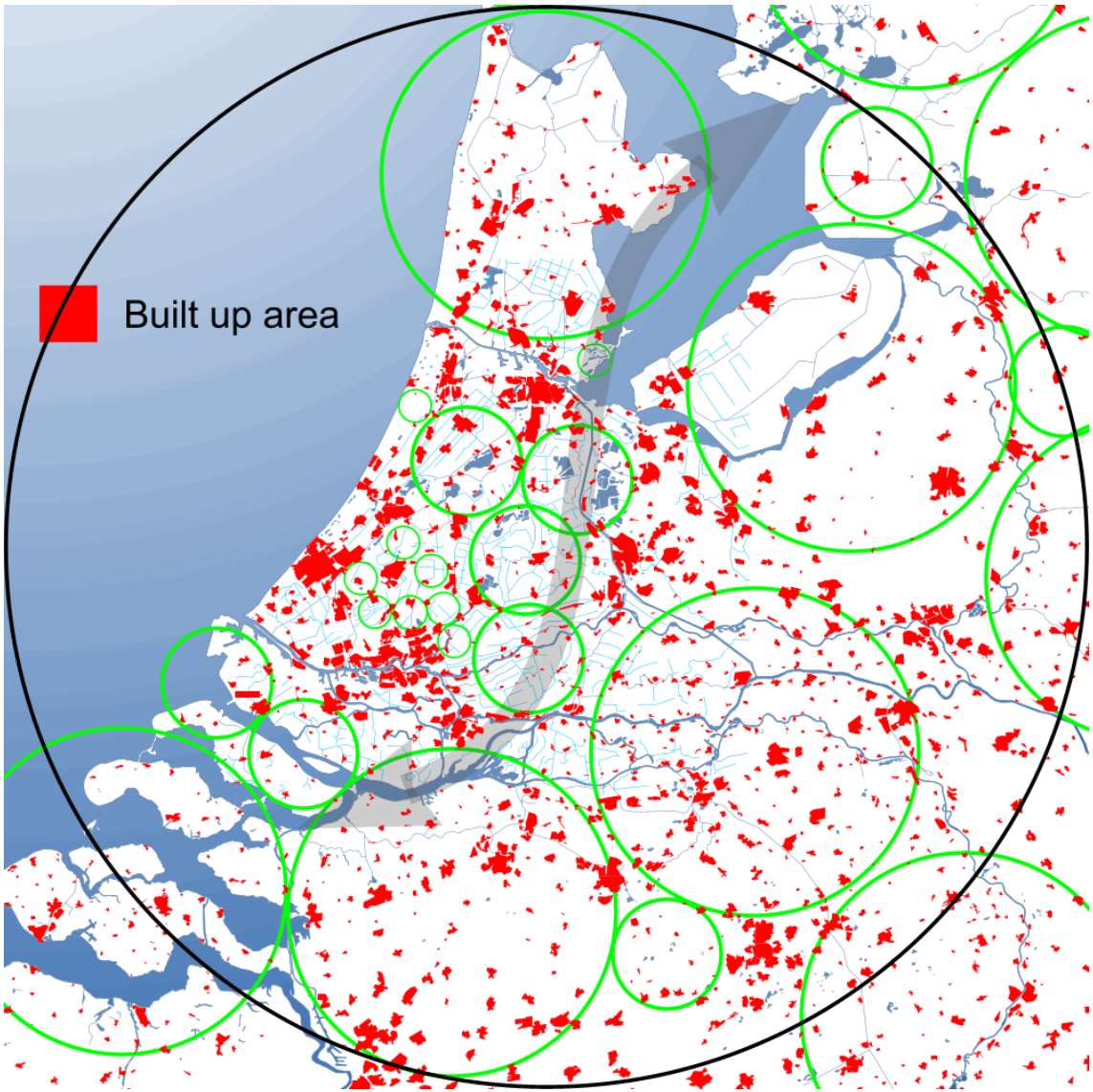
Nature potential



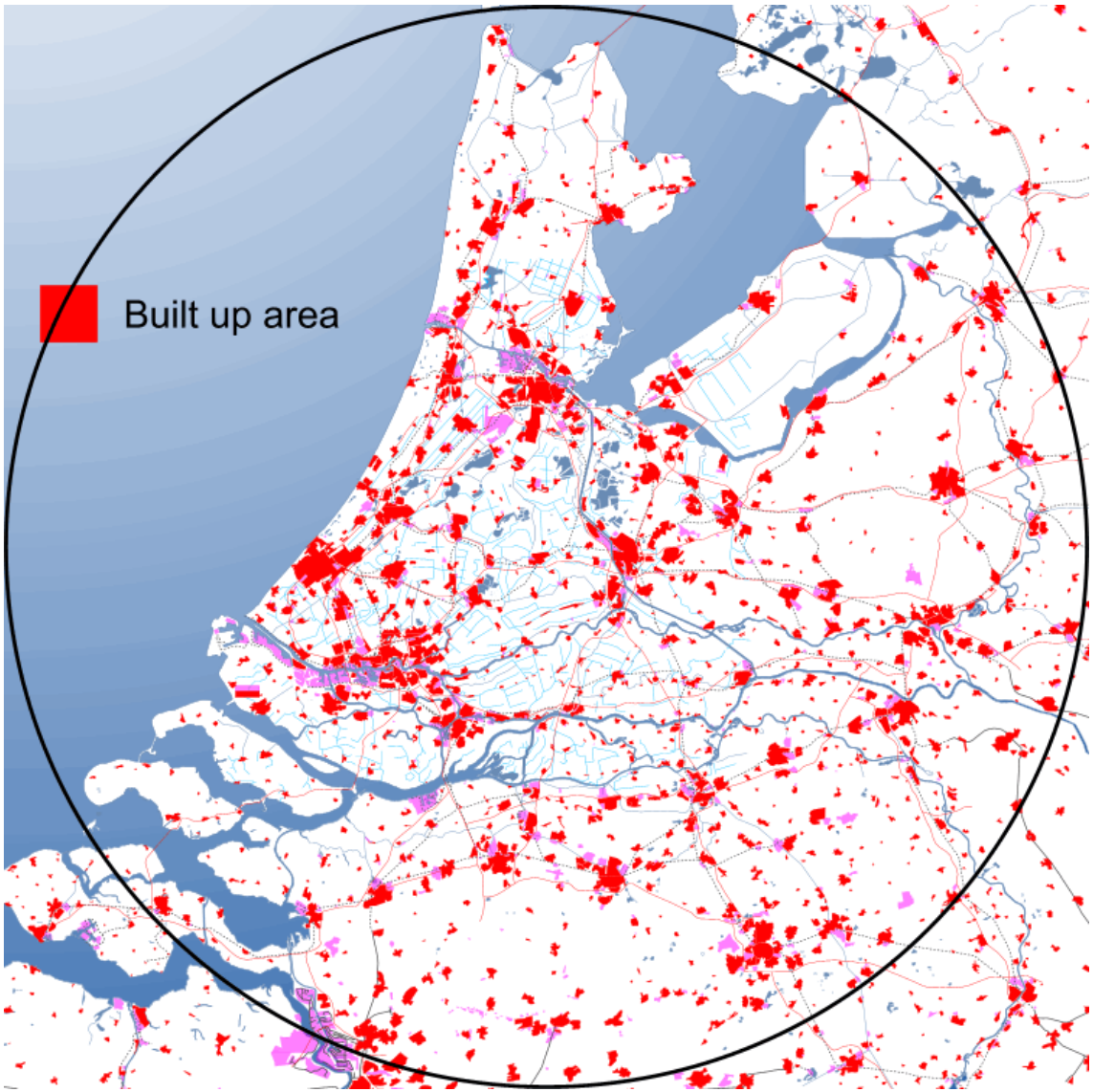
Built up and Nature



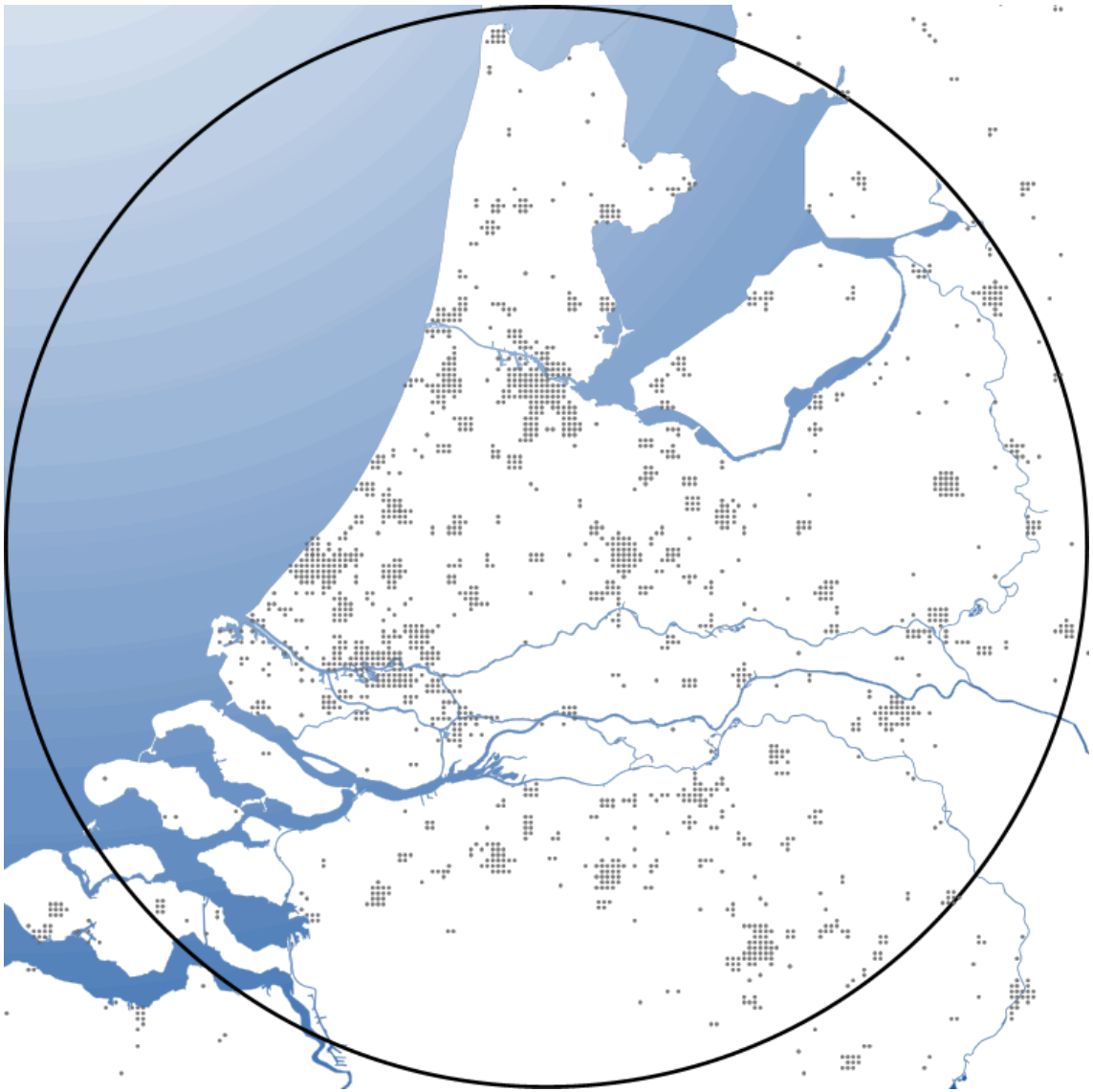
BuiltUp



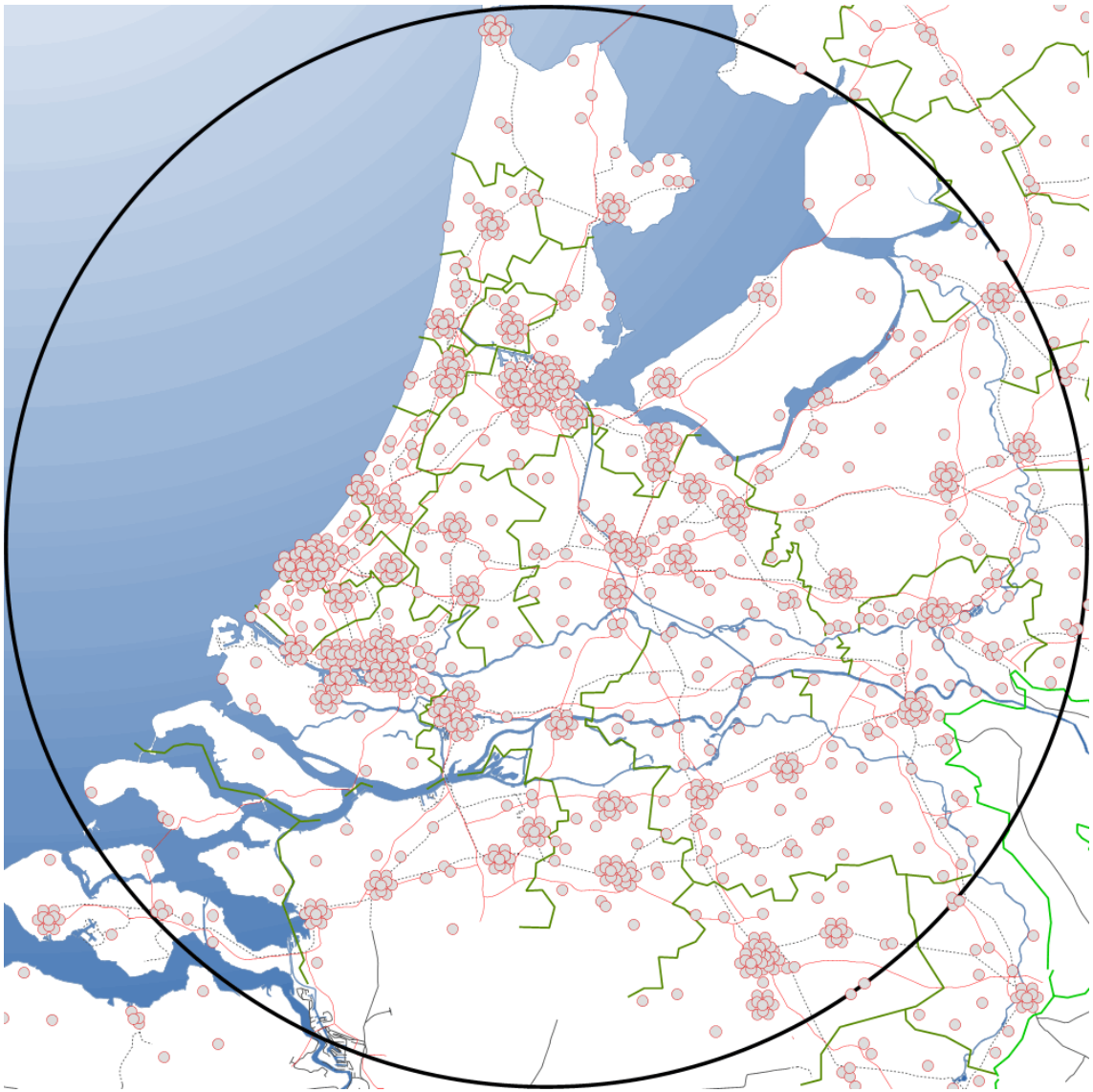
Networks



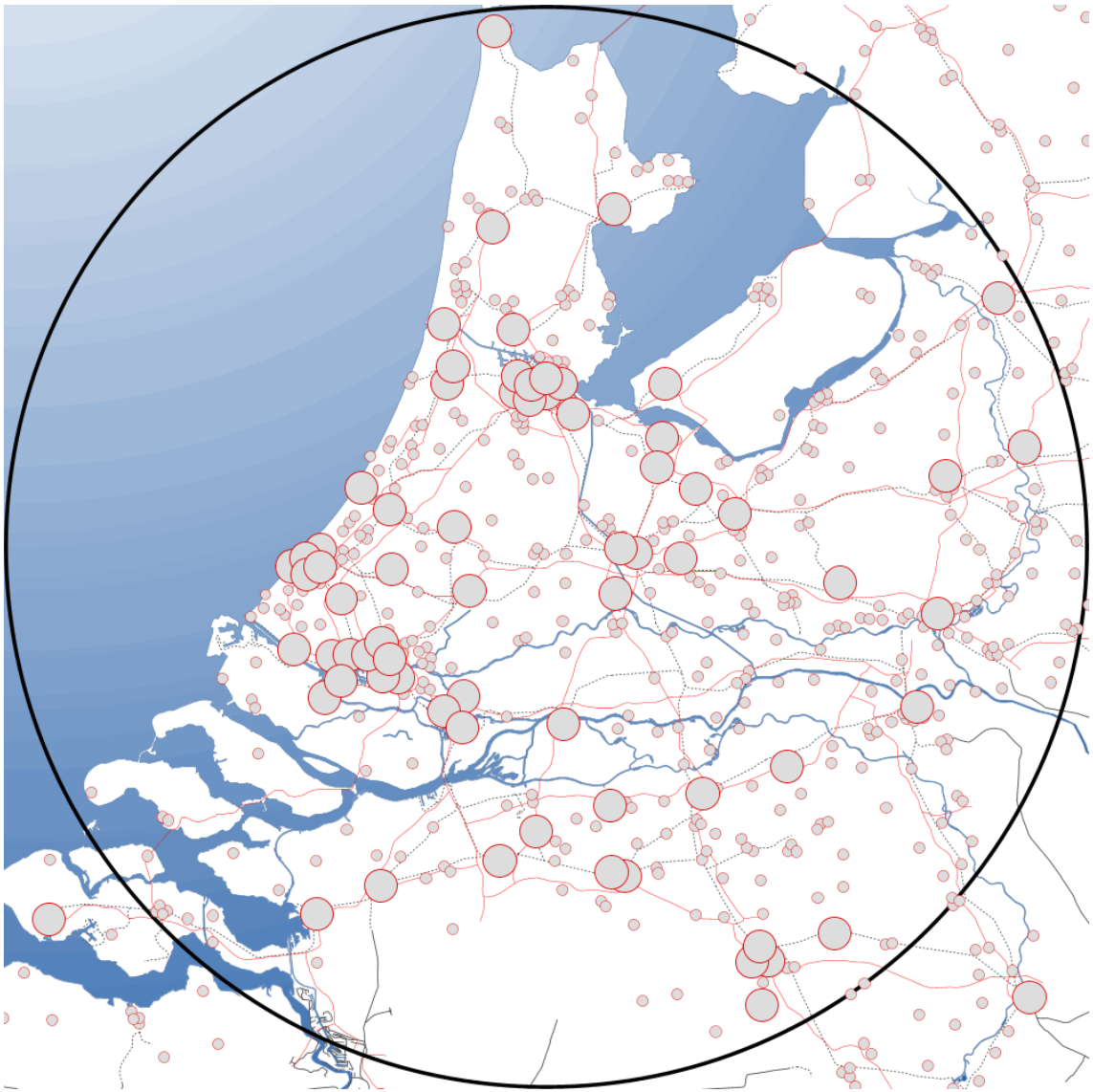
Investment



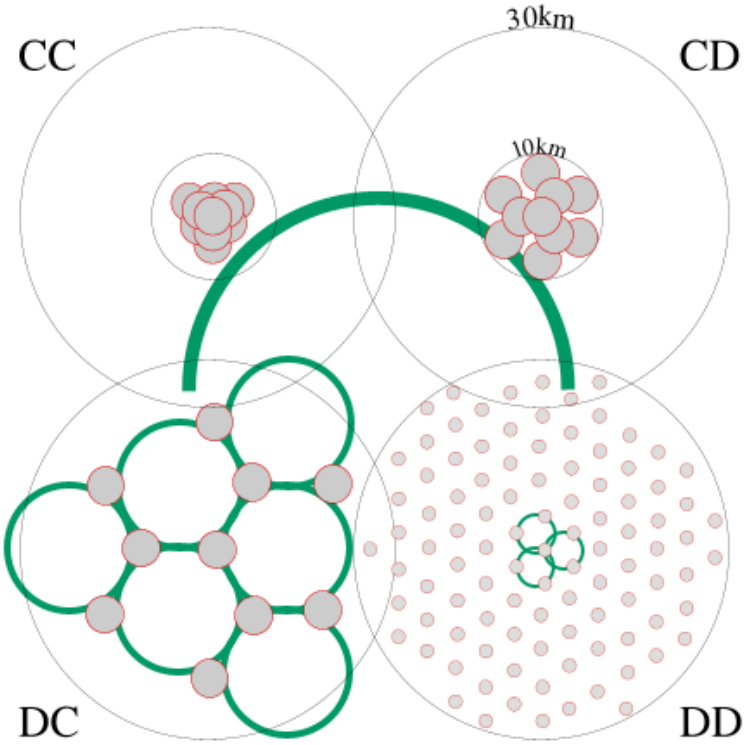
Population x 10 000



Population x 100 000



Different states of dispersion per level of scale



Legend

name	radius km	inh.
agglomeration	10	1mln
city	3	100 000
village/district	1	10 000
city-landscape	3	<10 00
landscape park	10	<100 000
landscape	30	<1mln

Inhabitants generating facilities

Inhabitants per facility

Intensity of use

	hr/resident*year	m^2/resident	hr/m^2*year
ACTIVITY			
Shopping	238	2	135
Government, etc.	61	1	102
Social/cultural	539	8	70
Learning away from home	374	6	62
In and around the house	6552	137	48
Transport & communication	33	2	22
Other services	77	4	19
Trade	51	3	17
Industry	185	30	6
Moving	387	91	4
Building firms	71	20	4
Recreation	162	47	3
Sport	36	17	2
Public utility companies	8	10	0.8
Exploitation of minerals	1	5	0.3
Agriculture	11	1667	0.01

Life style

daily	Am I going home early or late today?	Do I give priority to (a) the family or (b) to work?
weekly	This weekend:	will I be (a) at home or (b) am I going out?
yearly	This year:	will I be (living and enjoying recreation) (a) with someone else or (b) alone?

	<tradition-directed						opportunity-directed>	
	A		S1				S2	B
daily rhythm	a	a	a	a	b	b	b	b
weekly rhythm	a	a	b	b	a	a	b	b
yearly rhythm	a	b	a	b	a	b	a	b

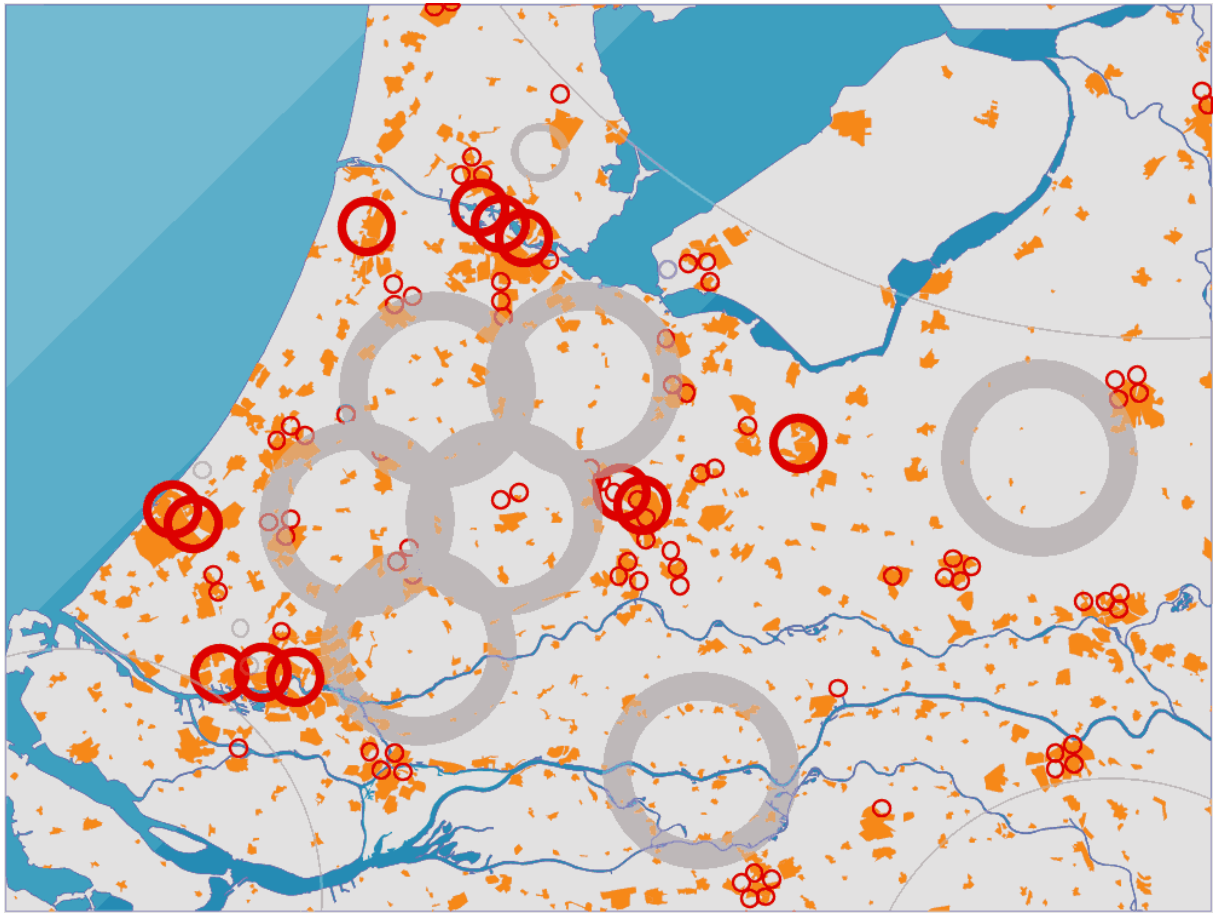
Political programmes

In a radius of	100km	30km	10km
	subnational	regional	subregional
Liberal	C	D	D
Socialistic	D	C	C
Christian-democratic	D	C	D
‘Purple’	C	D	C

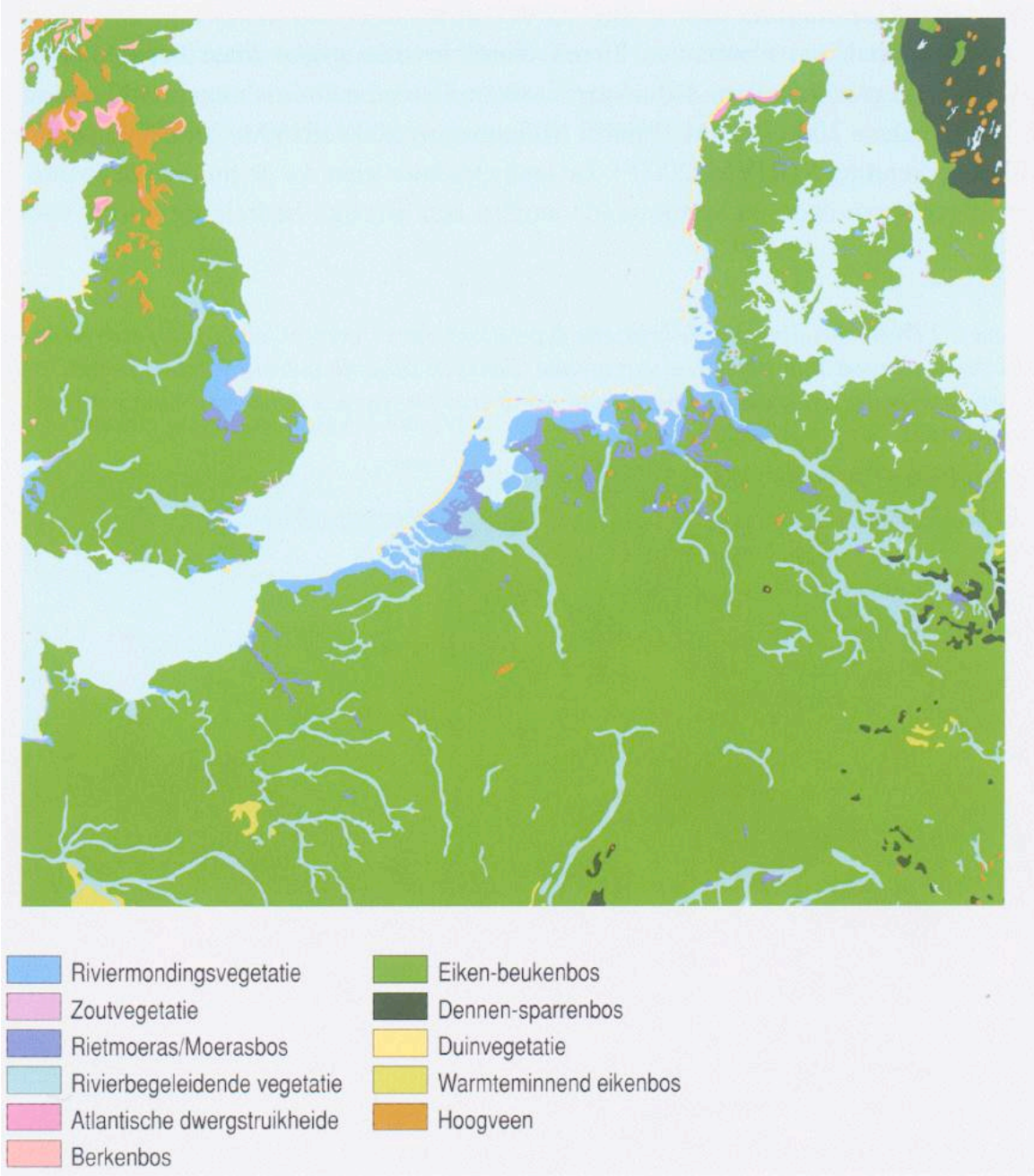
National spatial planning

In a radius of	300km	100km	30km	10km	3km
2nd National plan	Bundled Deconcentration				
	theory		C	D	C
	practice		D	C	D
3rd National plan	Structuurschets Verstedelijking 1978:				
Socialist period		D	C		
	Structuurschets Stedelijke Gebieden 1983:				
Liberal period		C	D	C	
4th National plan	Compact city: nodal points				
	C	C	D	C	

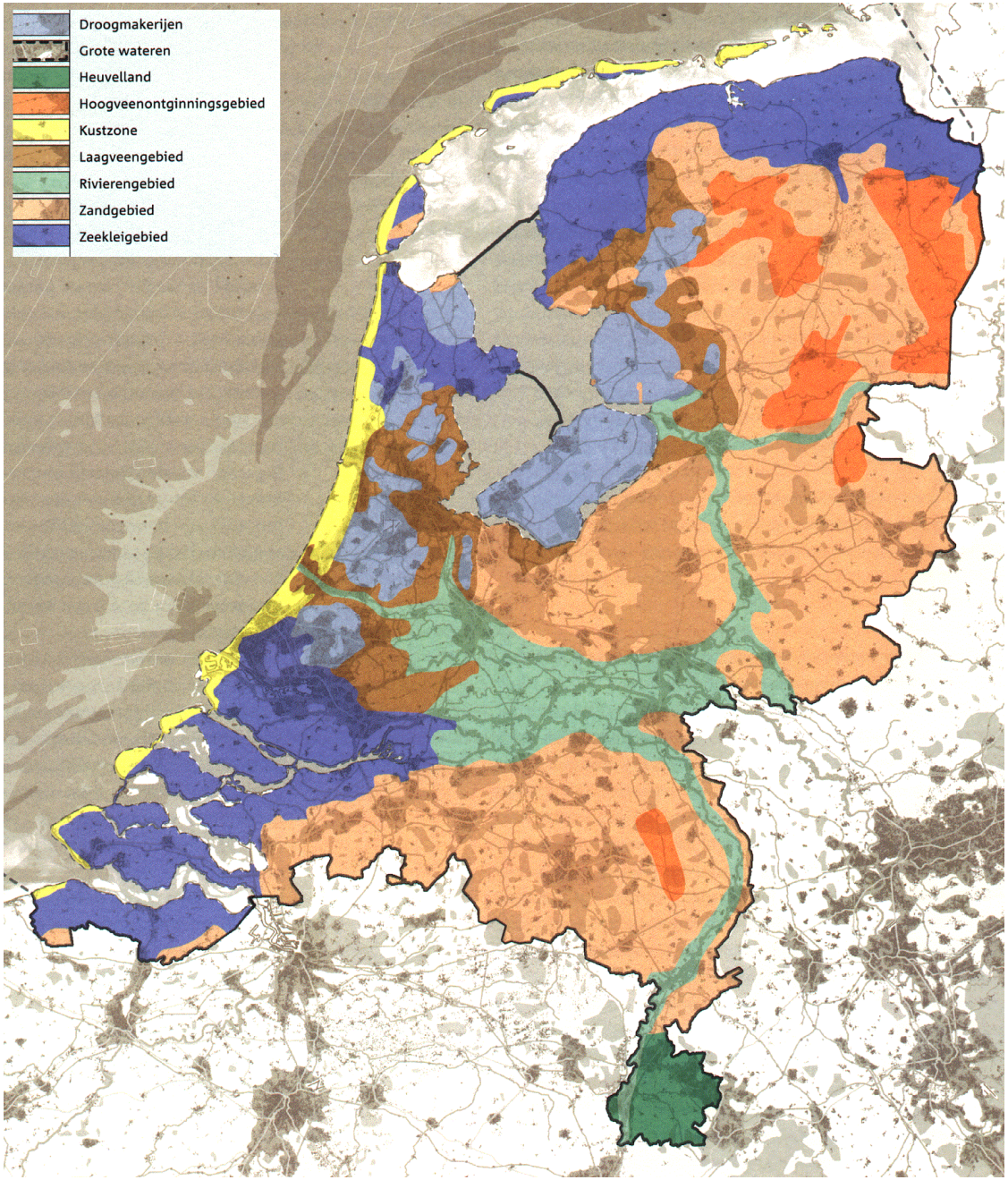
5th National Plan



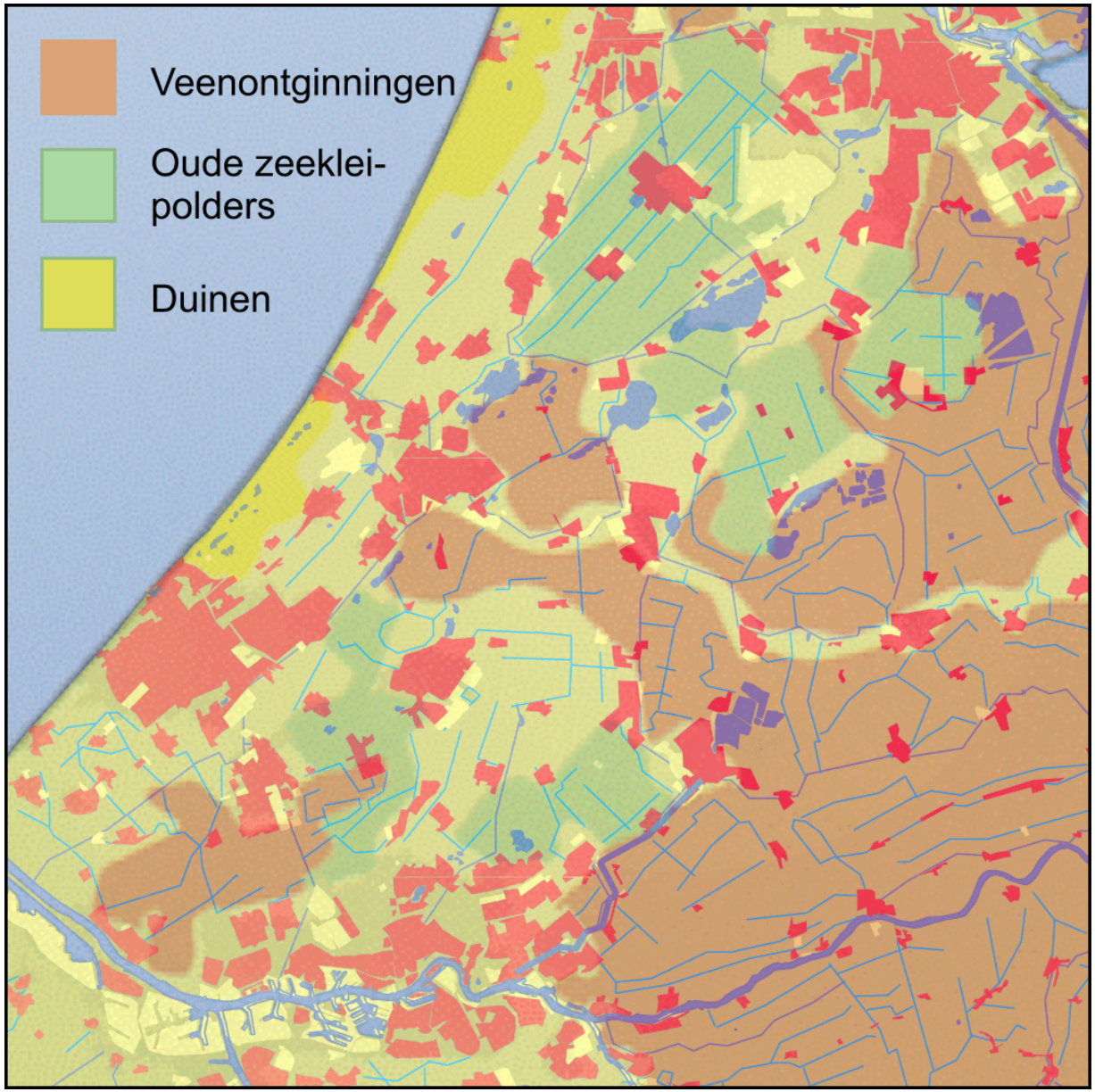
Dutch heritage



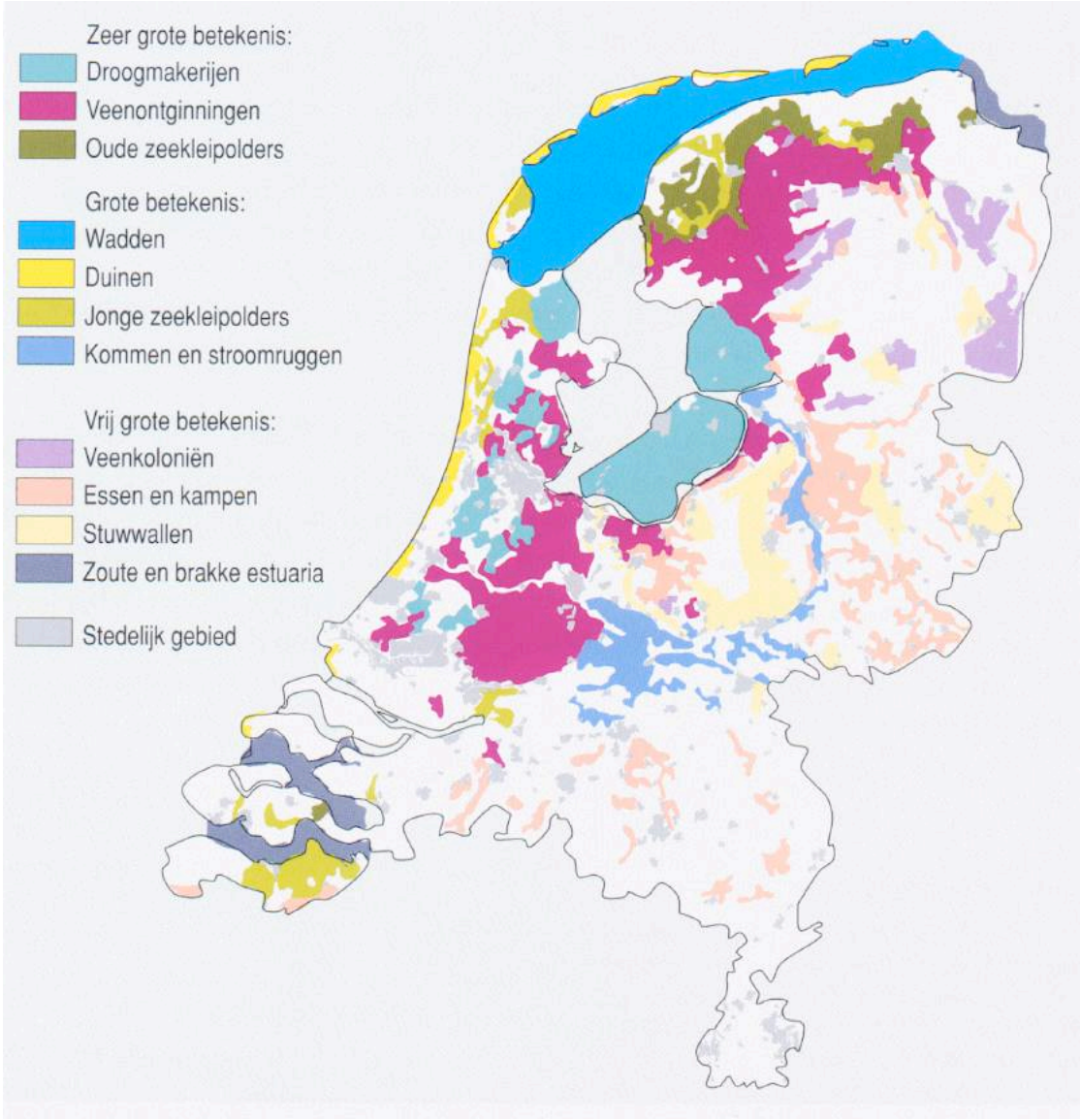
Land-scapes


Droogmakerijen
Grote wateren
Heuvelland
Hoogveenontginningsgebied
Kustzone
Laagveengebied
Rivierengebied
Zandgebied
Zeekleigebied

Delta-metro-pole symme-try

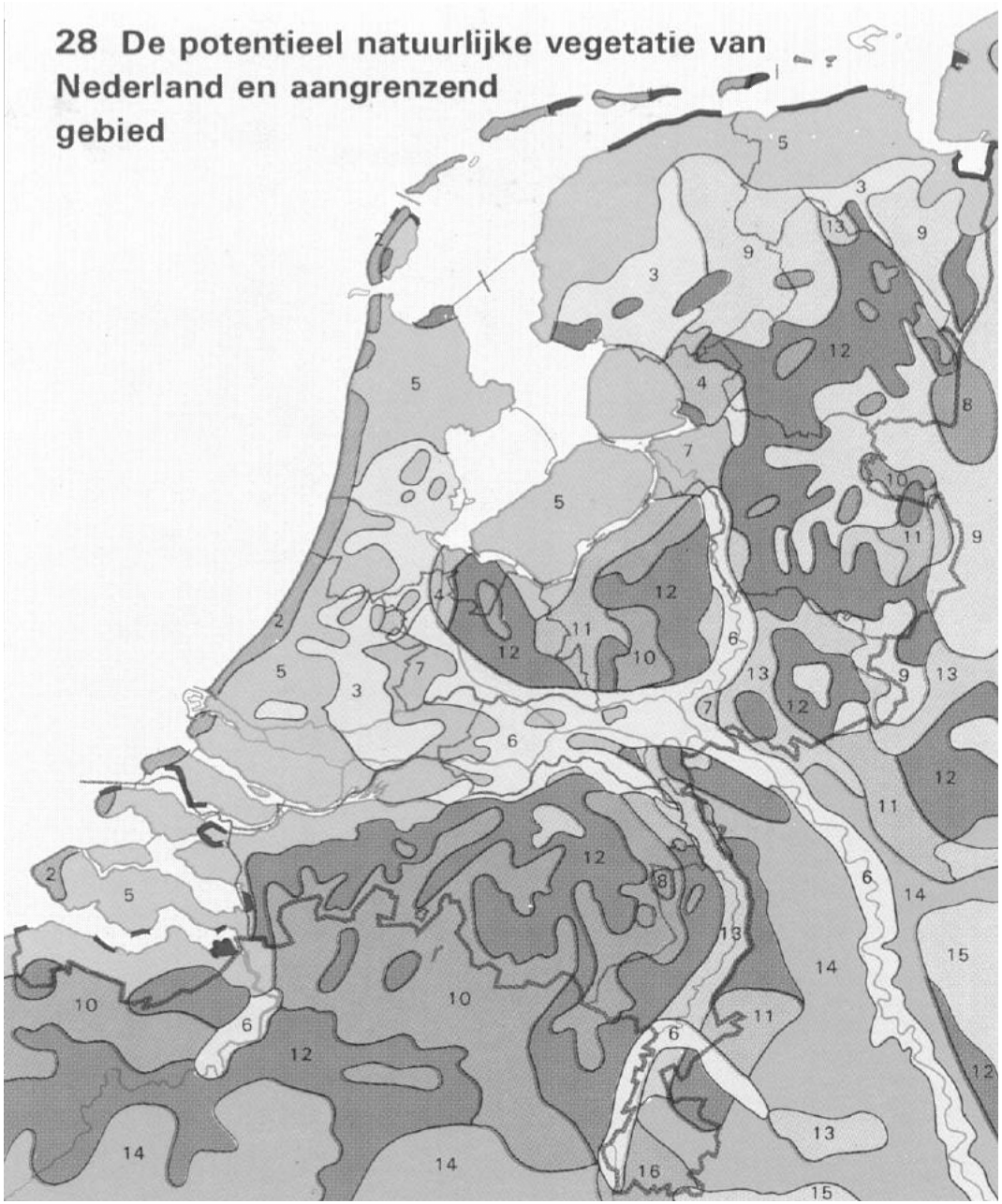


Rareness

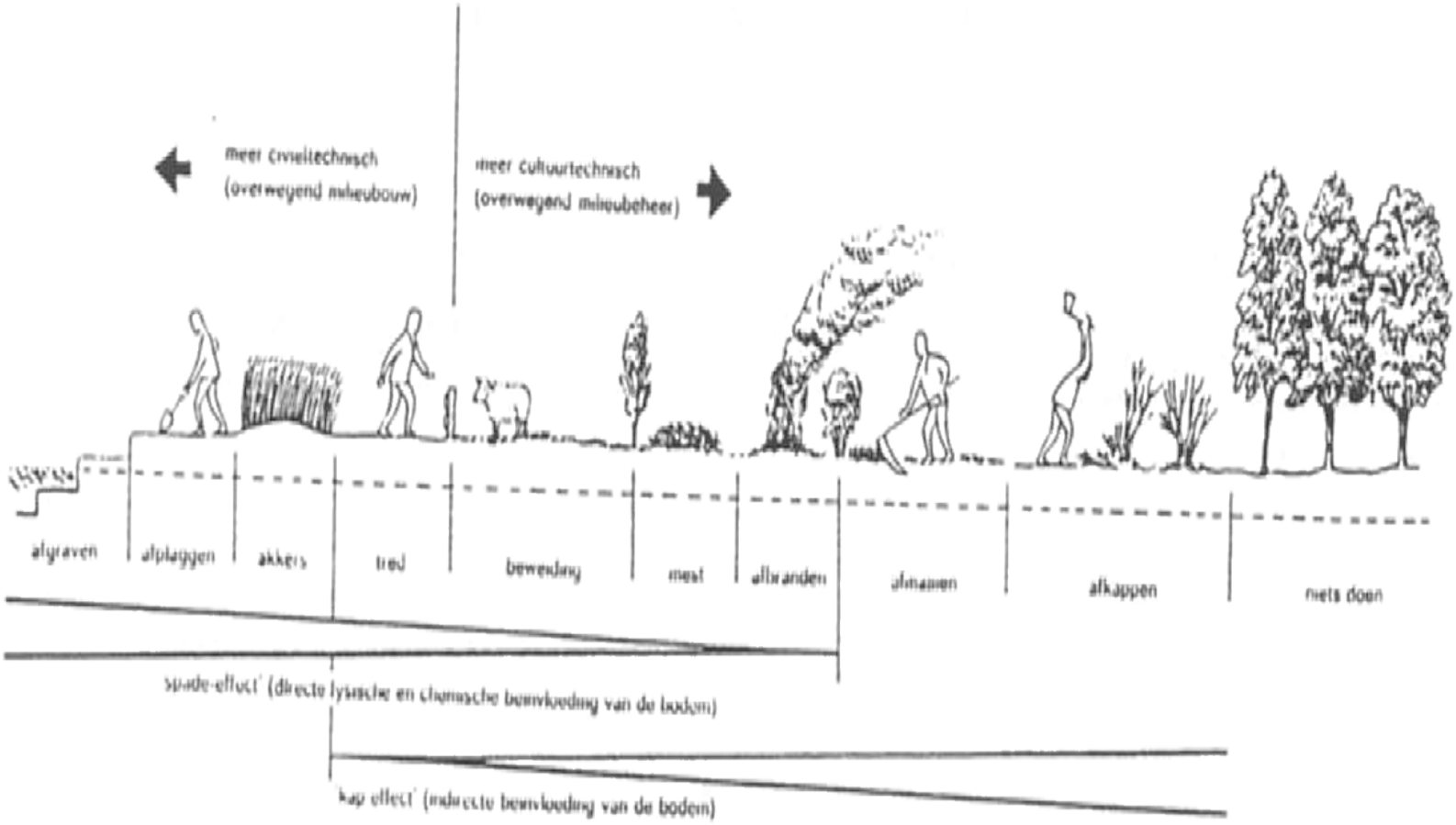

Zeer grote betekenis:
Droogmakerijen
Veenontginningen
Oude zeekleipolders
Grote betekenis:
Wadden
Duinen
Jonge zeekleipolders
Kommen en stroomruggen
Vrij grote betekenis:
Veenkoloniën
Essen en kampen
Stuwwallen
Zoute en brakke estuaria
Stedelijk gebied

Potential vegetation

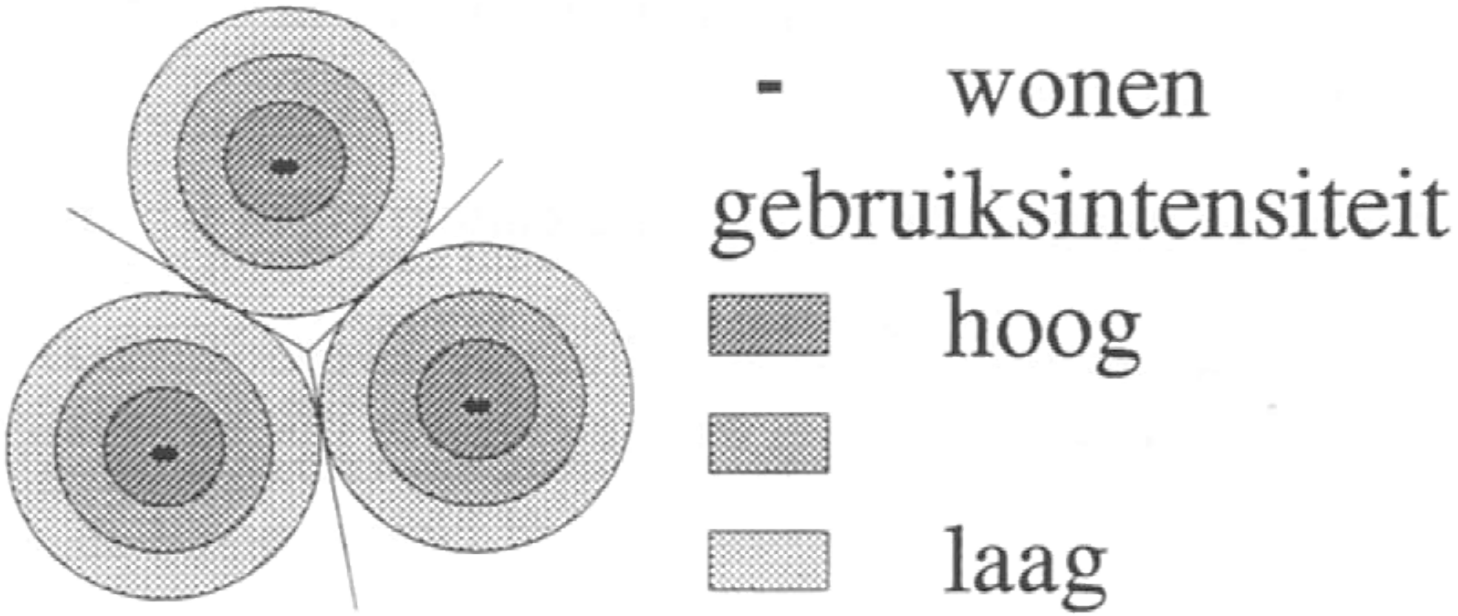
LEGENDA
1 Kweldervegetatie met o.a. lamsoor en kweldergras: overgangen van zout naar zoet milieu
2 Duinheide, -grasland en -struweel, duin-berkenbos en -eikenbos, berken-zomereikenbos
3, 4 Moerasvaren-elzenbroek e.d.
5, 6, 7 Essen-iepenbos e.d.
8 hoogveen e.d.
9 vochtig elzen, berken, zomereikenbos
10 droog berken-zomereikenbos
11 vochtig wintereikenbos e.d.
12 droog wintereiken e.d
13 eiken-haagbeuken e.d.
14 gierstgras-beuken e.d.
15 veldbies-beukenbos met eik
16 beukenbos, elzen- en essenbronbos e.d.



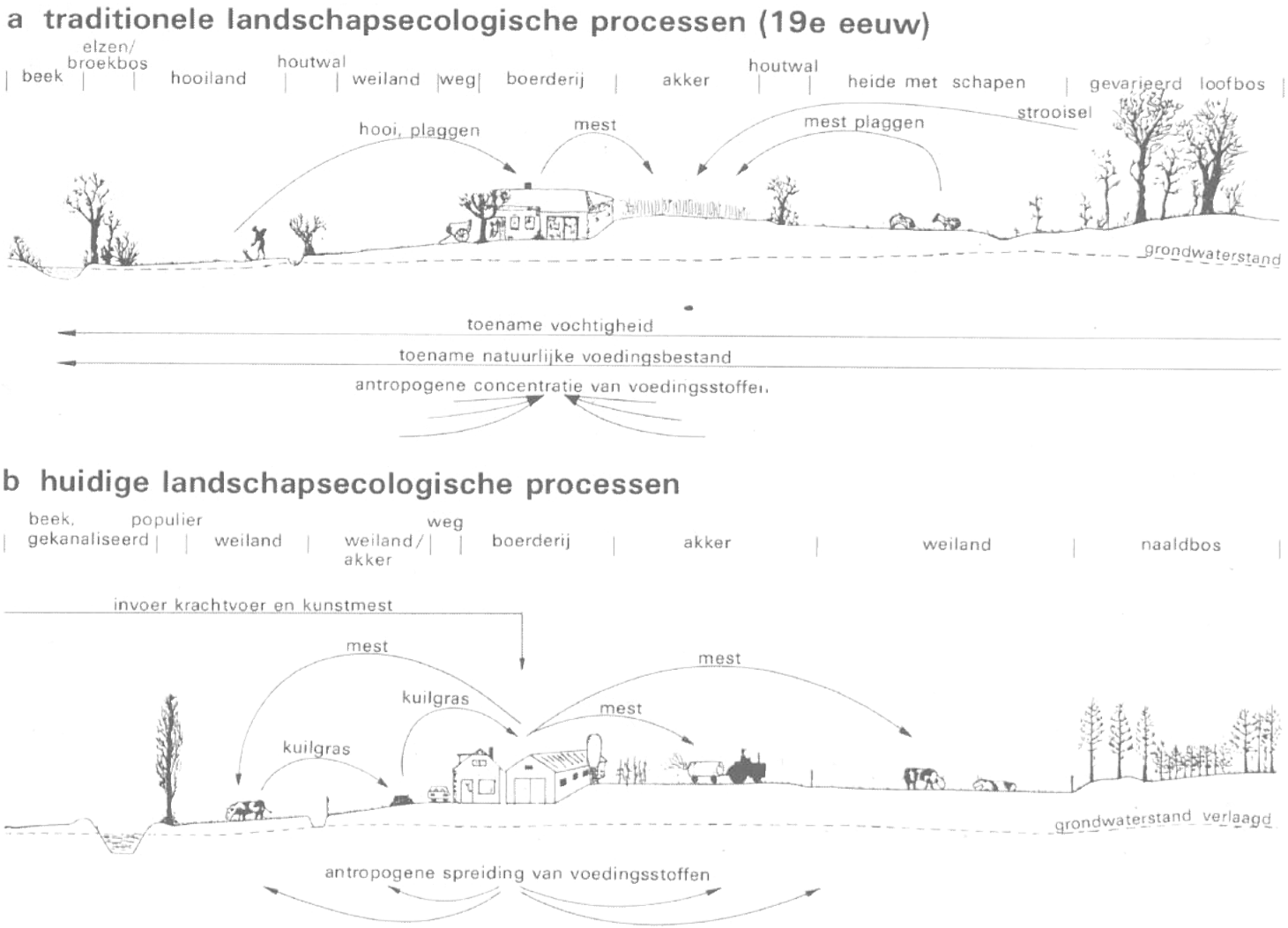
Human impact



Intensity of use

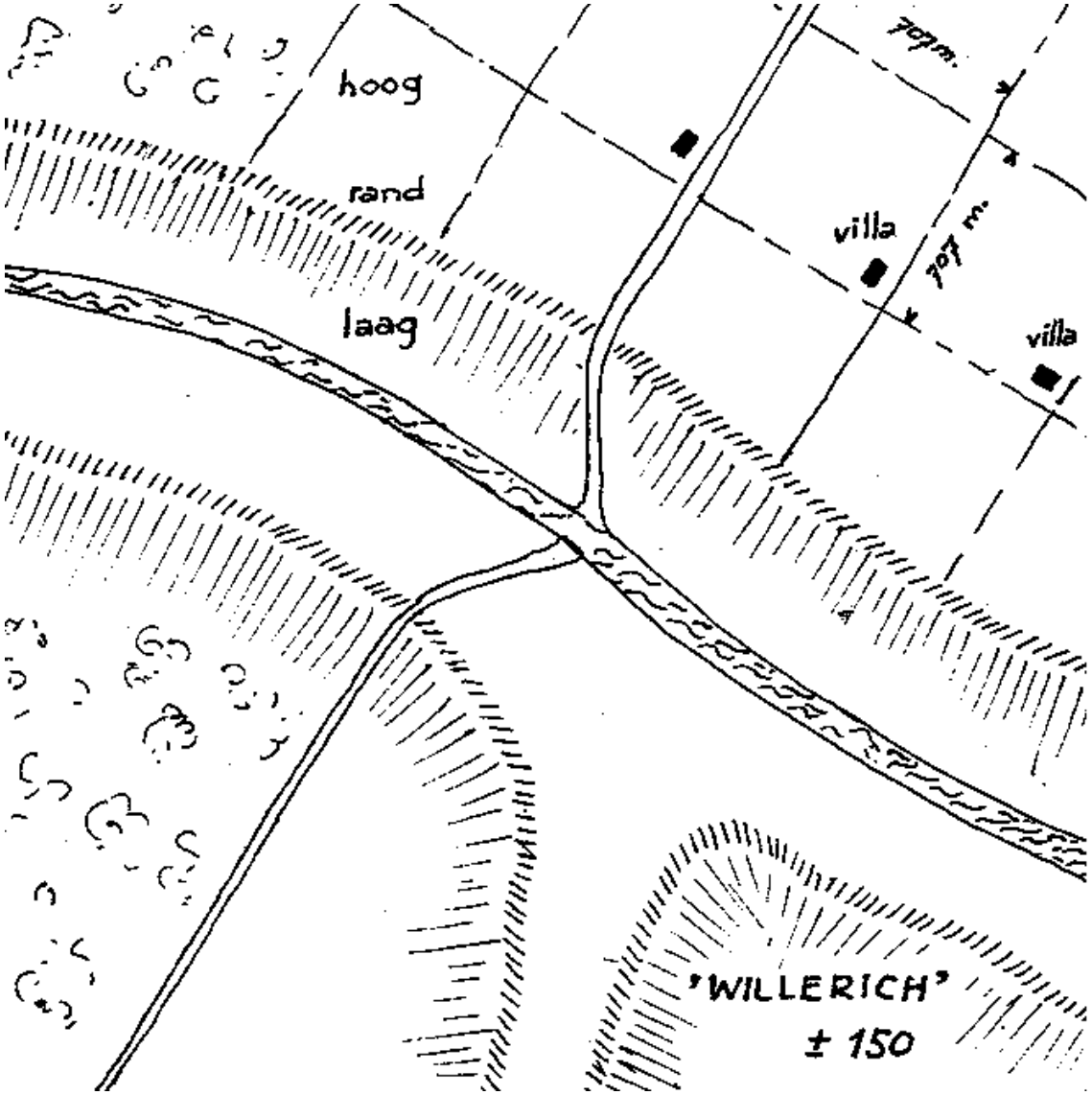


Traditional and current processes

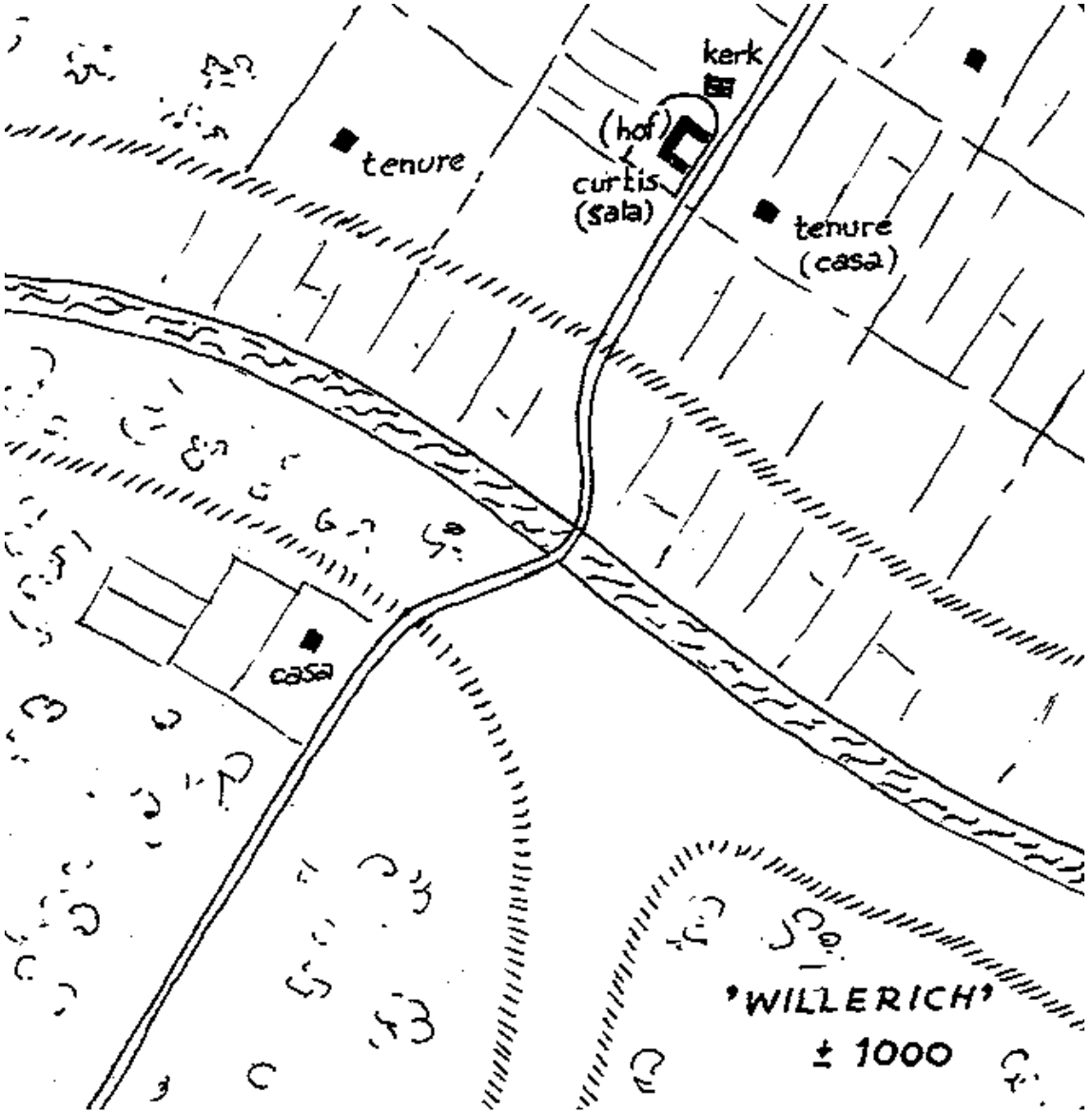


Residential development according to Steegh and Visscher (1972)

On löss

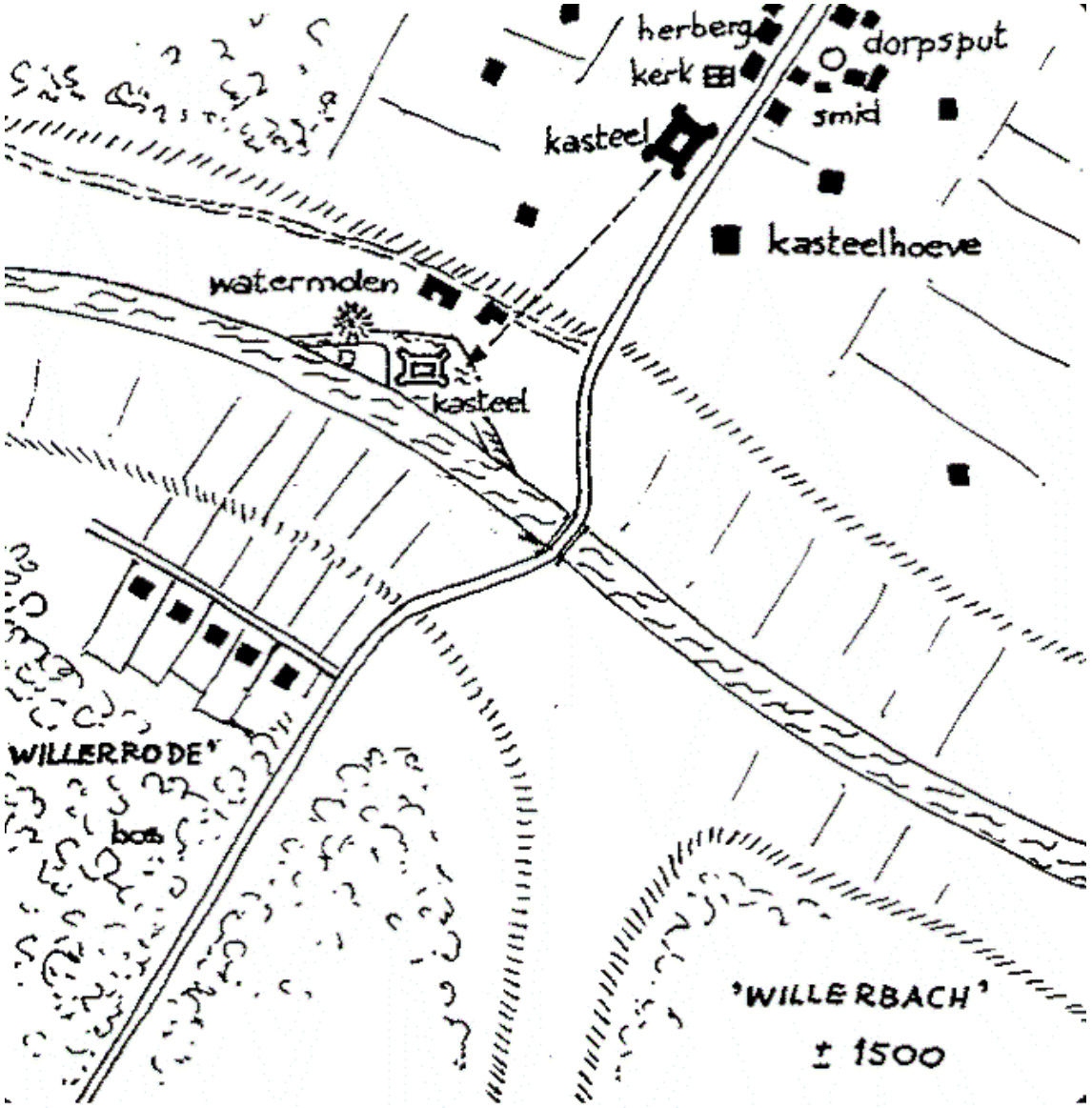


On löss


kerk
(hof)
curtis
(sala)
tenure
tenure
(casa)
casa
'WILLERICH'
± 1000

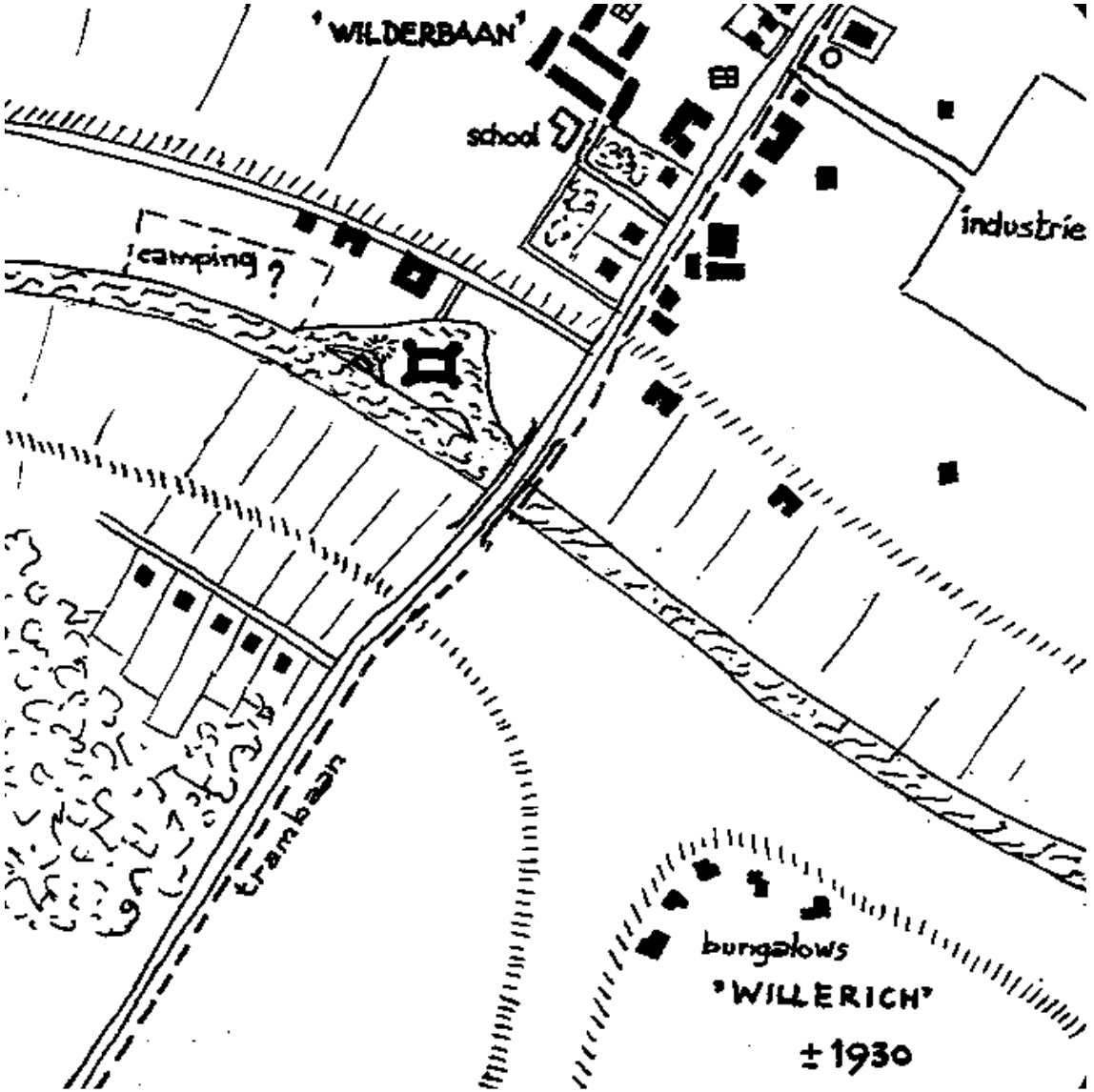
1000

On löss


herberg
kerk
dorpsput
smid
kasteel
kasteelhoeve
watermolen
kasteel
WILLERRODE'
bos
'WILLERBACH'
± 1500

1500

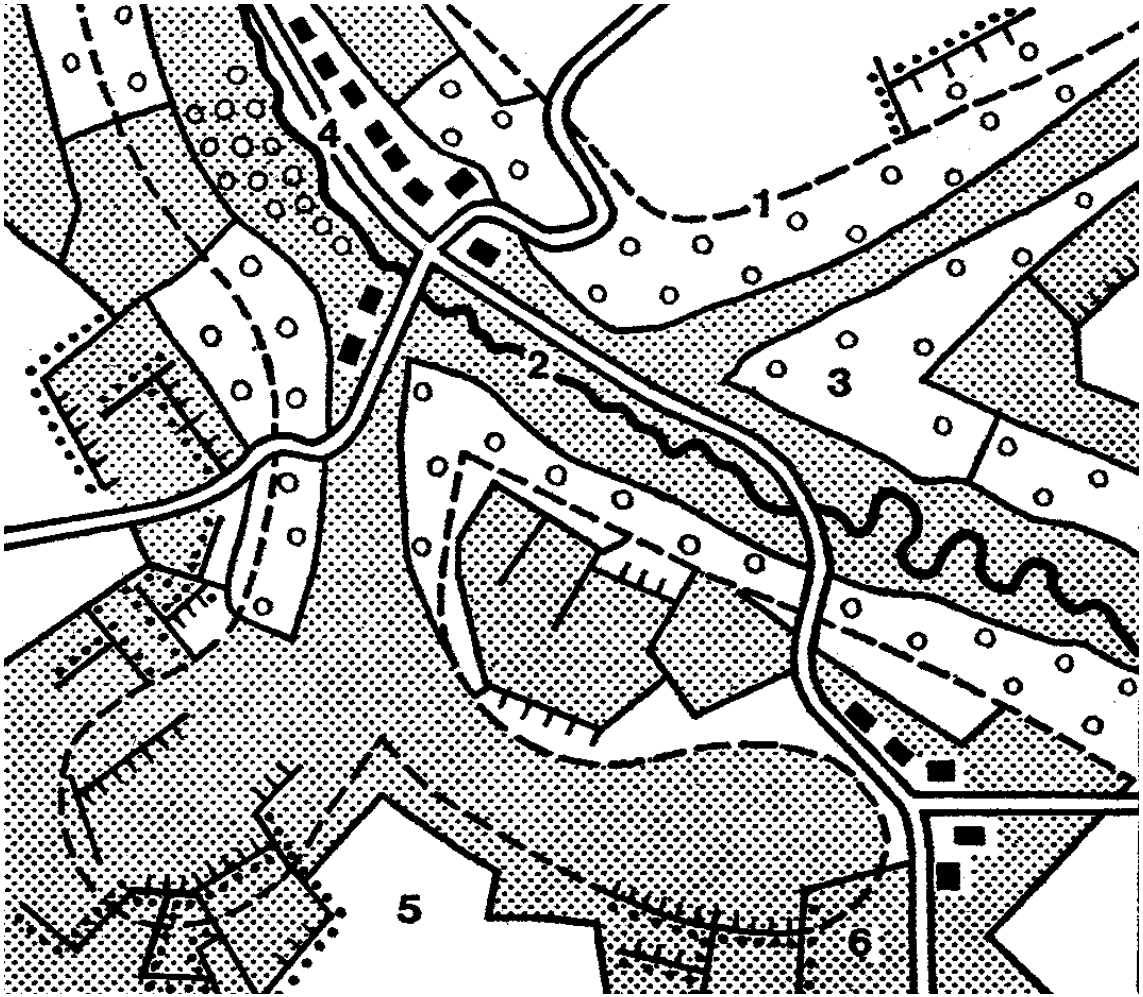
On löss


'WILDERBAAN'
school
industrie
camping ?
tramlijn
bungalows
'WILLERICH'
± 1930

1900

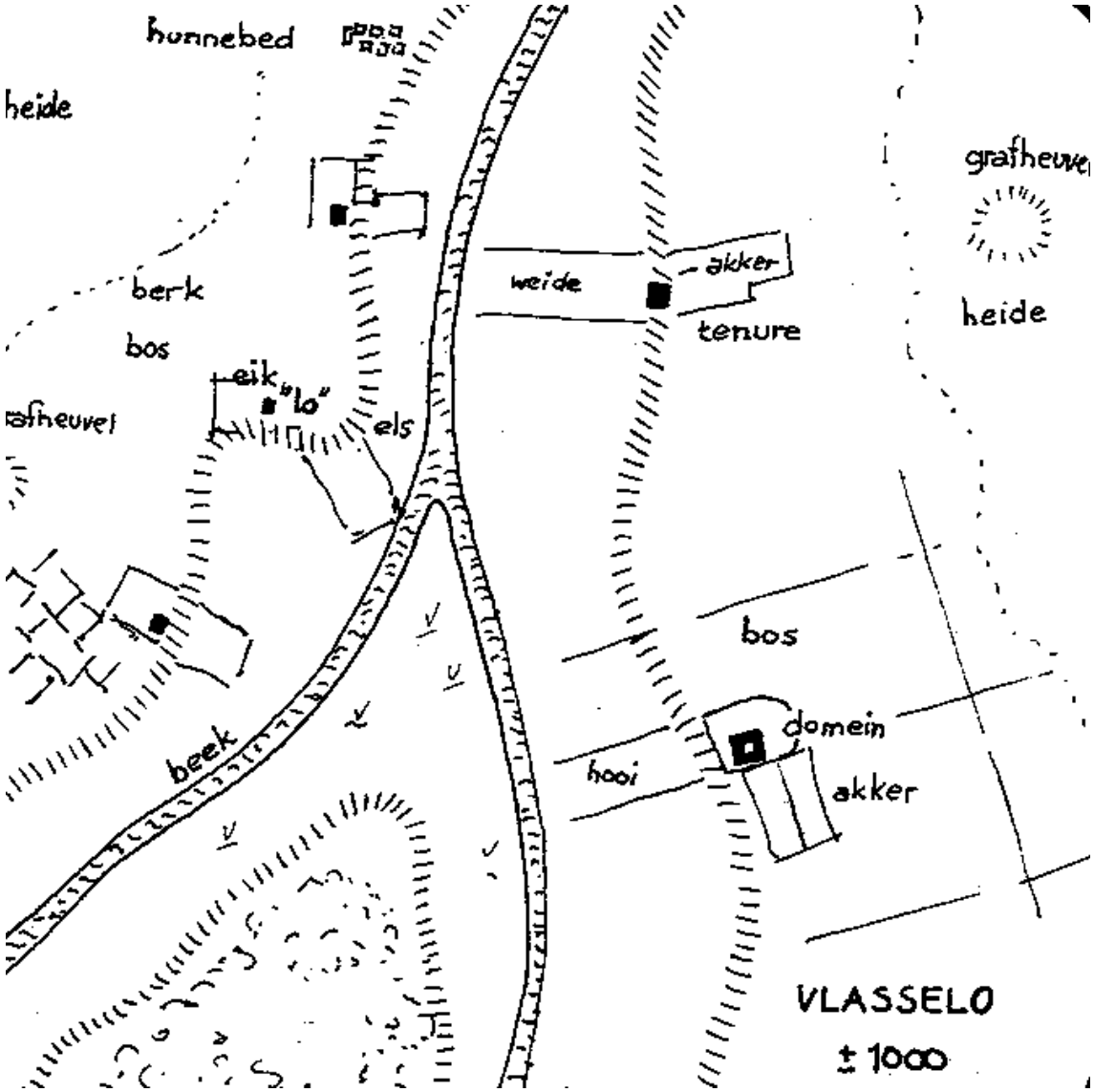
Zuid-Limburg

1. dalrand
2. beek
3. beboste dalflank
4. nederzetting
5. bouwland
6. grasland met houtwallen



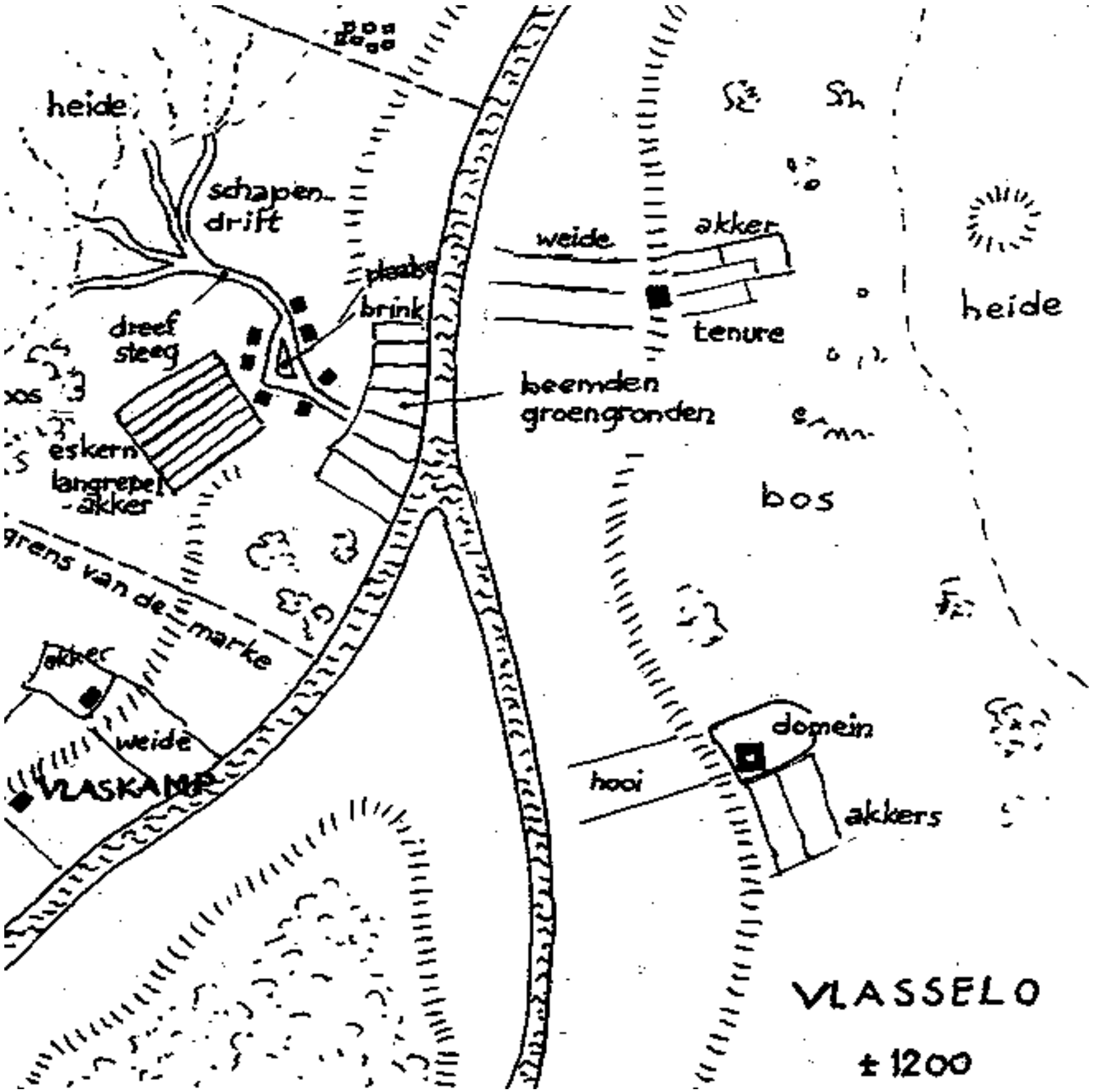
Residential developent on Sand

On sand



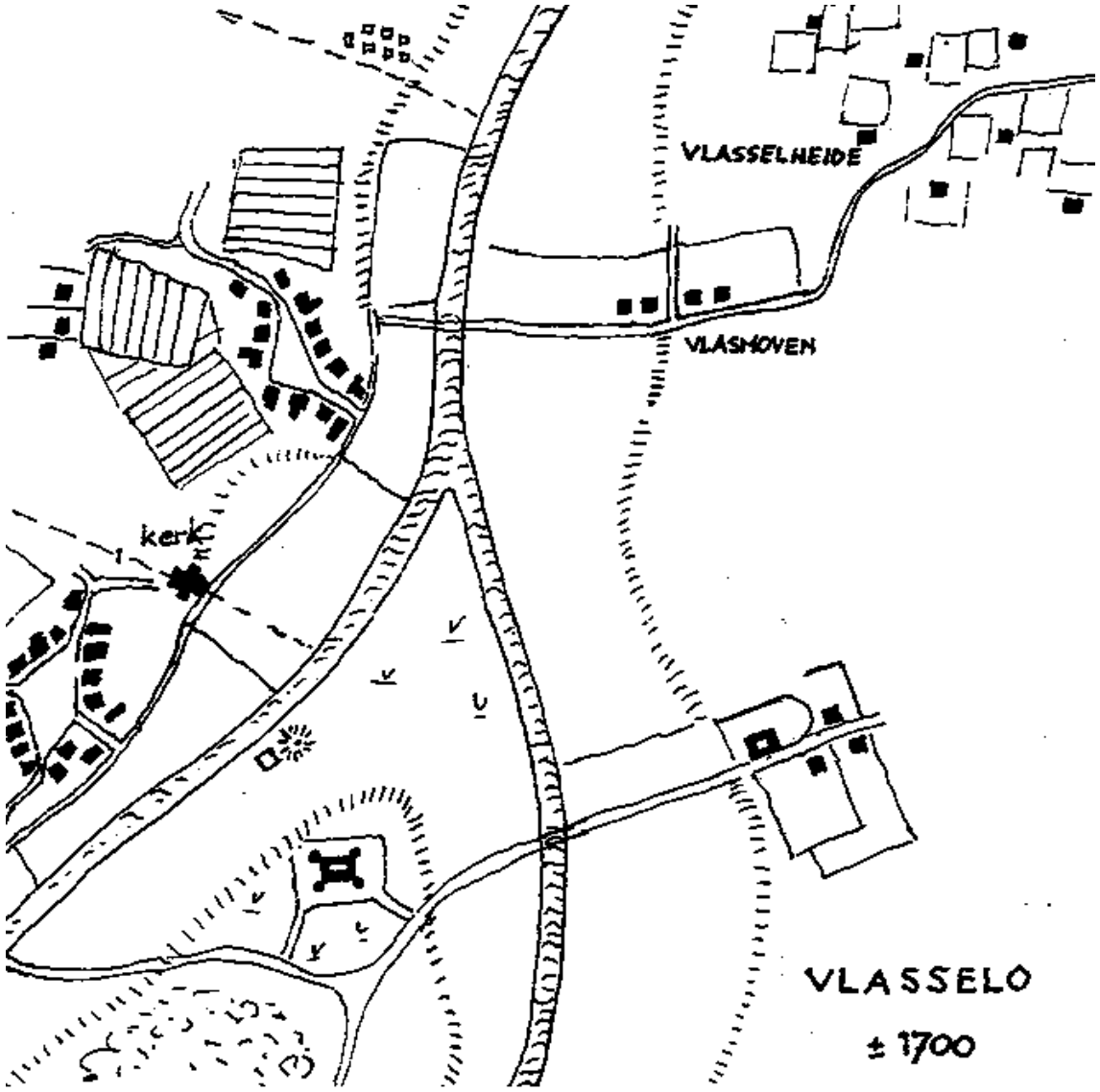
1000 na Chr.

On sand


heide
schapen-
drift
plaatse
brink
dreef
steeg
bos
eskern
langrepel
akker
weide
akker
tenure
heide
beemden
groengronden
bos
grens van de
marke
akker
weide
VLASKAMP
domein
hooi
akkers
VLASSELO
± 1200

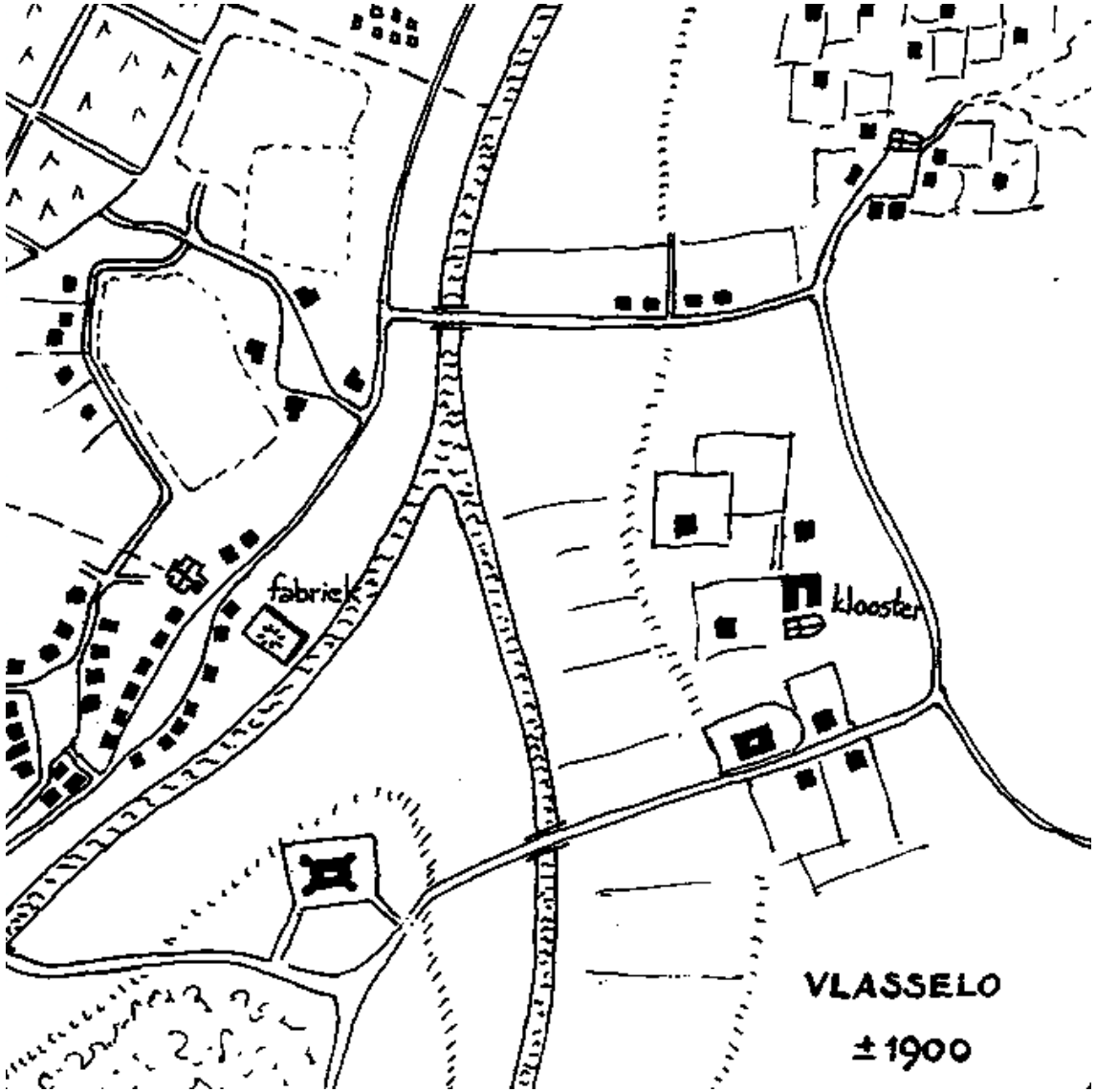
1200

On sand



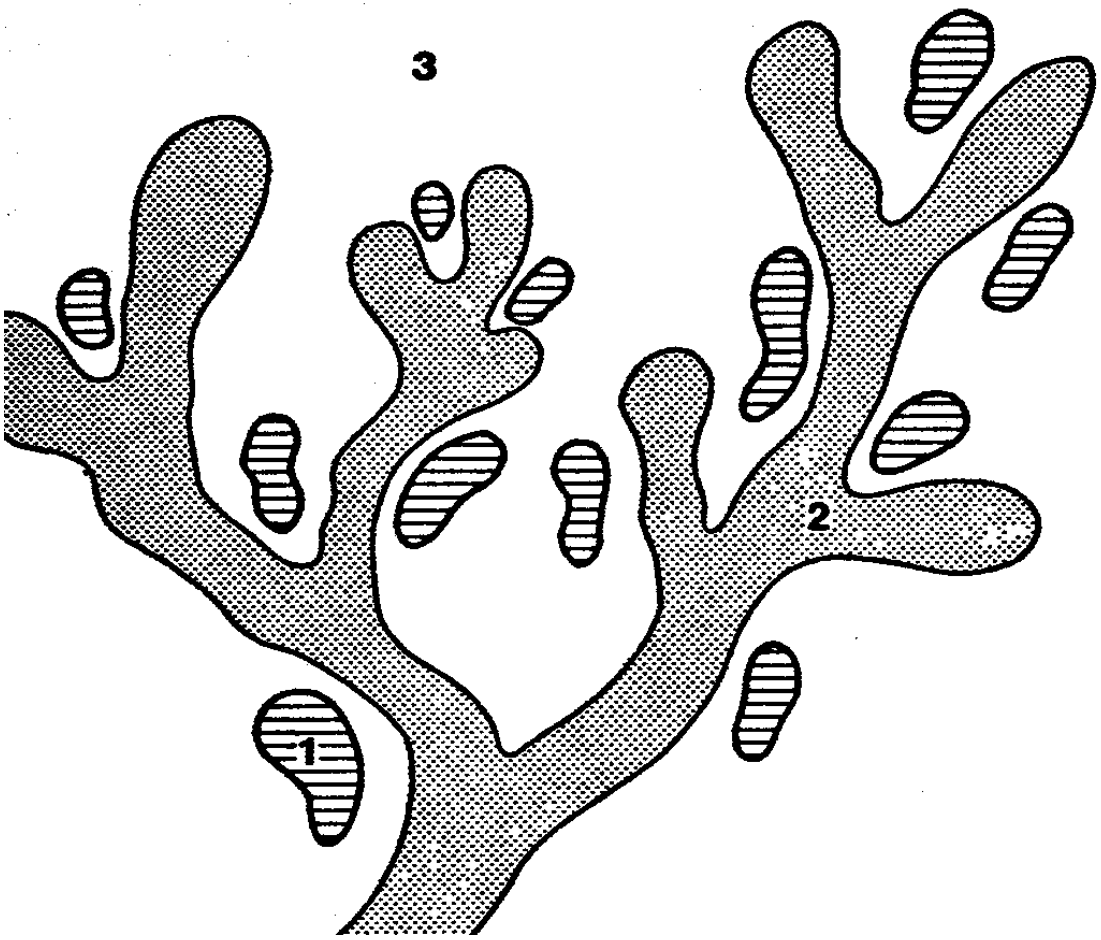
1700

On sand



1900

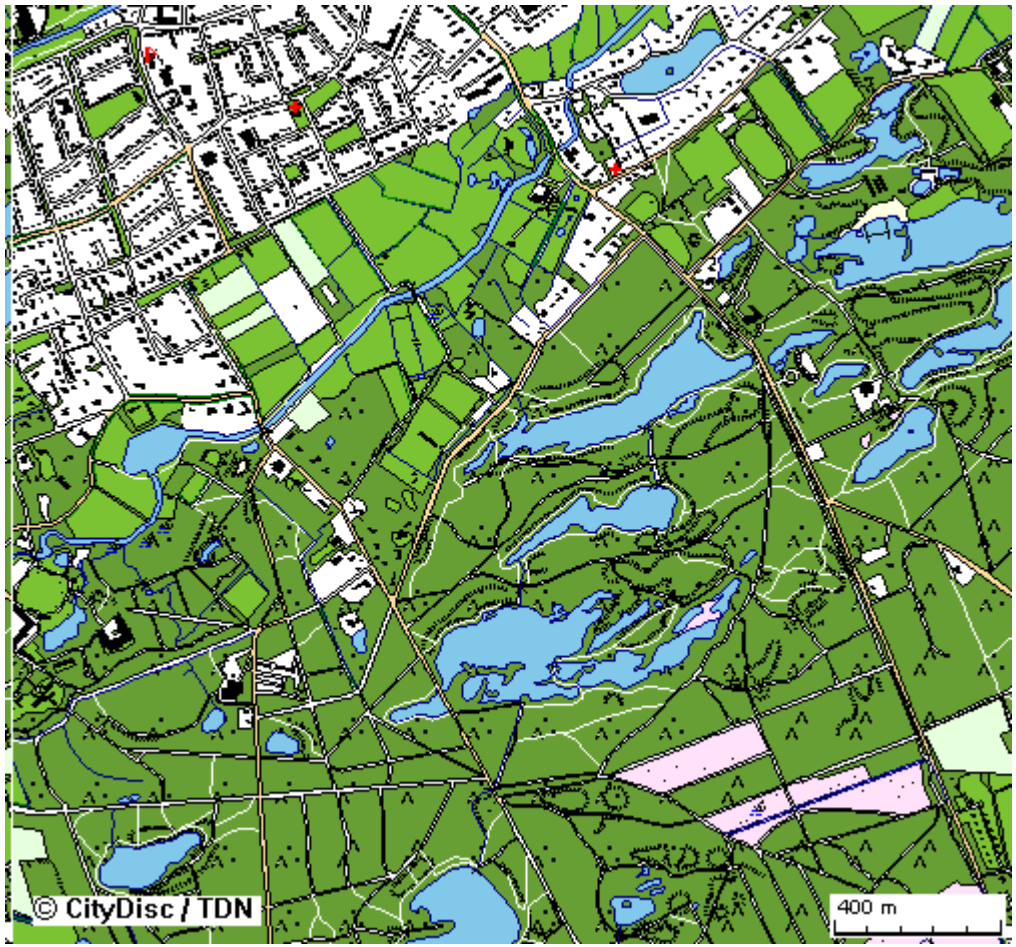
Essen langs beekdalen



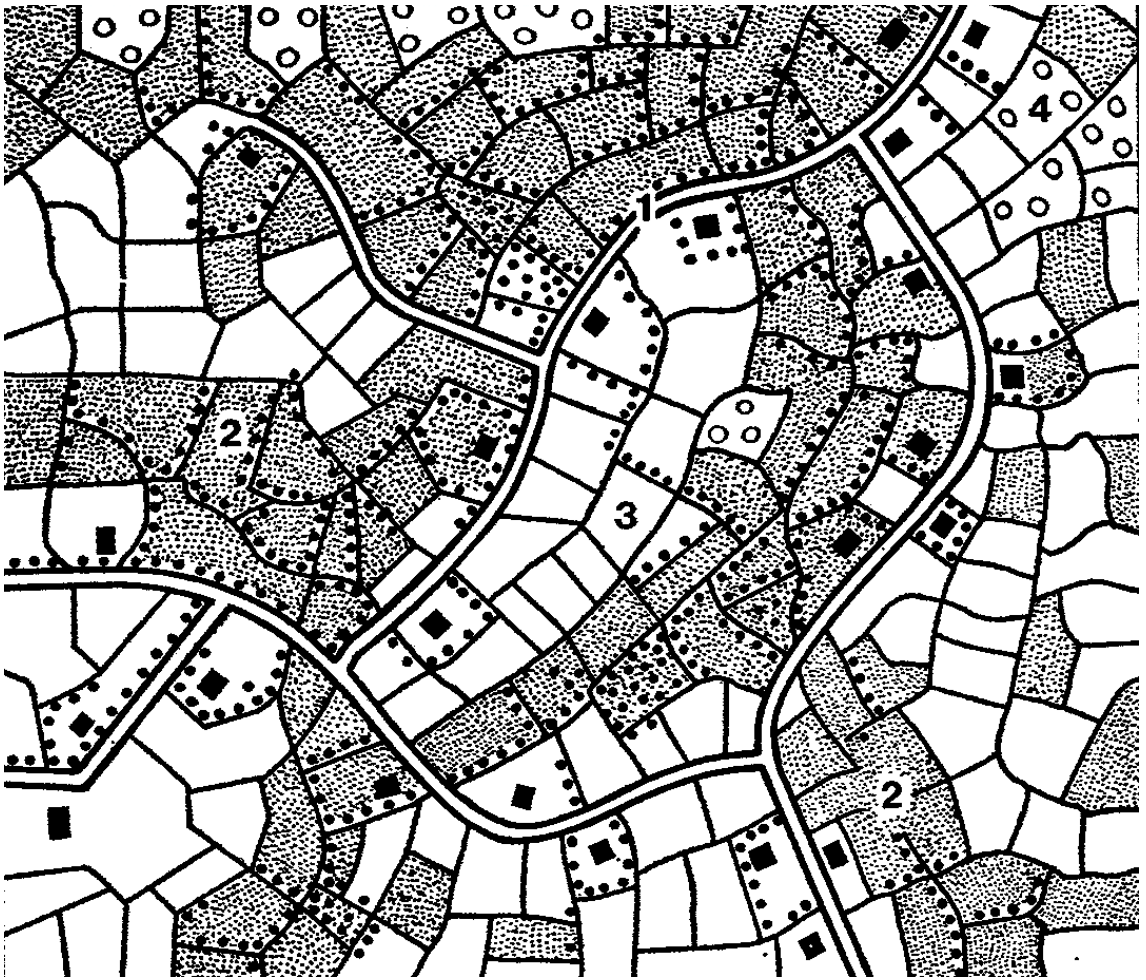
Noord-Brabant

1. duinrug
2. ven
3. beek
4. broekbos
5. nederzetting bij oud bouwland
6. grasland op beekvlakte
7. cultuurland buiten beekdal
8. aangeplant bos

Noord-Brabant

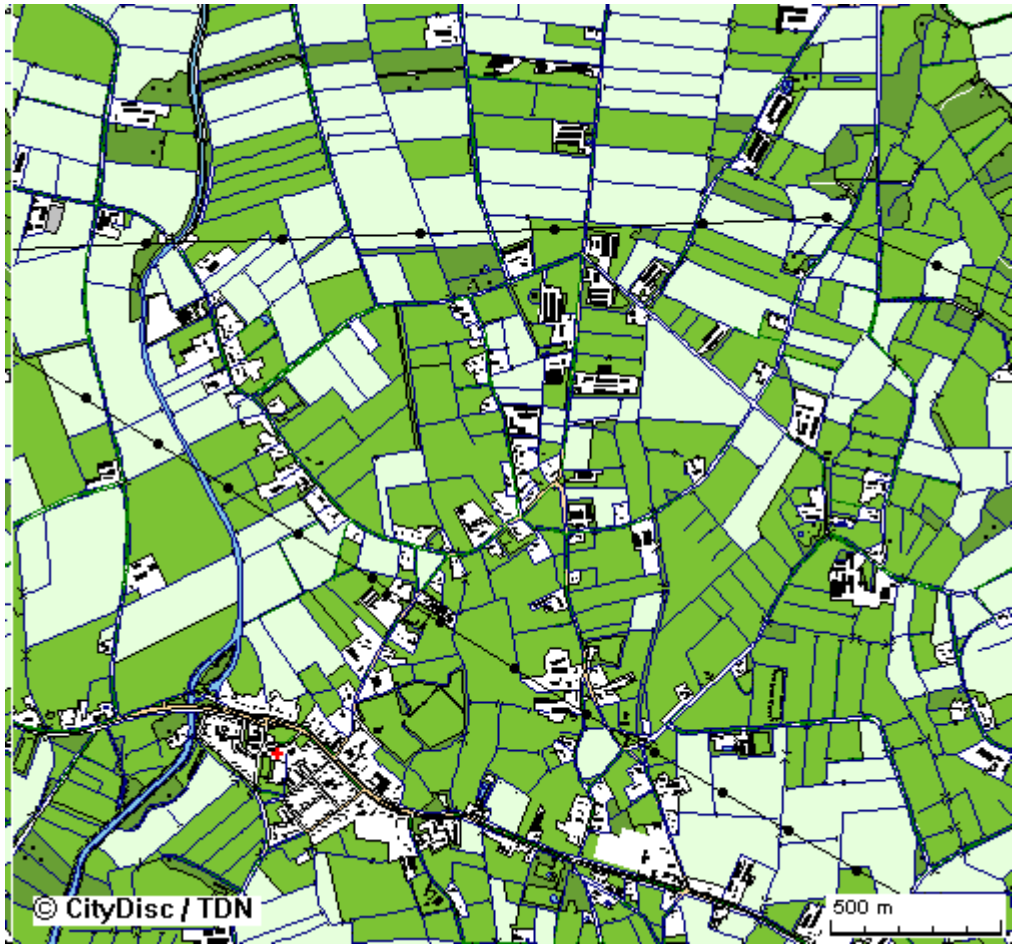


Centrale Slenk

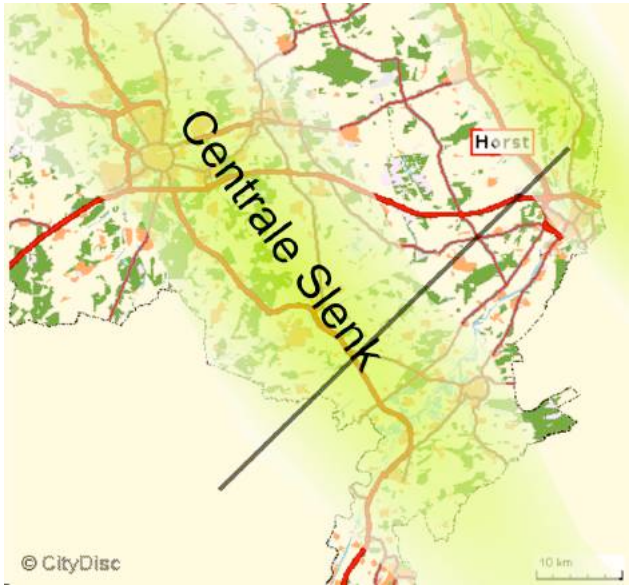


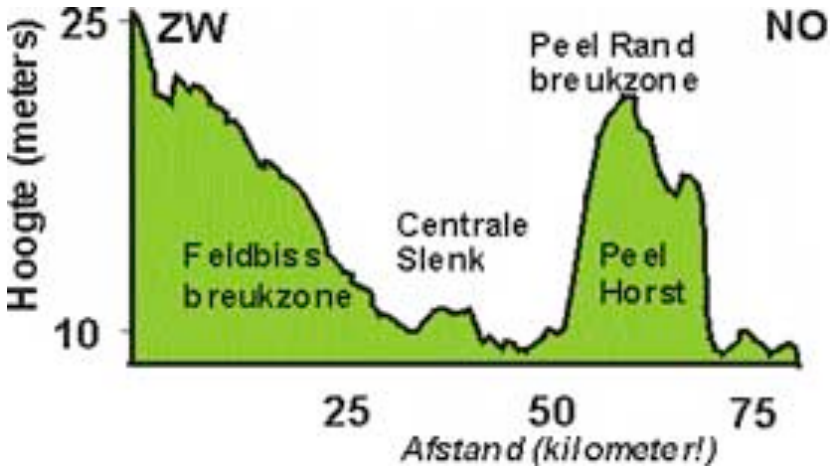
1. weg
2. grasland
3. akker
4. bosrelict

Centrale Slenk



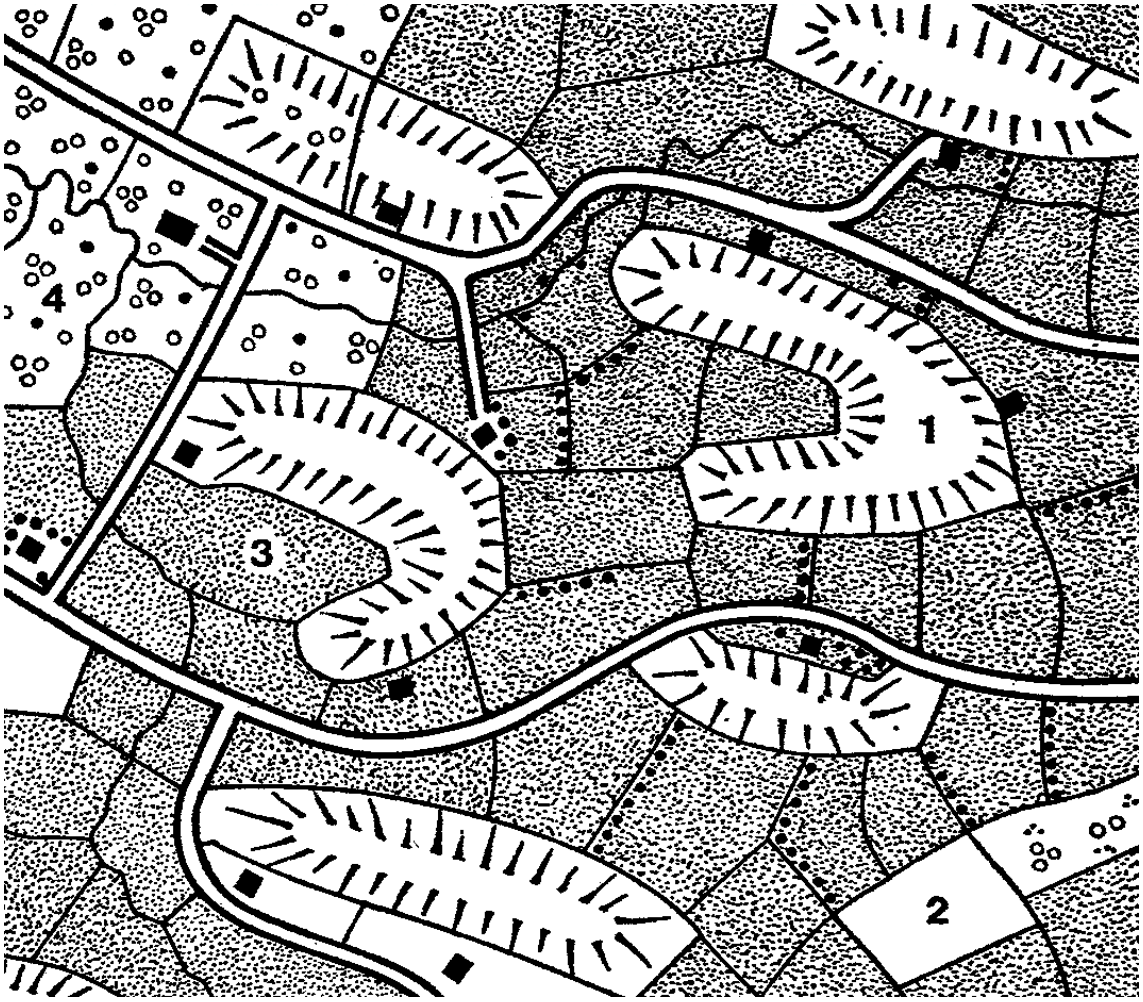
Centrale Slenk



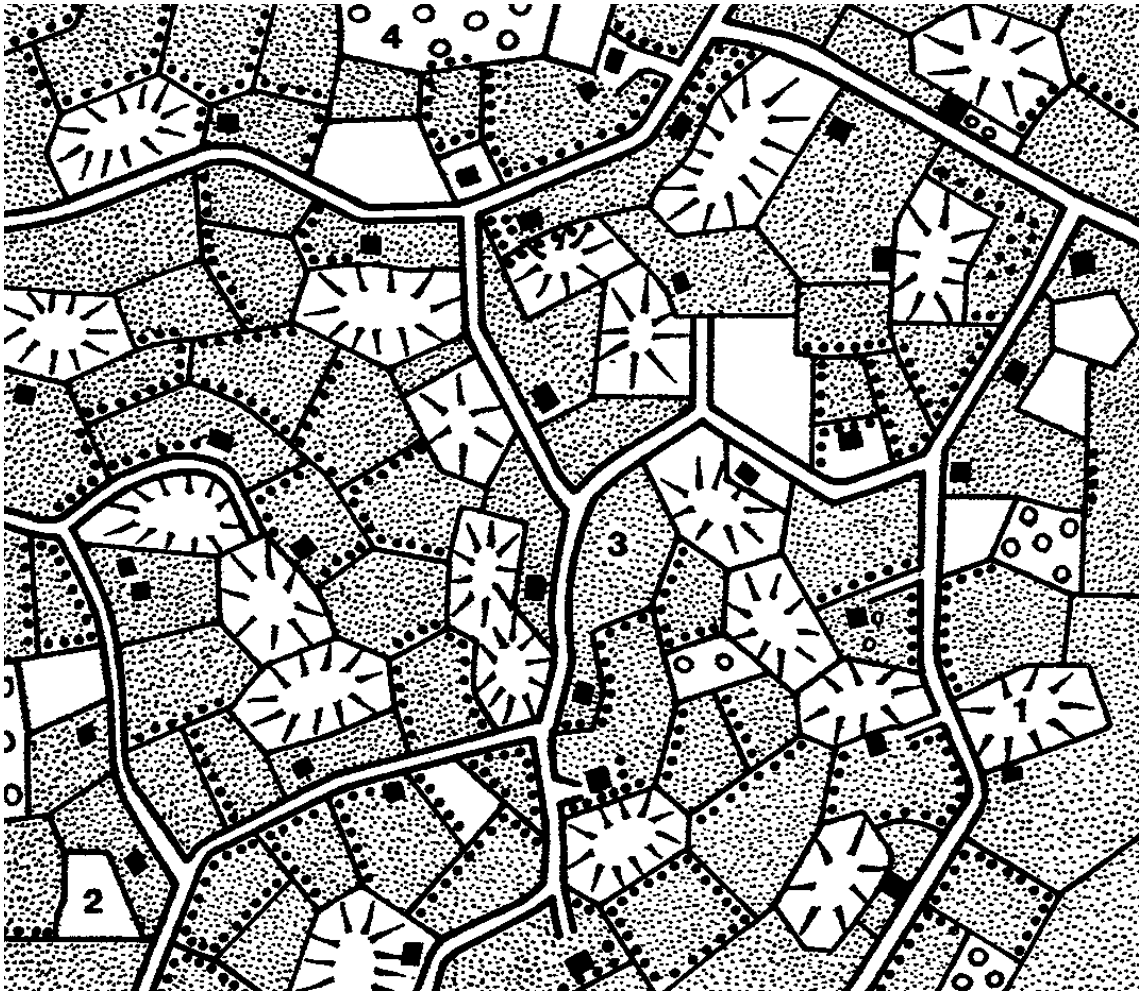


Dekzandruggen

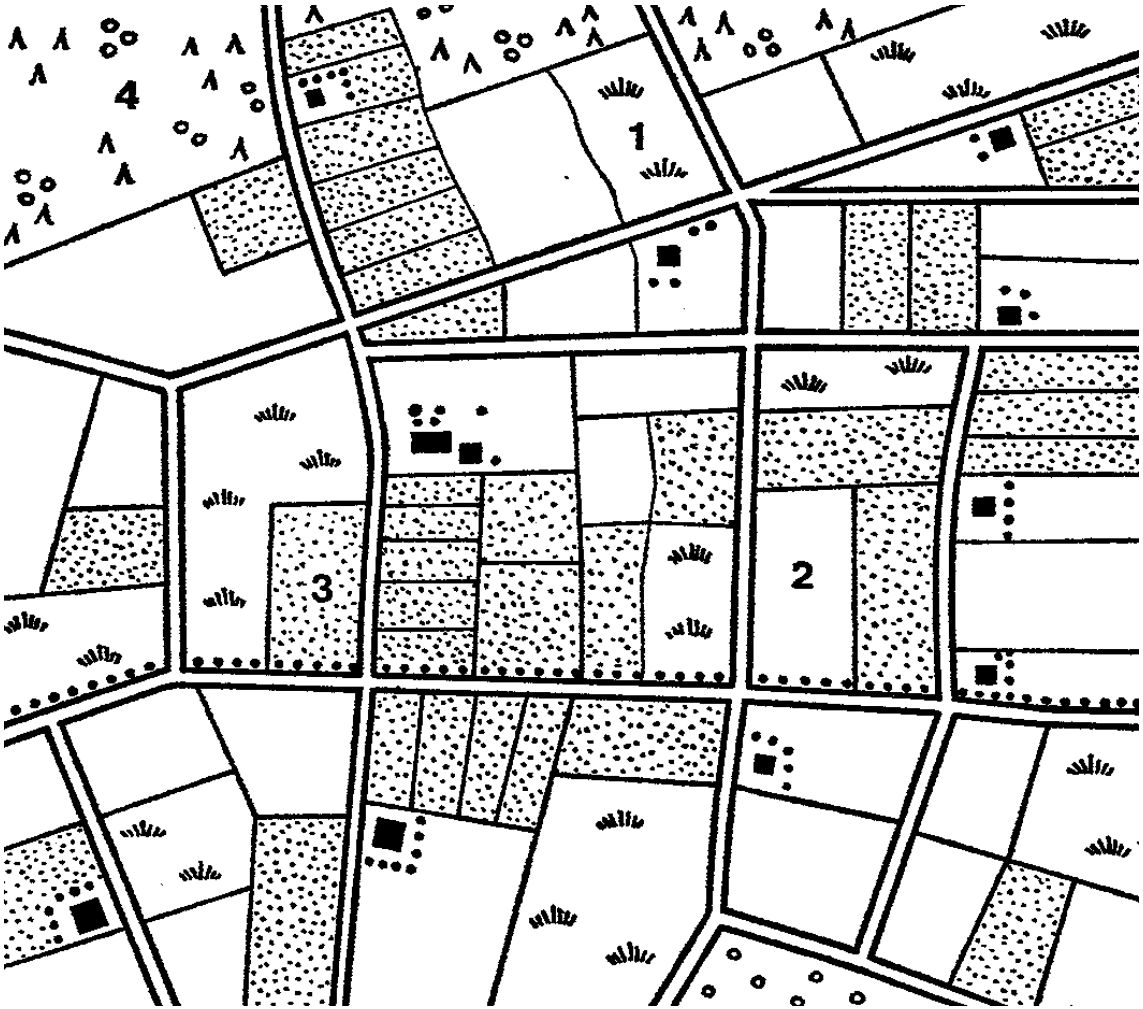
1. paraboolvormige dekzandrug
2. akkertje op vlakker terrein
3. grasland tussen ruggen
4. bos van een buitenplaats



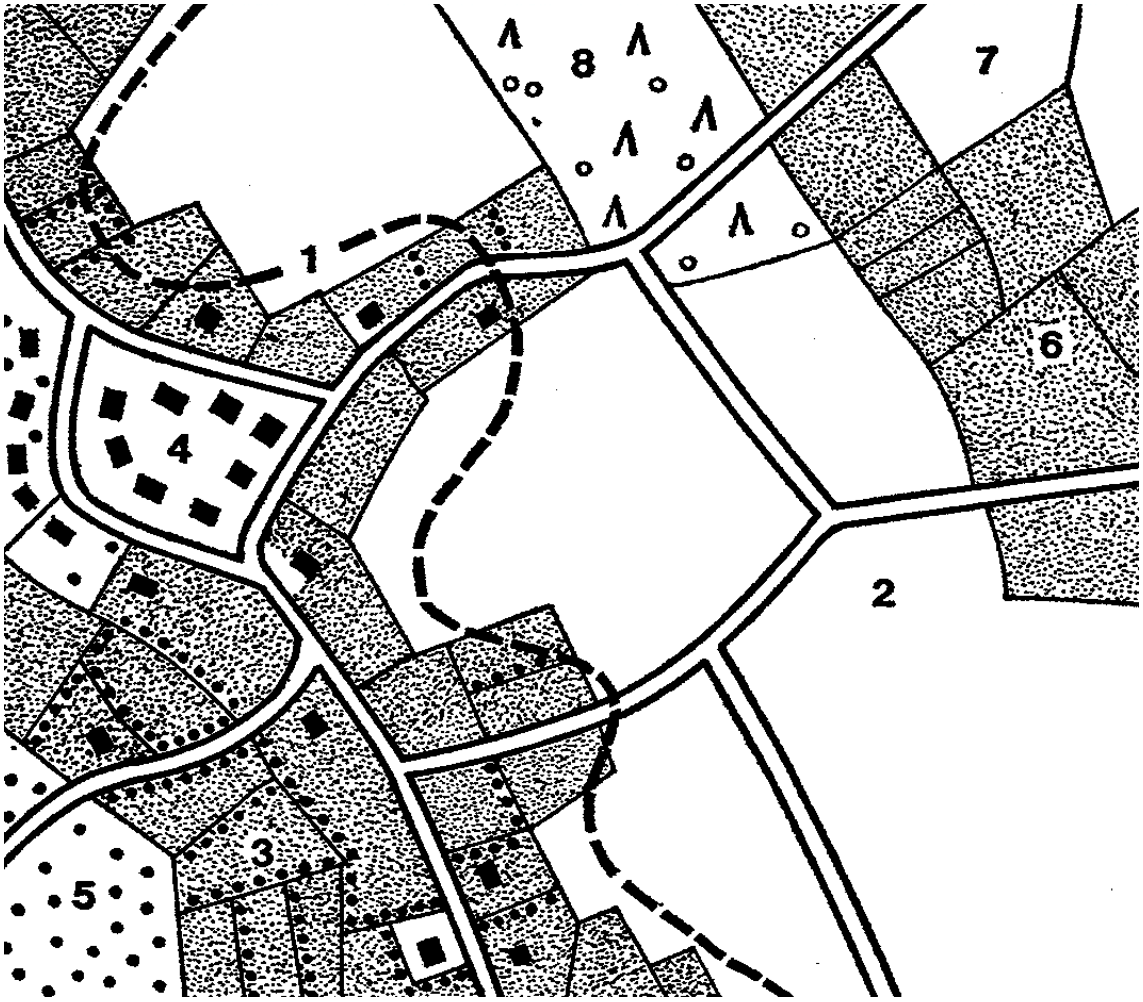
Achterhoek



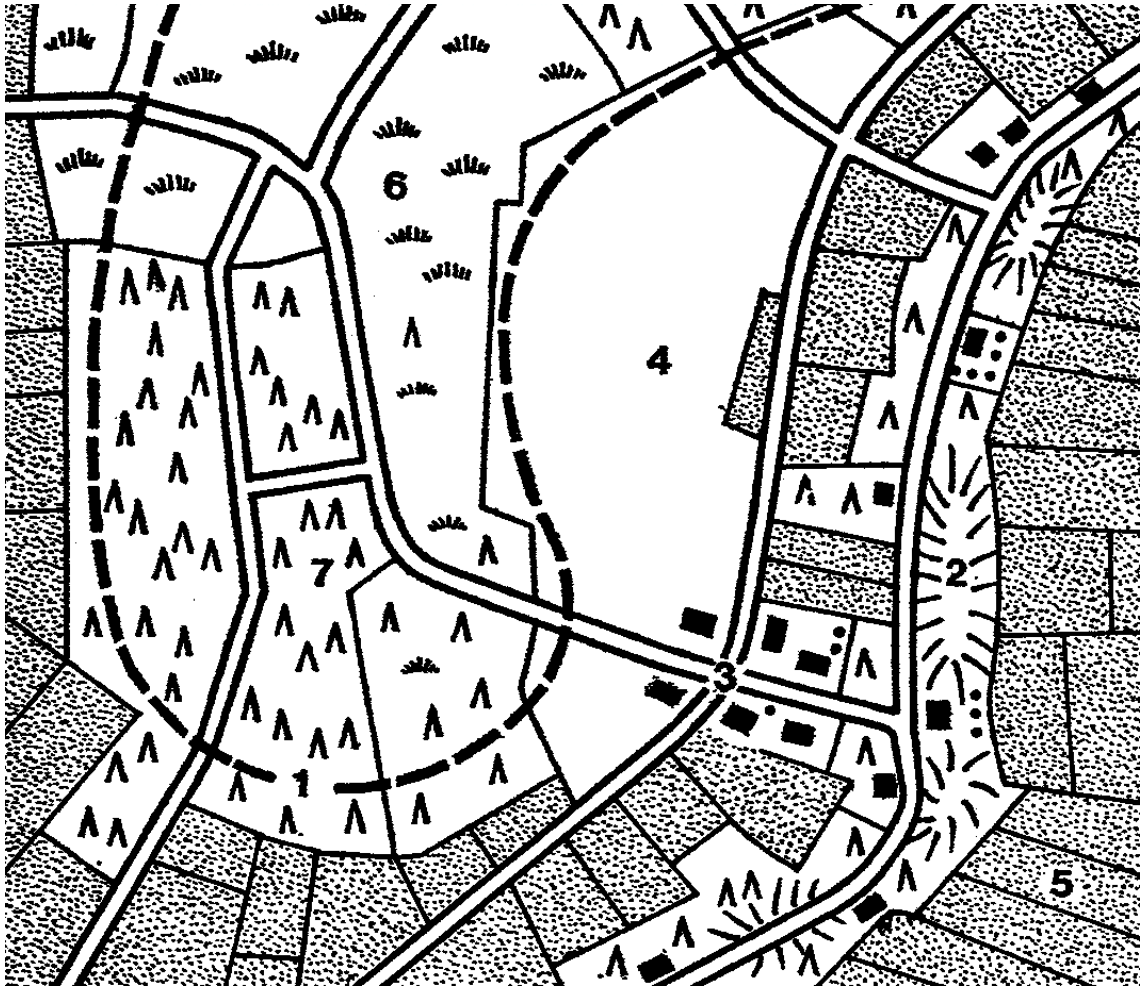
Heide-ontginningen



Stuwwallen Oost-Twente

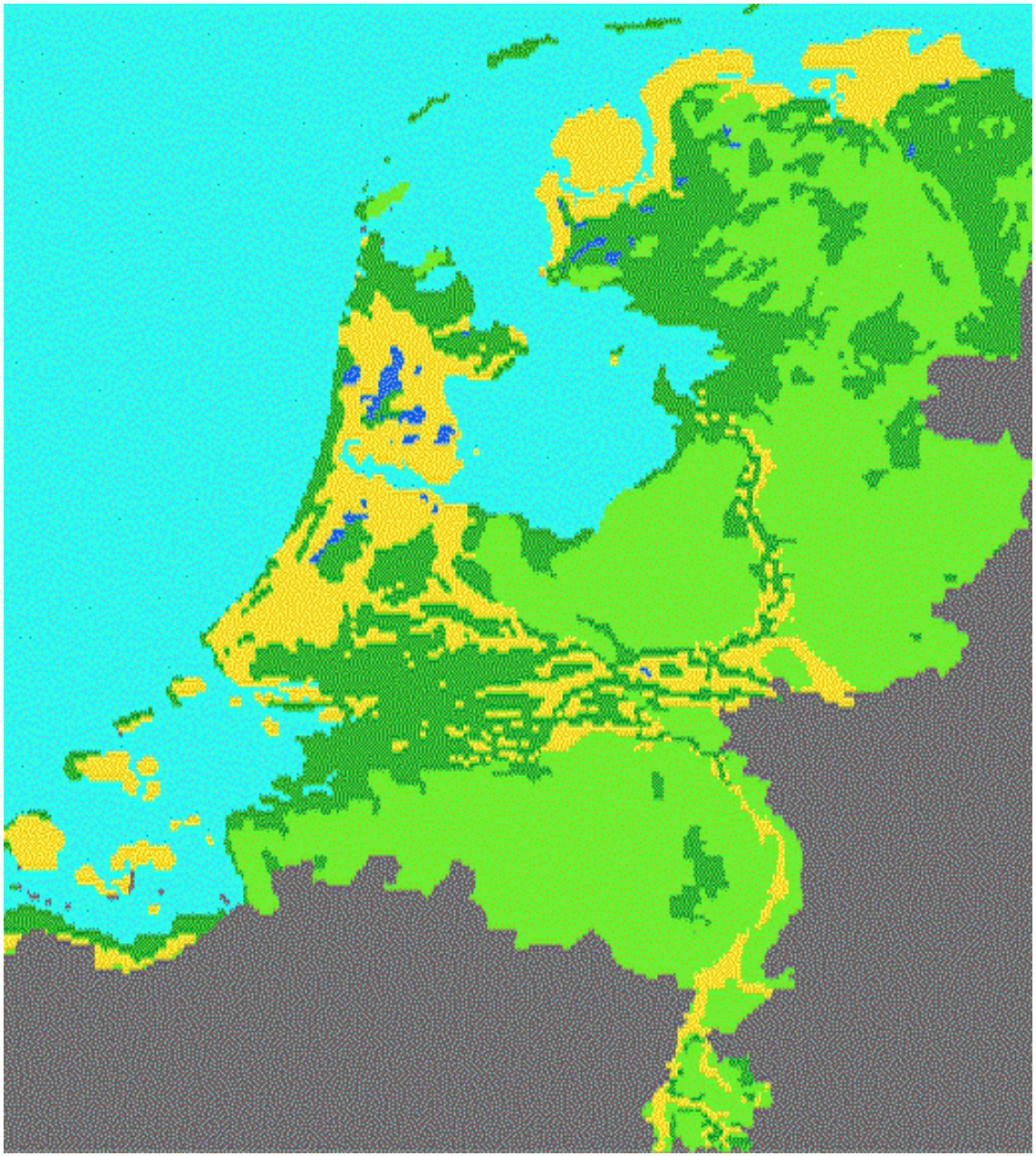


Stuwwallen West-Twente



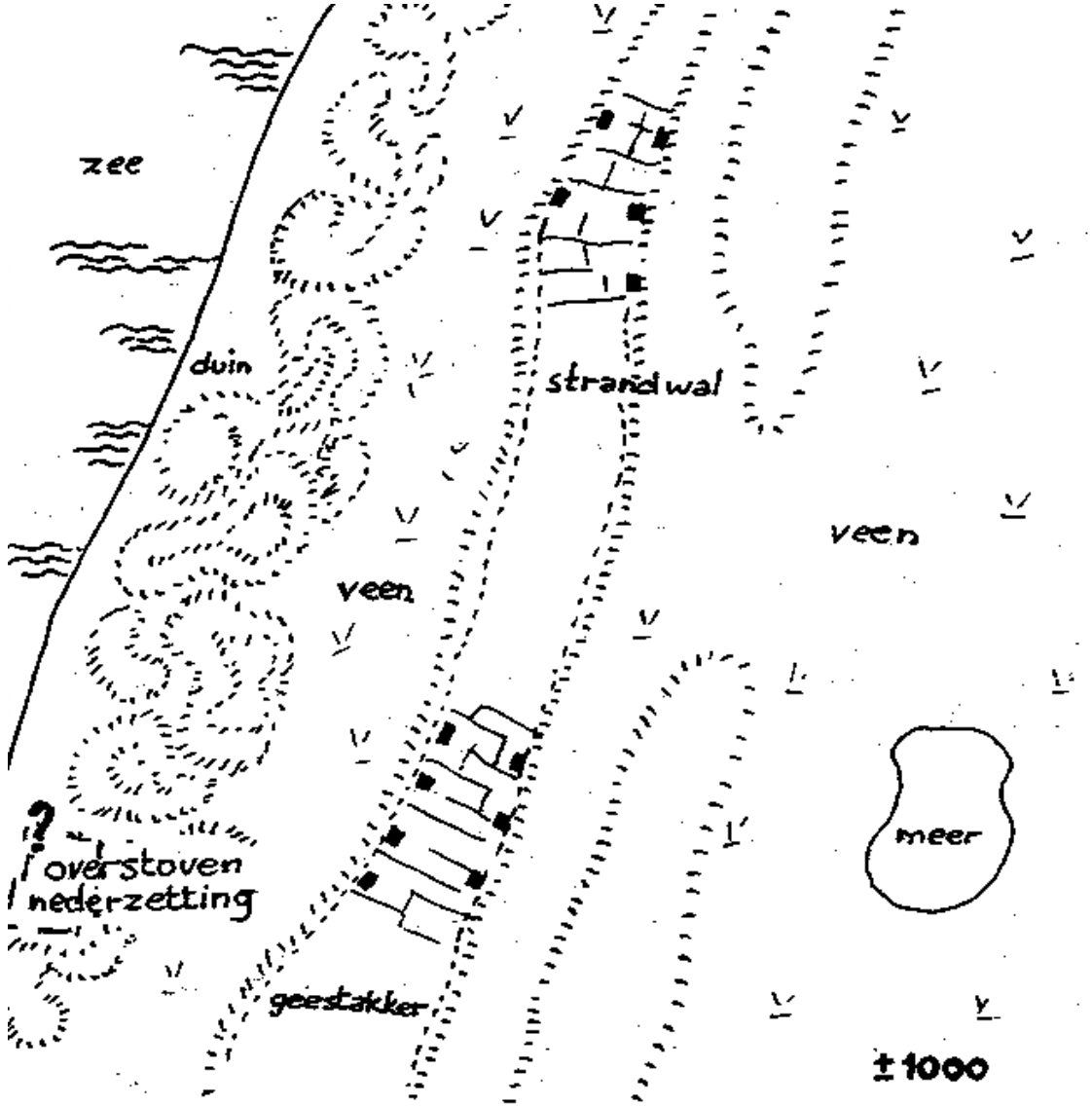
1000

1100



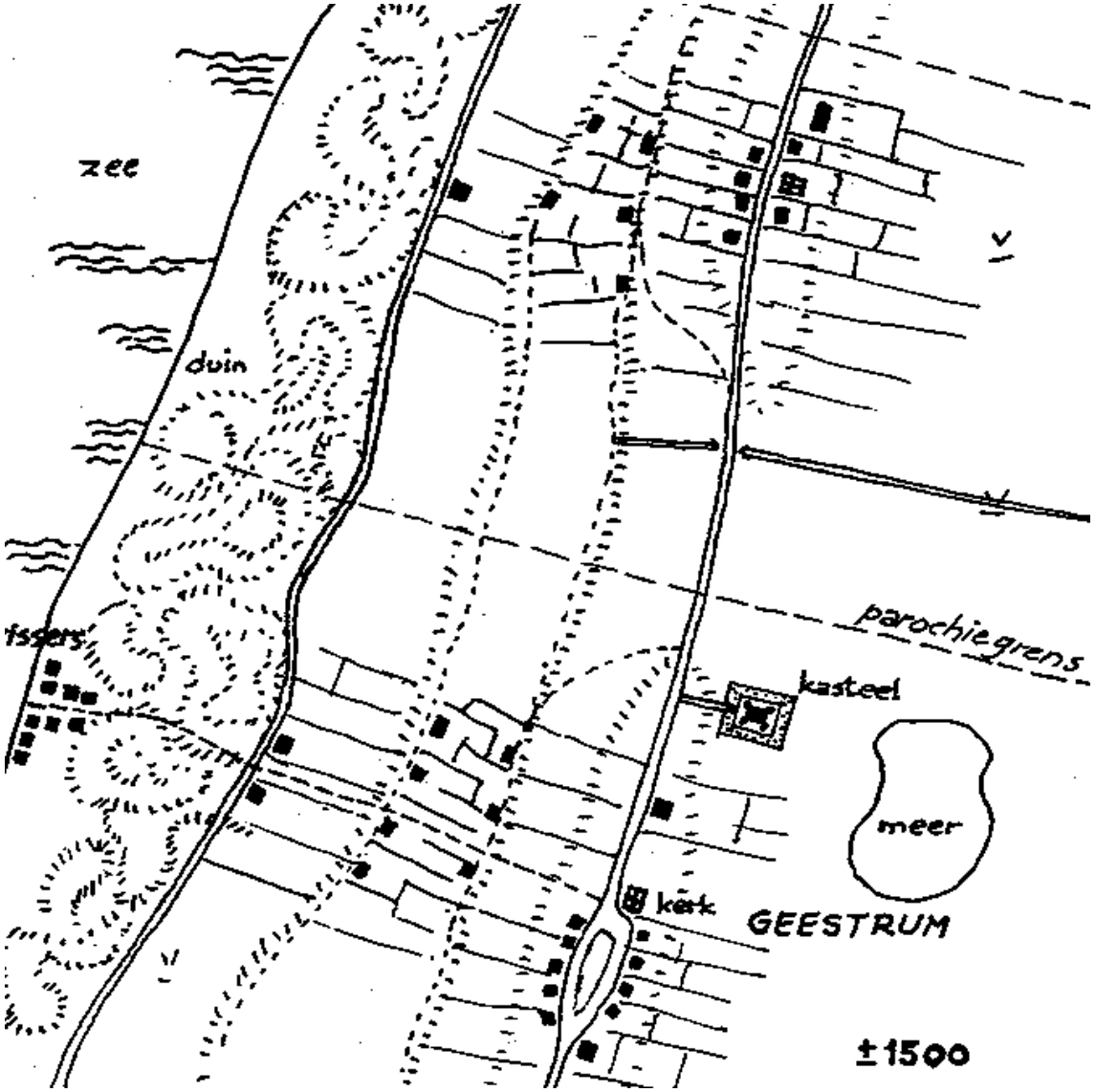
1300

Behind dunes



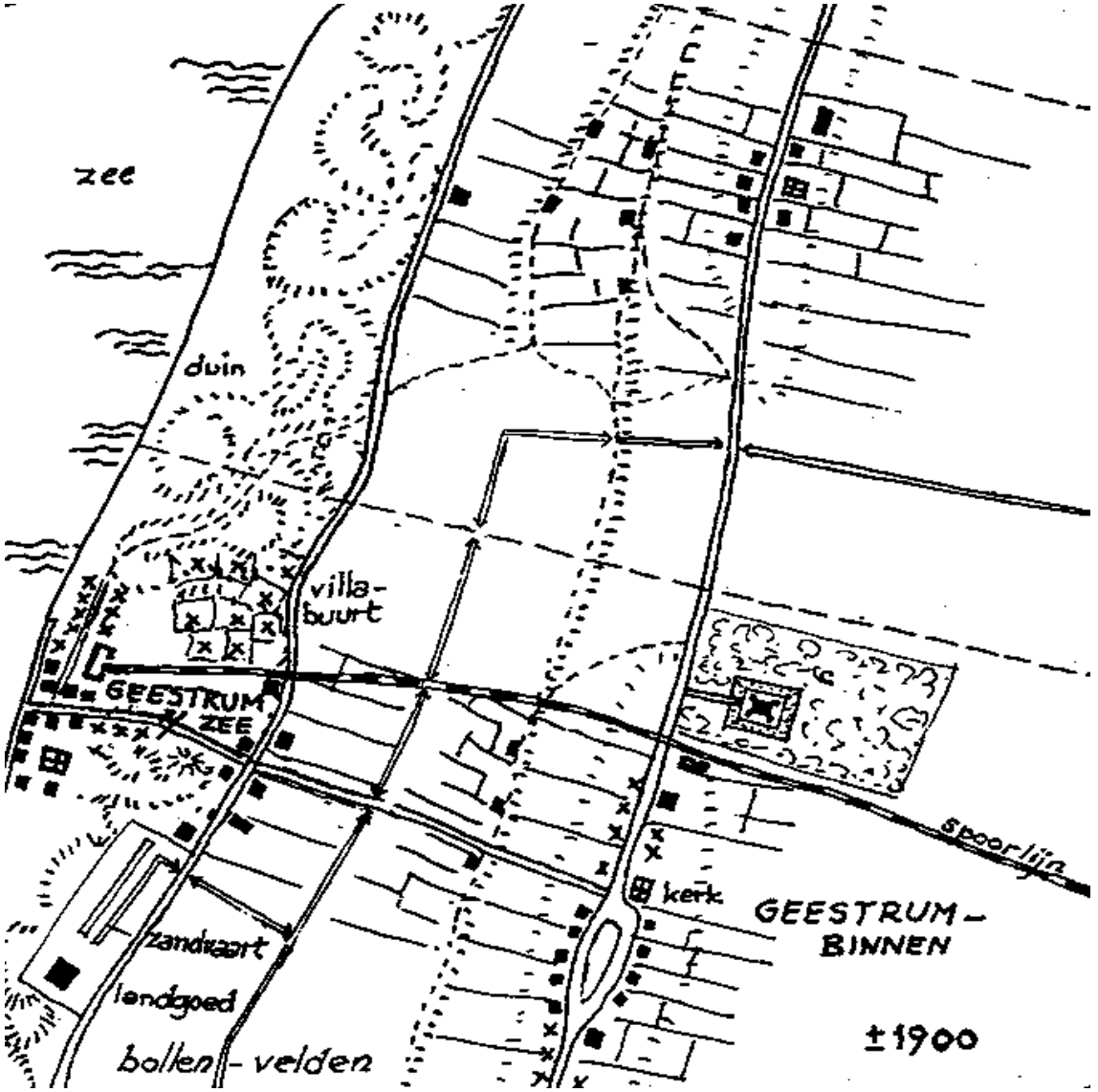
1000

Behind dunes



1500

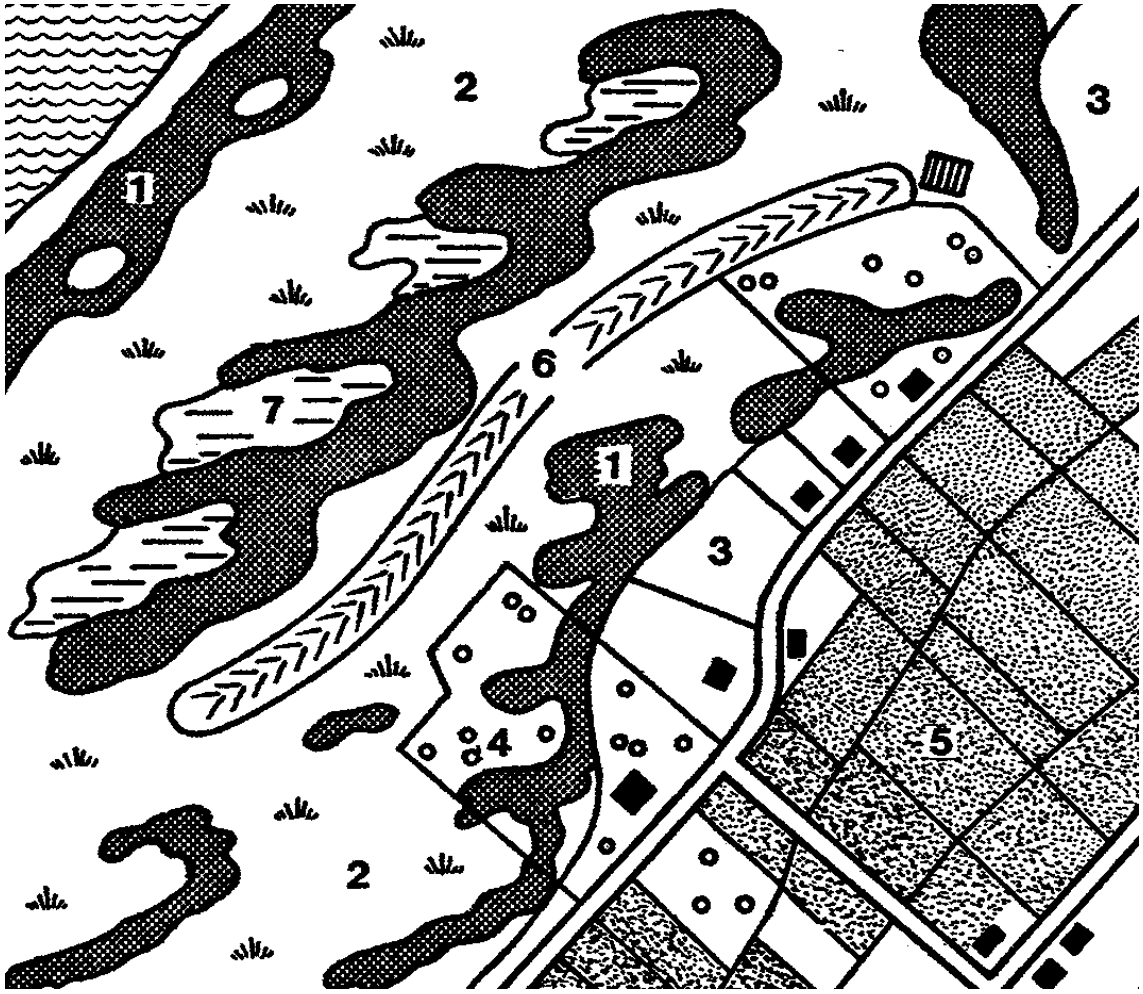
Behind dunes



1900

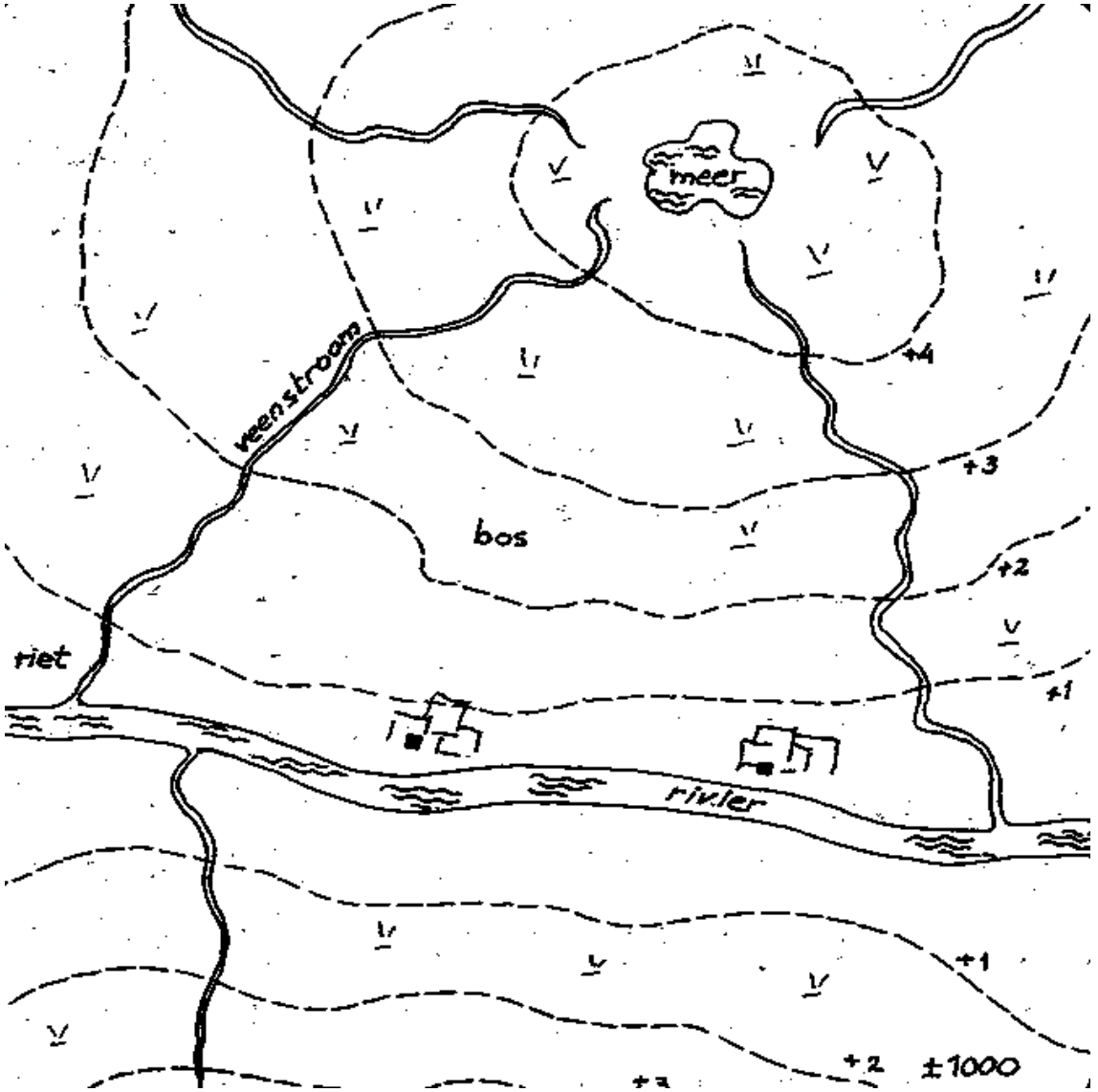
Strandwallen tussen Leiden en Haarlem

Duinlandschap waterwinning



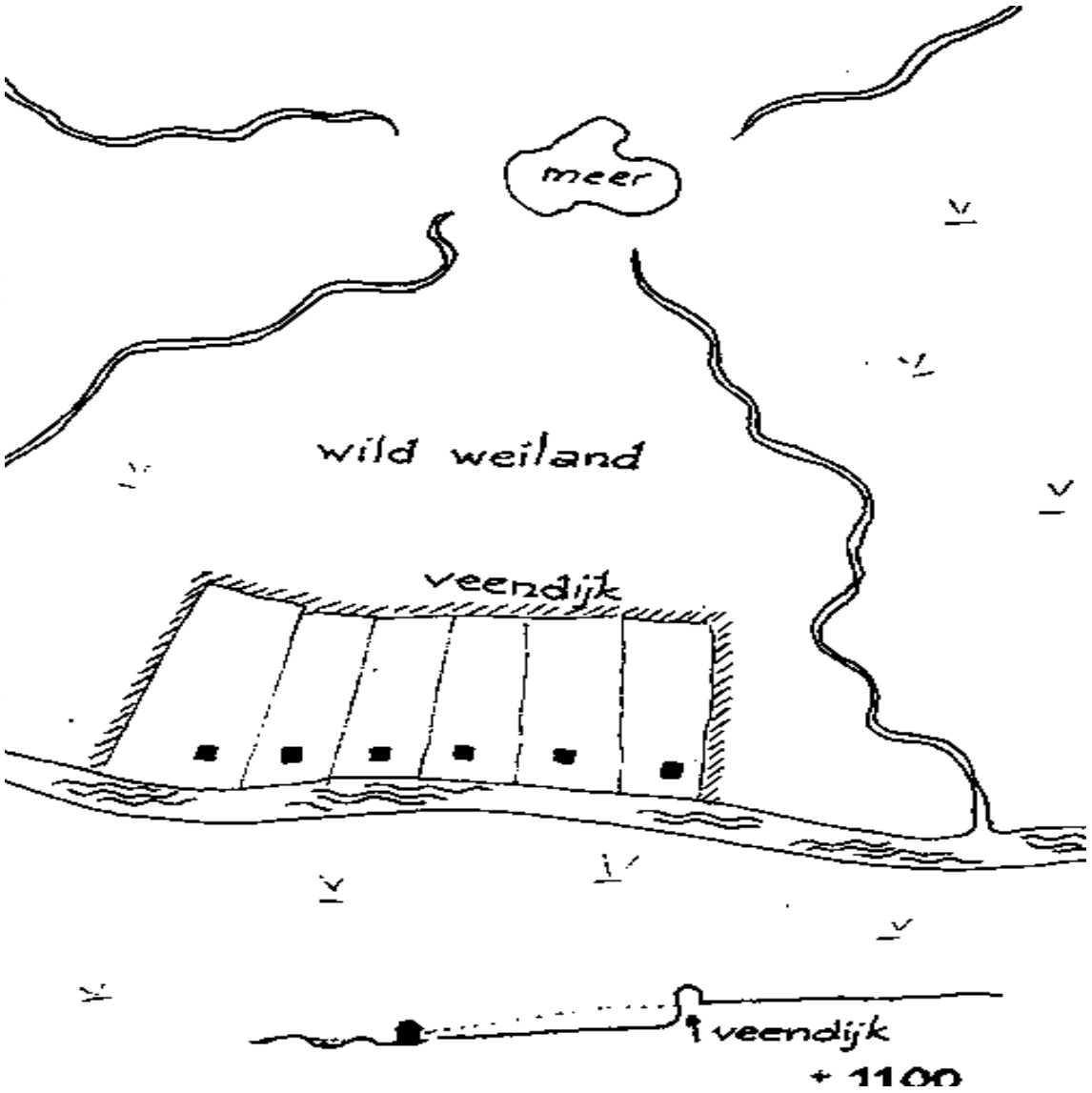
Residential developent on Peat

On peat



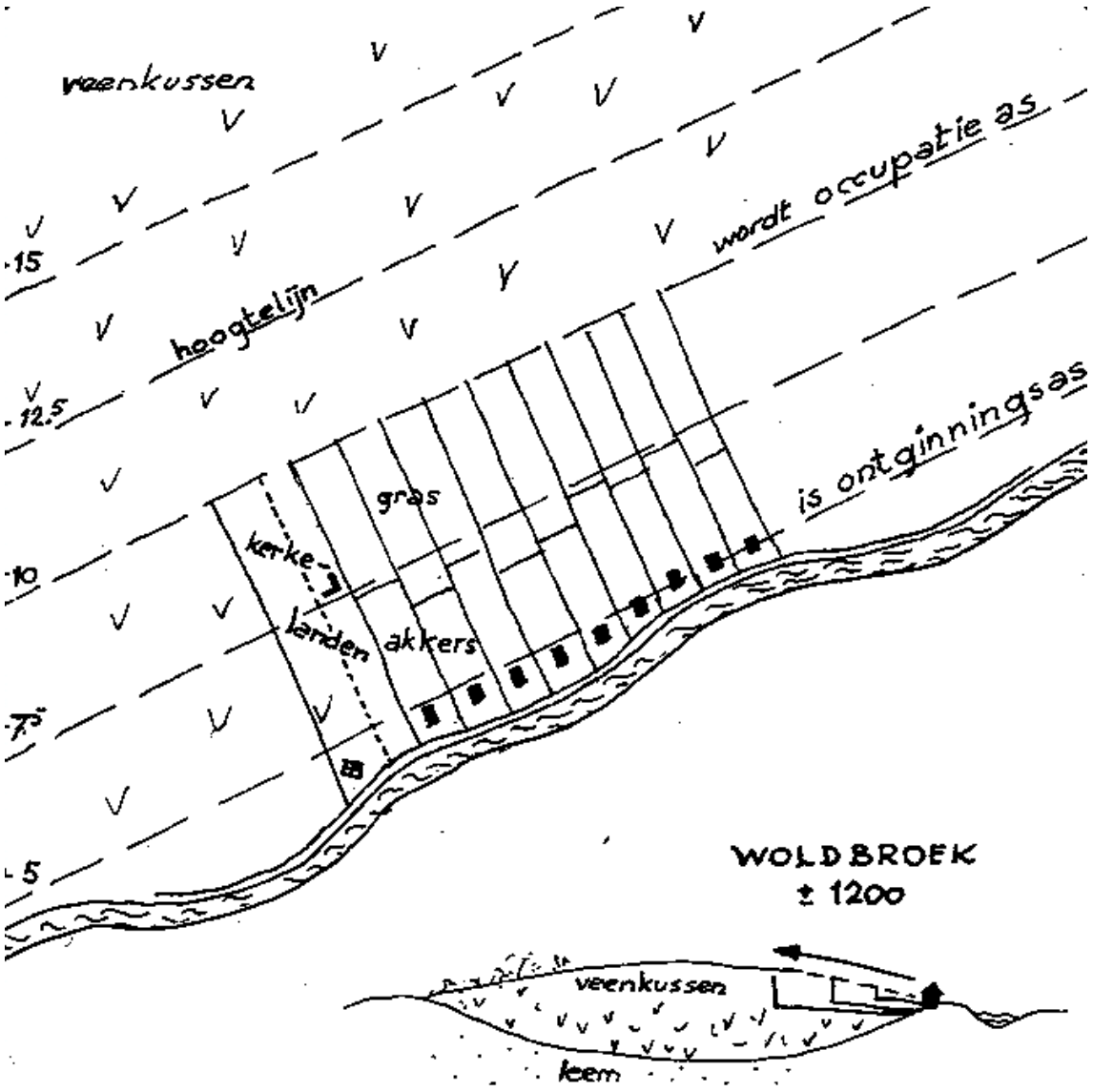
1000

On peat



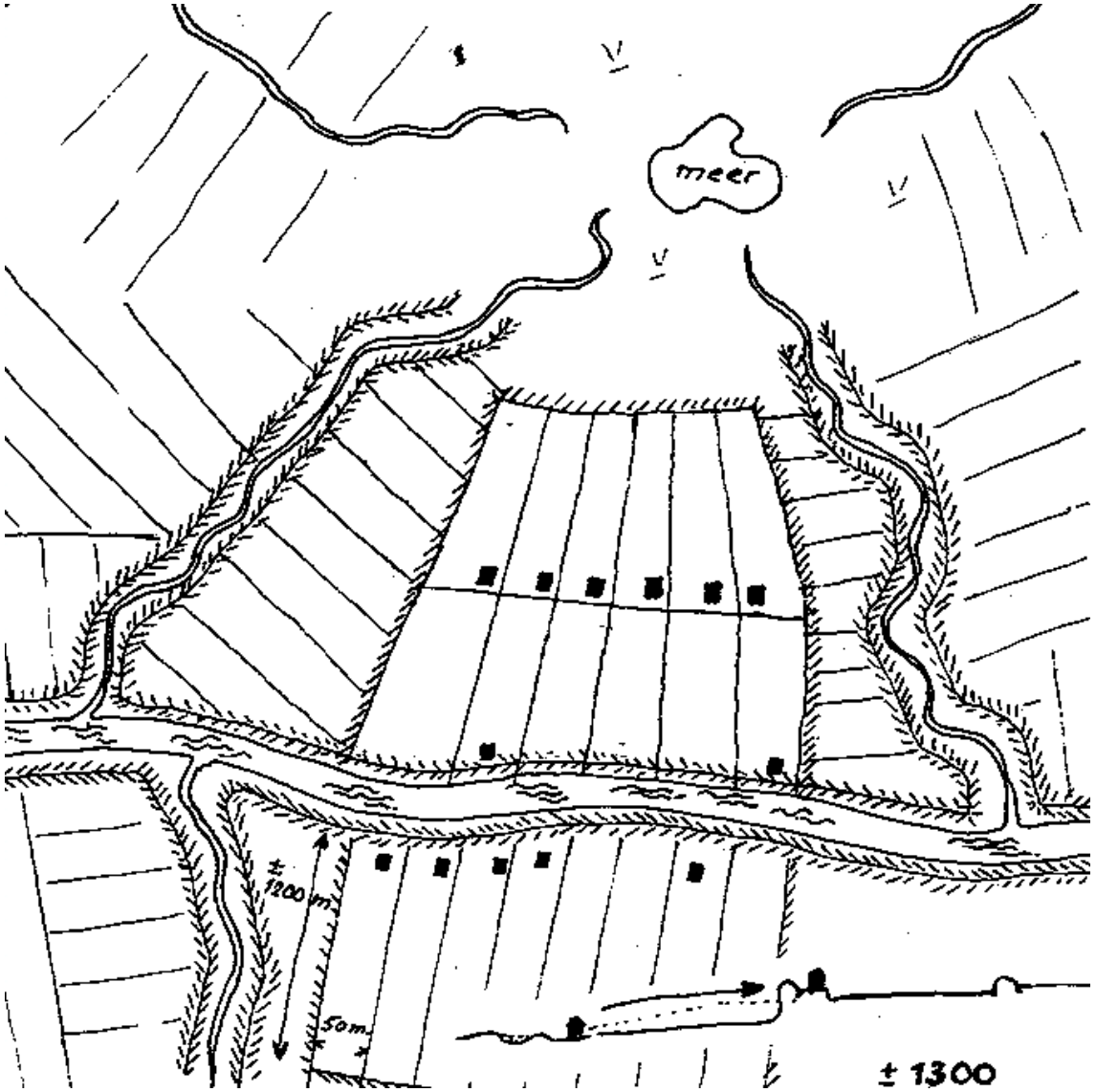
1100

On peat


veenkussen
wordt occupatie as
hoogtelijn
-15
-12.5
-10
-7.5
-5
kerke
gras
landen
akkers
is ontginningsas
WOLDBROEK
± 1200
veenkussen
leem

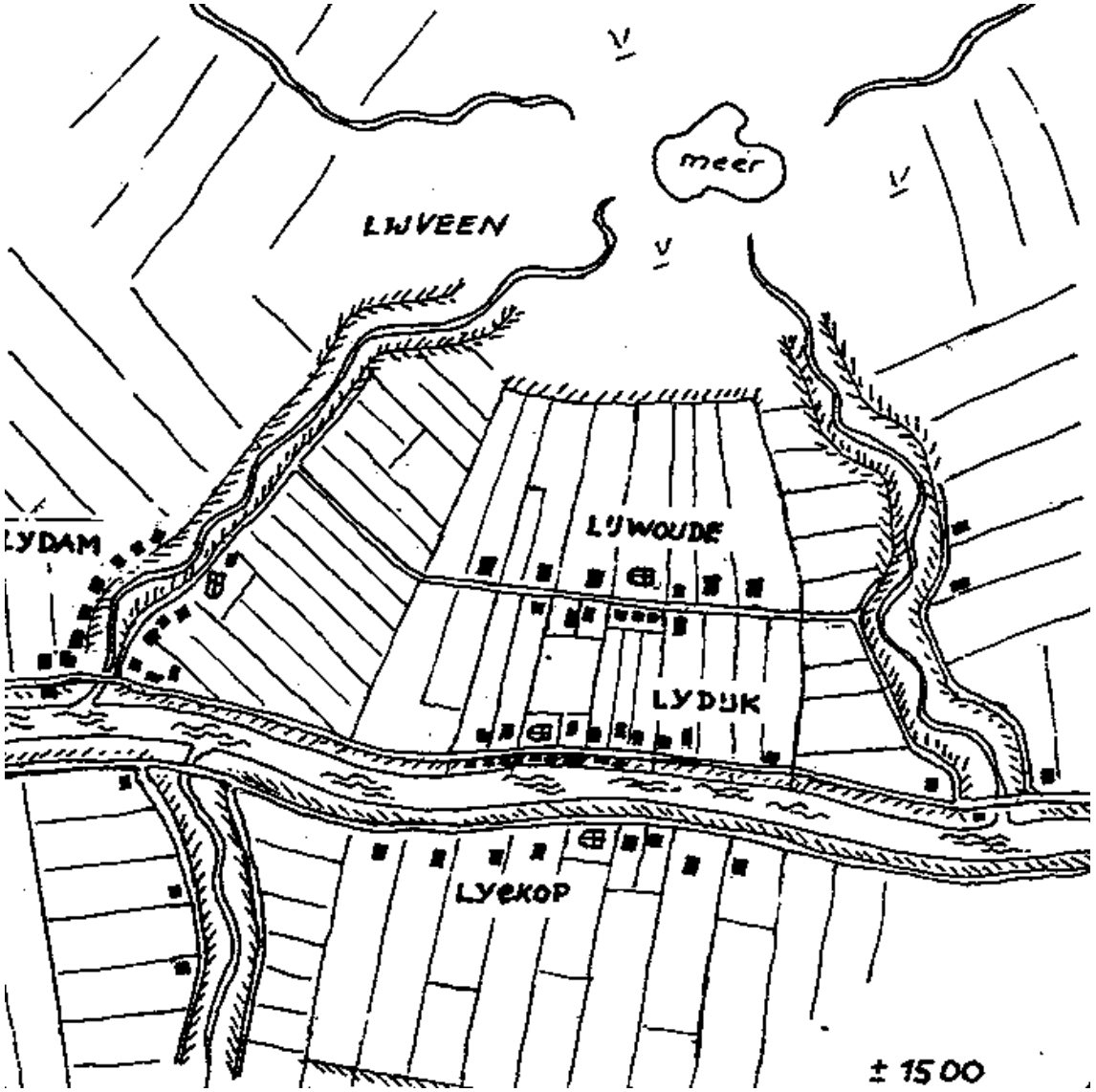
1200

On peat



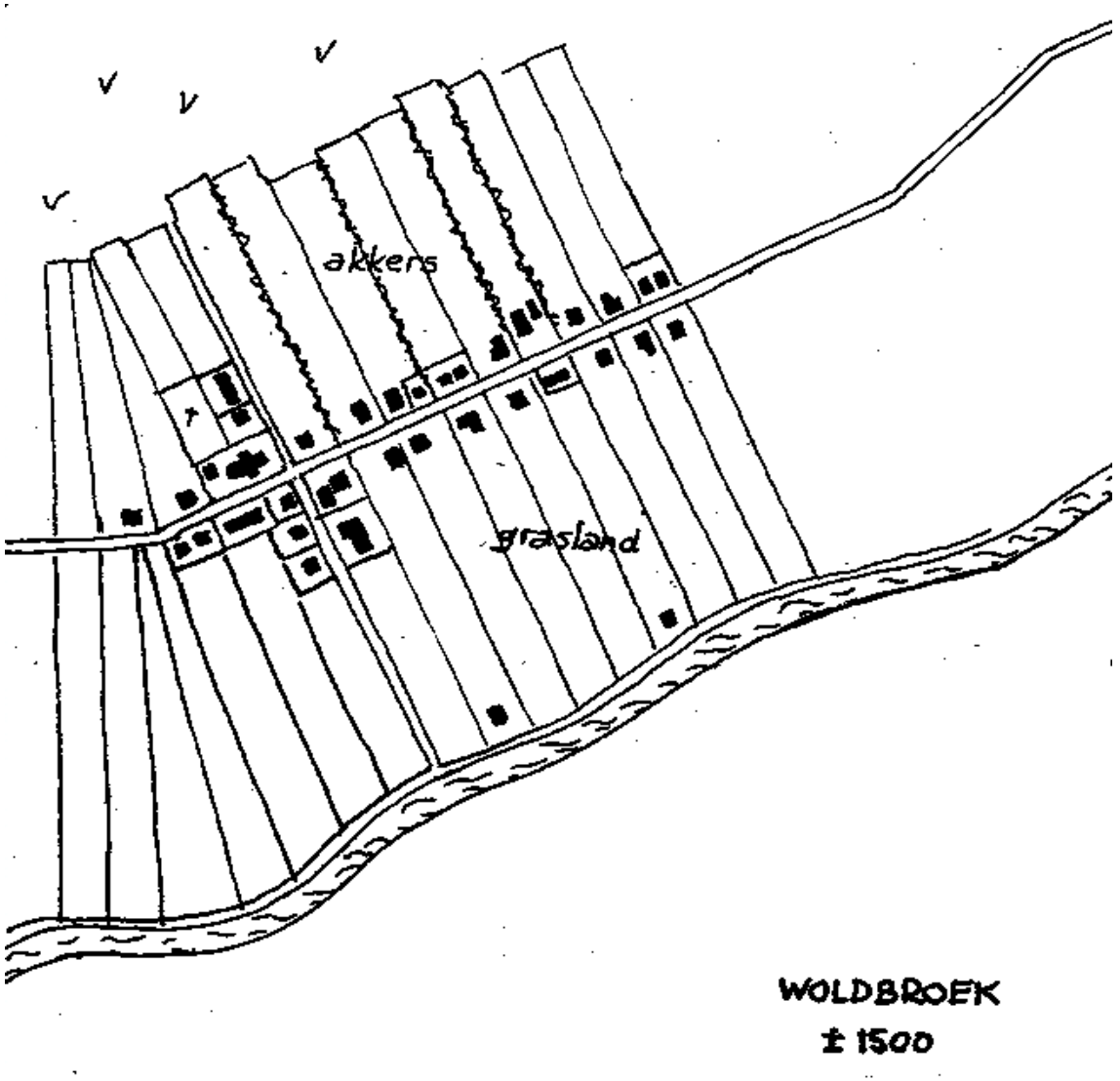
1300

On peat



1500

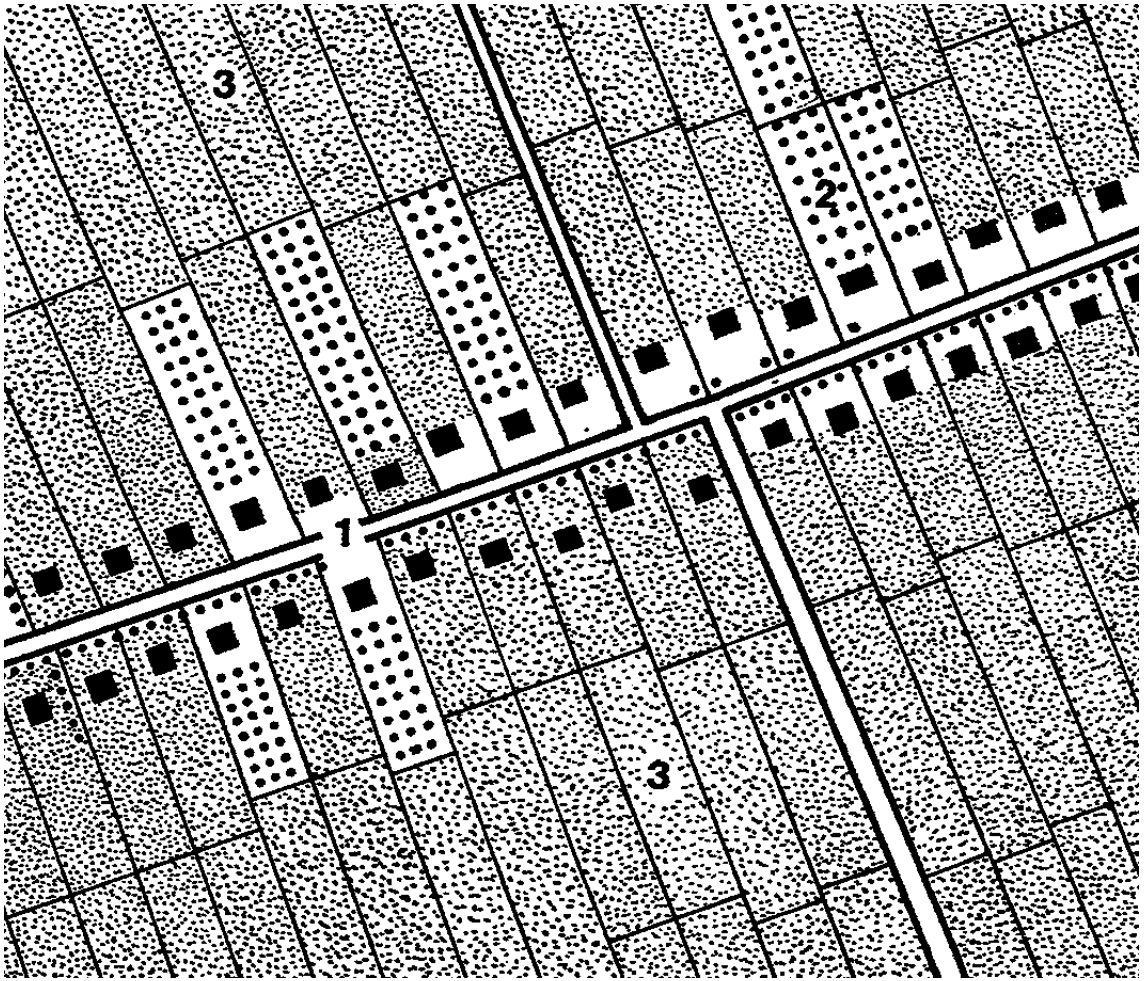
On peat



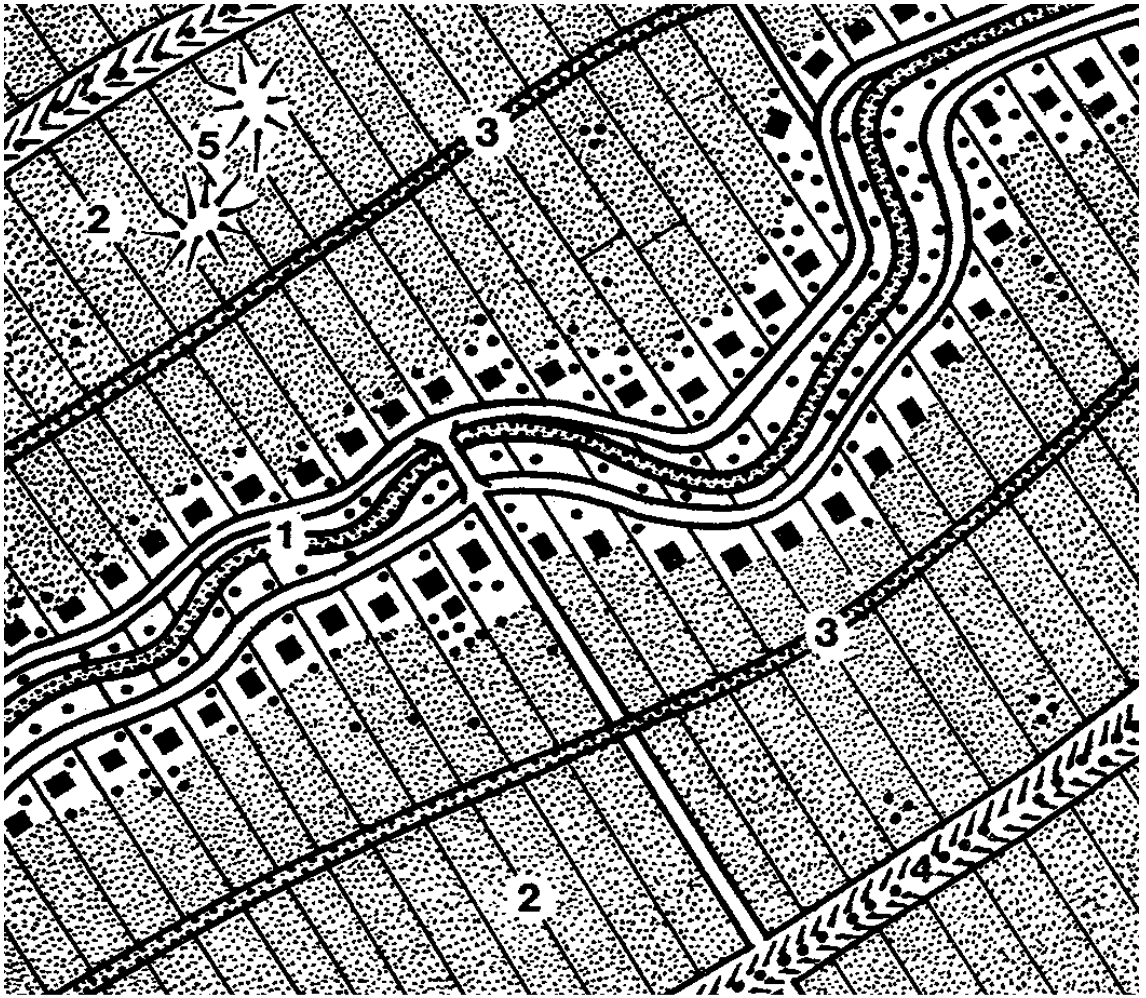
1500

Slagenlandschap N Nederland

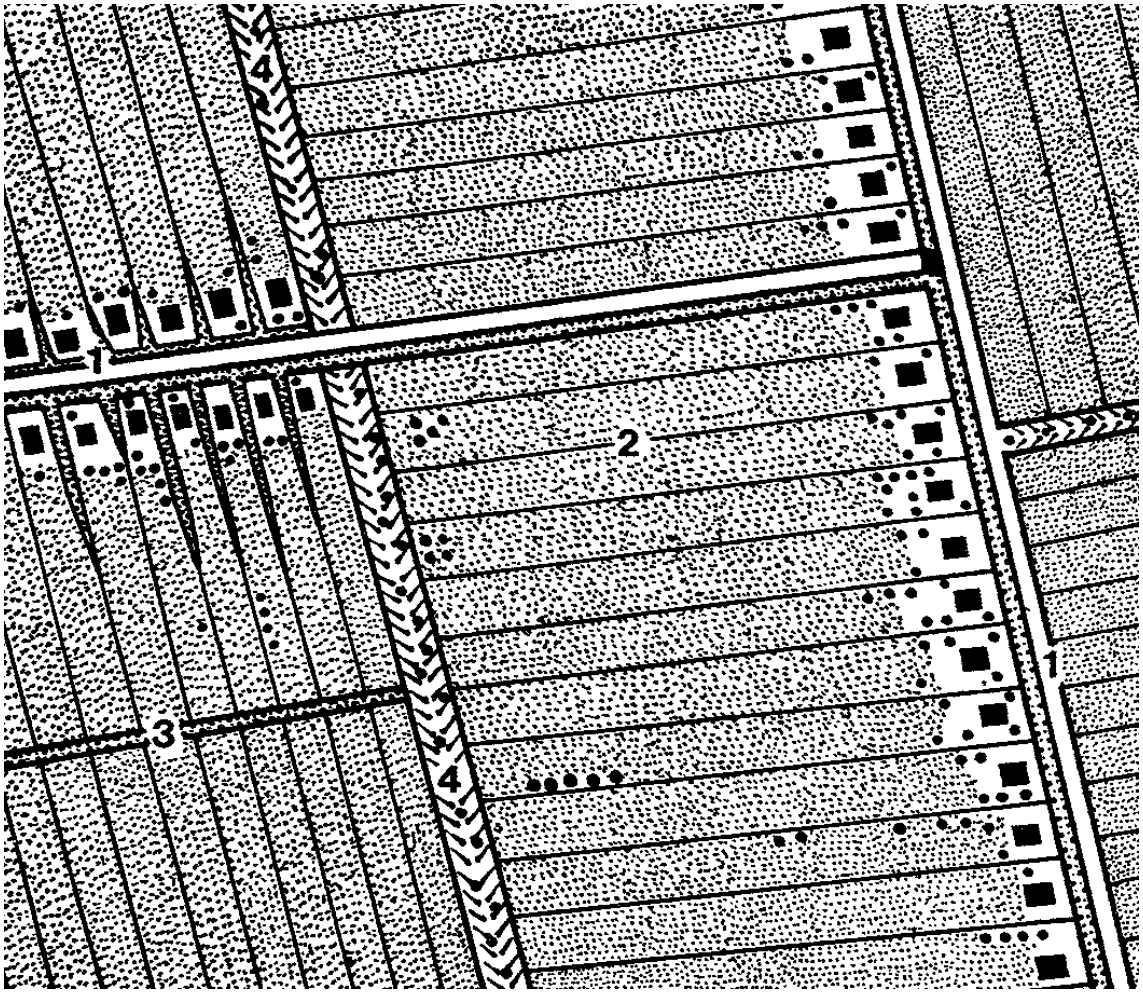
Slagenlandschap West-Friesland



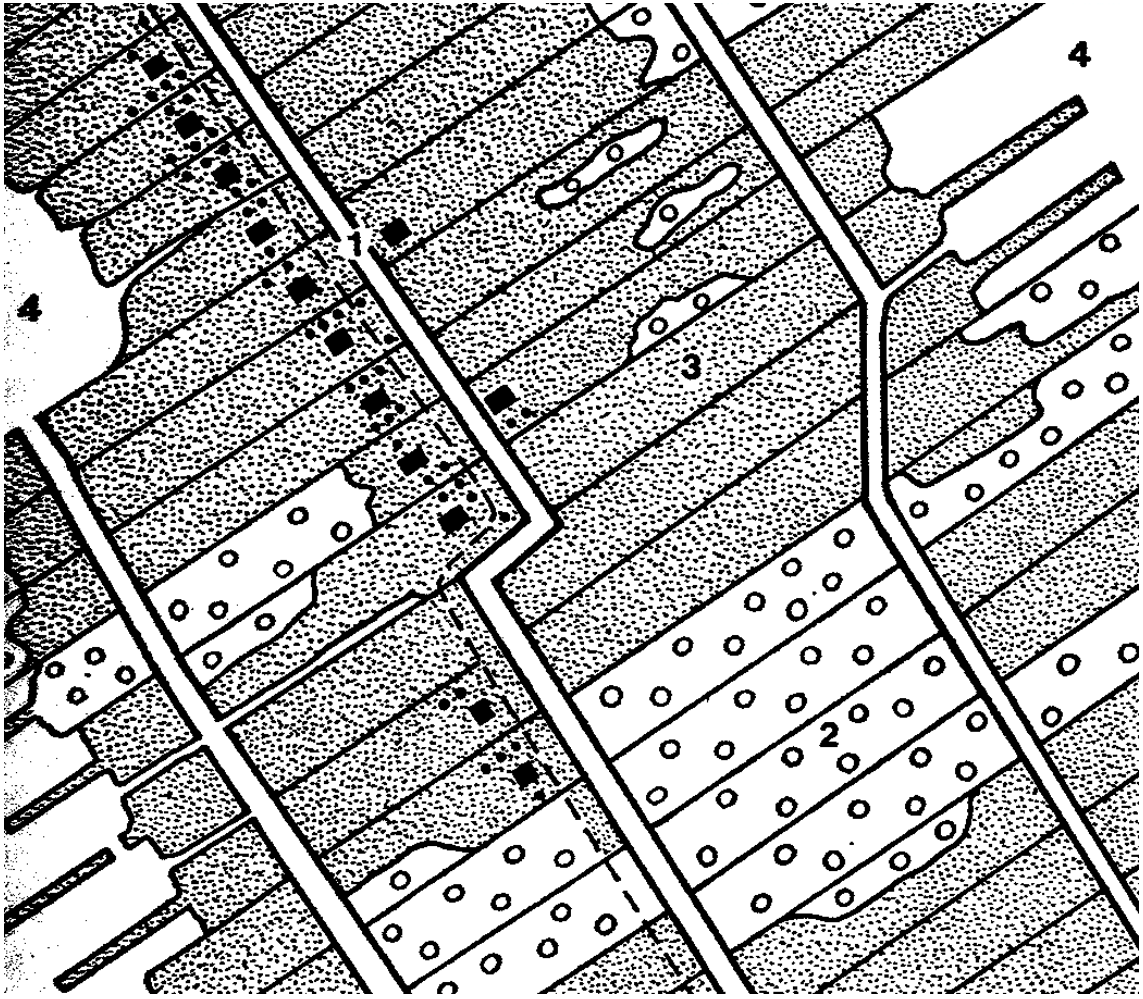
Laagveengebied met veenstroom



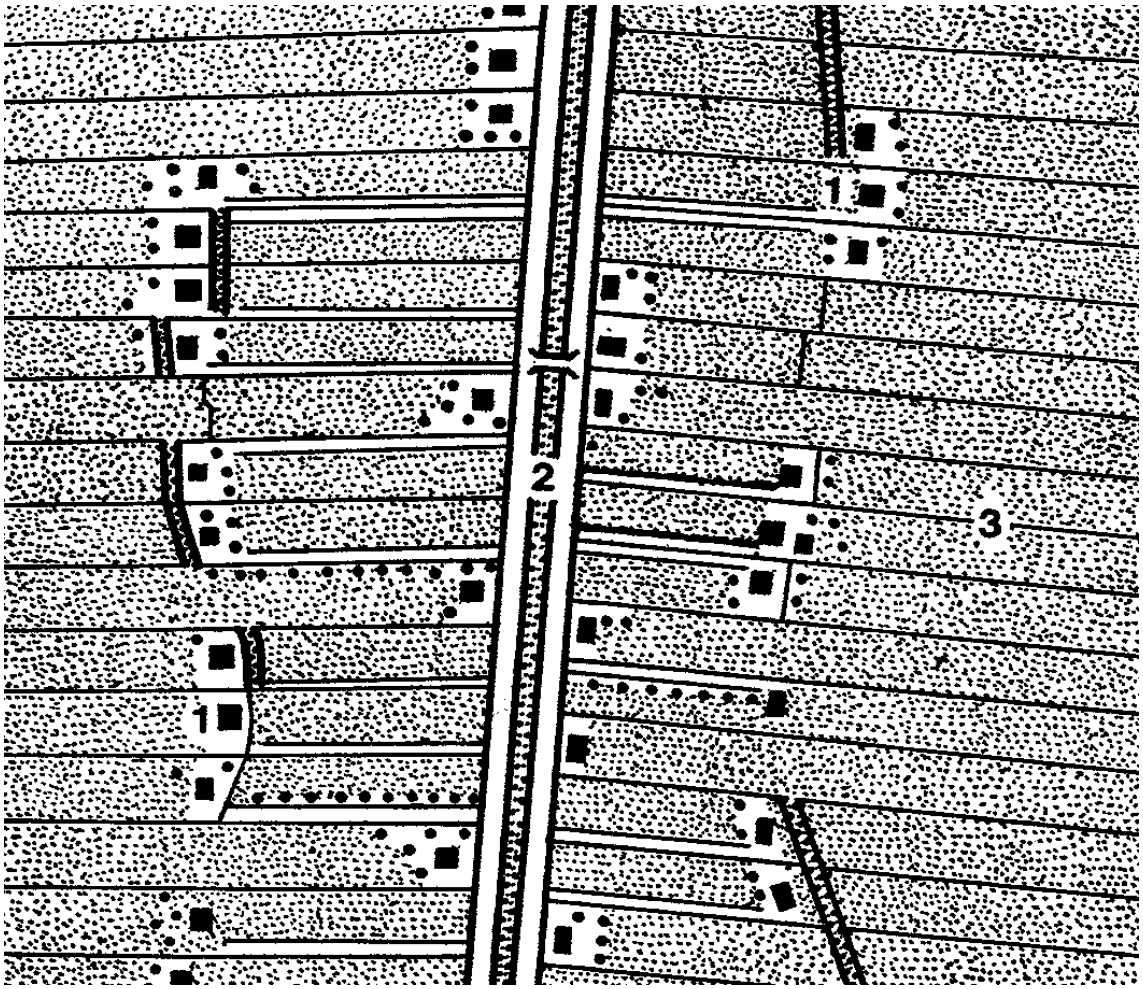
Laagveengebied met gegraven watergangen



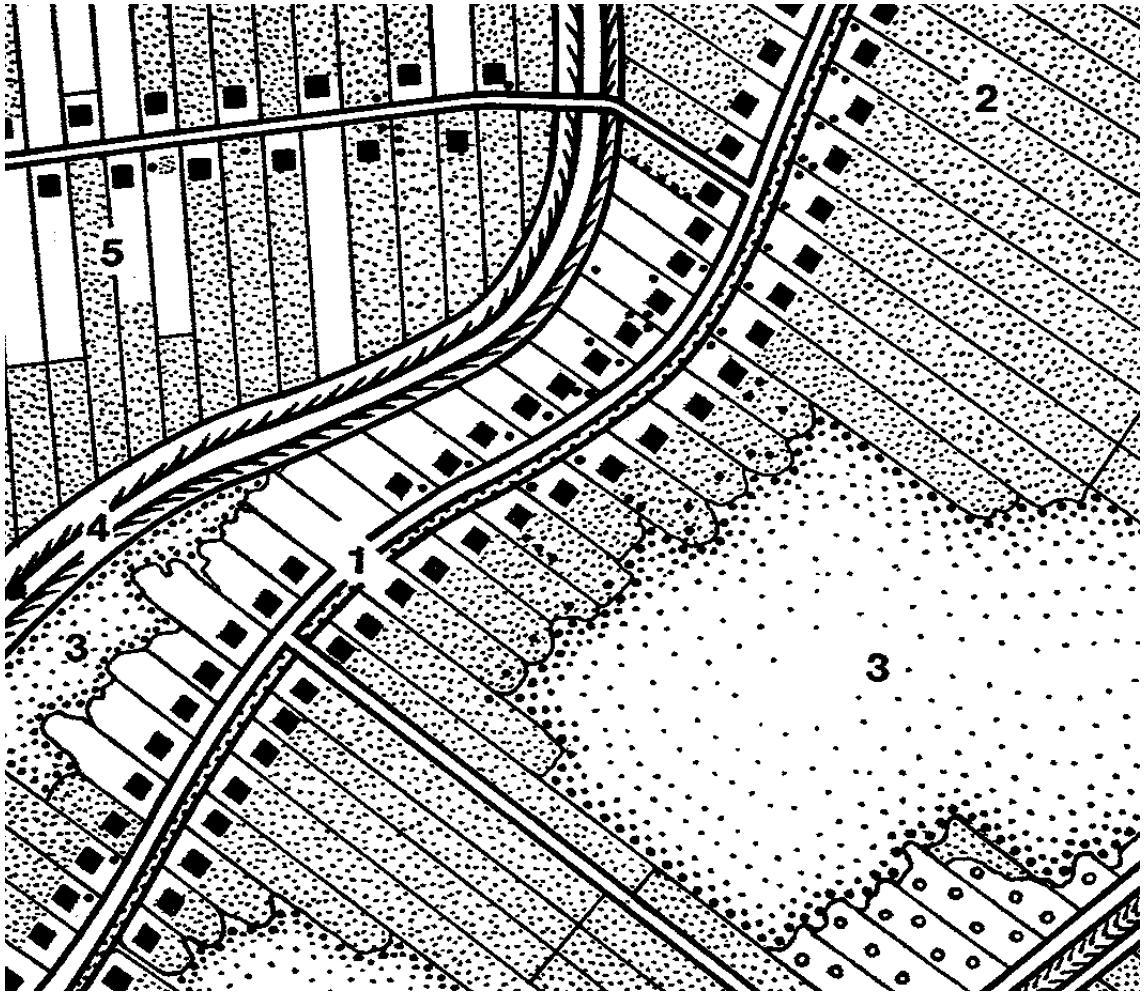
Laagveengebied NW Overijssel



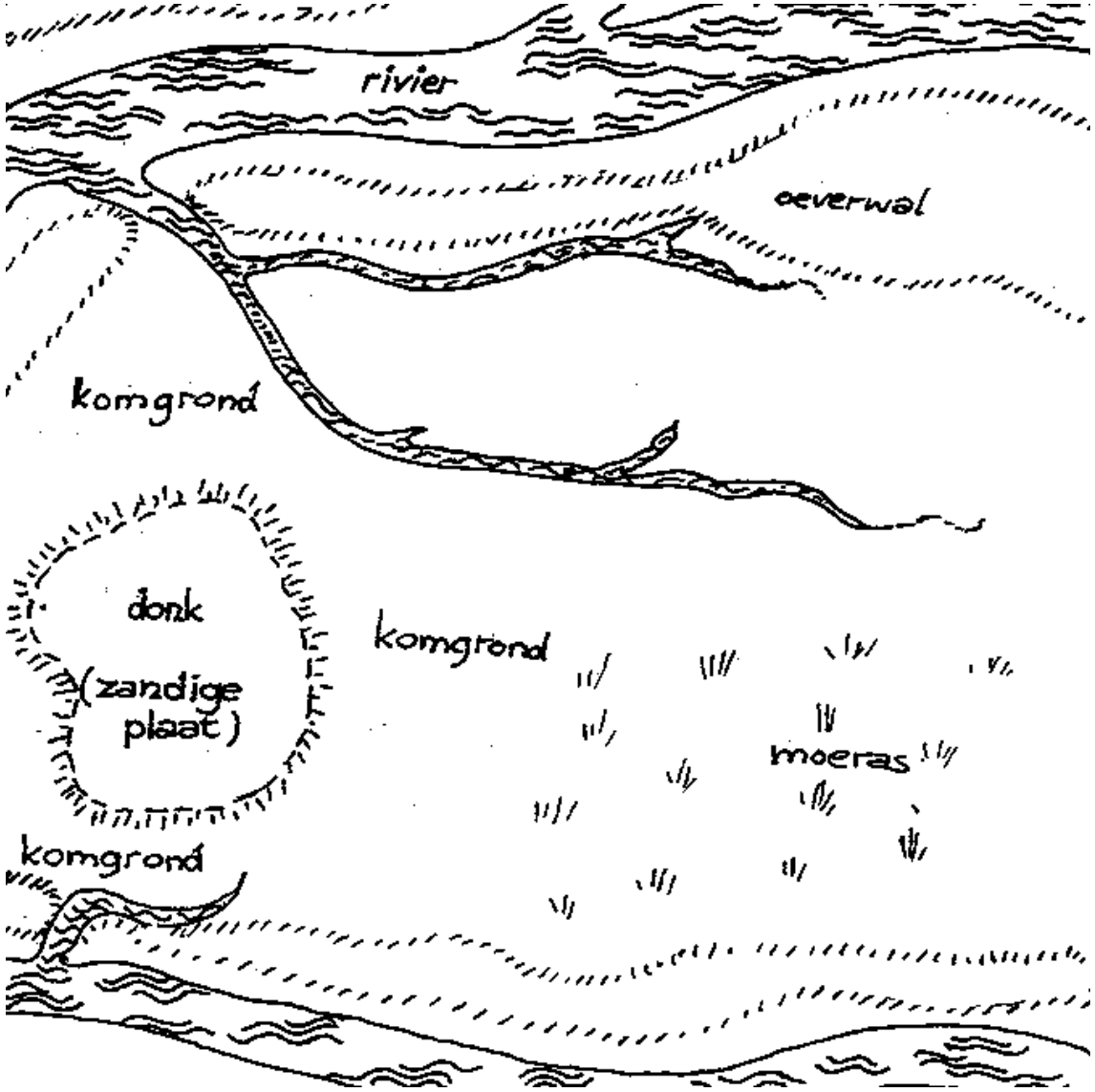
Laagveengebied Kamerik



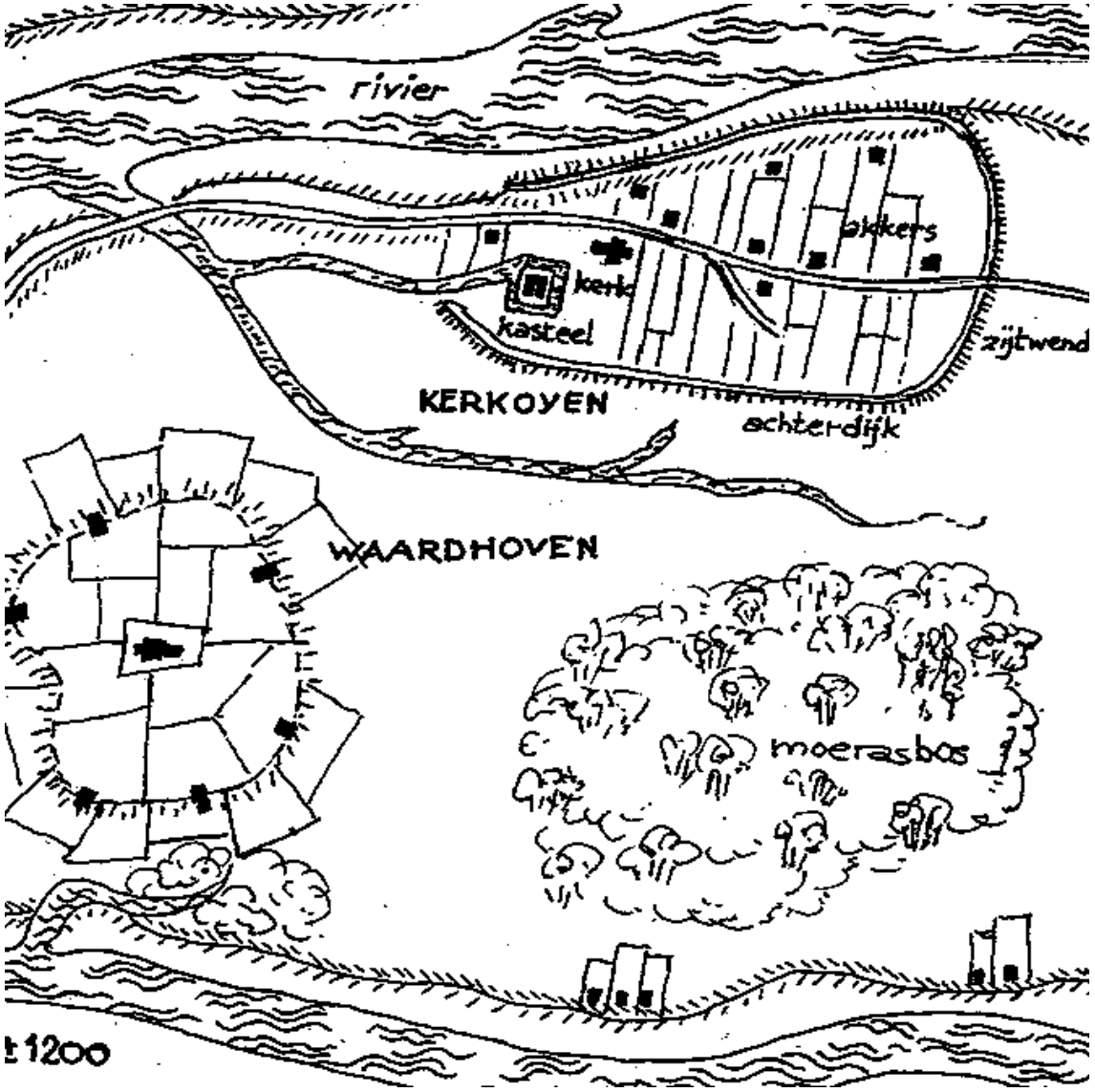
Laagveengebied met plassen en droogmakerijen



On clay along rivers



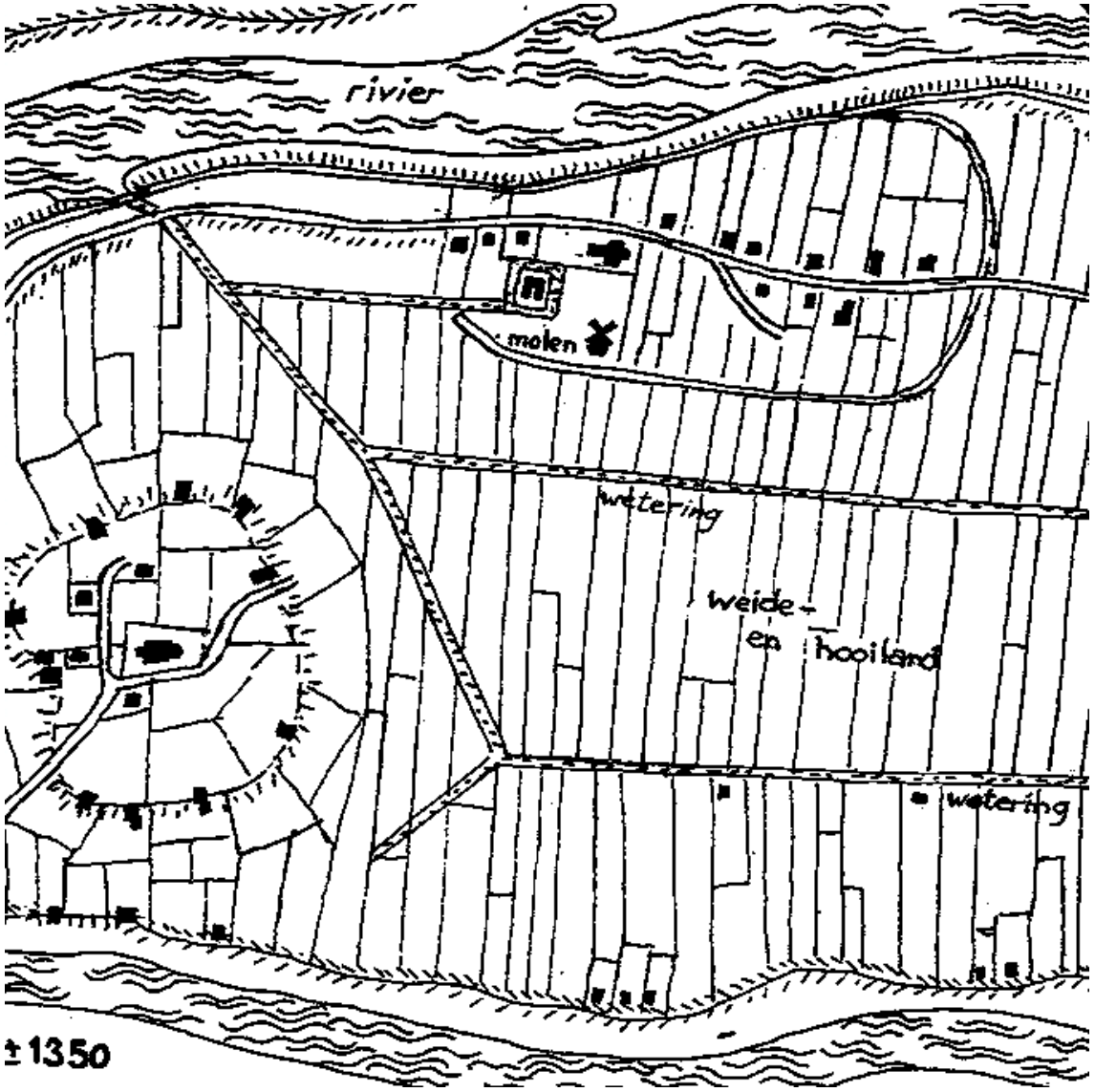
On clay along rivers



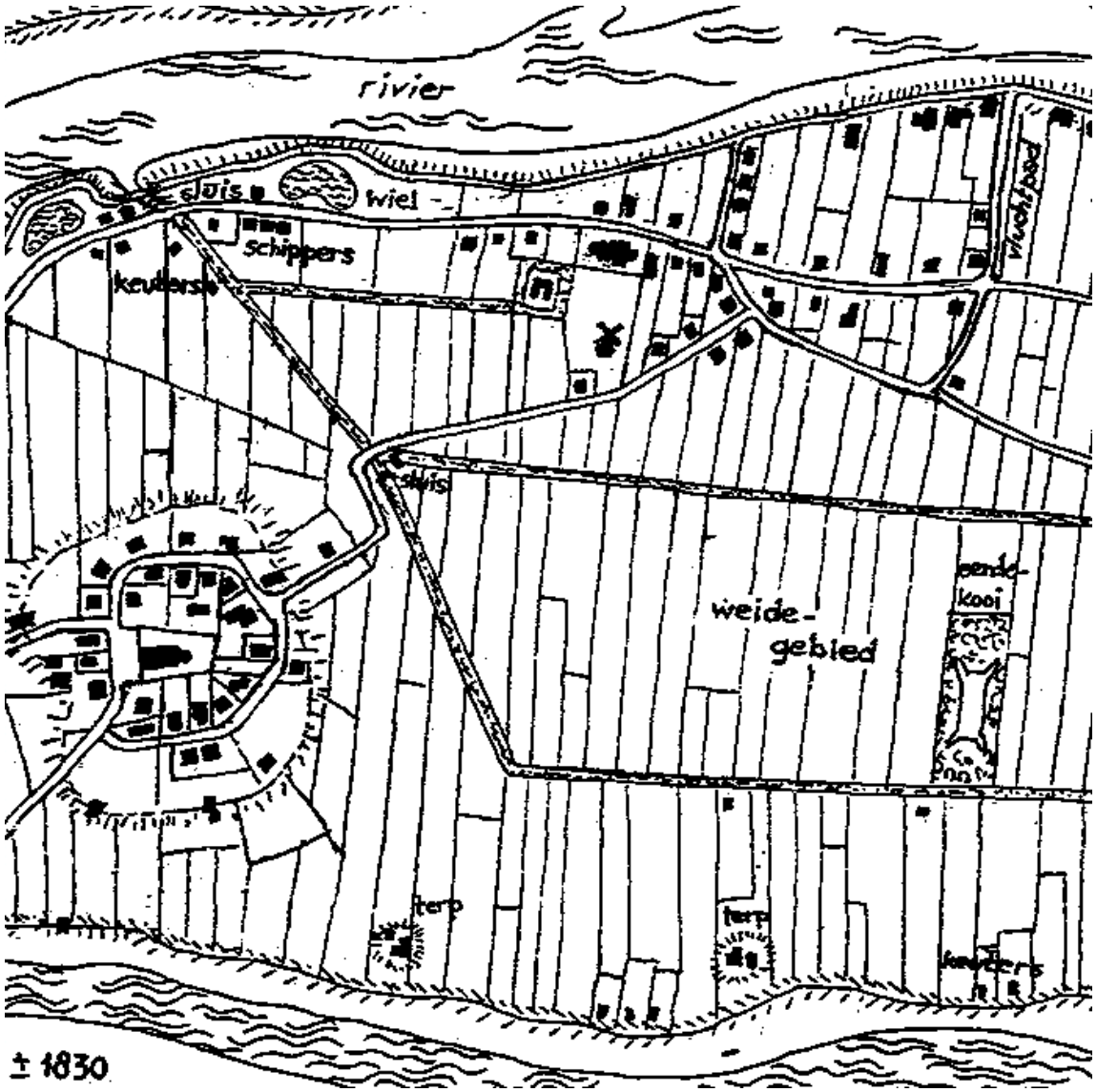
1200

On clay along rivers

1350

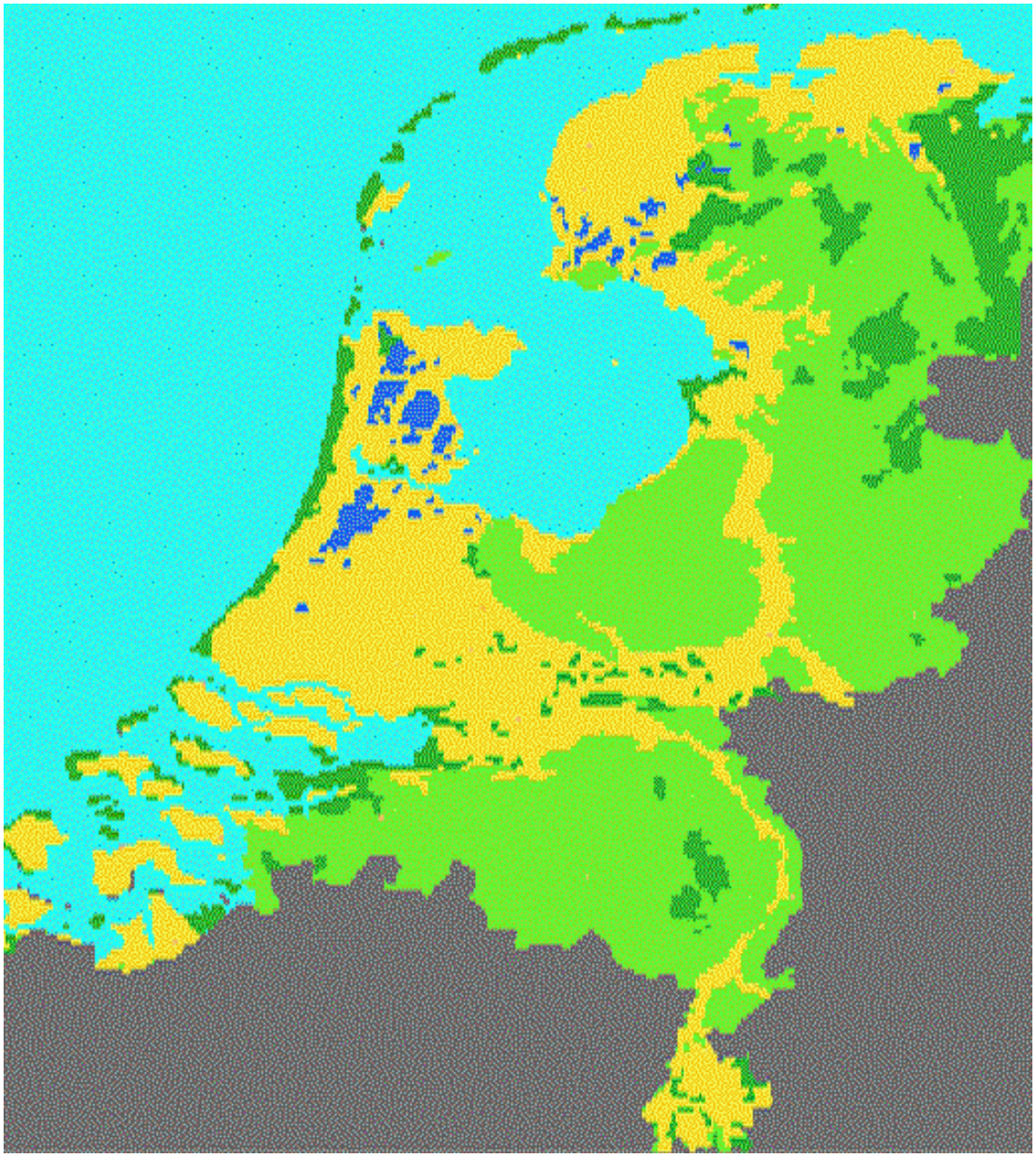


On clay along rivers

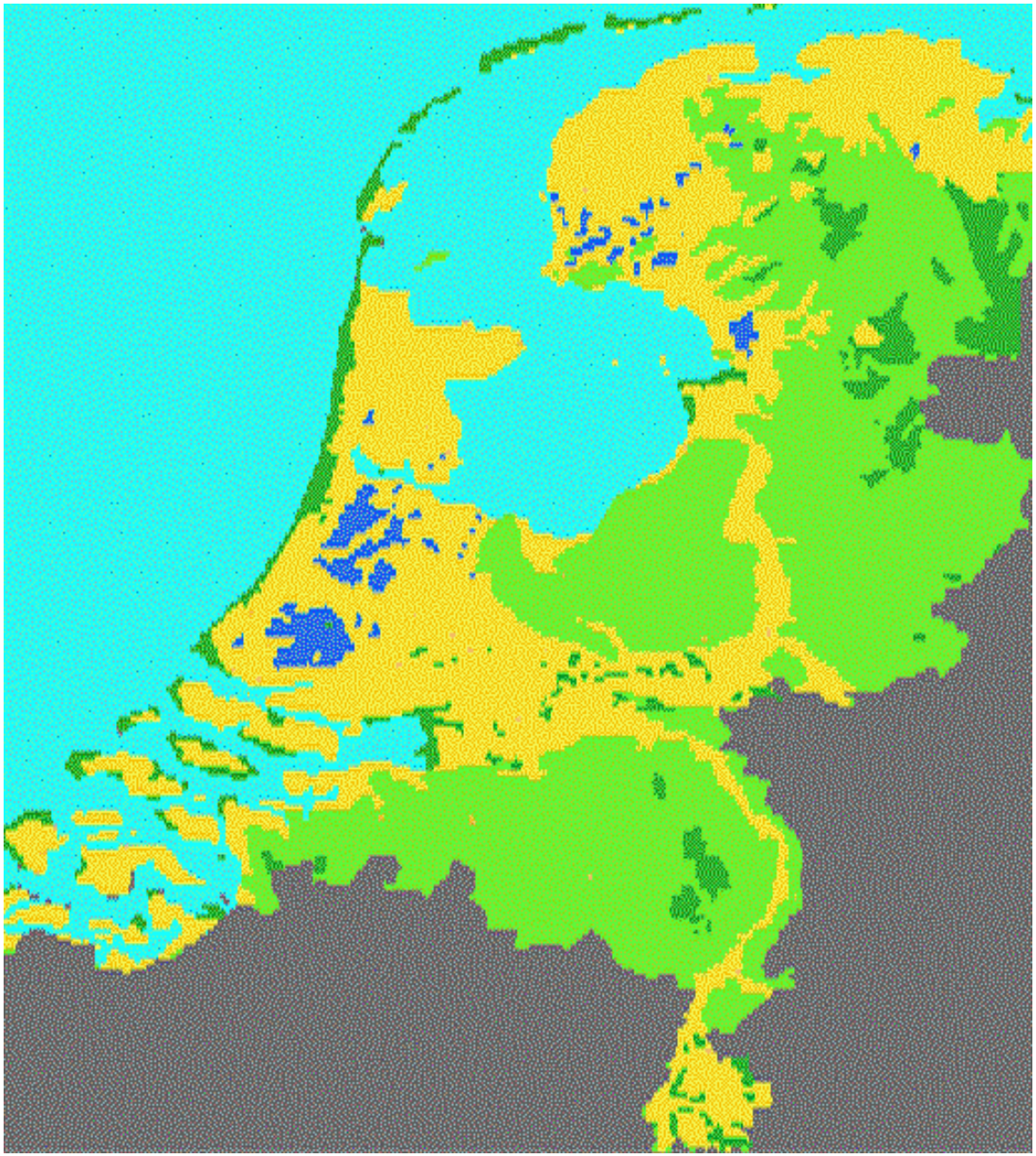


1830

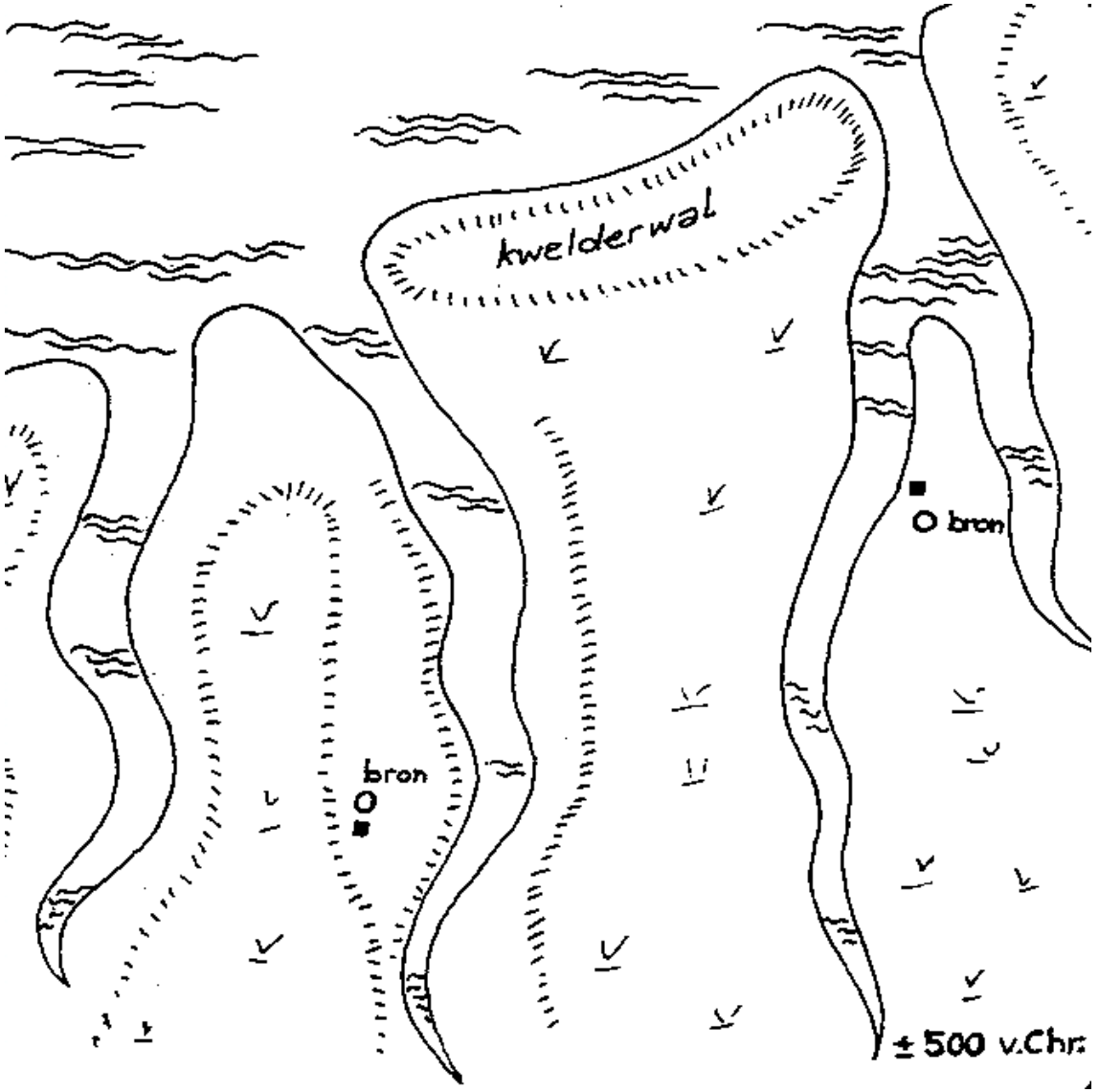
1550



1675

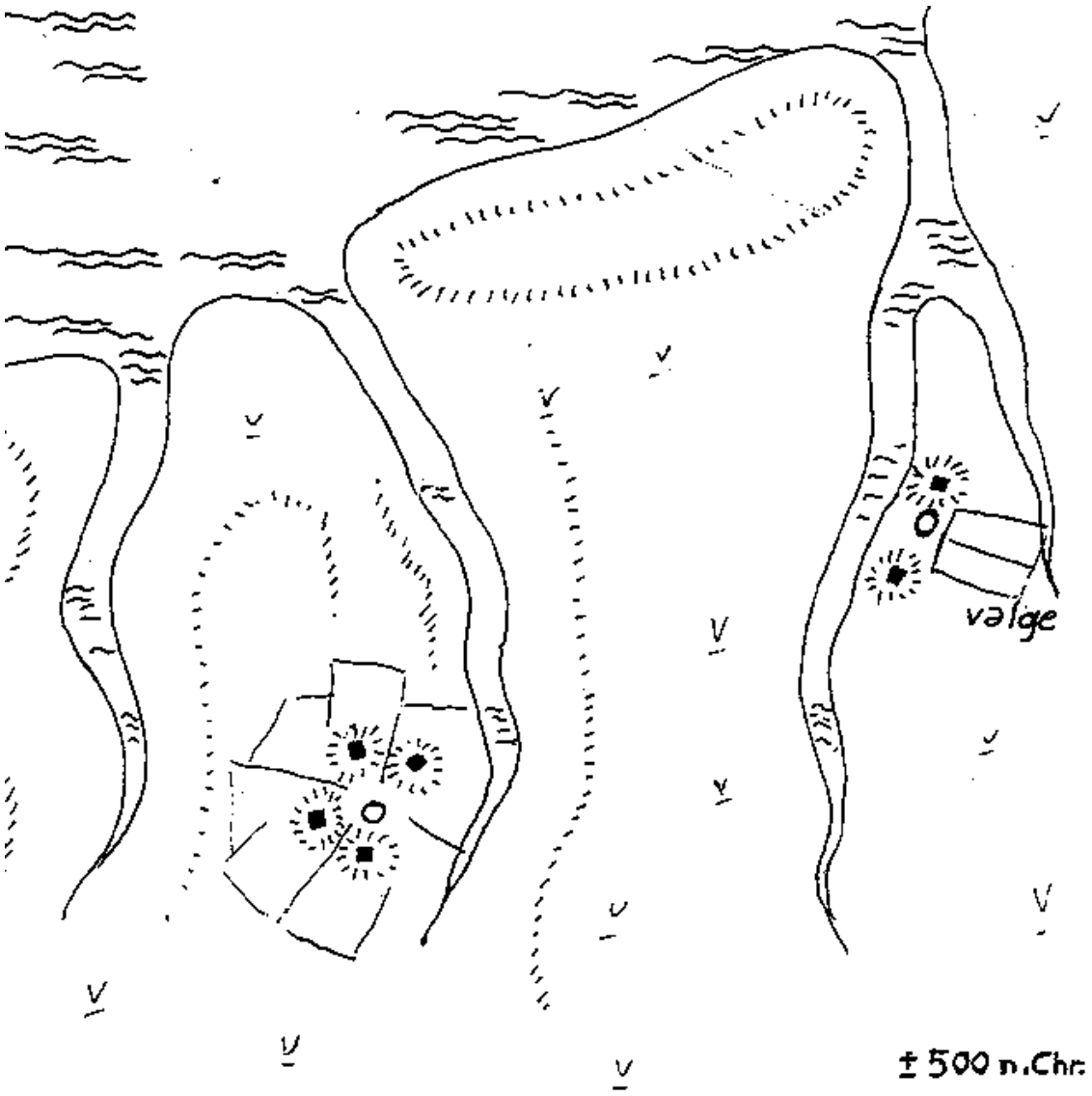


On clay along sea



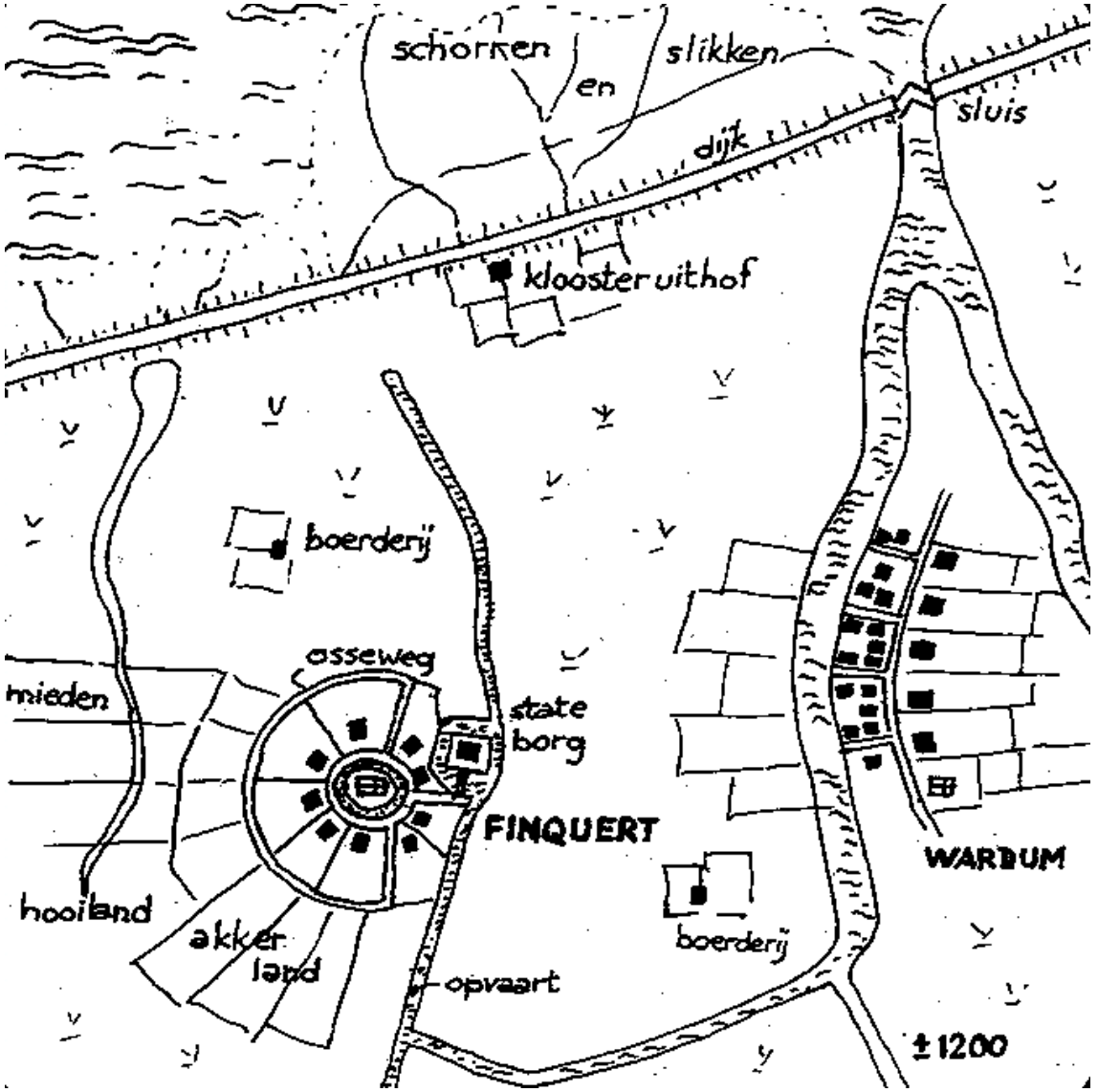
500 BC

On clay along sea



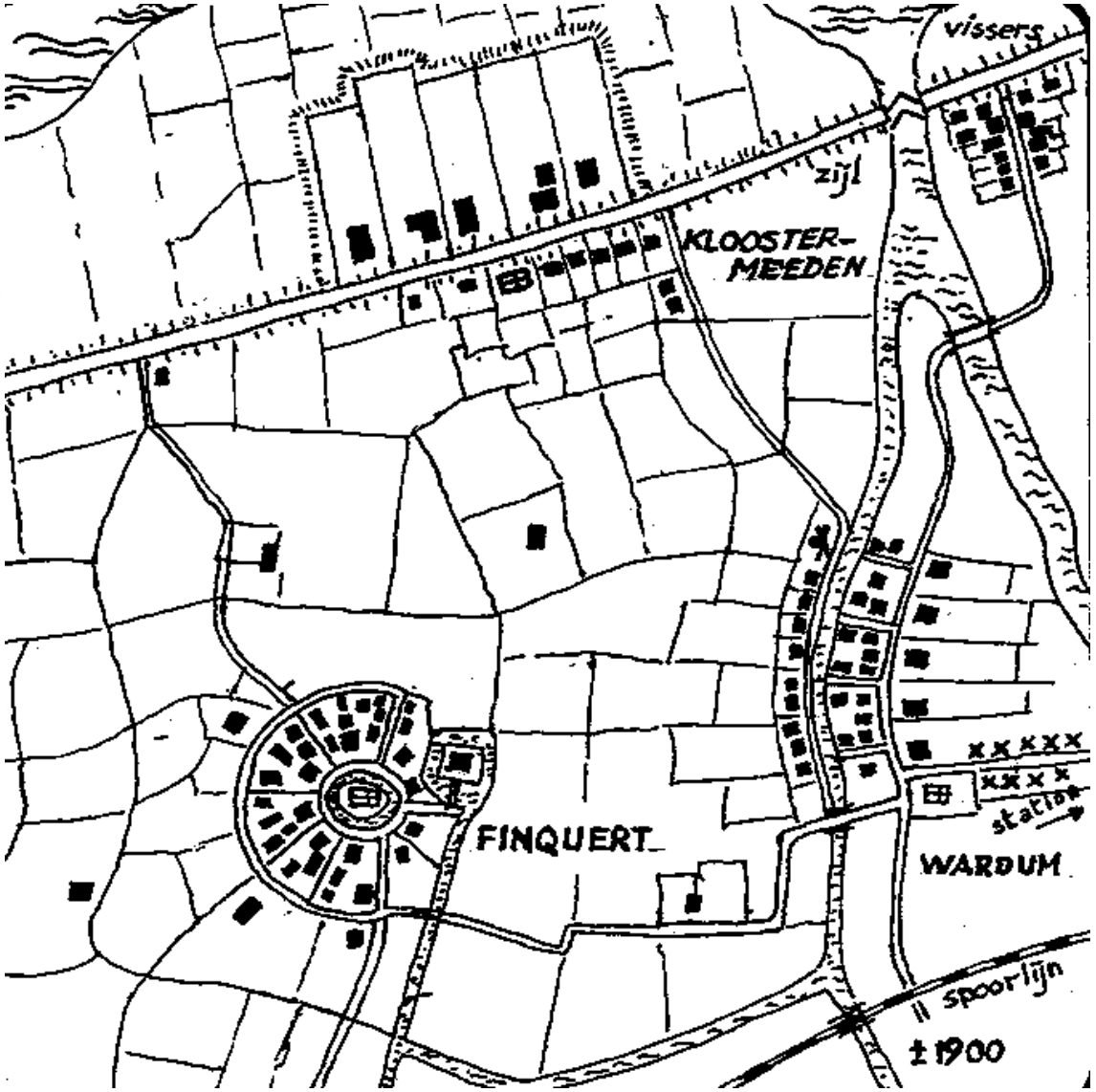
500AC

On clay along sea



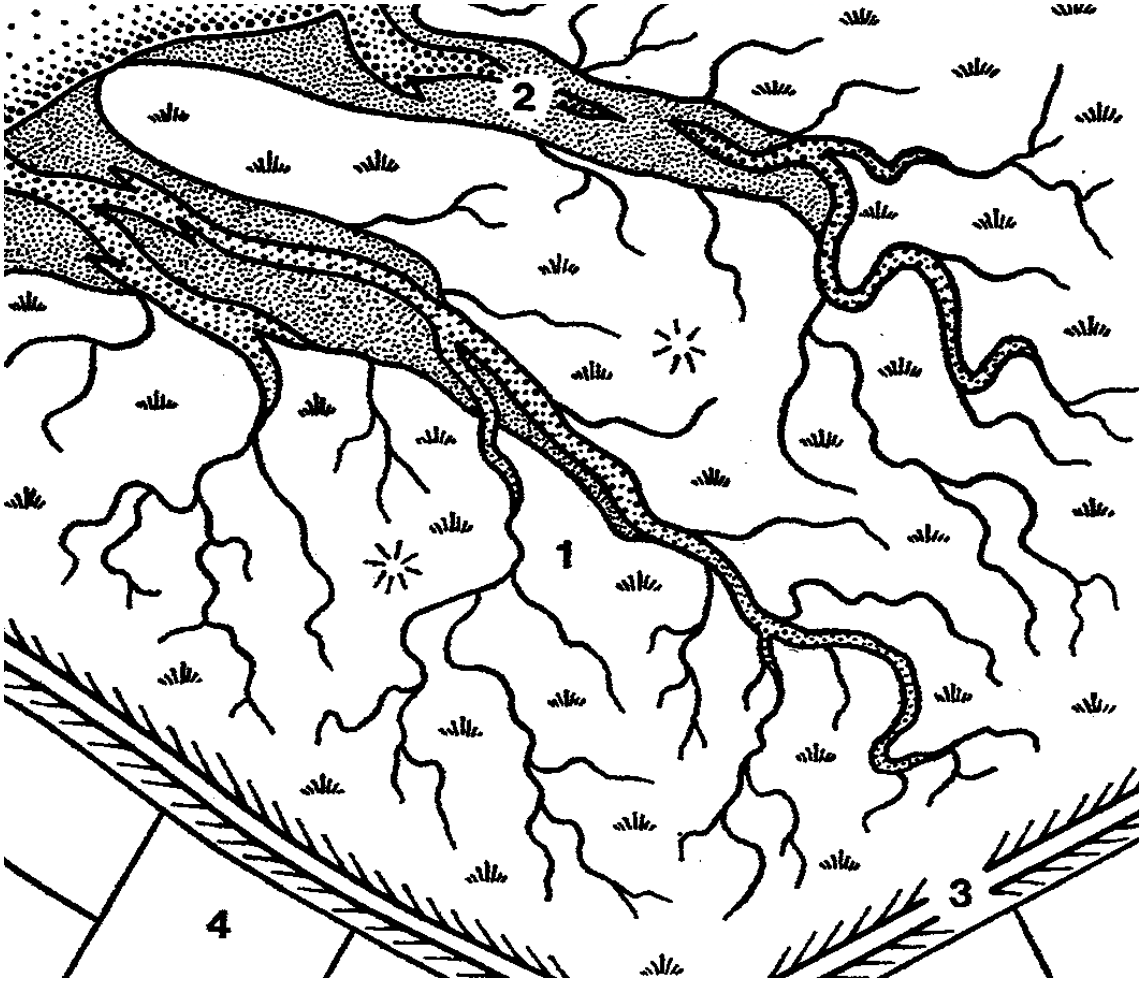
1200

On clay along sea

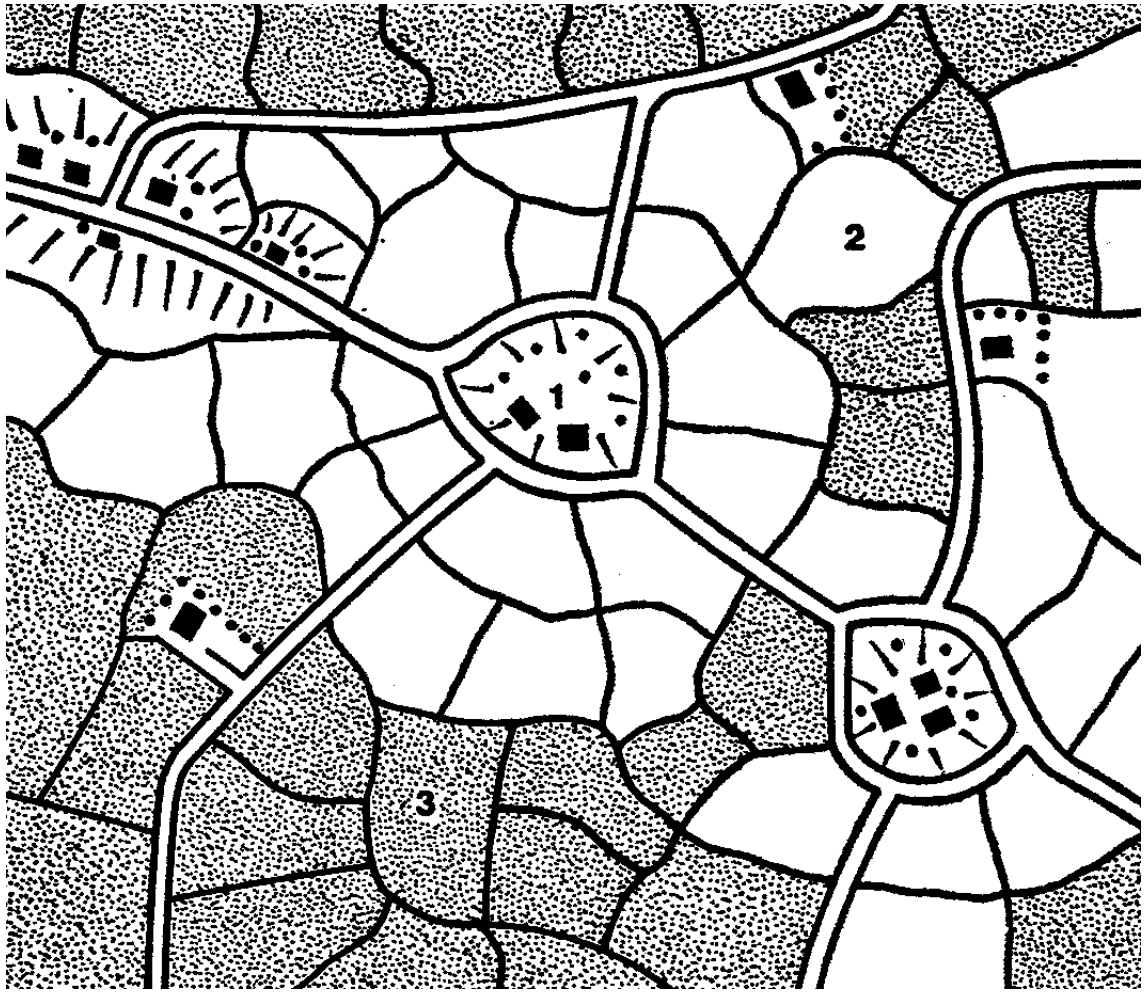


1900

Buitendijks natuurgebied

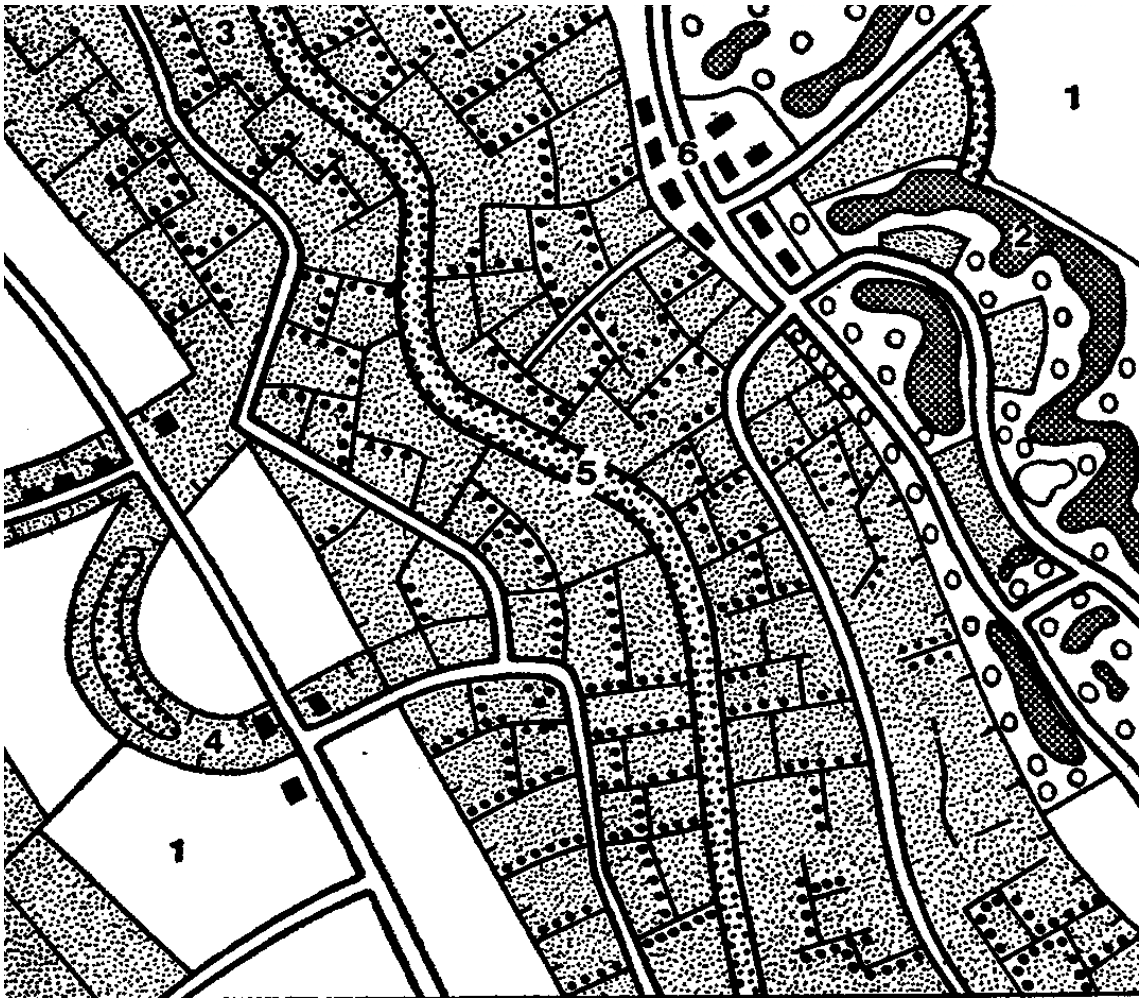


Terpenlandschap

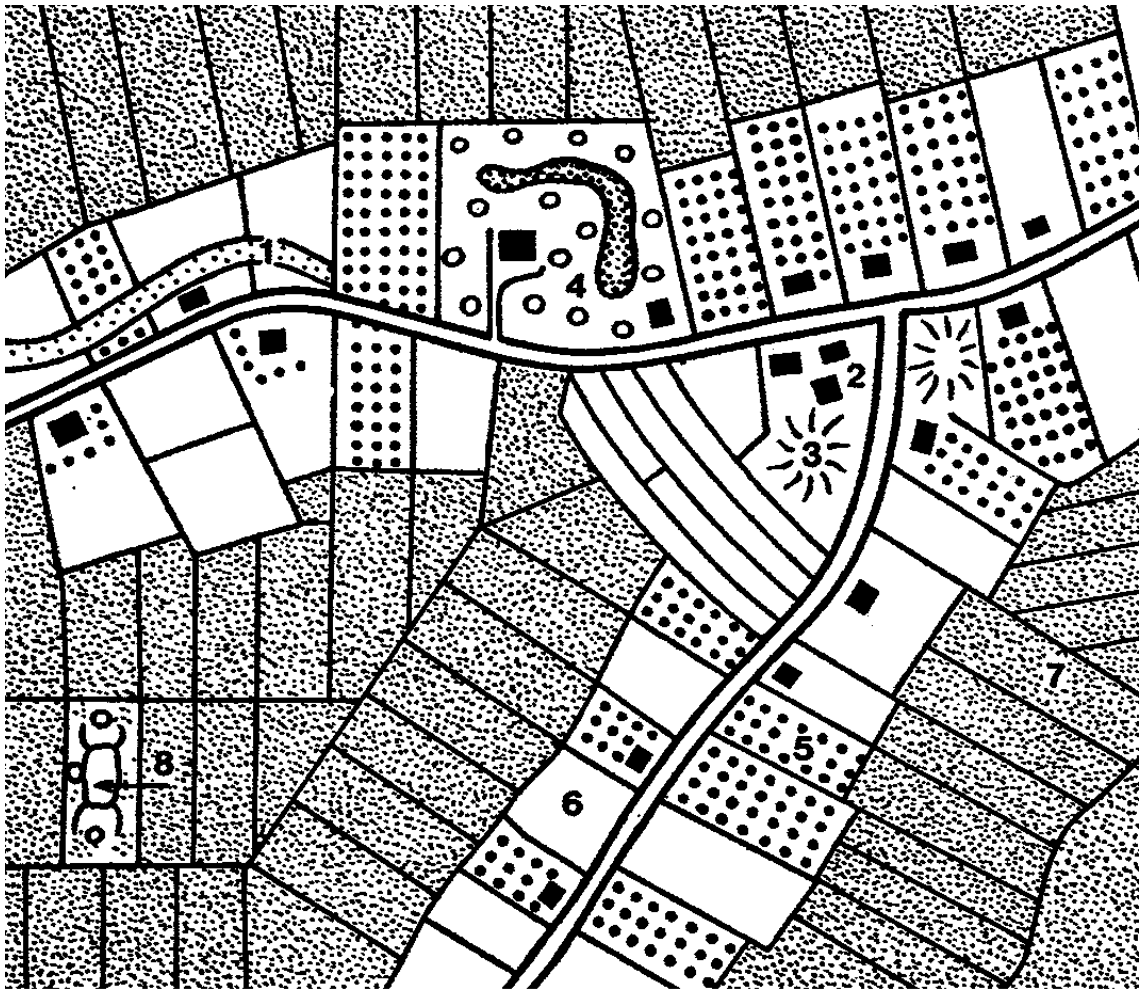


Noord-Limburg

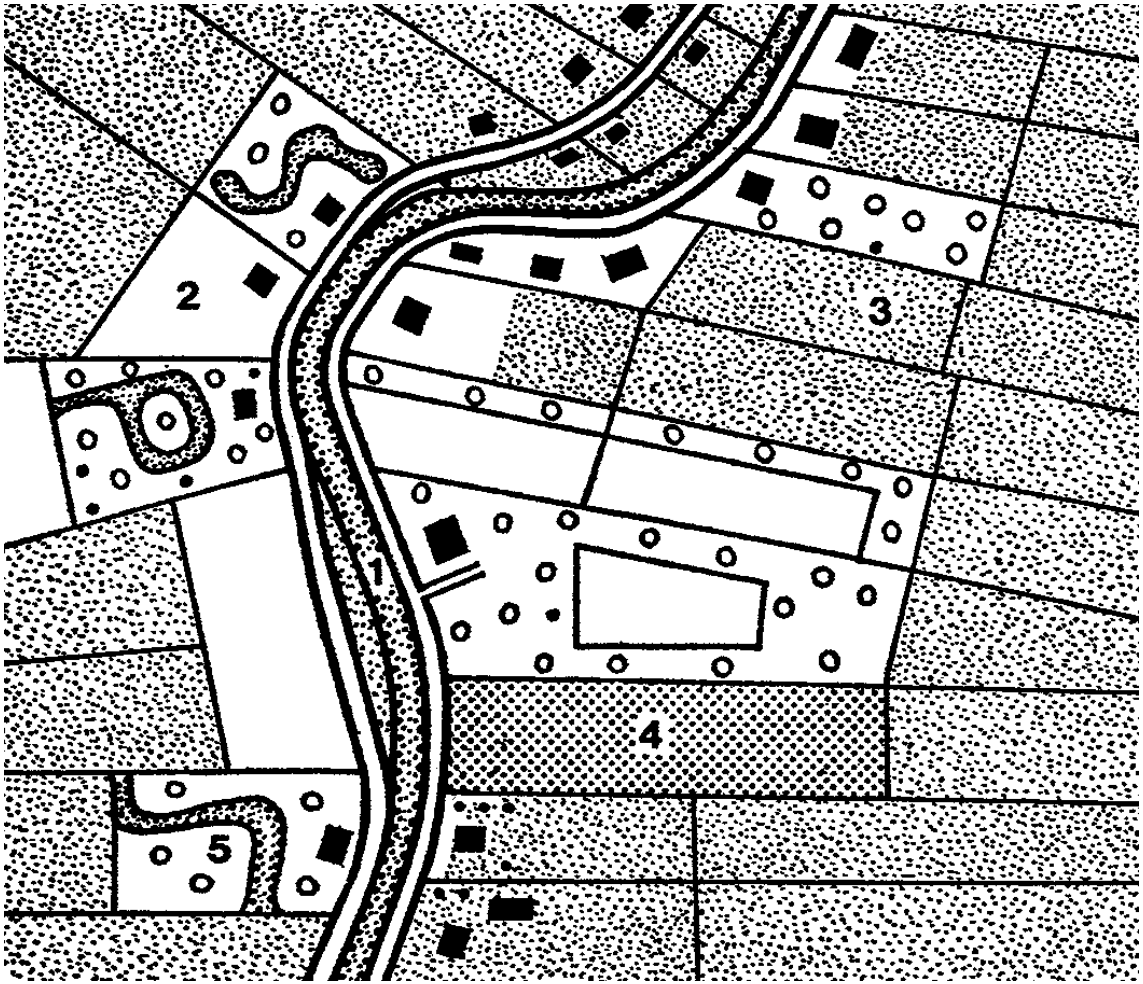
1. bouwland op rivierterras
2. oude rivierduinen
3. heggenlandschap
4. oude rivierbedding
5. rivier
6. nederzetting



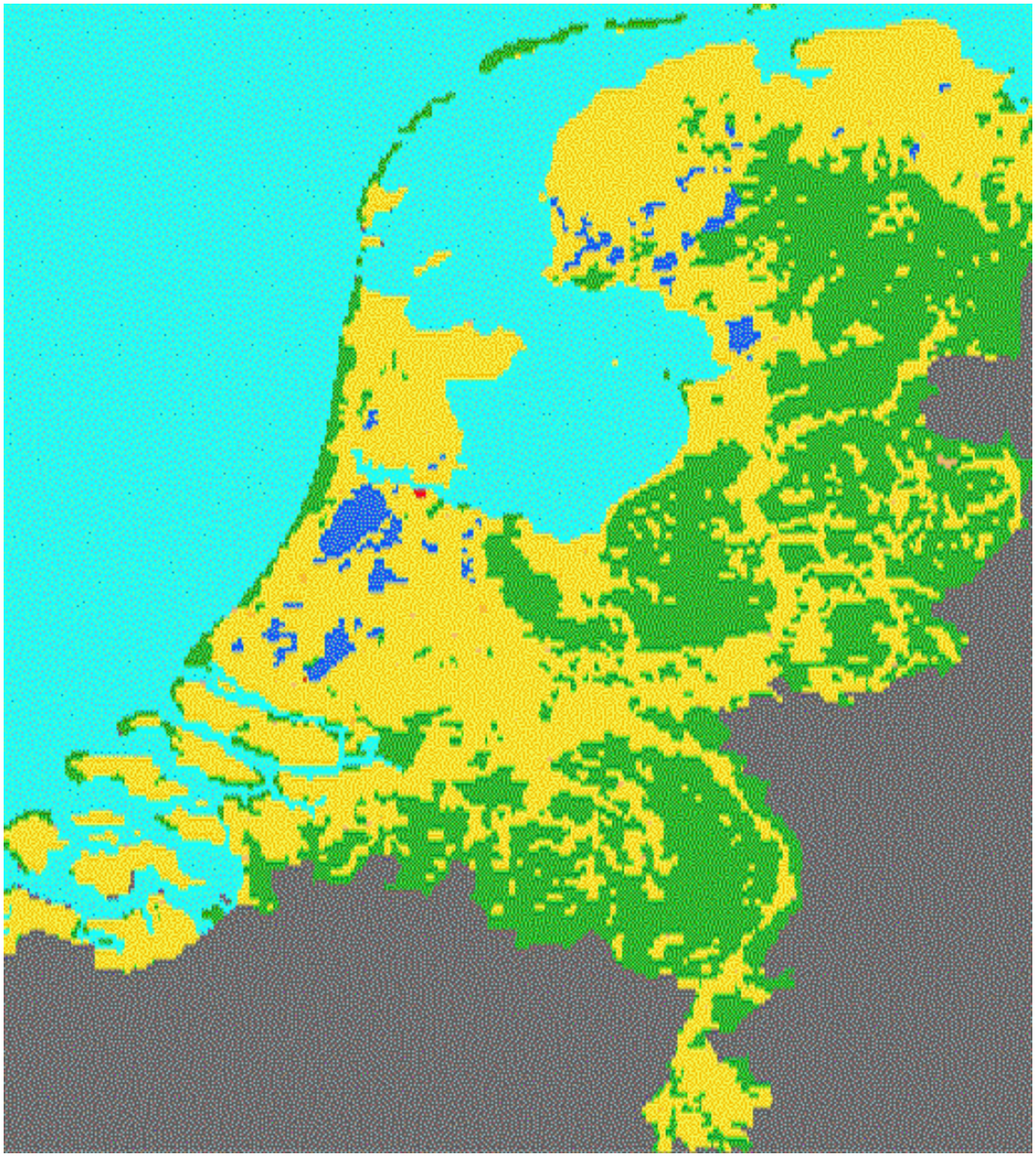
Rivierenlandschap



Landgoederen West-Utrecht

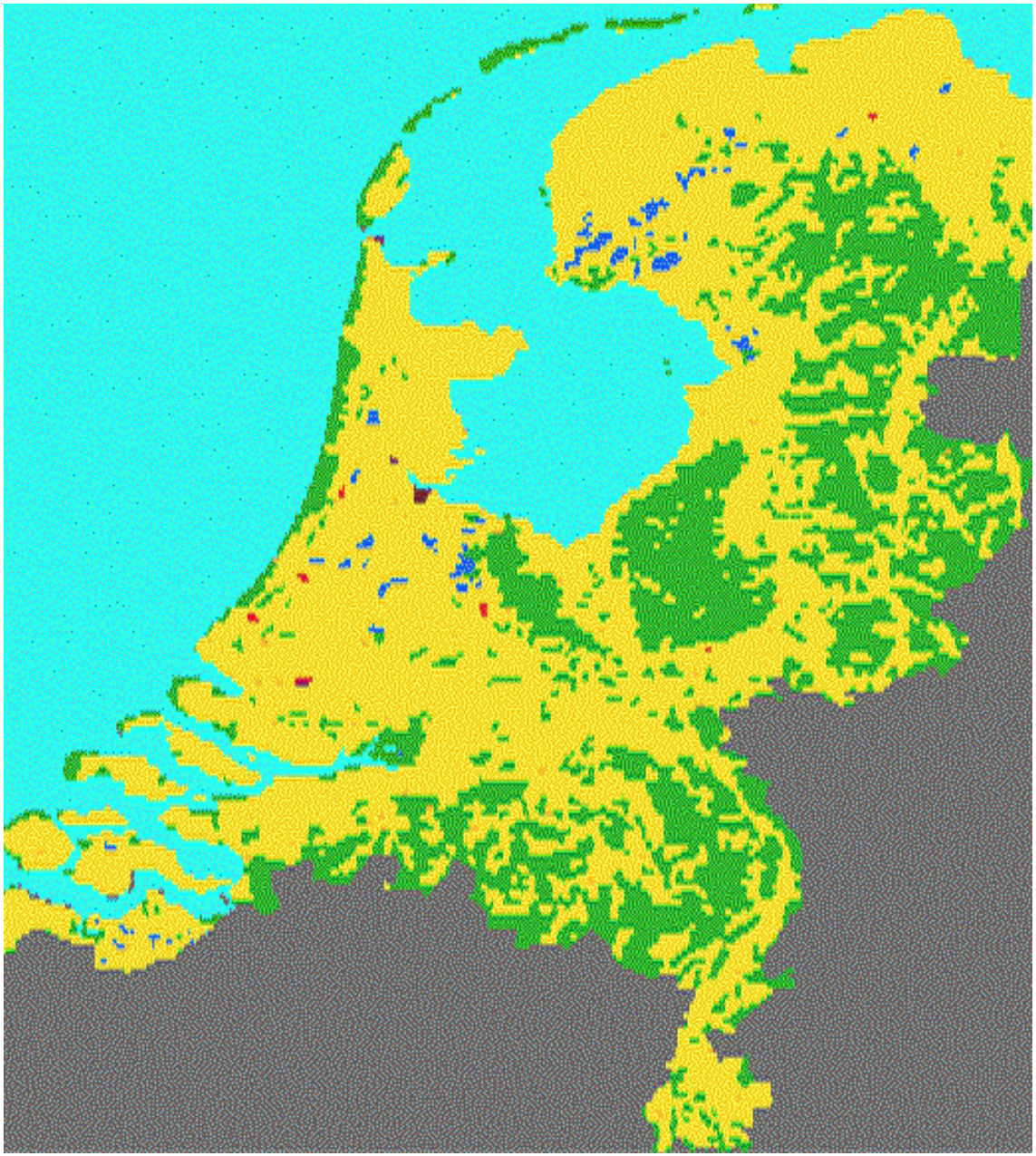


1800

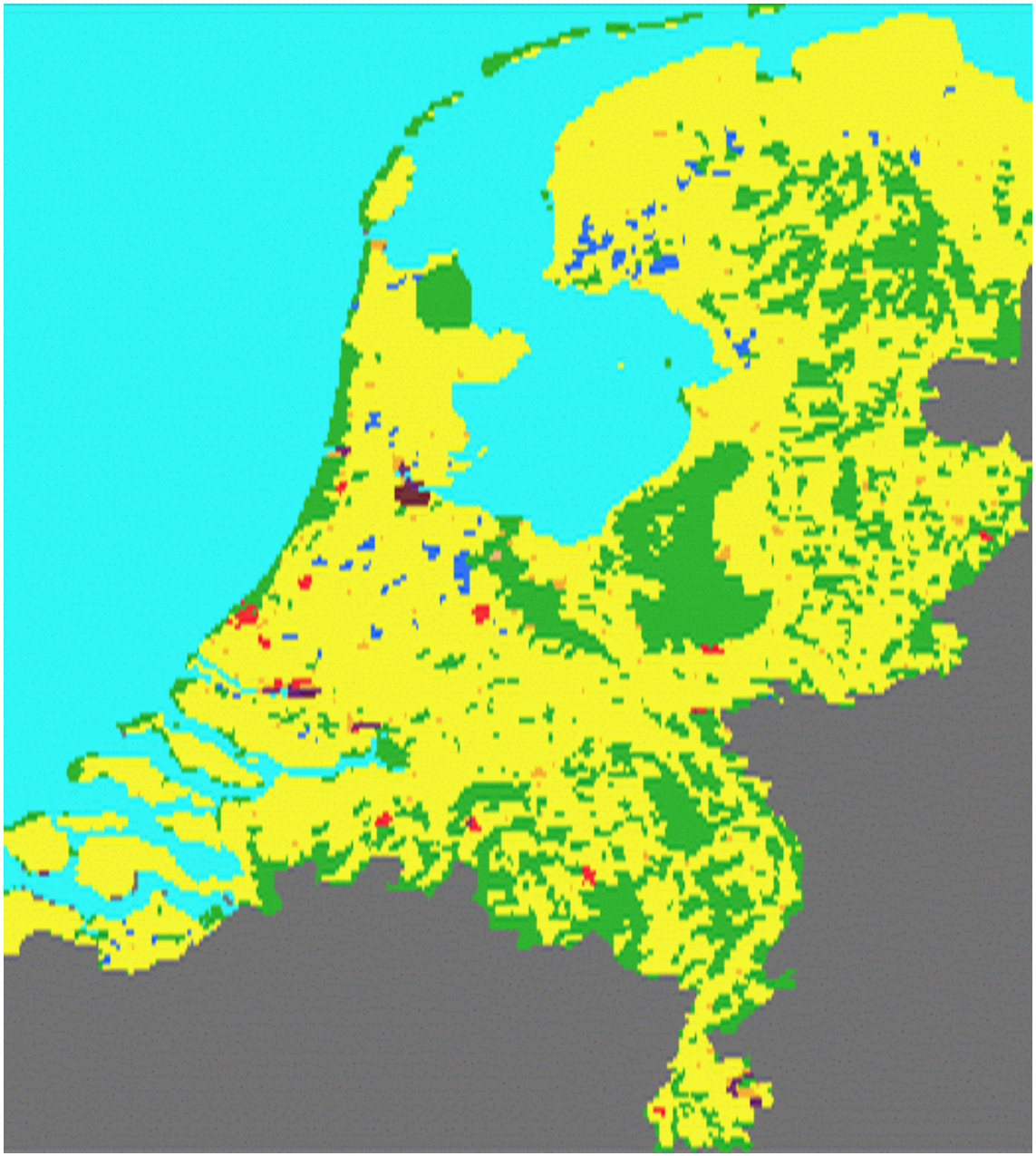


1850

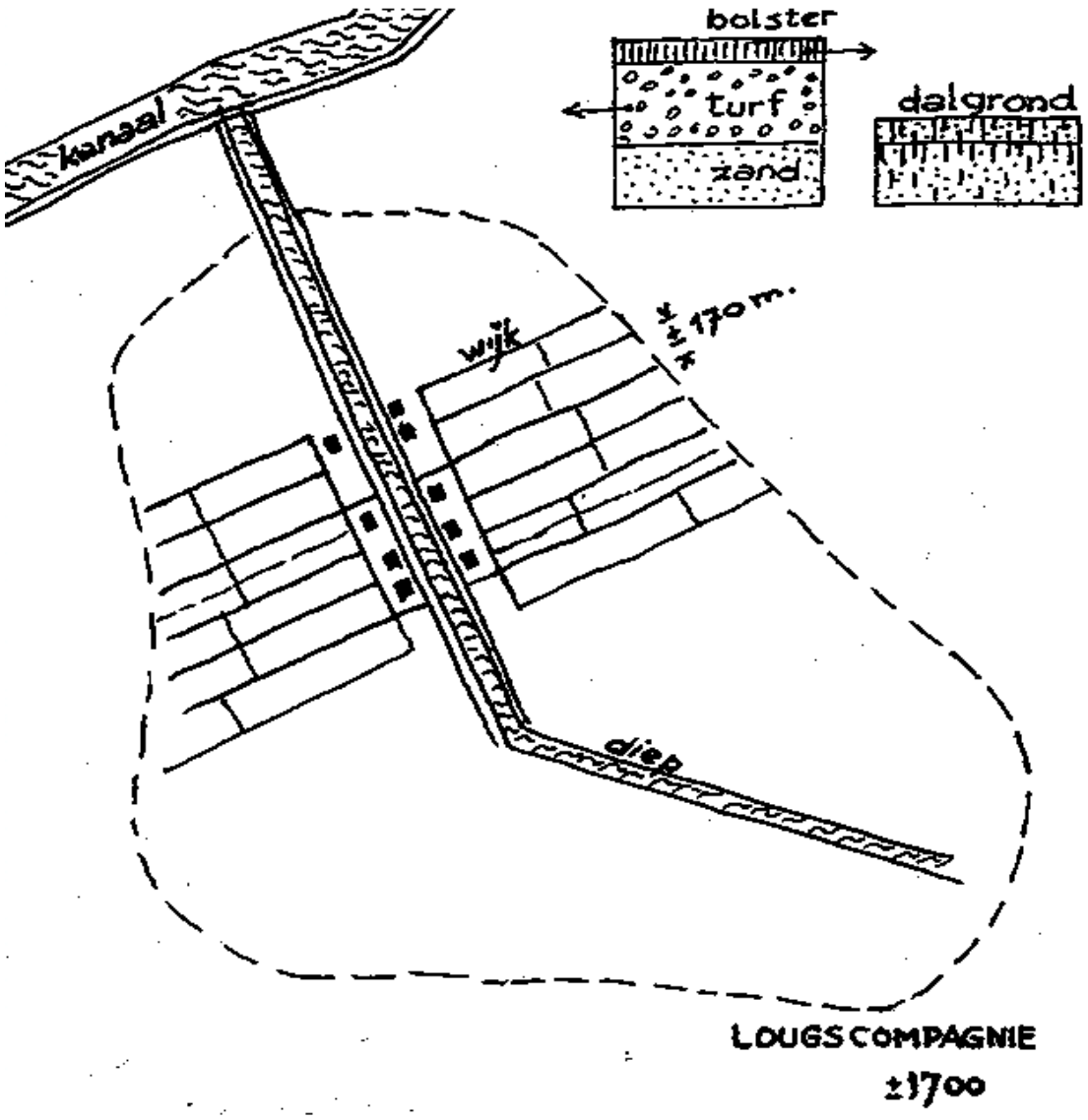
1900



1930

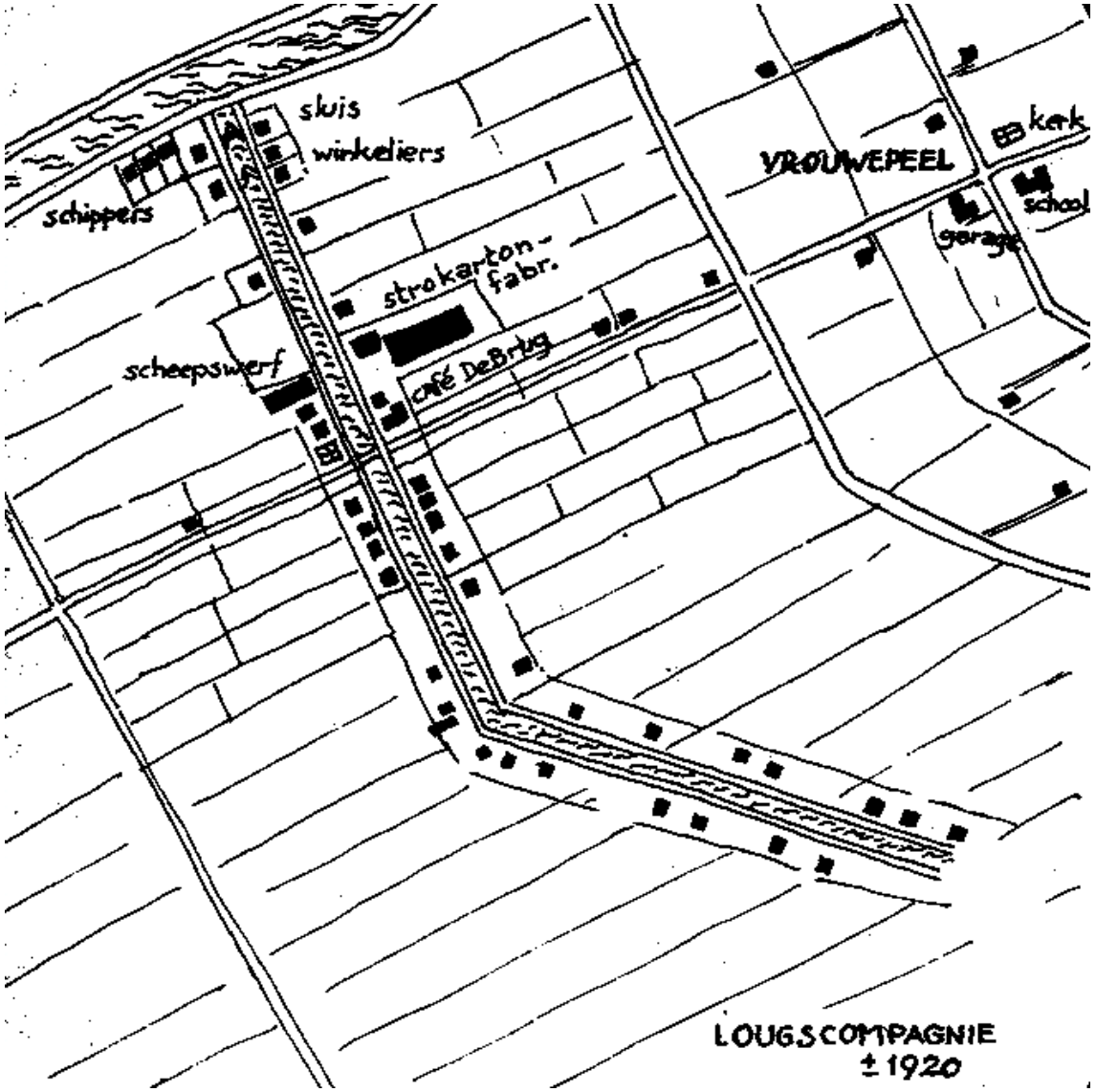


New on peat



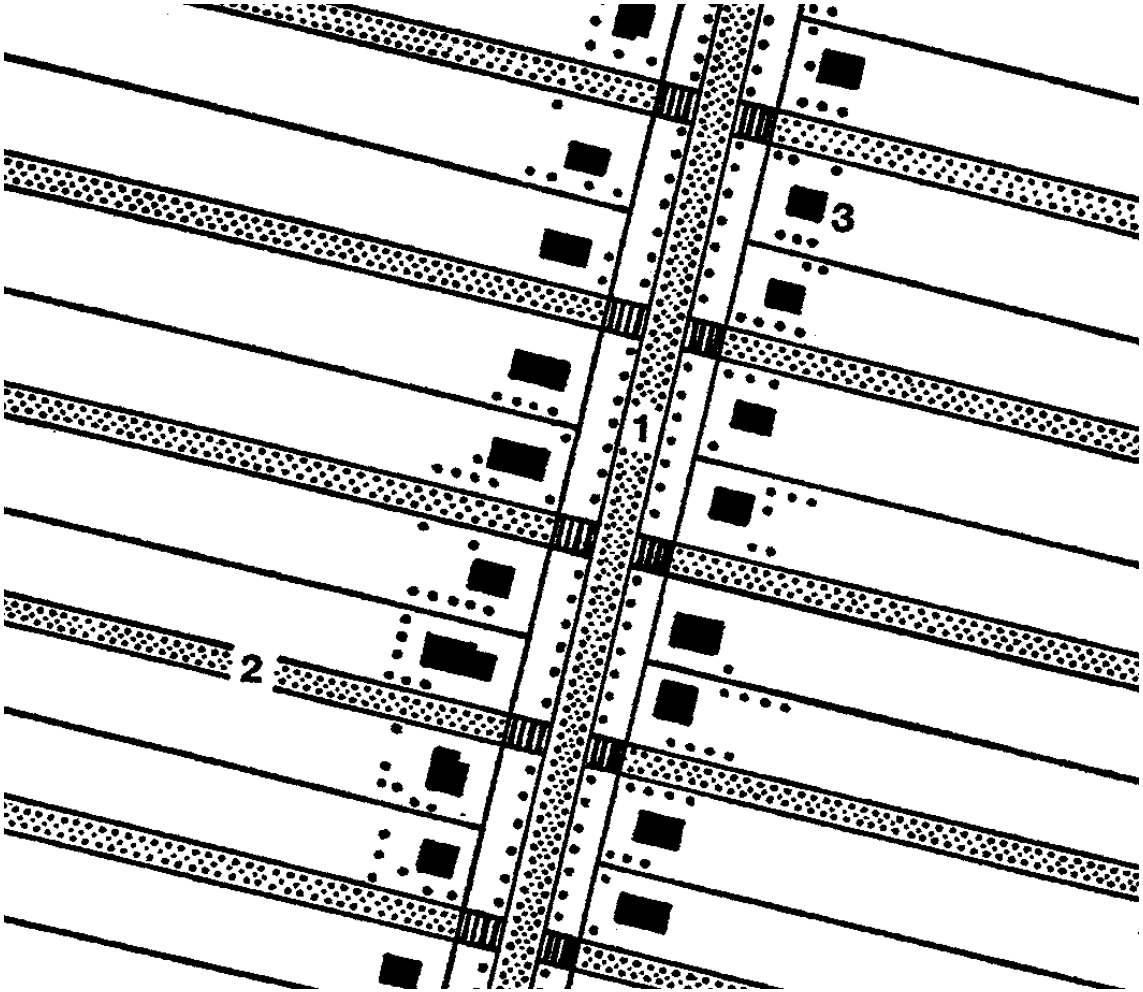
1700

New on peat

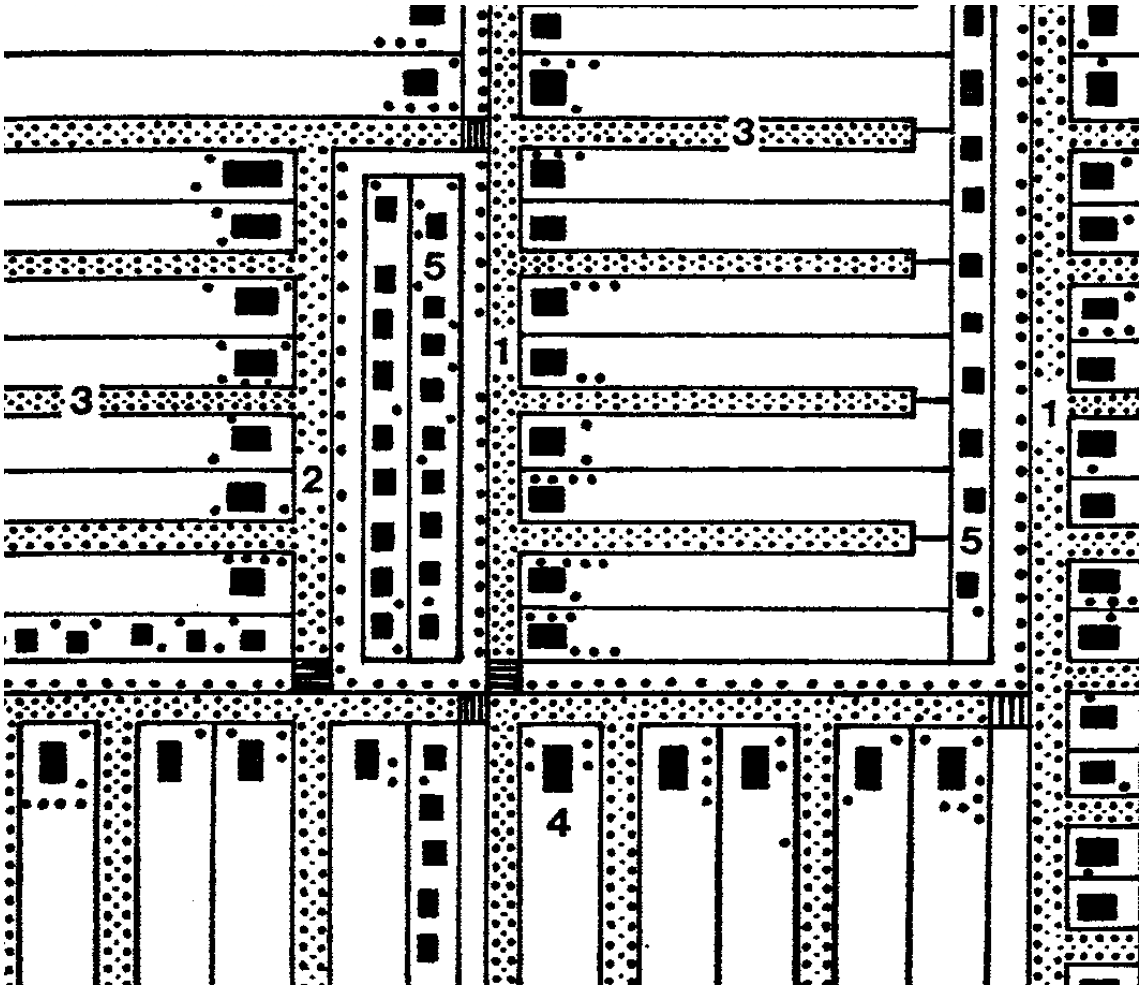


1920

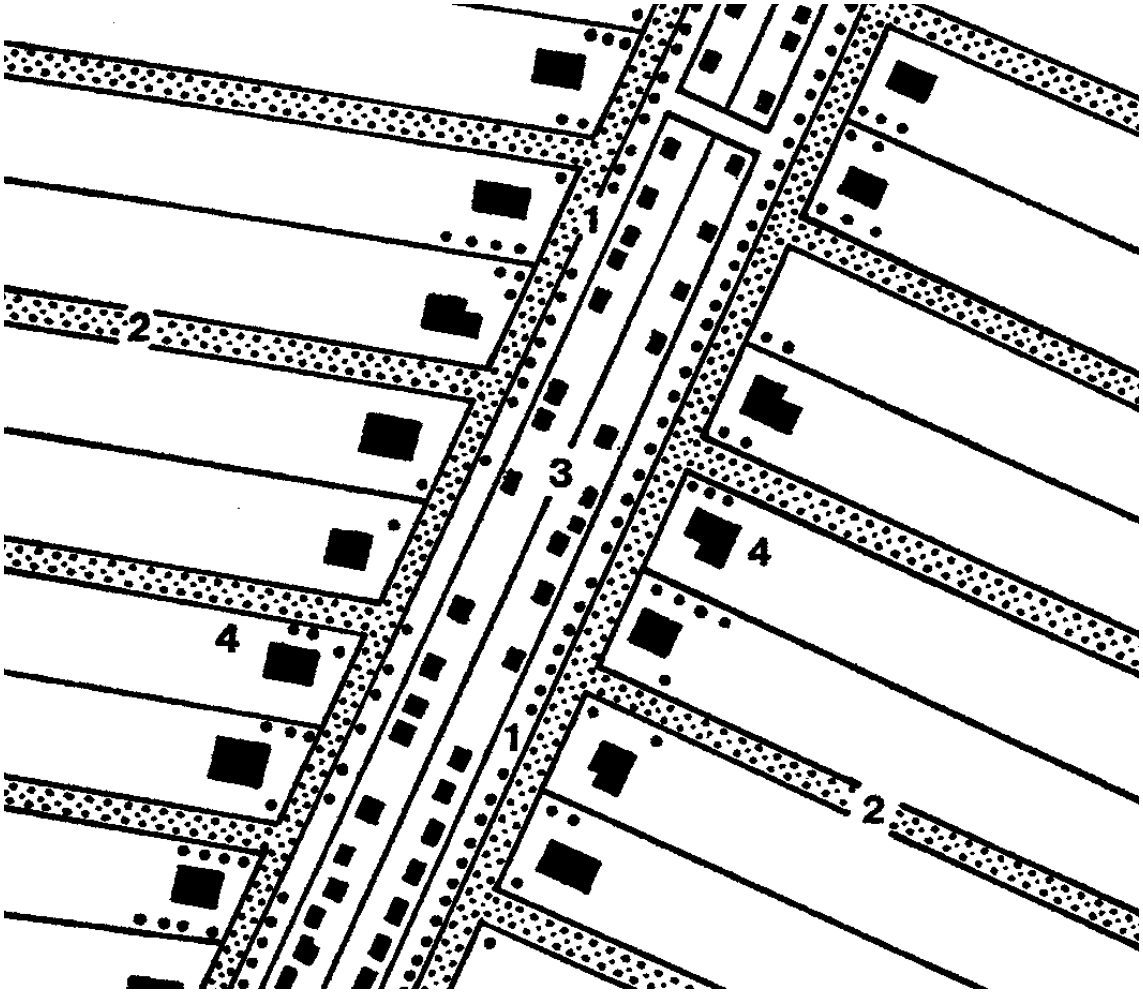
Kanaalveenkolonie



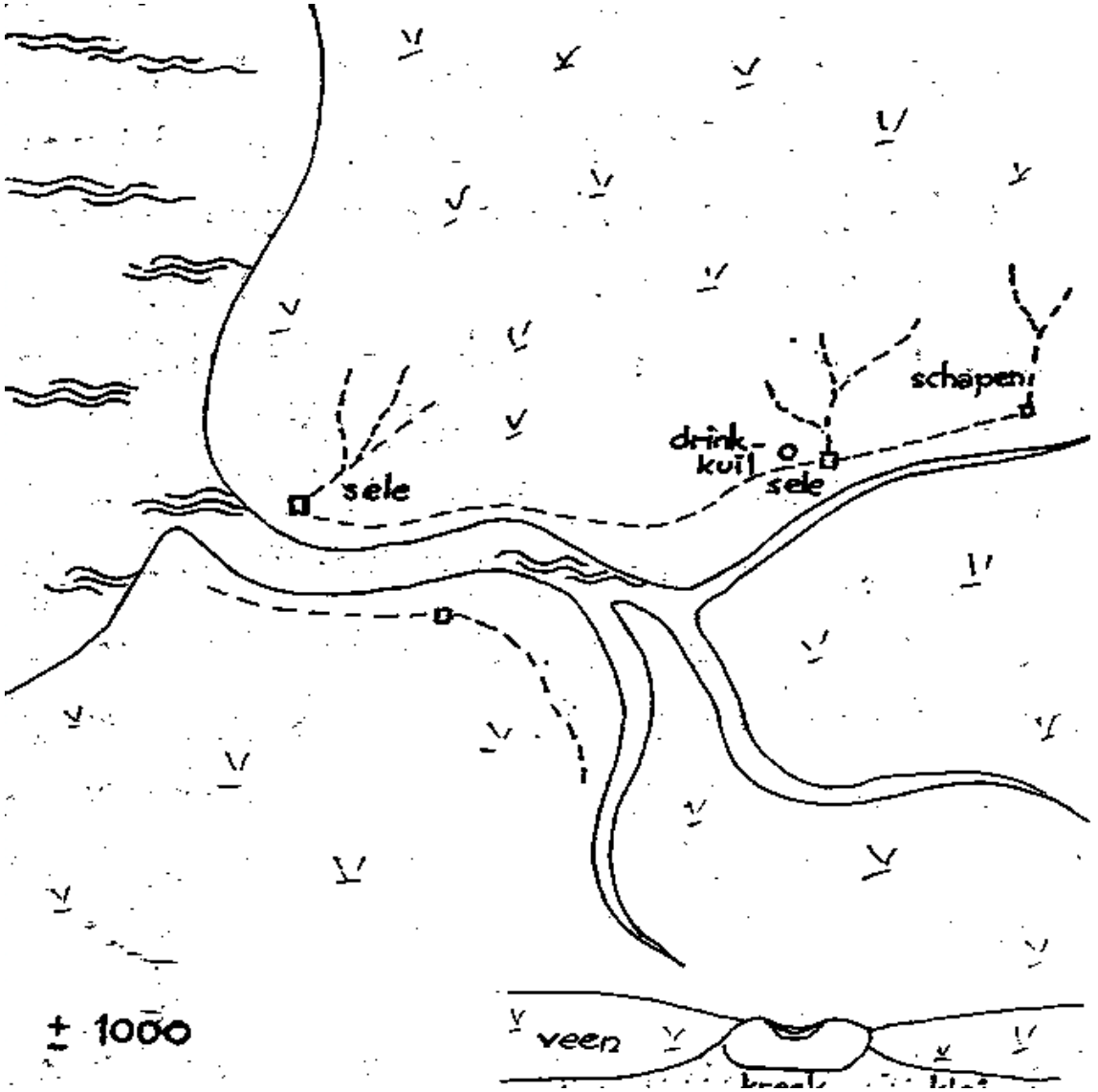
Kanaalveenkoloniën



Kanaalveenkolonie dubbelmondtype

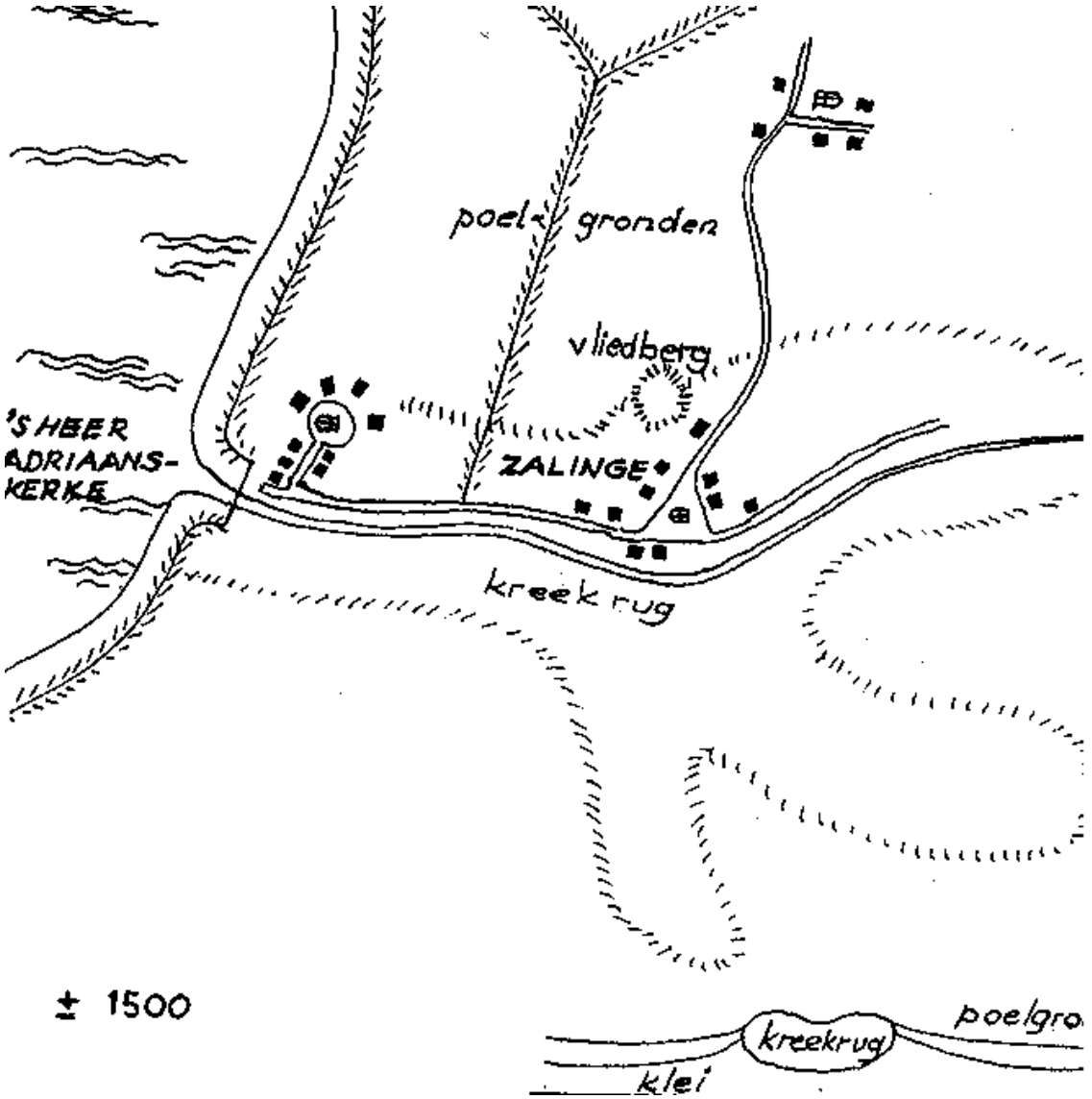


New on clay



1000

New on clay



1500

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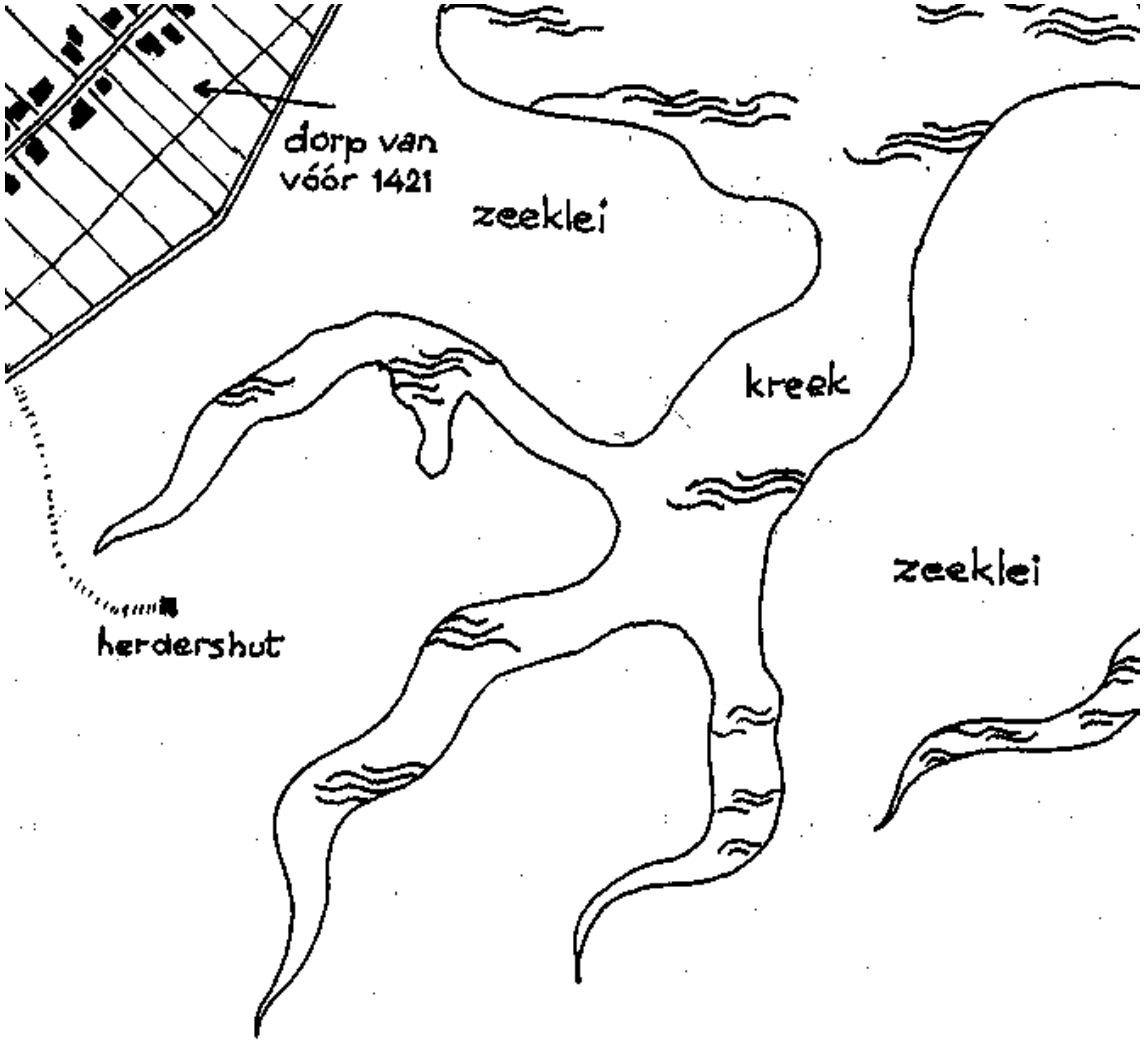

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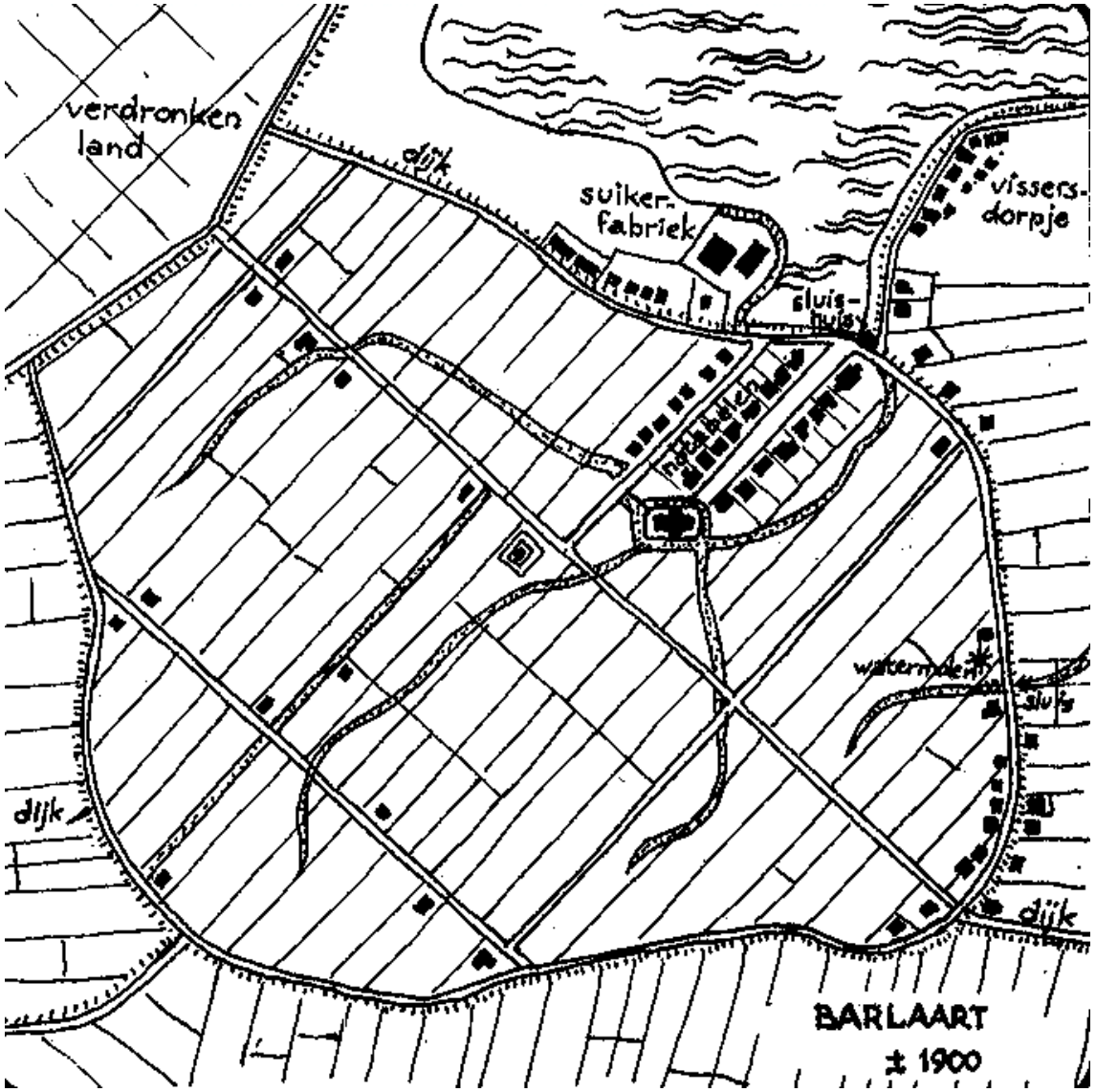
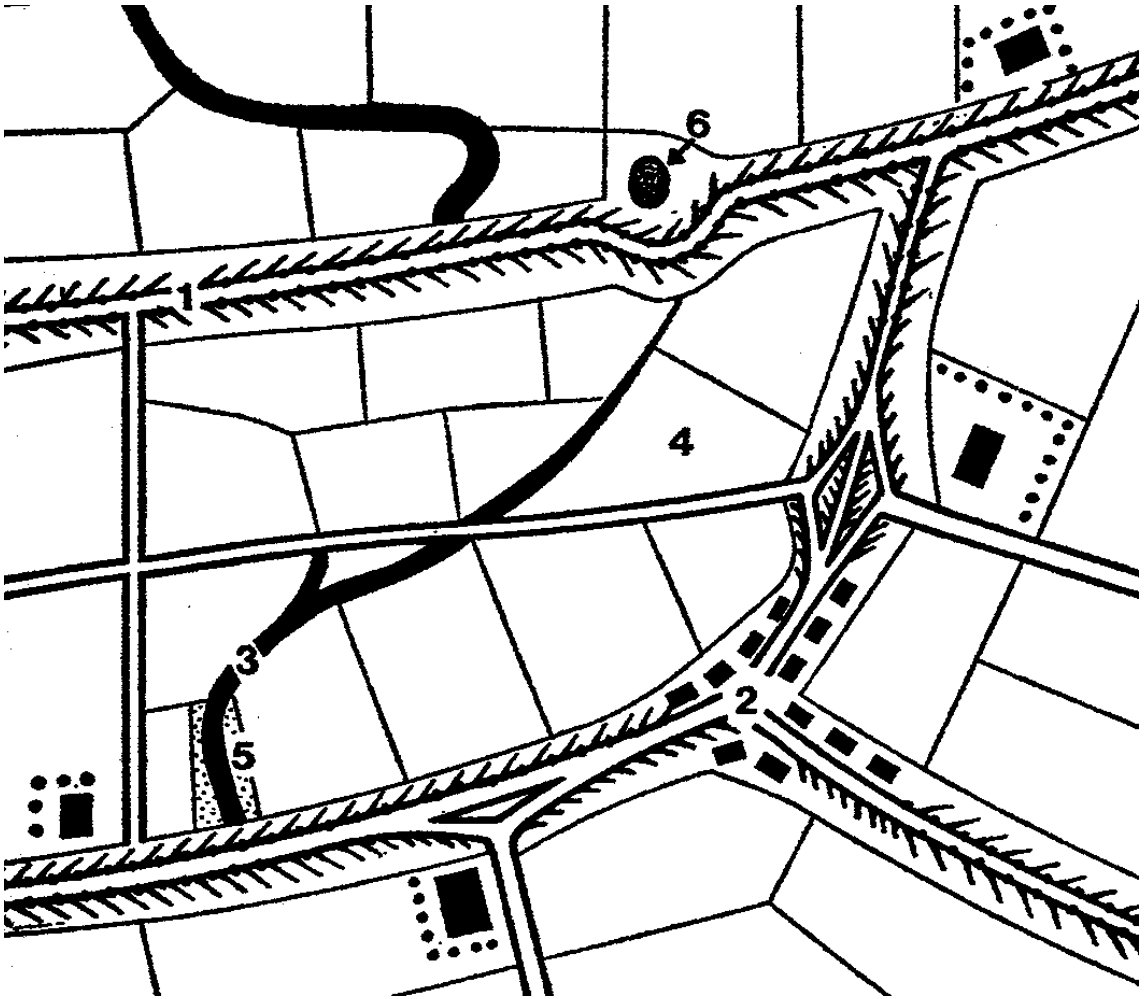


1900

Bedijking ZW Nederland



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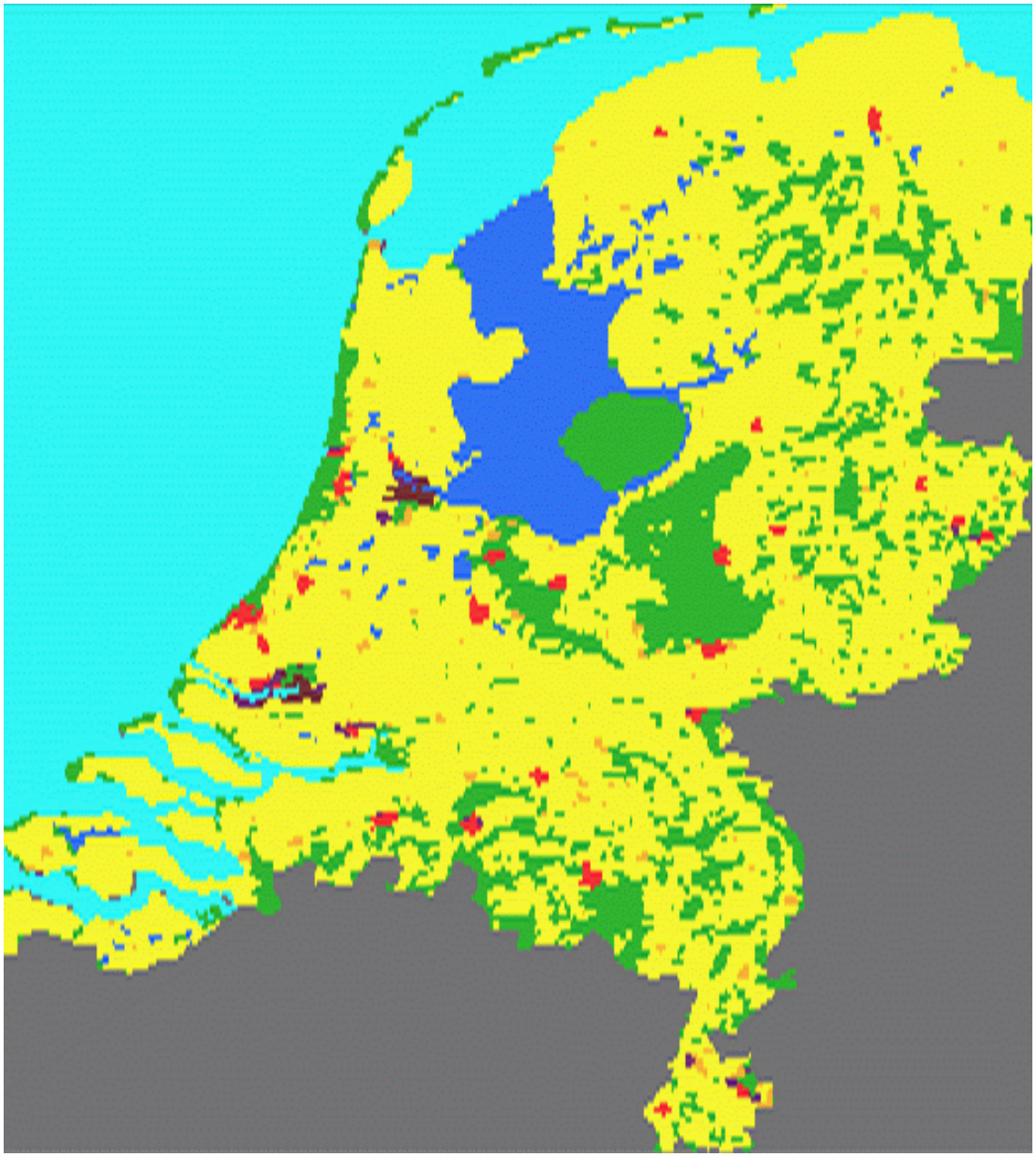

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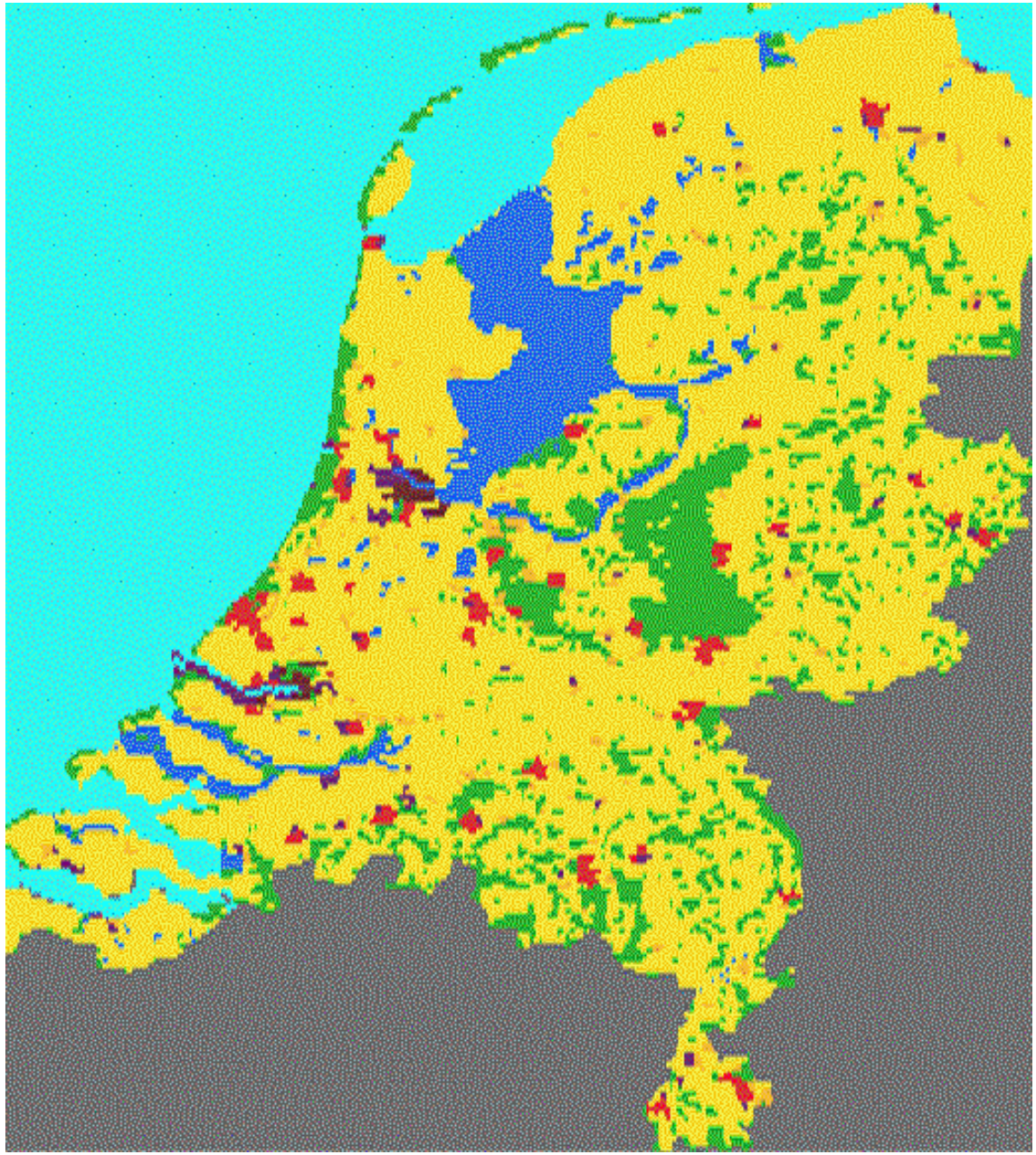

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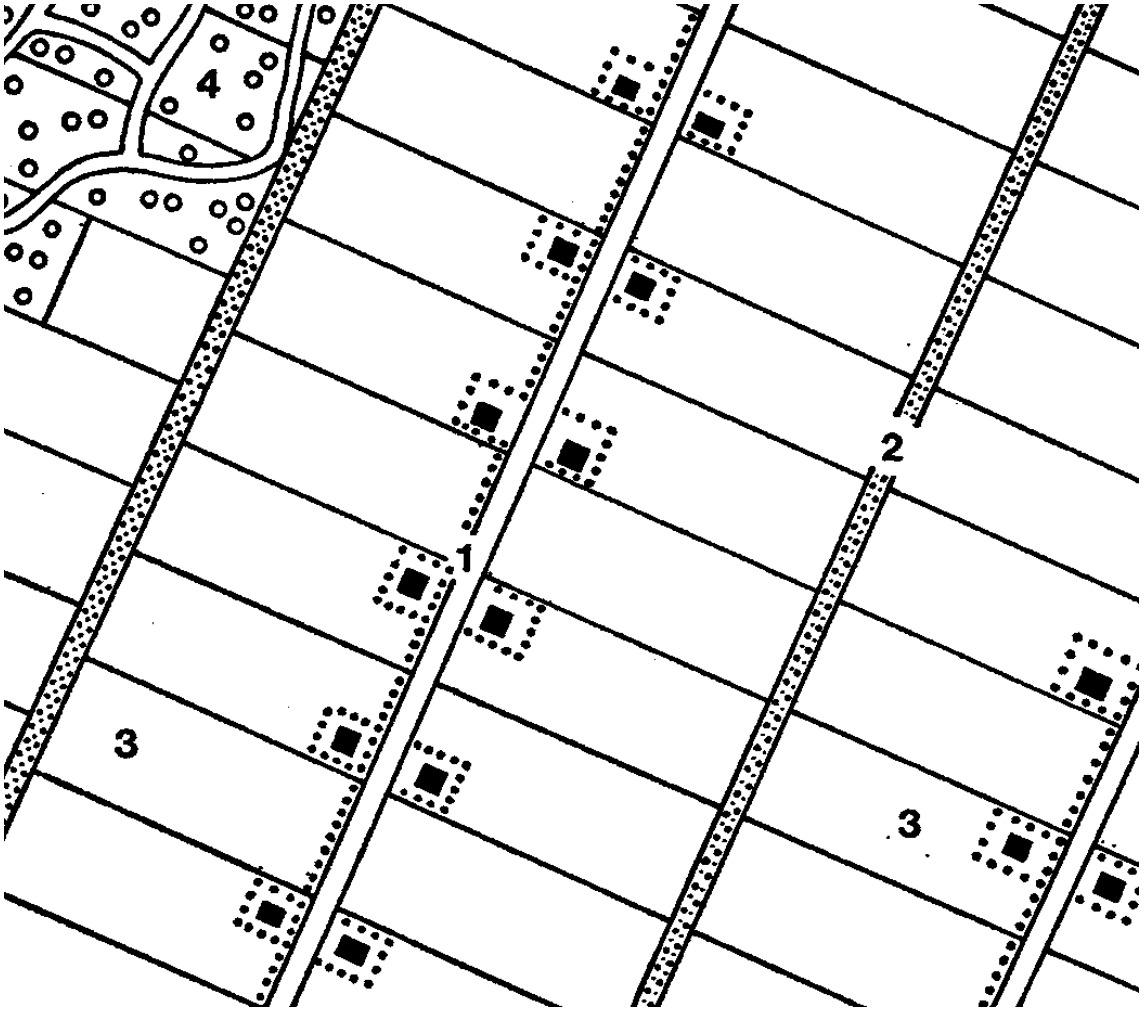

Land consoliation (Ruilverkaveling)