Advanced GIS Poster presentation, June 2007

Sustainable Urbanization in Utrecht Province

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Abstract

Using two scenarios, we investigate the possibilities for sustainable urbanization in Utrecht Province. First we study the concept of sustainable urbanization and formulate a sustainability measurement unit (SMU). By choosing a study area in which both scenarios can be expressed, we set the stage for this project. For this study area we calculate the suitability for both scenarios, using the SMU. Next we allocate areas for new dwellings. And finally, using network analysis as a check, we compare the outcome of both scenarios.

Sustainability:
- Socio-economic
- Environmental
  - Ecological
  - Spatial

Sustainable urbanization

In 2050 approximately 6 billion people will live in city agglomerations world wide. That means twice as much as nowadays. How to prepare for and manage these changes in the future? The notion of sustainable development has exactly this issue as main concern and refers to the knowledge and conviction to build a sustainable future with respect to both socio-economic and environmental situations.

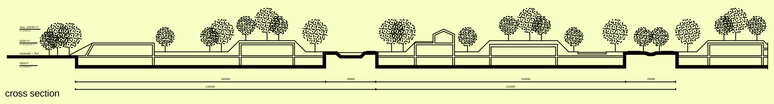
Spatial sustainability

- Location
- Transportation
- Identity

How can space best be used with respect to future developments and demands? The answer to this question must contain a reference to location – landuse, adminstrations, geology, soil – transportation – roads, rails, water – and identity – place, landscape and cultural heritage.

Quantifying sustainability: The SMU (Sustainability Measurement Unit)

In this project we introduce the SMU. The SMU is a conceptual tool to deal with aspects of sustainability in relation to urbanization. It measures the spatial sustainability of a specific place in accordance with a chosen scenario. Location is operationalized as landuse, transportation as infrastructure and identity as culture, each with constraints and specific values ascribed to the attributes. Using a weighted overlay operation these classes are proportionalized which results in an indicator for suitability.



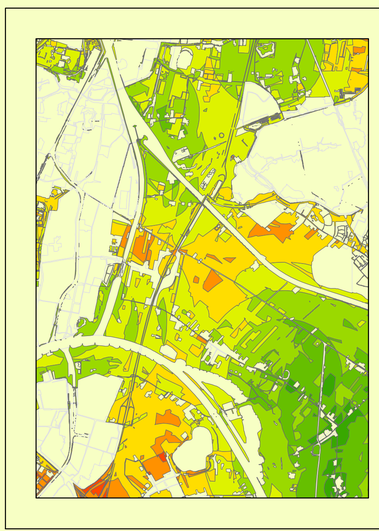
cross section

scenario 2:
small sites

Small Sites

The Small Sites scenario is based on the idea of living in small communities, spread out in open space and green areas. It emphasizes the cultural value and local heritage of the area, which we translated in the concept of fortification. Low dense dwelling islands, protected by trees, water and slopes placed in a natural environment make sure people can live in a secure autarkic way.

small sites
density:
200m2 per person
5 persons 1000m2

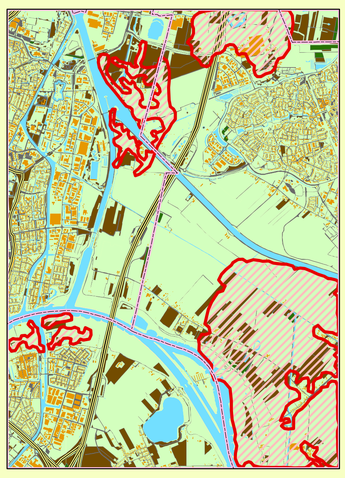


Small Sites Suitability

Quality of location for scenario Small Sites

Legend
suitability: 2, 3, 4, 5, 6, 7, 8, 9
Excluded areas

Kilometers
0 0,250,5 1 1,5 2

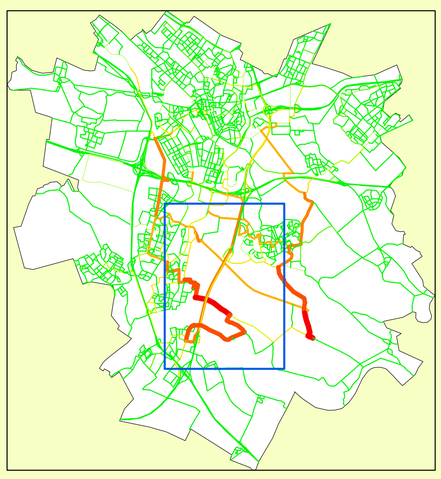


Small Sites Allocation Areas

Suggested locations for scenario Small Sites

Legend
Allocation areas
Traffic
Builtup Area
Open Space
Woodlands
Nature
Water
Agriculture
Municipalities
Main Roads

Kilometers
0 0,250,5 1 1,5 2

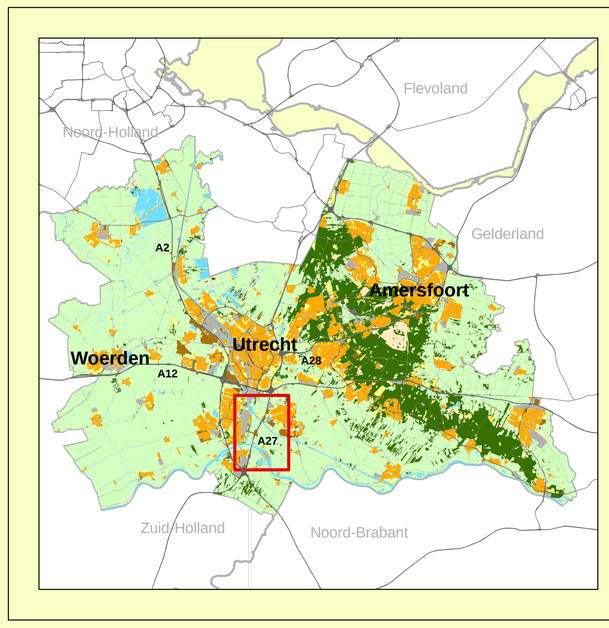


Small Sites Road pressure

Extra Forensic Flow per road section generated by scenario Small Sites

Legend
0 - 100
101 - 250
251 - 500
501 - 750
751 - 1250
1251 - 2500
2501 - 5000
5001 - 7500
7501 - 10000
10001 - 15000
studyarea

Kilometers
00,51 2 3 4 5



Utrecht Province

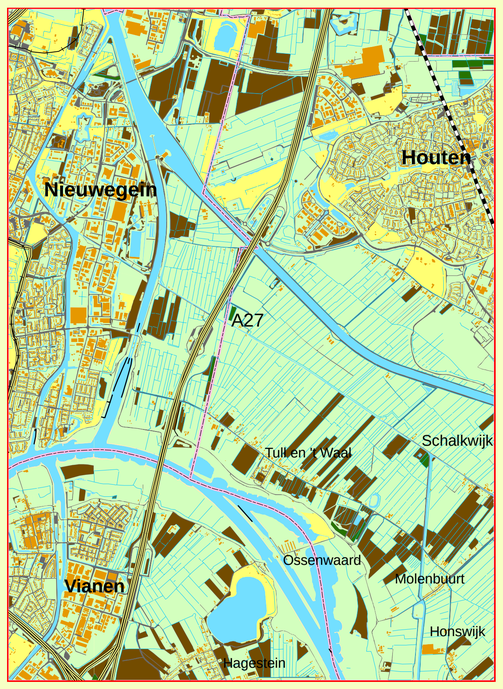
Landuse 2003
Main Roads
and studyarea

Legend
Traffic
Builtup Area
Industry
Open Space
Recreation
Agriculture
Woodlands
Nature
Water
Main Roads
Provinces
studyarea

Kilometers
01,53 6 9 12 15

Study Area

Landuse 2005
Roads
and Municipalities



Legend
Traffic
Builtup Area
Open Space
Woodlands
Nature
Water
Agriculture
Recreation
Train
Tram
Main Roads
Municipalities

Kilometers
0 0,25 0,5 1 1,5 2

Scenarios

Two opposing scenarios for sustainable urbanization are elaborated in this project: Small Sites and Compact City. Using scenarios gives us the opportunity to show the bandwidth of sustainable urbanization. The scenarios emphasize different parts of sustainability mentioned in the SMU but share common ground in the demand of the amount of people, 50.000, that need to be accommodated.

Demands per scenario

Small sites

Demands	value	unit
p	50000	#
m2 pp	200	m2
m2	10000000	m2
layers	1	#
total area	10000000	m2
contiguous at least	15000	m2
structures min	666,6666667	#

Compact city

Demands	value	unit
p	50000	#
m2 pp	50	m2
m2	2500000	m2
layers	30	#
total area	83333,33333	m2
contiguous at least	1000	m2
structures min	83,33333333	#

Small sites

Suitability	total area (m2)
10	0,00
9	665162,93
8	3125627,86
7	8022199,50
6	9373222,27
5	7204822,88
4	1287847,12
3	109227,12
2	701,05
1	0,00
Total	29788810,73

Compact city

Suitability	total area (m2)
10	15998,46
9	573740,74
8	9265422,71
7	9025731,89
6	4657225,18
5	2865740,75
4	1060182,23
3	4594,08
2	0,00
1	0,00
Total	27468636,04

SMU per scenario

Small sites

Suitability	condition	weight 1	weight 2
Landuse	recreation	10	35
	city	25	
	water	25	
	wood	25	
	gasstation	5	
	hindrances	10	
	total	100	
Infrastructure	Roads	40	25
	Mainroads	40	
	Train	10	
	Tram	10	
	total	100	
Culture	Fort	75	40
	Monument	25	
	total	100	
Total			100

Compact city

Suitability	condition	weight 1	weight 2
Landuse	recreation	20	45
	city	20	
	water	20	
	wood	20	
	gasstation	5	
	hindrances	15	
	total	100	
Infrastructure	Roads	30	45
	Mainroads	30	
	Train	20	
	Tram	20	
	total	100	
Culture	Fort	50	10
	Monument	50	
	total	100	
Total			100

Suitability

On these maps the suitability of areas for the specific scenario is represented. Notice the complementary values of both maps. The scenarios differ significantly in suitability areas. In the tables the area per suitability measure is calculated.

Allocation areas

The most suited areas are filled in. Scenario compact city becomes a big line in the landscape parallel to the Lek Canal. Small sites scenario is less defined. More areas are suitable, spread over the area. Two main areas appear the best.

Check

Based on the demands expressed by the scenarios, we made a check with respect to road pressure with Flowmap. The extra road pressure of forensic traffic on the existing road network is calculated using the population and job figures of postal zones. Firstly the check shows the consequences on the road network in a limited surrounding per scenario. Based on this information plans can be made to make adjustments in the road network, or opening up public transportation. Secondly it enables us to compare the impact of the different scenarios on the surroundings. The outcome shows quite different patterns of road congestion as consequence of forensic (car) traffic. On basis of these and further calculations the decision for new roads, alternative transport facilities, another way of spreading the employment facilities, but also readjustment of

Acknowledgements

With the poster presentation on Monday the 25th of June in the Van Unnik Building of the GeoScience-faculty the bachelor course Advanced GIS comes to an end. This poster is the result of the project we, Hielke Koppert and Ferry Westdijk, worked on for four weeks. This poster together with the report is the result of this project. The maps and underlying calculations, analysis and modeling are made and done with the computer programmes ESRI ArcGIS 9.2 and Flowmap 7.2. The tutors that assisted us are Stan Geertman, Tom de Jong, Fred Toppen and Maarten Zeylmans Van Emmichoven all related to the University of Utrecht.

Universiteit Utrecht

Conclusion

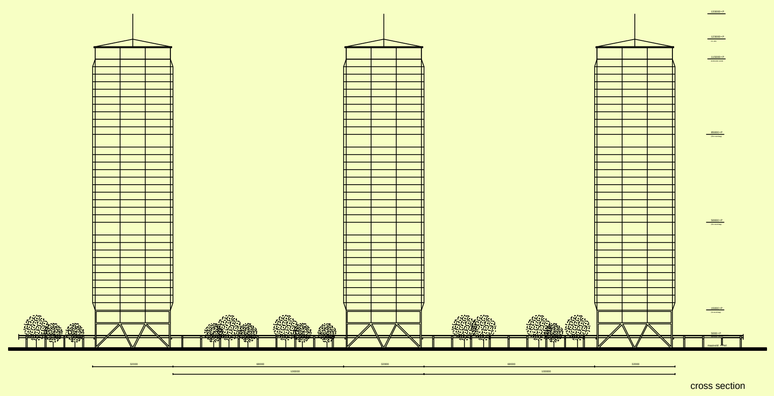
Sustainable urbanization has a broad bandwidth. Depending on the scenario chosen, outcomes vary significantly. The suitability maps show this clearly. Most areas well suited for Small Sites are not well suited for Compact city. The geographical spread of the suitable areas in the different scenarios shows that the way the sustainability factors are weighed in the SMU has a great effect on the geographical reality. In fact the idea of sustainability can be realized in many ways, depending on the way the conditions are weighed – it appears to be a political issue, a matter of choice, preferences and priority.
Transportation is a key factor in the concept of sustainability. How to achieve a qualitative good connection to the infrastructural network is a inevitable question for planners in urban development. The network analysis with Flowmap is a powerful tool in order to bring demographical data into account and shows in The Road pressure maps clearly an increase in road pressure on the current road network. Infrastructural adjustments seem indispensable. Depending on the scenario chosen, these adjustments must take place in the current road network, or by opening up public transportation.

Sustainable urbanisation in the Randstad province of Utrecht

As part of “The Randstad” - the city agglomeration also containing the cities Amsterdam, The Hague, Rotterdam – Utrecht city is a highly urbanized area. Utrecht province complements this highly urbanized area with lots of open space and diverse landscapes wherein countless elements of cultural heritage can be found. The Grebbelinie and the Oude en Nieuwe Hollandse Waterlinie as well as the Roman Limes are located in the province. Such a versatile area, the development of Utrecht province poses an interesting challenge.

The study area

We choose an area between Utrecht, Houten, Nieuwegein and Vianen for it is close to the city and has large sections of open space, it contains various infrastructural elements (highway A27, waterways Amsterdam-Rhine canal and the Lek river and the Houten railway station, Nieuwegein Tram station and, furthermore, the area is rich with elements of cultural heritage.



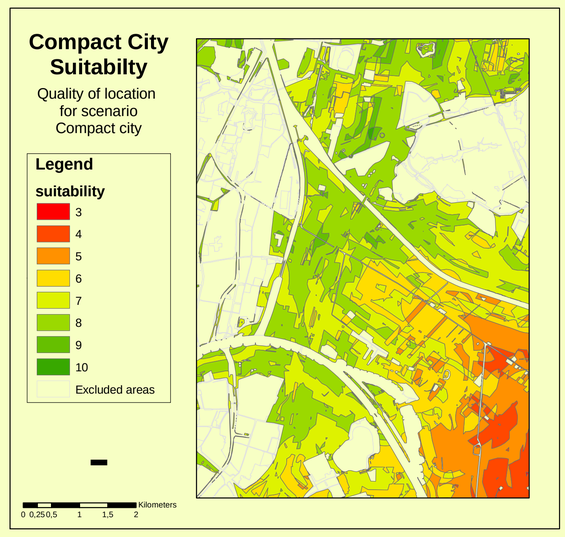
cross section

scenario 1:
compact city

Compact City

The Compact City is a collection of high rise and high dense buildings in or near city areas and transportation facilities. The Compact City emphasizes on the infrastructural network and landuse. The connectivity with the surrounding urban areas is key for this scenario.

compact city
density:
50m2 per person
20 persons 1000m2



Compact City Suitabilty

Quality of location for scenario Compact city

Legend
suitability: 3, 4, 5, 6, 7, 8, 9, 10
Excluded areas

Kilometers
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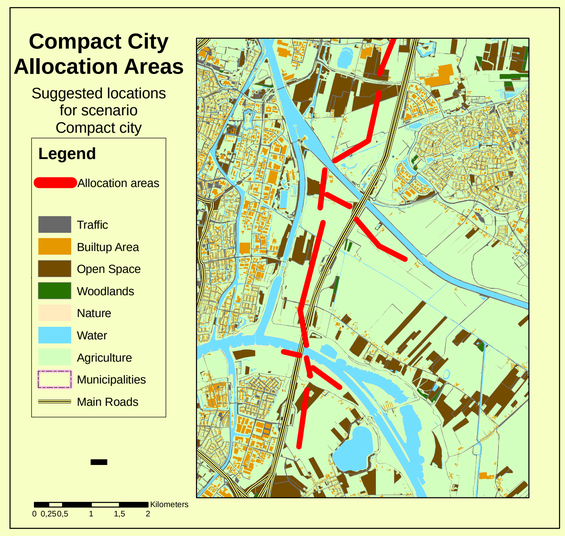

Compact City Allocation Areas

Suggested locations for scenario Compact city

Legend
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Water
Agriculture
Municipalities
Main Roads

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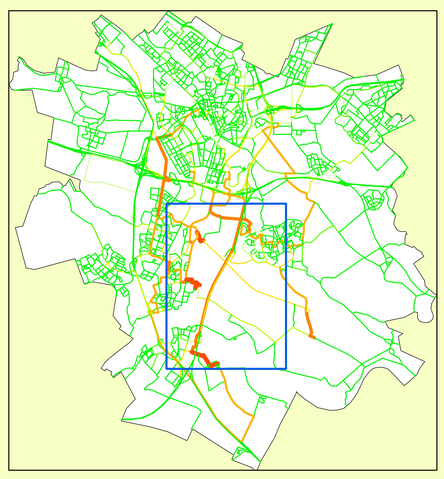

Compact City Road pressure

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