Future Cities urban networks to face climate change

Making city regions fit to cope with the predicted impacts of climate change

Investing in Opportunities



URBAN CLIMATE ANALYSIS MAP FOR THE CITY OF ARNHEM





The City of Arnhem (NL) focuses on the urban heat island effect (UHI) to determine the urgency to act and which adaptive measures are the most (cost) effective to reduce the unwanted negative effects.

Information from (inter)national research helped us to identify the five, strongly related, factors that causes the UHI-effect:

- 1. Topography
- 2. Land use
- 3. Urban morphology
- 4. Material use and colour
- 5. Wind path

In essence, two mechanisms are involved:

- The extent in which heat is stored in the city
- The extent of possibilities to cool the city





Legend Urban Climate Analysis Map (Heat Map) of Arnhem:



Climatope	Description
Fresh air producing	Thermal Induced Winds / Slope winds
zones	The slopes formed by the edges of the Veluwe massive have a
	considerable cooling potential for the city of Arnhem. The presence of
	nature (forest) on the slopes makes that this area cools down very quickly
	the arrow
	Background winds
zones	The mainly green areas of the floodplains, agricultural grounds and
201100	transition zone absorb only a small amount of heat during the day. The,
	for The Netherlands, predominant south-westerly winds cools down these
	areas and has a cooling effect on the rest of the city in the prolonged
	direction of the arrows.
Mixed Climate	Larger green areas in and around the city
	Because of the high concentration of greenery in and around the city,
	these areas have certain robustness to heat accumulation. To some
 Madarata Urban Uaat	extent these area's have a cooling potential for the surrounding areas.
Island	This category includes the less dense built-up residential and business
Isianu	park areas. Because of the openness and vicinity of green structures and
	open water, these areas don't accumulate a lot of heat.
Remarkable Urban	Sensitive area for heat accumulation
Heat Island	This category includes the residential areas and business parks with
	higher densities and larger building volumes. In these areas there is not
	enough green to cool to area down and the roughness makes that the
	cooling effect of air paths is marginal. These areas are having trouble
	losing the accumulated heat.
Maximum Urban Heat	Hignly sensitive area for heat-accumulation
Island	In this group we find the city centre and its surrounding dense and stony
	and a very rough surface, which makes that the wind can not penetrate
	this area to cool is down. These areas have high difficulty losing their
	accumulated heat during the night.

With these factors we constructed the Urban Climate Analysis Map (UCA-Map) that shows us:

- What areas of the city are at most risk for heat storage and have difficulties to cool in the evening 'on its own'?
- What are possibilities to ventilate the city to cool the city during daytime and especially at night?

VERIFICATION OF THE MAP



In the same period Arnhem made a heat scan of the city and the region. At a height of 4 kilometres an aeroplane made pictures with a heat sensitive camera.



In August 2009 after some hot days Arnhem measured the temperature in the cities of Arnhem and Rotterdam. In both cities the same temperature differences were found, up to 7° C in the evening between stony and green areas. Now Arnhem compares the measurements with the UCA-Map.



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Now Arnhem analyses the differences between the UCA-Map and the heat scan.

NEXT STEPS

Next step is to translate the UCA-Map into a Urban Climate Recommendation Map. This map will be used as well in the new city structure vision as for the renewal projects.

At the same time we have started mapping the UHI-effect in the City of Nijmegen and, later on, in all 20 municipalities in the City region.



PROJECT PARTNERS

