Future Cities
urban networks to face climate change

Working Group 1
Working Group Meeting 2bis

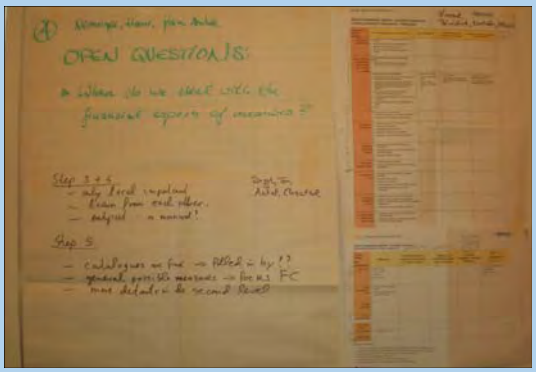
Municipality of Nijmegen,

't Oude Weeshuis and Marienbeurs

17th – 18th June 2009

Report




OPEN QUESTIONS:

Contents

Annex

Programme

Wednesday, 17th June, 2009

't Oude Weeshuis, Nijmegen

13.00 Welcome and introduction
Ton Verhoeven, Municipality of Nijmegen

Working Group Session I, plenary

- Discussion and agreement: Aims and target groups
- Existing examples of checklists/ assessments and conclusions for *Future Cities*
  Birgit Haupter, INFRASTRUKTUR & UMWELT
- Introduction to mini group work
  Ton Verhoeven

15.30 Working Group Session II, split up in mini groups:

- Develop the structure of the climate assessment check

17.00 Working Group Session III, plenary:

- Presentation of results of mini group work, agreement on basic structure

18.00 End of meeting for the day

Thursday, 18th June, 2009

Marienbeurs, Nijmegen

9.00 Working Group Session IV, plenary:

- Introduction to 2nd day
  Ton Verhoeven
- Guideline “Climate Change” for a water board
  Matthias Weilandt, EMSCHERGENOSSENSCHAFT
- Adaptation study Arnhem
  Hans van Ammers, Municipality of Arnhem
- Table “contribution of partner projects to the assessment”: explanation
  Vincent Kuypers, Wageningen University and Research

10.00 Working Group Session V, plenary:

- Starting to fill in the structure of the climate assessment *All*

12.30 Working Group Session VI, plenary:

- Work plan and conclusions

13.00 End of meeting

Wednesday, 17th June 2009

Welcome and introduction to the working group meeting

The chair of WG 1, Ton Verhoeven welcomes the participants of the working group meeting to Nijmegen and explains the programme of the two days meeting. The aim of the working group meeting is to define an outline for the assessment check as basis for the future working group's work as well as for the work in the other *Future Cities* working groups.

Discussion and agreement: Aims and target groups

Ton Verhoeven recapitulates the aims and target groups of the "assessment check" as it was discussed at the previous working group meetings.

After discussion, the aim as stated so far is confirmed. The target groups should be broadened in the sense that municipalities – actually doing the assessment -, have to "sell" the results of the assessment to the target groups which are responsible for implementation (e.g. housing associations, development agencies, businesses). Furthermore, it becomes clear that the "assessment tools" need to be adapted according to the different levels addressed.

Conclusions: Aims and target groups

Aim:
Make city regions fit to cope with the predicted impacts of climate change

The focus should be on a check for adaptation measures. Existing checklists/ guidelines on mitigation (reducing / avoiding greenhouse gas emission) could be included as an information source.

Furthermore, the three key components of *Future Cities* - Green structures, water systems and energy efficiency - plus the combination of these were agreed to be in the main focus. The aspects of city morphology which play an important role in the heat island study of Arnhem should be taken into account.

If applicable, further aspects (e.g. transportation) could be added later.

Target groups:
The assessment check itself is targeted at planners at cities/water boards, the results have to be used responsible for implementing measures.
More general results should be generated for politicians and decision makers.

Time schedule:
Preliminary checklist to be used by *Future Cities*-partners until autumn 2009
Improved final version which can be used by similar organisations until 2012

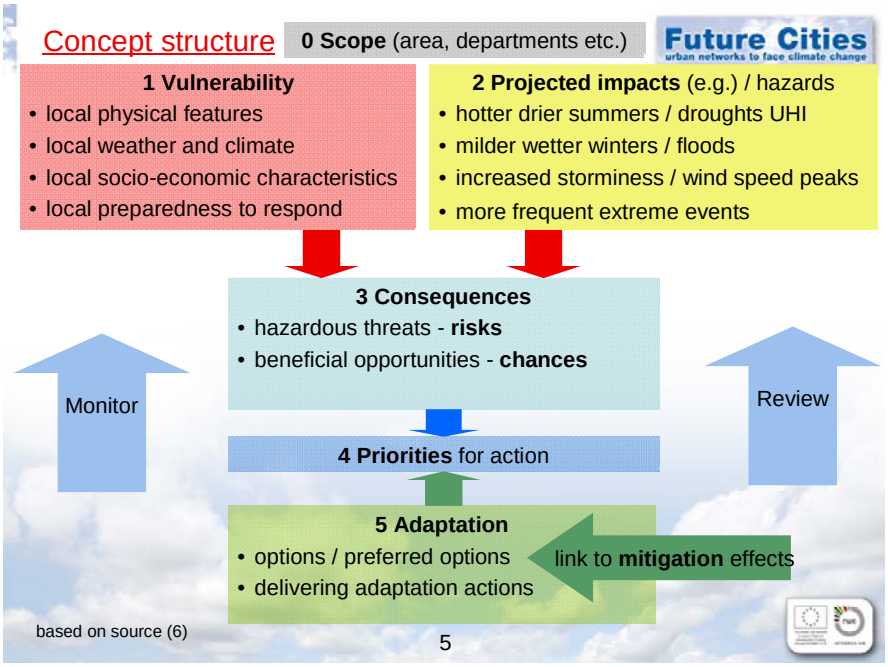
Form:
Practical instrument, comprising of different tools (paper/digital), to be decided on more detailed when the content is more clear.

Working Group Session I

Overview of existing assessment checks and conclusions for Future Cities
by Birgit Haupter, Infrastruktur & Umwelt

In her presentation Birgit Haupter explains that various assessment checks already exist for specific levels (e.g. the building level or general aims for the national level), specific items (e.g. transportation with view to greenhouse gas emissions) or regarding new developments. (Note: These will be provided for download on the *Future Cities* website – section "Further documents related to climate change"). Many of the examples demonstrate a quite similar general approach – comparable to risk management approaches.

Based on the risk management approach a possible concept as framework for the *Future Cities* "assessment check" could be structured as shown in the figure below.



Birgit Haupter stresses the point that the concept shall give an overview of the approach as a whole. This does not necessarily imply that the *Future Cities*-partnership works out each step in detail. On contrary, the working group members and project partners have to decide which parts will be in the main focus of the work. Nevertheless a common understanding of the concept as a whole will help to define the boundaries and links of the work of *Future Cities*-project. The concept comprises five major parts:

- A vulnerability check
- The assumptions/ projected impacts
- The determination and assessment of the resulting consequences
- The determination of priorities for action
- Determining, assessing and delivering adaptation actions

Underlying, in a **basic step (0) the scope** of the assessment has to be defined: The geographical area which is covered (e.g. a region, a city or parts of a city) as well as the organisational boundaries (e.g. which sectors or city functions shall be included) and the stakeholders concerned.

In the **vulnerability check (1)** the current vulnerability of the local physical features and socio-economic conditions should be checked against weather events in order to be able to detect critical thresholds. An interesting method is provided by the approach of the Local Climate Impacts Profile (UK) where information about weather events and the impacts they had is collected by research of journalistic sources.

Birgit Haupter introduces a possible concept for a vulnerability check within the *Future Cities* assessment is proposed based on the catalogue of topics which was developed by SEERA / Jörn Peters and combined with the approach of the UK Adaptation Wizard tool:

Catalogue of topics to check

- Population e.g. public health, vulnerable groups
- Built environment e.g. existing building stock, construction material, urban spaces
- Infrastructure e.g. Transport, Water services, Waste water, Heat services, Electricity services, Waste services
- Economy e.g. important businesses, sectors
- Natural resources e.g. water resources, water quality, air quality, landscapes
- Administration e.g. preparedness to respond

with view to

- previous weather events, weather sensitivity
- attitude to risk, (thresholds for key impacts)
- local / spatial relevance
- possible direct / indirect impacts

The **projected impacts (2)** of a changed climate need to be combined with the vulnerability. It has to be known, where to get the information and – because of the manifold uncertainties – how to use it. In general, each *Future Cities* partner's country disposes of regional climate models, often for specific variables (e.g. precipitation). The accuracy needed for an assessment check might differ for different vulnerability features and/or adaptation options. Thus, for *Future Cities* it is proposed to develop a manual (or apply an existing one) on how to get the information and how to use it. This might include the following:

Requirements

- Time horizon: link to adaptation issue, e.g. building's life time
- Accuracy: link e.g. to sector (e.g. quantitative threshold needed or spectrum sufficiently)

Local scenarios

- Possible sources: regionalised models - status different (e.g. per country, per topic)
- Gaps

Critical thresholds which are needed

- Max. - min temperature, precipitation, wind speed, humidity etc.
- Occurrence
- Comparison: historic events.

Step 1 and 2 are not to be addressed consecutively but influence each other, being linked closely. A **basic catalogue** on direct and indirect impacts which are associated with climate variables might help to inform both, the vulnerability check (1) and the compilation of projected impacts (2).

Therefore, it is suggested to collocate such a basic catalogue from existing sources and develop a form which is adapted to the needs of *Future Cities*. Interesting for *Future Cities* would be to categorise the indirect impacts on different urban features, on buildings, the water system, etc..

Step 2

Basic catalogue: Changes in climate variables - associated impacts (e.g.)

Changes in climate variables	Examples of associated impacts	Impact on urban / regional feature / spatial relevance
Higher mean temperatures	•Increased evaporation and decreased water balance. •Increased severity of droughts (see below). •Reduced alpine winter snow cover. •Reduced range of alpine ecosystems and species.	e.g. On buildings •increased cooling loads and costs and reduced energy supply reliability
Higher maximum temperatures, more hot days and more heat waves	•Increased incidence of death and serious illness, particularly in older age groups. •Increased risk of damage to some crops. •Increased electric cooling demand and reduced energy supply reliability.	
Decrease in precipitation	•Decreased average runoff, streamflow. •Decreased water quality	e.g. On buildings •Reduced soil moisture affecting

In the next step the **consequences (3)** of the projected impacts with view to the local vulnerability can be assessed. The assessment may deliver threats, but also may unveil opportunities. Consequences will be of different magnitude (e.g. from insignificant to catastrophic) as well as the likelihood of the future impact varies (e.g. from rare to almost certain). A possible way how to follow the assessment steps could be based on the UK Adaptation Wizard (marked blue as step 3 in the table):

Step 3

Concept - Consequences - threats/opportunities - risk

- Apply projected impacts locally
- together with local vulnerability ⇒ consequences
- e.g. table per climate variable

Step 1	Step 2			Step 3						Step 4
Urban feature / receptor	change in future?	Time-scale	Impacts	Conse-quence	Likely future threats	Likely future oppor-tunities	Likeli-hood of impact	Magni-tude of conse-quence	Risk	Priority action

Following the risk assessment the **local areas for priorities (4)** can be defined, e.g. areas of extreme and high risk. However, further criteria such as the legal framework or political focus or funding/ financing possibilities might be applicable. In general, the aim of this step is to

localise the “hot-spots” (e.g. geographically or regarding sectors) where action should be taken predominantly.

The 5th box comprises the assessment of possible **adaptation (5)** options and the selection of preferred measures which finally shall be implemented. Here, the link to mitigation of greenhouse gas emission becomes evident. Adaptation measures should be no-regret measures. They should not raise greenhouse gas emissions (e.g. more electric air conditioning devices used to adapt houses to higher temperatures). A two-step-catalogue of possible adaptation measures is proposed for *Future Cities*:

- **A general catalogue of adaptation measures** which is clearly linked to the impacts on different urban / regional features e.g. the topics according to the vulnerability assessment.
- **A catalogue of evaluated *Future Cities* measures** which is linked to the *Future Cities* key components as well as to the possible effects regarding the impacts on urban features. It could provide the basis for deciding on priority adaptation measures (in combination with the priority action areas or sections as determined in box 4).

The implementation as well as the effects of adaptation measures need to be **monitored** (in a shorter term, e.g. yearly or less) as well as basic assumptions or assessment standards have to be **reviewed** (in a longer term, e.g. 3-5 years).

Birgit Haupter draws the conclusions that for the boxes concerning the vulnerability (1) and adaptation options and actions (5) the *Future Cities*-project could contribute to or develop catalogues and information bases. Box 2 (assuming the projected impacts), box 3 (determining the consequences) and box 4 (determining priority areas / sections for actions) are more subject to describing the steps which should or could be done, e.g. in a manual. Possibly this could include describing the experiences how the *Future Cities*-partners did these steps.

In the following **plenary discussion** the basic concept is agreed on as a basic framework for the *Future Cities* assessment check (see conclusions page 17ff.). Jörn Peters remarks that the concept reflects his working approach for his regional vulnerability assessment. It is clarified that it is possible to start also from the bottom from an adaptation measure and looking for the effect of the measure. Also, for different levels the starting points can be different. For the local / building level it is possible to start with the adaptation measure and detect the effect(s). Coming from the regional level it seems more appropriate to start with the vulnerability check, where one intention is to provide hints for the local implementation level about priority areas/sectors. Also, it should be possible to enter the process at each point resembling a circular structure. However, for the overview an abstract “linear” structure is reasonable. Since there is no strict linear dependency of the steps the boxes should be named “module” which have logical interfaces.

The link to the work of WG 2 and 3 seems clear with regard to the evaluation of the *Future Cities* adaptation measures. The issues of WG 4 “awareness” are addressed among others in the vulnerability check – preparedness to respond, but also if different types of adaptation measures are taken into account – structural and educational measures.

In the discussion it becomes clear that the word “mitigation” needs to be clarified for use in the *Future Cities*-project:

Mitigation is used mainly regarding reduction or avoidance of greenhouse gas emissions. It could also be used regarding mitigating the impacts of climate change by an adaptation measure, but this may lead to misunderstandings, so it should not be used in this sense.

Working Group Session II – Mini group work

In three mini groups possible contents of the assessment check are discussed, especially the modules 1 and 5:

Mini group A: Anke Althoff, Hans van Ammers, Veroniek Bezemer, Jörn Peters

Mini group B: Bénédicte Salle, Nathalie Garré, Albert Anijs, Vincent Kuypers

Mini group C: Ton Verhoeven, Chantal Lass, Antal Zuurman, Birgit Haupter

The questions are:

- Which are the parts *Future Cities* focuses on (with checklists, tools etc.)?
- Which could be first steps for the preliminary assessment, e.g. vulnerability assessment of one sector and / or start to fill catalogue of (evaluated) *Future Cities* measures
- Work on suggested charts: amend or change topics, develop further etc..

Working Group Session III – Results of mini group work

The results of mini group A are presented by Anke Althoff.

Concerning the framework as a whole the group stresses the importance of module 4 “Priority for action” especially for the local level. Here, the financial and legal framework must not be forgotten. Actions have to be financed (by the municipality, the regional, national level or other implementing organisations etc.) which could be supported by various funding possibilities.

For the *Future Cities* assessment check it should be checked in detail that the “wheel is not reinvented”. It always should be kept in mind what the extra information is that the *Future Cities*-partnership can provide.

The mini group focussed on module 1 – the vulnerability check. The catalogue of topics to check comprises topics of more or less importance for city regions. Very important is e.g. the topic population and the built environment. Concerning the built environment the different uses (working places, homes etc.) should be taken into account. Less important are e.g. the topics agriculture and forestry.

The “general weather sensitivity” should be checked according to the specific climate change impacts, e.g. heat, floods etc.

The necessity of the columns “Regional/ local/ spatial/ relevance” (because this should already be determined with the scope) and “uncertainties” should be thought over.

Necessary is a column for conclusions: Vulnerable or not? Or using a scale: e.g. high – medium – low.

Furthermore it could be helpful to visualize the vulnerability of a city region (or part of a city) in a map.

Albert Anijs presents the results of group B.

The group remarks on the whole concept which in general is a good concept but the interdependency is more of a circular form but linear.

With regard to module 1 the group concludes that the vulnerability check has to be done on different scales. It is sensible to start with the compilation of previous events (= 1st column).

In the group it is also remarked that the

problems (vulnerability) identified have to be checked against at which level the problem can be addressed adequately.

The table of module 5 "*Future Cities*-measures" can be amended by the line "show cases". The results of monitoring feed into the last column "evaluation". The effectiveness of a measure also has to be rated against the spatial scale.

The results of group C are presented by Ton Verhoeven.

He reports that the group went through each module discussing who can fill in the modules and what could be the contribution by *Future Cities*-partners.

Module 1 – the vulnerability check – could be filled in by each *Future Cities*-partner for his city or parts of the city, perhaps with support by students. From the experiences made the vulnerability check can be refined – e.g. which topics are needed and the applicability of categories. Also, this could be an item for twinning. Especially for module 1 and 2 the basic catalogue of impacts, categorised according to urban features for the local level, seems to be of high value. The question is raised how to derive such a targeted catalogue from existing data bases (with the help of students?). Regarding module 3 and 4 the partners can exchange their experiences how these parts could be done. For the *Future Cities* assessment check a manual of examples (best practice?) could be the output.

The 2-step-catalogues for module 5 – in general possible adaptation measures and in detail the *Future Cities* measures – seems to be practical. The question is who will fill in the general table. Furthermore it is remarked that thought should be given how to link the two tables logically and technically.

Thursday, 18th June 2009

Working Group Session IV

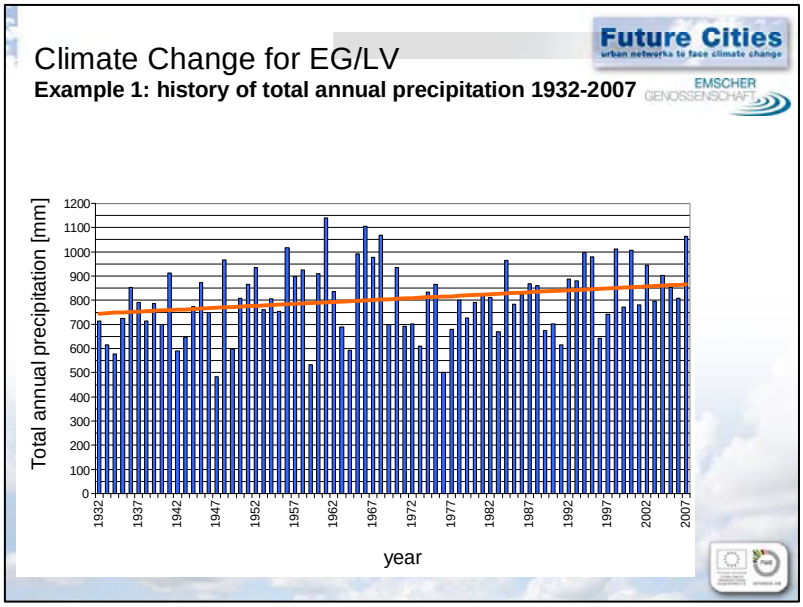
Guideline "climate Change" for a water board
presented by Matthias Weilandt, Emschergenossenschaft

Matthias Weilandt from the water board for the Emscher catchment presents the motivation and framework guideline "Climate Change" which is being preprared at the water board.

Emschergenossenschaft and Lippeverband (EG/LV) want to take a closer look at what climate change really means to the region and what can be done today, not depending on the uncertainties. This leads to no-regret-measures.

The check of the facilities for waste water, stormwater collection and treatment lead to the conclusion that the technical capacity should be sufficient. Nevertheless, the water boards want to be well prepared and want to conduct their responsibility as a regional public player.

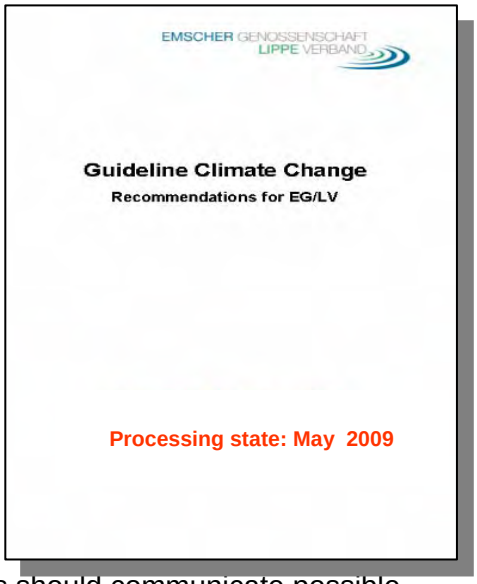
The regional projection reveals an increase of mean temperature up to 2,0°C (average-temperature), more days with higher temperature and less frost days. Predicted is more precipitation in winter (monthly) and less precipitation in summer (monthly) with a higher occurrence probability of storm water events. The survey of existing historical data revealed a – not significant – increase of the total annual precipitation. The effects on the facilities of the water boards were estimated. In the sewer system more deposits because of longer dry flow periods and higher damages in case of technical failure because of more storm water events might take place. At the storm water tanks more and longer overflows with higher emissions could happen. The capacity of pumping stations could be more frequently overloaded. With regard to flood protection more intense storm water events have consequences for the protection facilities.



At present there is no need for immediate action, because there are no significant changes yet observable in the historical data of EG/LV. At the same time still uncertainties in the accuracy of the projections exist.

Consequently, with the guideline the water boards focus on a long term no-regret strategy:

- All decisions/ measures considering climate change have to consider the uncertainties, the special needs and solutions of experts of different divisions
- Sustaining the existing infrastructure, fitting to future demands
- Compensating the effects of climate change by strengthening the natural water cycle e.g. disconnection of paved areas and decentralised retaining and infiltration of rainwater.



In the guideline the information about global and regional climate change is summarised and the consequences for the different types of facilities of EG/LV are explained. Special focus is laid on dealing with uncertainties. Here, especially the non-technical staff of the water board shall be informed.

Activities and measures are named, such as: Research projects, adaptation measures (e.g. decentralised retaining and infiltration of rain water), vulnerability checks for facilities as well as risk assessments to minimise the damage potential in case of failure (e.g. optimising of facilities and controlled flooding of “less vulnerable areas” to protect “areas with high damage potential”).

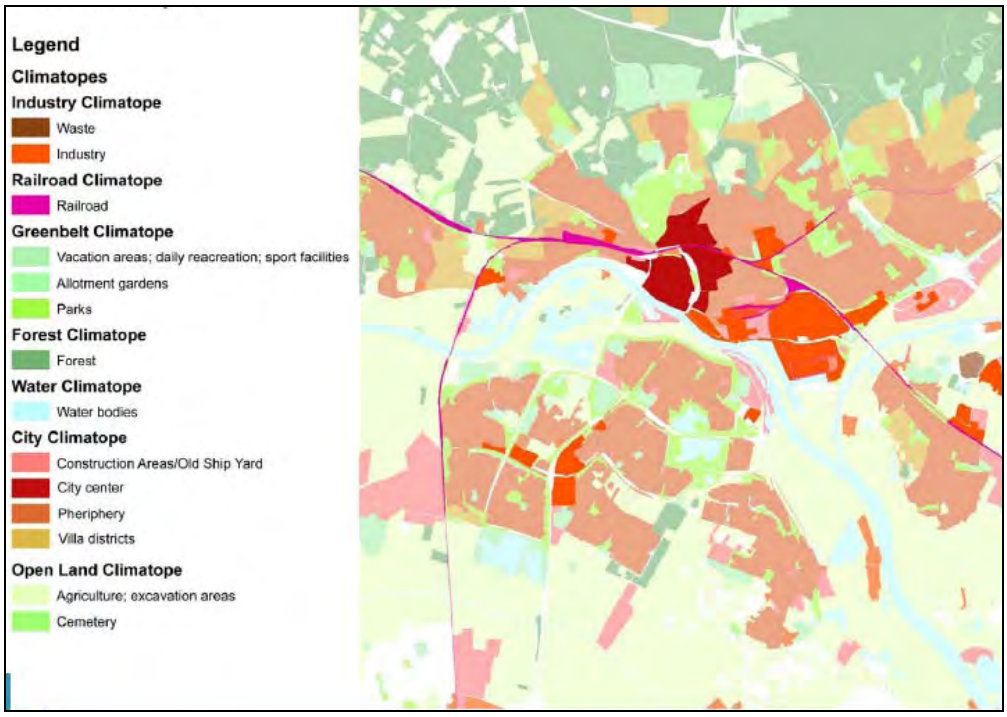
In the **discussion** the question is raised how public services should communicate possible future problems to the general public. It is concluded that it is important to inform the public about the risk, but in a non-alarming way.

Climate adaptation in Arnhem - Results climate adaptation study for Arnhem
presented by Hans van Ammers, Municipality of Arnhem

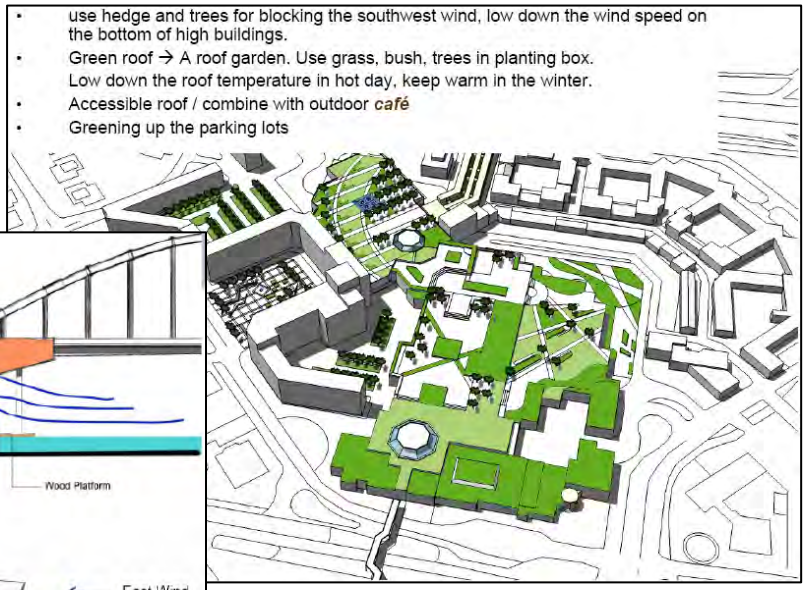
Hans van Ammers introduces the procedure of the climate adaptation study as it is undertaken for Arnhem and presents first results.

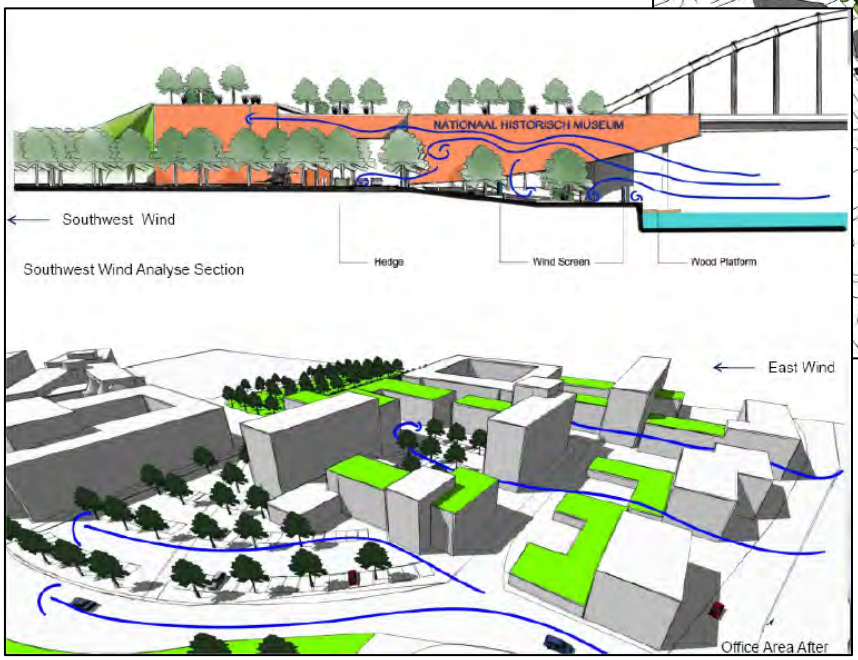
The aim of the study is to develop a plan which shows the climate functions of the city parts. It is not an adaptation scan to discover all strength and opportunities related to all projected impacts of climate change.

On the basis of existing maps and data the city area is structured according to so-called “climatopes” e.g. “Greenbelt Climatopes” or “City Climatopes” which possess similar features with regard to the urban climate (see figure below). Also, the influence of wind related to the “urban porosity” especially within the densely built city centre is evaluated.



The idea of effective use of green structures and the paths of cooling winds was then applied to planned reconstruction projects by students' sketches of Wageningen University. The results of the students' work demonstrate various possibilities e.g. combining the effects of green roofs of a shopping centre for lowering the roof temperature on hot days with remediating the lack of outdoor leisure space for the nearby residential area. Another example demonstrates possibilities for using cooling wind effects, to allow for entrance for ventilation. However, although cooling effects are desirable during summer heat waves they might not be preferable during the cooler winter season.





In a further step the basic data collection will be verified by means of a model by University of

Kassel which will result in a climate function map. This map will provide information on the different climatopes as well as the potential airflow corridors which are needed for air exchange. For further verification measurements will be made during nights with adequate weather conditions (warm, clear night) using a special bicycle with measurement instruments.

Finally, the results of the study as laid down in the climate function map shall inform the new structure vision plan of Arnhem. A planning reference map might include the protection of compensation areas and airflow corridors such as areas with building limits or no further building-over and areas for improvement of climate conditions such as areas for planting or extending green areas or opening the built-up area.

In the **discussion** it becomes clear that solutions for problems which arise during summer , e.g. cooling ventilation might not be preferable during winter. The same applies to the cooling effect of water surfaces which might be effective during the day. However, at night water surfaces might add to heating up because of the higher specific heat capacity of water compared to the air.

The use of a vulnerability check on city level is discussed. For the issues of the urban climate it seems to be more sensible to check the local conditions of climate variables such as temperature, wind and radiation to develop a climatopen map. There, the problematic areas can be identified and solutions / projects can be suggested. Different projects can feed a database where possible solutions for problems which were identified can be selected from.

Table "Contribution of partner projects to the assessment / issues & tools"
explained by Vincent Kuypers, Wageningen University and Research

The table (see figure) aims at an inventory who of the project partners is doing what in the different fields of interest. It shall supply the basis for deciding where more detailed information (e.g. by means of interviews) is available for the Urban Heat Island Study of Arnhem. The "issues" refer to topics which are addressed by various measures by the project partners. The "tools" refer to the different measures which are used and applied by the project partners. The clustering of the tools considers the different scales such as building level or the whole geographical area of a municipality. A cross means that studies are ongoing or planned within Future Cities. The rating of available information is demonstrated in different colours informing about where a good knowledge basis already exists in general and where the knowledge basis is still lacking. This also allows for the check where the collection of added knowledge is really needed.

Issues

		cluster urban climate					cluster water-problems				cluster environm. protect.		energy efficiency	
	Comunication	UHI-rel. risk	humidity	wind	thermal comfort public	thermal comfort privat	flood- prevention	water-retention re-use (+)	groundwater incl drought		air pollution	key- habitats	energy use incl. cooling	energy prod. incl geotherm
tools	**water structure**													
	Arnhem	x			x									
	Nijmegen	x			x			x	x				x	
	Tiel						x	x					x	
	Rouen	x	x	x	x			x			x	x	x	x
	Ieper	x			x			x (+)				x		
	Kamen		x				x	x						
	Bottrop	x						x					x	
	Hastings	x						x						
	green structure													
	Arnhem	x	x	x	x			x			x		x	x
	Nijmegen	x	x		x			x			x		x	
	Rouen	x	x	x	x			x			x	x	x	x
	Ieper	x			x			x			x	x		
	Bottrop	x						x			x			
	Kamen	x	x	x	x							x		
	Tiel						x	x			x		x	
	urban morphology													
	Arnhem	x		x	x								x	x
	Nijmegen	x		x	x									
	Ieper	x												
	Hastings	?		?			x							
	Rouen			x			x				x	x		
	building technology													
	Hastings												x	x
	Nijmegen							x					x	x
	Rouen							x						x
	Tiel						x	x	x				x	
	Arnhem								x				x	x
	bottrop							x			x			
	Ieper	x				x		x					x	x
	energy structure													
	Tiel	x											x	x
	Hastings	x											x	x
	Arnhem	x											x	x

LEGEND

good knowledge basis exists

some knowledge basis exists

knowledge basis lacking

x studies either already on the way, or to be investigated in future cities

Working Group Session V – Discussion on module 5

Based on the results of the previous day the scope and structure of module 5 is discussed in more detail. The results are laid down in the tables on page 17ff. of this report.

Module 5 table 5a

For column 1 – associated impacts on urban feature(s) – the significance for the *Future Cities* partners is discussed. Some are added, e.g. in North Rhine Westfalia higher mean temperatures are of importance with regard to the tourism economics.

It is agreed that column 2 "aim of adaptation" is necessary especially regarding the communication of the statements. However, the content of this column might be more or less concrete. For example it could comprise recommendations what an aim might be. Furthermore the point is stressed that it is important to be clear about the aim of adaptation: Which extreme events should be dealt with? That might be different according to the subject and the local conditions. One aim of adaptation is "to be better prepared". There, curative and/or pro-active/preventive measures / actions can be taken.

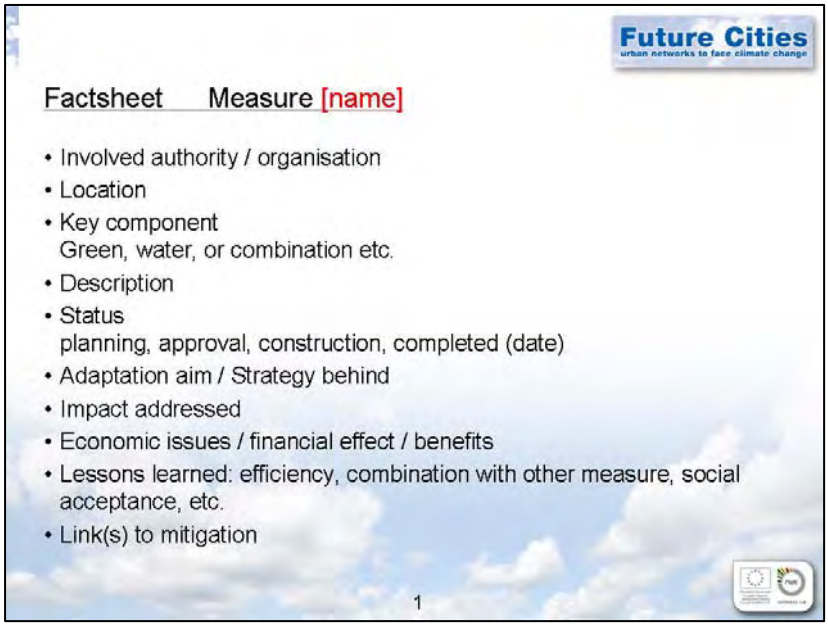
Furthermore it is important to make clear on which level which impact can be tackled, which measure is appropriate, who will finance the measure etc..

Column 3 shall comprise the list of general possible measures to address the various impacts always with the concrete link to different urban features.

In column 4 especially the combination of measures with view to the key components of *Future Cities* shall be addressed. The topic of urban morphology needs to be accounted for but this has to be developed further.

Module 5 table 5b

Table 5b will inform the "*Future Cities* database on adaptation measures" comprising the measures which are planned and/or implemented by *Future Cities*-partners. Each measure should be evaluated possibly with view to possible effects, effectiveness in terms of combination with other measures, cost-benefit-effectiveness, and other criteria to be developed further. Here, a clear link to the evaluation activities of working group 2 and 3 is given. At the moment the focus is on structural measures. However, especially educational and behavioural measures (awareness raising) have to be taken into account. There, different criteria have to be applied. To start the database a format for a fact sheet on the *Future Cities*- adaptation measures is proposed by IU. Conclusions from the assessment of the filled in fact sheets will serve as starting point for the discussions at the next working group meeting in Hastings in September 2009. After discussion the topics for the format are amended and agreed on (see figure).



Working Group Session VI - Agreements for the next months and wrap-up

The working steps until next working group meeting in Hastings, in September 2009 are agreed on:

- Amend module 5 tables as discussed: with minutes of the meeting (resp. IU)
- Develop format for a fact sheet and send to WG members (resp. IU, end of June)
- Fill in fact sheets (resp. project partners / WG members; send back to IU, end of July)
- Compile information, as feedback for module 5 (resp. IU / preparation material for next WG meeting)
- Revise module 5 tables in Hastings (resp. WG 1)
- Test case for vulnerability check ARN (resp. PP2; start, might not be ready for Hastings)
- Check possibility for students to deliver data for basic table for module 1 and 2 (resp. Arnhem and Nijmegen, to be discussed with all PPs in the next Project Steering Group)

The working group members thank the municipality of Nijmegen and Ton Verhoeven and his staff members for organising the meeting. The working group meeting is closed at 1 pm.

Working Group Planner: WG1 – Climate Assessment
(parts in grey lettering were executed)

WG - meeting n° /date	WG – topics / agenda	Preparation of PP / Input	Output / products of PP (action no. as in application)
2 3/2009	• Background: list of direct/indirect impacts (prepared by PP2/Alterra) • Review on existing research results (prepared by PP4/SEERA) • Exchange existing information of project partners, determine gaps (organised by chair) ➲ ROUGH OUTLINE OF ASSESSMENT preparation table (prepared by chair)	◄ presentation for WG ◄ finished input for WG, if sensible ◄ Part 1 "Keep dry feet" done Part 2 "Experimental Building" 2010	◄ Report cost-effective low carbon design; 3/PP4 SEERA ◄ Report ground water policy plan for adaptation; 2/PP5 NI ◄ Report water adapted development; 2/PP7 TI
2bis 6/2009	• further discussion of the input papers and reports • Discussion and improvement of the outline (prepared by IU) ➲ ROUGH OUTLINE OF ASSESSMENT	◄ definition of criteria, presentation for WG 2bis ◄ definition of criteria, presentation for WG 2bis draft	◄ Regional climate change guideline; 5/PP1 LV, PP3 EG ◄ Report on vulnerability/adaptation examples; 4/PP4 SEERA
3 9/2009	• Further discussion of module 1 and 5 • Discuss and agree on steps for developing basic table on impacts on urban features • Discussion of inputs / criteria to the assessment check check list • Format for fact sheet (prepared by IU, end of June 2009) • Fill in formats (all PPs, end of July 2009) • Conclusions from fact sheets / combination of different inputs (prepared by IU as input for Hastings) ➲ PRELIMINARY ASSESSMENT CHECK (LIST)	◄ Case study city of Arnhem available ◄ Only draft –very rough version available ◄ Direct input for checklist ◄ Combined use of energy and groundwater ◄ Contribution to assessment check ◄ definition of criteria, presentation for WG 3 ◄ definition of criteria, presentation for WG 3 ◄ definition of criteria, presentation for WG 3	◄ Climate map of City region UHI; 4/PP2 AR ◄ Rough Outline climate toolkit; 4/PP2 AR ◄ Regional sustainability guideline wvi; 5/PP8 WV ◄ Masterplan underground Nijmegen; /PP5 NI (link to report ground water policy plan see above?) ◄ Report /maps for energy measures in urban structures; 3/PP5 NI ◄ Energy study cold/heat storage; 3/PP2 AR ◄ Energy map Arnhem and area with manual explanation; 3/PP2 AR ◄ Report combination green/water in the city (courtyards; roofs, walls) – general part, 1/PP5 NI
4 3/2010	• Prepare presentation of preliminary assessment check for midterm conference • Meeting date not foreseen for WG 1, decide on need at 3rd meeting	◄ List of possible measures to reduce heat island effect ◄ Direct input for checklist ◄ Contribution to assessment check	◄ Rough Outline climate toolkit; 4/PP2 AR ◄ Regional sustainability guideline wvi; 5/PP8 WV ◄ Business Plan for "Retrofit Demonstration"; 3/PP4 HA

WG - meeting n° /date	WG – topics / agenda	Preparation of PP / Input	Output / products of PP (action no. as in application)
		INPUT FOR WG 2 ➔	◄ Plan for local Green Homes Service; 3/PP4 HA
		◄ Contribution to assessment check / WG 4	◄ Report on state of art green/ water in the city (courtyards, roofs, walls) - details; 1/PP5 NI
		◄ presentation for WG 4	◄ Report on climate robust development (energy efficiency, durable energy); 3/PP7 TI
5 10/2010 Conf.	• Improve assessment check with input from evaluation interim results WG 2 and 3 ➔ PRESENTATION OF PRELIMINARY ASSESSMENT CHECK	◄ Available for City region Arnhem Nijmegen	◄ Climate map of City region UHI 4/PP2 AR
6 3/2011	• Improve and adjust assessment check	◄ Check: Experiences for participation strategy (WG 4?)	◄ Cooperation with housing companies/other parties 1/PP5 NI
7 10/2011	• Improve and adjust assessment check with confirmed evaluation results from WG 2 and 3		
8 3/2012	• Prepare input for final report • Climate model as one building stone of assessment check	◄ Including experiences of *Future Cities* partners	◄ Climate model, adapted, tested in City Region 4/PP2 AR
9 6/2012	➔ FINAL RESULT INPUT REPORT	◄ Check: Interim results earlier available?	◄ Synthesis report of possible options for combined measures 4/PP6 RS
11/2012 Conf.	➔ FINAL ASSESSMENT CHECK/ PRESENTATION		

Conclusions and agreements for a Concept "Assessment for climate proof cities"

List of charts / modules:

Concept: Overview and framework (status: agreed)

Module 1 (status: draft proposal with remarks of mini groups)
Table 1: Vulnerability check

Module 2 (draft proposal)
Table 2: How to get Information about future weather / climate and impacts of changed climate variables

Basic catalogue for module 1 and 2 (draft proposal with remarks)

Module 3 - 4 (draft proposal)
Table 3/4**:** How to determine consequences (threats/opportunities) and priorities for action

Module 5 (draft proposal including results of plenary discussion)
Table 5a: Adaptation options - possible measures; Linking impacts to measures
Table 5b: Adaptation options - possible measures; Evaluating *Future Cities* measures

Concept structure

0 Scope (area, departments etc.)

Future Cities
urban networks to face climate change

1 Vulnerability

- local physical features
- local weather and climate
- local socio-economic characteristics
- local preparedness to respond

2 Projected impacts (e.g.) / hazards

- hotter drier summers / droughts UHI
- milder wetter winters / floods
- increased storminess / wind speed peaks
- more frequent extreme events

3 Consequences

- hazardous threats - **risks**
- beneficial opportunities - **chances**

Monitor

Review

4 Priorities for action

5 Adaptation

- options / preferred options
- delivering adaptation actions

link to **mitigation** effects

based on source (6)

Module 1: Vulnerability check - Check local/regional conditions of vulnerability on

Remarks of mini group A (blue lettering), mini group B (violet lettering) and mini group C (green lettering)

Check **Catalogue of Topics (e.g.)**	General weather sensitivity (catalogue?) Split up in climate change effects: heat, floods, storm… Weight	Former events/ consequences/ responses taken Has something been done before? Should be column 3 Example	Regional / Local / spatial relevance Needed?	Capacity to adapt Should be column 2 Can do	Uncertainties Needed? Range
x **Population** **important**					
Public health					
Vulnerable groups					
Built environment Working places + homes **important**					
Existing building stock					
Construction material					
Urban spaces					
important **Infrastructure**					
Transport					
x Water services					
x Waste water put together with water services					
Heat services					
Electricity services put together with heat services					
x Waste services					
Emergency for services					
important **Economy**					
e.g. important businesses, sectors, e.g. tourism					
Natural resources **less important**					
x Water resources					
x Water quality					
x Air quality					
x Landscapes					
x? Agriculture					
x? Forestry					
x Biodiversity					
Coastlines					
Administration **less important**					
e.g. preparedness to respond					

Conclusion:

Vulnerable yes or no?

Rating: High/ medium/ low: 1-5, 6-10, 11-15

Provide Maps?

Module 2 Projected impacts:
Information about future weather / climate and impacts of changed climate variables

	Which information is needed and where to get it
Requirements	• Time horizon: link to adaptation issue – e.g. building's life time • Accuracy: link e.g. to sector; (e.g. quantitative threshold (water management)- spectrum (green management) • •
Local scenarios	• Possible sources (regionalised data available: status different per country / per topic) • Gaps •
Critical thresholds	• Maximum temperature, precipitation, wind speed, humidity etc. • Minimum precipitation, humidity etc. • Number of occurrence • Comparison with historical events •
	•
	•
	•

Basic Catalogue for module 1 and 2: Direct / indirect impacts (examples) associated with changes in climate variables (Could also be used to detect general weather sensitivity)

Changes in climate variables	Examples of associated impacts	Impacts on urban / regional feature / spatial relevance (categories as in vulnerability check?)	
		e.g. on built environment / building stock (source 2)	e.g. On infrastructure / waste water system
Higher mean temperatures	• Increased evaporation and decreased water balance. • Increased severity of droughts (see below). • Reduced alpine winter snow cover. • Reduced water quality by higher mean temperature •	• increased cooling loads (and cooling costs) • building envelope (roofing, cladding, window systems) at increased risk of cracking / failure. • soil drying and movement (could affect foundations, especially clay soils) • increased thermal discomfort and heat stress for occupants • reduced water heating loads and associated costs.	•
Higher maximum temperatures, more hot days and more heat waves	• Increased incidence of death and serious illness, particularly in older age groups. • Increased heat stress in livestock and wildlife. • Increased risk of damage to some crops. • Increased forest fire danger (frequency and intensity). • Increased electric cooling demand and reduced energy supply reliability. • Reduction in cooling water influences functioning of infrastructure / energy plants •	• See above	•
Higher minimum temperatures, fewer cold days and frost days	• Decreased cold-related human morbidity and mortality. • Decreased risk of damage to some crops and increased risk to others. • Extended range and activity of some pest and disease vectors. • (Reduced alpine winter snow cover only indirect by impact on discharge of Rhine) • Reduced heating energy demand	•	•
Decrease in precipitation	• Decreased average runoff, streamflow. • Decreased water quality. • Decreased water resources. • Decrease in hydro-power potential. • Impacts on rivers and wetland ecosystems.	• pressures on urban water resources • soil drying and cracking, potentially affecting foundations and walls (drying out and cracking of mortar). •	•
Increased severity of drought	• Decreased crop yields and range and productivity. • Increased damage to foundations caused by ground shrinkage. • Increased forest fire danger	•	•
Decreased relative humidity	• Increased forest fire danger. • Increased comfort of living conditions at high temperatures	• reduced mould-related problems • reduced condensation problems • reduced lag-time of corrosion commencement of reinforced concrete in commercial buildings • higher forest fire danger	•
More intense rain	• Increased flood, landslide and mudslide damage. • Increased flood runoff. • Increased soil erosion. • Increased pressure on disaster relief systems	• localised flooding events, depending on drainage system capacity (including roof damage, pipes, sewer connections, etc.) (see Flooding) • weathering (e.g. corrosion of metals) leading to higher maintenance requirements •	•
Increased intensity of storms	• Increased risk to human lives and health. • Increased storm surge leading to coastal flooding, coastal erosion and damage to coastal infrastructure. • Increased damage to coastal ecosystems.	• structural loading by pressure forces, leading to structural failure (e.g. removal of individual tiles or iron sheeting through to uplifting of entire roofs or walls) • general structural failure of building components leading to potential for total building collapse and destruction • impact damage from flying debris • rain/moisture penetration leading to internal damage (see Flooding).	•
Increased mean sea level and storm surge	• Salt water intrusion into ground water and coastal wetlands. • Increased coastal flooding (particularly when combined with storm surge).	• water damage to building contents • possible contamination of interior of building from sewage, soil and mud • undermining and/or destruction of foundations, potentially leading to structural collapse • salt spray (coastal) affecting most material‘s durability • coastal erosion (in some areas likely to be severe) resulting in loss or damage to property	•
Increased radiation	• • • •	• plastics, wood and surface coatings subject to greater degradation • increased requirements for solar glare control • benefits for solar hot water and electricity.	•
Decreased radiation	• • •	• plastics, wood and surface coatings less subject to degradation • less energy for solar hot water and electricity	•
Increased hail events	• •	• potentially increased likelihood of damage (mostly roofs, guttering, windows).	•

Future Cities
urban networks to face climate change

Concept - Consequences - threats/opportunities - risk

- Apply projected impacts locally
- together with local vulnerability ⇒ consequences
- e.g. table per climate variable

Step 1	Step 2			Step 3						Step 4
Urban feature / receptor	change in future?	Time-scale	Impacts	Conse-quence	Likely future threats	Likely future oppor-tunities	Likeli-hood of impact	Magni-tude of conse-quence	Risk	Priority action
based on source (7)										

Module 5a Adaptation options - possible measures
Linking impacts to measures – Examples

Adaptation options / Changes in climate variables	Associated impacts on urban feature (linked to module 1 and 2) Categories according to urban features	Aim of adaptation (just taking no-regret measures or measures to be prepared to events) linked to module 4	Possible measures (sectoral and combination) • In general in this column measures not in focus as in focus of the partners • more specific on Future Cities in table 5b	Effectiveness/ combination with other measure
Higher mean temperatures	• Increased evaporation and decreased water balance. • Increased severity of droughts (see below). • (Reduced alpine winter snow cover only indirect by impact on discharge of Rhine) • Reduced water quality by higher mean temperature • Reduced ecological system • Reduction in cooling water influences functioning of infrastructure / energy plants	different levels for all lines • Curative actions • Preventive actions • Actions to be prepared	•	•
Higher maximum temperatures, more hot days and heat waves	**E.g. Population /public health /vulnerable groups** • Increased incidence of death and serious illness, particularly in older age groups.	•	•	•
	e.g. Built environment /Buildings: • increased cooling loads (and cooling costs) and reduced energy supply reliability • building envelope (roofing, cladding, window systems) at increased risk of cracking / failure. Sealants and finishes are also potentially affected • soil drying and movement (could affect foundations, especially clay soils) • increased thermal discomfort and heat stress for occupants • reduced water heating loads and associated costs.	• Reduce vulnerability • reduce maintenance costs • Achieve safety / insurance standards • etc.	• E.g. Green tools • [more detailed information on separate sheets provided see below table 5b and fact sheets]	• Water tools / energy tools / Awareness raising? • [more detailed information on separate sheets provided]
	E.g. Agriculture / biodiversity • Increased heat stress in livestock and wildlife. • Increased risk of damage to some crops.	•	•	•
More/ less radiation	•	•	•	•
Decrease in precipitation	• Decreased average runoff, streamflow. • Decreased water quality. • Decreased water resources. • Decrease in hydro-power potential. • Impacts on rivers and wetland ecosystems.	•	•	•
Increased severity of drought	• Decreased crop yields and range and productivity. • Increased damage to foundations caused by ground shrinkage. • Increased forest fire danger • Cooling water problems for energy plants due to lower water quantity reasons as well as higher temperature of the water	•	•	•
Decreased relative humidity	• Increased forest fire danger. • Increased comfort of living conditions at high temperatures	•	•	•
Increased precipit. (seasonal)	•	•	•	•
More intense rain	• Increased flood, landslide and mudslide damage. • Increased flood runoff. • Increased soil erosion. • Increased pressure on disaster relief systems • Waste water pipes flooding ; WWTP overloading	• general measures to reduce risks (f.e. 100-year flood event) • specific measures to protect vulnerable areas	•	•
Increased intensity of storms	• Increased risk to human lives and health. • Increased storm surge leading to coastal flooding, coastal erosion and damage to coastal infrastructure. • Increased damage to coastal ecosystems. •	•	•	•
Increased mean sea level and storm surge	• Salt water intrusion into ground water and coastal wetlands. • Increased coastal flooding (particularly when combined with storm surge). • •	•	•	•
Increased hail events	•	•	•	•

Module 5b Adaptation options - possible measures
Evaluating Future Cities measures (including showcases)

Future Cities Key component **(comprise mainly structural / physical measures)**	**Measure**	**Possible effect of measure on impact / on urban feature**	**Effects of combination with other measure**	**Link with mitigation / energy measures (curative, proactive/preventive measure)**	**Evaluation (different criteria, e.g. monitoring results) Including showcases Link to evaluation reports of WG 2/ WG 3**
Green structures	• Green roofs. • Green walls. • squares. • River banks • Etc. •	•	•	•	E.g. • Cost-benefit • Applicability • Social acceptance • Etc. •
Water systems	• Blue structures (roofs/art works), • blue squares, rivers/pools and ground water • •	•	•	•	•
Energy efficiency	• •	•	•	•	•
(Urban morphology)	•	•	•	•	•

Addressing people **(mental measures)**	**Measure**	**Criteria / headlines – link to working group 4**			
• Awareness raising	•	•	•	•	•
• Educational / behavioural	• Students summerschool	•	•	•	•
• Including showcases	•	•	•	•	•

Types of measures:

- structural / technological: prevent effects through engineering solutions and changed practices
- educational/behavioural: public / stakeholder awareness etc.

Other types:

- regulatory/institutional: prevent or mitigate effects through revised regulation and planning
- avoidance: avoid and explore changes in risk (e.g. location, forecasting)
- research: improve knowledge climate / risks
- (businesses: spread risks, e.g. geographical and financial diversification)

Participants 2nd Working Group Meeting

Name	Project Partner
Anke Althoff	PP1 Lippeverband
Hans van Ammers	PP2 Municipality of Arnhem
Albert Anïjs	PP2 Municipality of Arnhem
Vincent Kuypers	WUR with PP2 Municipality of Arnhem
Matthias Weilandt	PP3 Emschergenossenschaft
Chantal Lass	PP4 Hastings
Jörn Peters	PP4 Sub-Partner South East England Regional Assembly
Henk-Jan Nijland	PP5 Municipiality Nijmegen
Veroniek Bezemer	PP5 Municipality of Nijmegen
Ton Verhoeven	PP5 Municipality of Nijmegen
Antal Zuurman	PP5 Municipality of Nijmegen
Bénédicte Salle	PP6 Rouen Seine Aménagement
Annemieke de Kort	PP7 Municipality of Tiel
Nathalie Garré	PP8 West-Vlaamse Intercommunale
Birgit Haupter	Infrastruktur & Umwelt Prof. Böhm und Partner - facilitation

Aside from the working group meeting, Antal Zuurman from the municipality of Arnhem explained the functioning of a new flood protection wall in Nijmegen as an art object. When operating water drops generate the impression of a curtain flowing in the wind.

Presentations (for download: www.future-cities.eu)

Future Cities Draft Concept Climate Assessment_Haupter.pdf

Guideline Climate Change EG_LV_Weilandt.pdf

Adaption Study Arnhem_van_Ammers.pdf

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