Educating Climate – A Guide for Climate-adaptive Urban Planning

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Introduction

Identify the problem

Turn it into plans → realise them!
Considerably high amount of researches conducted in the field of urban climate.

Modelling and field measurements are available on the effect of different green infrastructure elements on urban (micro)climate.
Introduction

**Urban climate researches**

- Considerably high amount of **researches** conducted in the field of urban climate.
- **Modelling and field measurements** are available on the effect of different green infrastructure elements on urban (micro)climate.

**Urban design**

- Active urban designers and architects were **not educated to cope with climate issues**.
- Climate-conscious principles are not implemented in urban planning.
- BUT: There seems to be a **lively interest among architects** towards climate-adaptive planning.
Considerably high amount of researches conducted in the field of urban climate. Modelling and field measurements are available on the effect of different green infrastructure elements on urban (micro)climate.

Active urban designers and architects were not educated to cope with climate issues. Climate-conscious principles are not implemented in urban planning. BUT: There seems to be a lively interest among architects towards climate-adaptive planning.

**PROBLEM:** lack of communication between climate experts and urban planners.

BUT there is a need, as in the new programming period of the European Union (2014-2020), the novel system of planning and funding requires a climate conscious approach in urban reconstruction.
• **UHI project**
We created a new genre of urban planning: climate adaptive planning (with OMSZ)
Background

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- **CLIM-CAP course:**
  Landscape designers and architects are interested, but they need requirements formulated in their own language
Background

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- **W. Klemm et al**: developing design guidelines for climate-responsive green infrastructure, ICUC9, 2015

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**Fig. 1: RTD approach to derive evidence-based design guidelines**
• Providing **understandable and easy-to-use tools** to architects to enable adapting climate-conscious principles in everyday planning routine.

• Improve the methodology of **climate-adaptive planning**

• Help to **fulfil EU requirements** regarding climate-conscious planning and developing green infrastructure

• Create **liveable urban environment**

• **Additionally:**

  • Helping introduce **RES** in urban areas

  • Improve **energy-efficiency**, water-management, air quality
1. Step:
   • Creating a framework describing urban microclimate
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2. **Step: Data collection:**
   - Collecting data about how green infrastructure elements influence the selected characteristics:
     - Measurements
     - Microclimate modelling made in ENVI-met
     - Literature available
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2. Step: Data collection:  
   • Collecting data about how green infrastructure elements influence the selected characteristics:  
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     • Microclimate modelling made in ENVI-met  
     • Literature available

3. Step: Simplifying the presentation of data collected.
Why do we need to present results in a simplified way?

Fig. 2: Map showing the difference in MRT due to plantation of a single alley.
Why do we need to present results in a simplified way?

**Fig. 2:** Map showing the difference in MRT due to plantation of a single alley

**Fig. 3:** Device used for our on-site microclimate investigations
## Results 1.

<table>
<thead>
<tr>
<th>ELEMENT OF GREEN INFRASTRUCTURE</th>
<th>$\Delta T_a$ $[^{°C}]$</th>
<th>$\Delta MRT$ $[^{°C}]$</th>
<th>$\Delta v$ $[^{m/s}]$</th>
<th>$\Delta PET$ $[^{°C}]$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 alley</td>
<td>min: -1 max: +0.1</td>
<td>min: -34 max: +2</td>
<td>min: 2-2.5 max: -0.25-1</td>
<td>min: -2.5 max: 0.5</td>
</tr>
<tr>
<td>2 green space</td>
<td>min: -1.8 max: 1.5</td>
<td>min: -32.6 max: 0.5</td>
<td>min: -9.2 max: 0.2</td>
<td>min: -16.1 max: 3.1</td>
</tr>
<tr>
<td>3 covering / paving</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>medium dark paved stone</td>
<td>min: -1.6 max: 3.7</td>
<td>min: -17.3 max: 24.6</td>
<td>min: -5.0 max: 1.7</td>
<td>min: -9.8 max: 13.5</td>
</tr>
<tr>
<td>light-coloured gravel</td>
<td>min: -0.7 max: 3.2</td>
<td>min: -13.1 max: 19.5</td>
<td>min: -9.1 max: -0.7</td>
<td>min: -3.3 max: 14.6</td>
</tr>
</tbody>
</table>
## Results 2.

<table>
<thead>
<tr>
<th>ELEMENT OF GREEN INFRASTRUCTURE</th>
<th>BENEFITS</th>
<th>change of air temperature</th>
<th>change of Mean Radiant Temperature</th>
<th>change of wind speed</th>
<th>Human comfort?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 alley</td>
<td></td>
<td>$\Delta T_{a}$ [°C]</td>
<td>$\Delta \text{MRT}$ [°C]</td>
<td>$\Delta v$ [m/s]</td>
<td>-2.5 - +0.5 PMV</td>
</tr>
<tr>
<td>2 green space</td>
<td></td>
<td>-1</td>
<td>-34</td>
<td>-65% - +10%</td>
<td></td>
</tr>
<tr>
<td>3 covering / paving</td>
<td></td>
<td>-2.4</td>
<td>-36.3</td>
<td>-10.8</td>
<td>-16.1</td>
</tr>
<tr>
<td>4 water surface</td>
<td></td>
<td>+3.7</td>
<td>+31.3</td>
<td>-</td>
<td>+20.1</td>
</tr>
<tr>
<td>5 green façade</td>
<td></td>
<td>-0.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 green roof</td>
<td></td>
<td>0</td>
<td></td>
<td></td>
<td>No precise data available</td>
</tr>
</tbody>
</table>
## Results 3.

<table>
<thead>
<tr>
<th>BENEFITS</th>
<th>Summer energy use</th>
<th>Winter energy use</th>
<th>Human Comfort</th>
<th>Stormwater runoff regulation</th>
<th>air pollution removal</th>
<th>carbon sequestration</th>
</tr>
</thead>
<tbody>
<tr>
<td>alley</td>
<td>+++</td>
<td>+</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>green space</td>
<td>+</td>
<td>+</td>
<td>++++</td>
<td>++++</td>
<td>++++</td>
<td>++++</td>
</tr>
<tr>
<td>lawn</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>asphalt</td>
<td>0</td>
<td>+</td>
<td>- - - -</td>
<td>- -</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>concrete</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>- -</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>pave stone</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>- -</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>gravel</td>
<td>0</td>
<td>0</td>
<td>+</td>
<td>+</td>
<td>++</td>
<td>-</td>
</tr>
<tr>
<td>water surface</td>
<td>0</td>
<td>0</td>
<td>+</td>
<td>++++</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>green façade</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>++</td>
<td>+</td>
</tr>
<tr>
<td>green roof</td>
<td>++</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>
• We have numerous projects to be started in the following year, an additional output should be a Guide for Climate-adaptive Urban Planning

• **Harmonise and refine data** (e.g.: validate modelling results with measurements)

• Introduce planning criteria in **education (university, trainings)**

• Present result to urban planners and architects, get **feedback** through practice

• **Improving methodology** – if needed

• Introduce **planning criteria on national scale**
Thank you for your attention!

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*project coordinator*

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