Health benefits of urban green infrastructures from science to policy

The case of urban planning in Trento, Italy

Chiara Cortinovis, Davide Geneletti, Linda Zardo
The Garden City is “a healthy, natural, and economic combination of town and country life” aimed to “to raise the standard of health and comfort of all true workers of whatever grade”

[E. Howard, 1902. “Garden Cities of To-Morrow”]

“It is a scientific fact that the occasional contemplation of natural scenes of an impressive character [...] is favorable to the health and vigor of men and especially to the health and vigor of their intellect beyond any other conditions which can be offered them, that it not only gives pleasure for the time being but increases the subsequent capacity for happiness and the means of securing happiness.”

ES as a framework and the different pathways

- Built on MA (2005) and Gomez et al. (2013)
### Dimensions of Human Health

<table>
<thead>
<tr>
<th>Engagement with Nature</th>
<th>Biological</th>
<th>Psychological</th>
<th>Epidemiological</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viewing</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Being in the presence</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Active participation</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

**MODELS TO QUANTIFY ECOSYSTEM SERVICES AT THE URBAN SCALE**

+ SPATIALLY-EXPLICIT ANALYSIS OF BENEFICIARIES

Which type of relations?
case study: the city of Trento
climate change in Trentino region

CLIMAWARE
CLIMatic change impacts on future Availability of WAter RESources and hydro-geological risks
heat waves and urban micro-climate

up: MODIS 8-day daytime 1km grid Land-surface Temperature

down: MODIS 8-day nighttime 1km grid Land-surface Temperature

2015-06-26 > 2015-07-03
1. identify the pathway: health components > relation with green spaces > ES supply

2. SUPPLY = “Cascade Model”: ecosystem << bioph. structure << function << ES

3. DEMAND = health-related vulnerabilities

4. assess the current state of the pathway through a spatially explicit comparison between supply and demand

5. recognize opportunities for improving the existing green infrastructures and plan their implementation
micro-climate regulation: supply

1. SHADING ASSESSMENT
   - functions involved: shading
   - components involved: tree canopy coverage
   - output: shading assessment

2. EVAPOTRANSPIRATION ASSESSMENT
   - functions involved: evapotranspiration
   - components involved: tree canopy coverage, soil cover, climatic area
   - output: evapotranspiration assessment

3. COOLING CAPACITY ASSESSMENT
   - functions involved: shading, evapotranspiration
   - components involved: size
   - output: cooling capacity assessment

4. VARIATION OF AIR-TEMPERATURE ASSESSMENT

[Zardo et al., (forthcoming)]
micro-climate regulation: supply

Legend:
- A+
- A
- B
- C
- D
- E

cooling capacity

cooling effect
micro-climate regulation: demand (vulnerability to heat stress)

[Kabisch and Haase (2014), Kazmierczak (2012)]
integration in urban policies: design of redevelopment scenarios

<table>
<thead>
<tr>
<th>baseline</th>
<th>scenario A</th>
<th>scenario B</th>
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</thead>
<tbody>
<tr>
<td>best cooling performance</td>
<td>medium-level cooling performance</td>
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</table>

### Population Distribution According to Cooling Class

<table>
<thead>
<tr>
<th>A+</th>
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<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
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<tbody>
<tr>
<td>total pop</td>
<td>foreigners</td>
<td>children</td>
<td>elders</td>
<td>total value</td>
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<tr>
<td>A</td>
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<td>40</td>
<td>11</td>
<td>73</td>
<td>124</td>
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<tr>
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<td>53</td>
<td>26</td>
<td>208</td>
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<tr>
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<td>29</td>
<td>201</td>
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<tr>
<td>D</td>
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<tr>
<td>E</td>
<td>250</td>
<td>31</td>
<td>11</td>
<td>72</td>
<td>114</td>
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</tbody>
</table>

### Sealed Surface with Canopy Coverage > 40%
(e.g. “green” parking area)

### Homogeneous Grassy Cover with Canopy Coverage > 80%
(e.g. urban forest or urban park with dense vegetation)

### Bare Soil with Some Individual Trees

<table>
<thead>
<tr>
<th>A+</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
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<tr>
<td>total pop</td>
<td>foreigners</td>
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<td>30</td>
<td>225</td>
<td>381</td>
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<tr>
<td>B</td>
<td>581</td>
<td>82</td>
<td>28</td>
<td>165</td>
<td>270</td>
</tr>
<tr>
<td>C</td>
<td>758</td>
<td>307</td>
<td>32</td>
<td>211</td>
<td>350</td>
</tr>
<tr>
<td>D</td>
<td>402</td>
<td>38</td>
<td>19</td>
<td>113</td>
<td>170</td>
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<tr>
<td>E</td>
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<td>1</td>
<td>4</td>
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### Benefits per ha

<table>
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<tr>
<th>benefit</th>
<th>112.3</th>
<th>37</th>
<th>10</th>
<th>6.8</th>
<th>12.9</th>
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<tbody>
<tr>
<td>per ha</td>
<td>458.47</td>
<td>322.56</td>
<td>52.14</td>
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</tbody>
</table>
Which type of intervention is required to increase the benefits of citizens?

Which planning action produces the highest benefits?

Where is it more cost-effective to intervene?

next steps

• Refine the analysis of demand considering the different exposures
• Complete the assessment of key urban ecosystem services
• Mainstream this information into the new Urban Plan (2016)
• Inform the procedure of **Strategic Environmental Assessment**
ANY QUESTION?

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