Megacities structure and water security: Past and future

BOLOGNESI, Thomas
Megacities Structure and Water Security
Past and Future

T. Bolognesi†

†University of Geneva
School of Public Affairs, CU Denver
thomas.bolognesi@unige.ch

Global Water Century: Looking ahead 100 Years
June 12, 2018
Where in the world are the megacities?
Why focusing on megacities?

1. An urban and concentrated world (UN, World Urbanization Prospect 2018):
   - Urban population: 30% (1950), 55% (2018), and 68% by 2050
   - 1 in 8 people live in 33 megacities (> 10 M inhab.)

2. Intense interactions between human and nature
Why focusing on megacities?

1. An urban and concentrated world (UN, World Urbanization Prospect 2018):
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2. Intense interactions between human and nature

Critical challenge of floods and droughts management

- “Day Zero” challenge: Cape Town, Sao-Paulo... California?
- > 70% of pop affected by water disaster in 2017 (EM-DAT, 2018)
- severe droughts costlier than floods (Damania et al., 2017)
Vulnerability to water-related disasters

Short-term perspective: How water-related disasters impact on megacities?
Vulnerability to water-related disasters

Short-term perspective: How water-related disasters impact on megacities?

Long term perspective: How megacities structure impacts on their vulnerability to water-related disasters?
A measure of urban structure (Bolognesi, 2013, 2015)

- 595 megacities, with 192 in the 154 largest watersheds

- 3 structural characteristics
  1. Maturity (33.4%)
  2. Antropization (29.8%)
  3. Centrality (18.8%)
• 595 megacities, with 192 in the 154 largest watersheds

• 3 structural characteristics
  1. Maturity (33.4%)
  2. Antropization (29.8%)
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• 6 Regional profiles
Macro structure of cities (Bolognesi, 2015)
Introduction  Megacities structure  Looking backward  Looking ahead  Implication for Utilities

Macro structure of cities (Bolognesi, 2015)
## Structural characteristics and vulnerability 1980-2009

<table>
<thead>
<tr>
<th></th>
<th>Maturity</th>
<th>Anthropization</th>
<th>Centrality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floods</td>
<td>-0.06</td>
<td>0.26**</td>
<td>-0.42**</td>
</tr>
<tr>
<td>Deaths</td>
<td>0.04</td>
<td>0.07</td>
<td>0.15*</td>
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<tr>
<td>People affected</td>
<td>-0.22**</td>
<td>0.30**</td>
<td>-0.28**</td>
</tr>
<tr>
<td>Damage in $</td>
<td>-0.1</td>
<td>0.25**</td>
<td>-0.28</td>
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<tr>
<td>Droughts</td>
<td>-0.22**</td>
<td>0.08</td>
<td>-0.2**</td>
</tr>
<tr>
<td>Deaths</td>
<td>-0.05</td>
<td>0</td>
<td>0.1</td>
</tr>
<tr>
<td>People affected</td>
<td>-0.25**</td>
<td>0.34**</td>
<td>-0.24</td>
</tr>
<tr>
<td>Damage in $</td>
<td>-0.18</td>
<td>0.1</td>
<td>-0.29**</td>
</tr>
</tbody>
</table>

N=192

OLS estimation, *p < 0.05, **p < 0.01
Future Water Deficit 2041-2070 (Flörke et al., 2018)

- + 80% urban water demand by 2050
- 27% studied cites with demand > water availability
- 19% high potential intersectoral conflicts
### Structural characteristics and Future Water Deficit 2041-2070

<table>
<thead>
<tr>
<th></th>
<th>Deficit</th>
<th>Magnitude</th>
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<tbody>
<tr>
<td></td>
<td>Robust</td>
<td>Bootstrap</td>
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<tr>
<td>maturity</td>
<td>-0.439***</td>
<td>-0.439***</td>
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<tr>
<td>centrality</td>
<td>-0.315*</td>
<td>-0.315+</td>
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<tr>
<td>bigbv</td>
<td>-0.617+</td>
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<tr>
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<td>_cons</td>
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<tr>
<td>N</td>
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<tr>
<td>pseudo $R^2$</td>
<td>0.115</td>
<td>0.071</td>
</tr>
</tbody>
</table>

+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
Implications for water profession and management practices

Embeddeness & connectedness:

- Spatial: widen the diagnosis (Bergsma, 2018)
- Time and path dependency: transition pathways (Renou and Bolognesi, 2018)
- Social-ecological systems: nested habitats and components, and vice-versa (Ostrom, 2009; Ostrom et al., 2007)

Management practices:

- Plan according to your state (structure) not only your outcome (vulnerability)
- The world is diverse, so should be management
- Regulatory entanglement, pay attention to the overall coherence
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Thank you
Appendix


