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Promoting research excellence in nature-based solutions for innovation, sustainable economic growth and human well-being in Malta.

Nature-based solutions and performance-based planning

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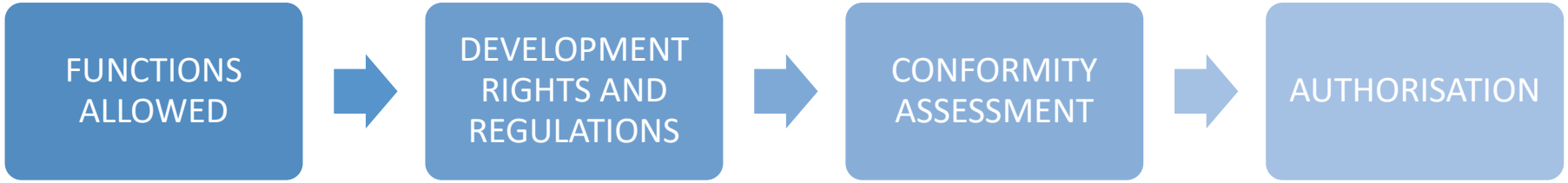
This project receives funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 809988.

prescriptive planning approaches (e.g., traditional zoning)

for each zone:



- plan as a regulatory tool
- predictability of the outcomes
- lack of flexibility

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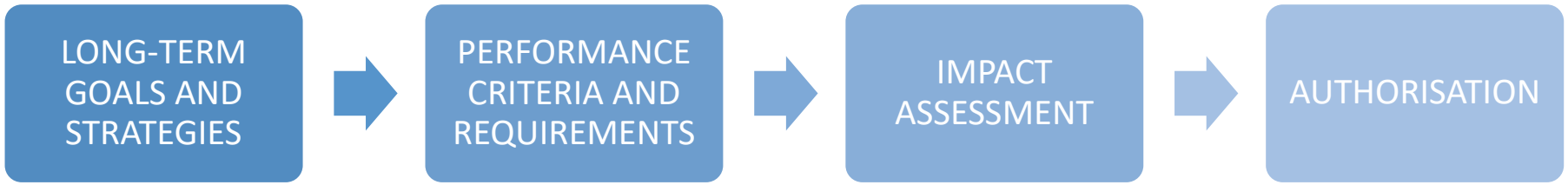
Performance-based planning



- plan as a strategic tool
- flexibility
- dialogue and negotiation
- Higher management complexity

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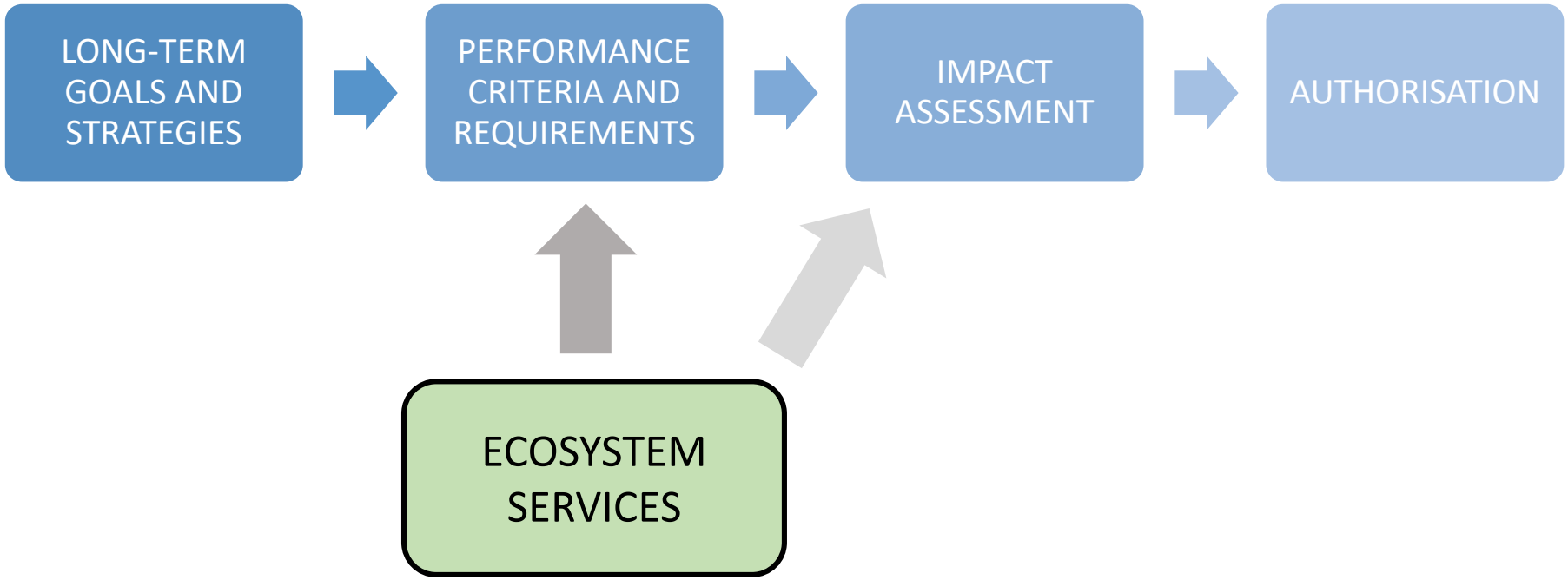
Performance-based planning using ecosystem services information



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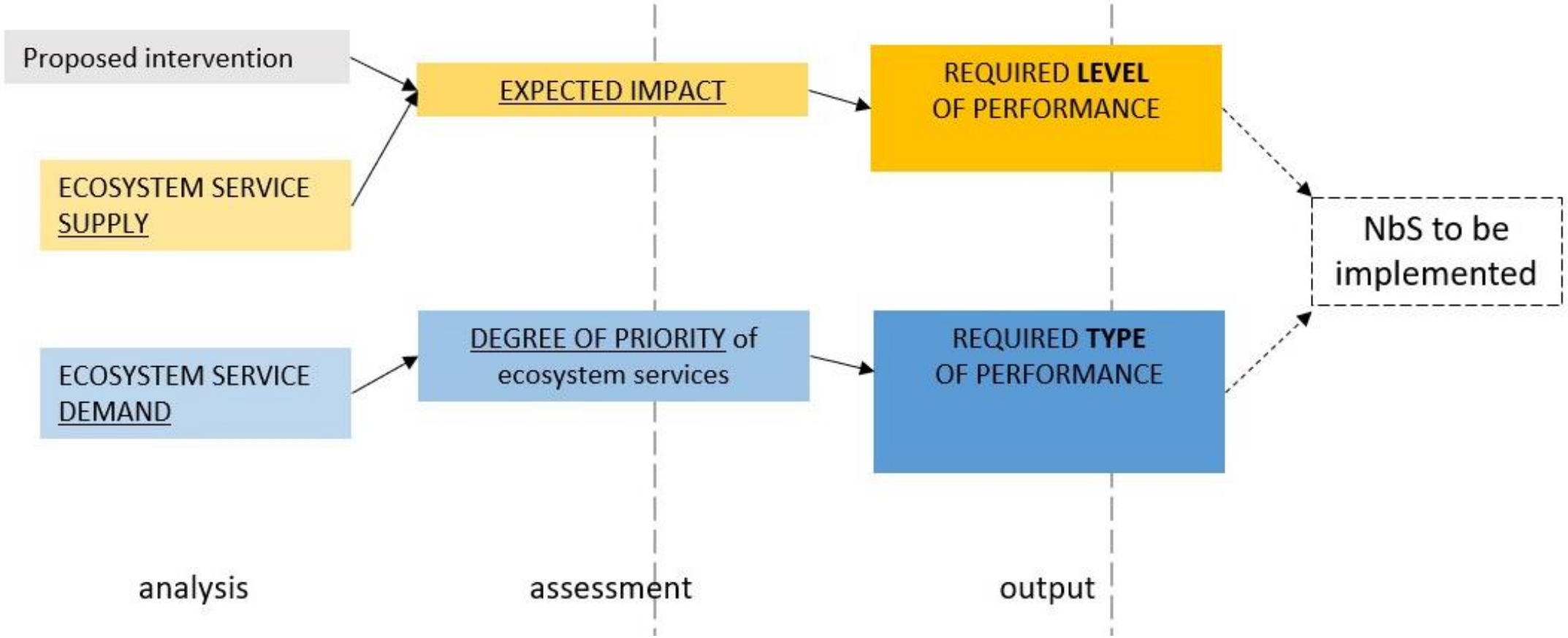
Conceptual approach



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Concepts for a performance-based approach in Trento

Photo by D. Geneletti

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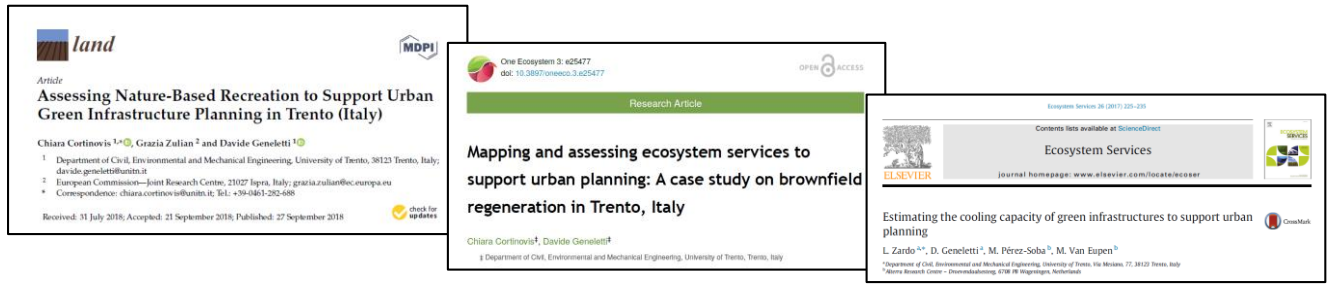
Assessing ecosystem services supply

Urban ecosystem service	Supply indicator	Method
Microclimate regulation (cooling)	Cooling capacity of green infrastructure	Spatial modelling based on *Zardo et al. (2017)*
Habitat provision	Relative richness of focal species	Ecological modelling (see *Pedrini et al., 2013 - Life+ T.E.N.*)
Recreation	Recreation Opportunity Spectrum	ESTIMAP-recreation model with inputs from local experts (see *Cortinovis et al., 2018*)
Noise mitigation	Reduction of traffic noise at selected receivers (residential buildings)	Spatial modelling through QGIS OpeNoise plug-in
Air purification	PM10 deposition	Proxy based on vegetation typology and distance from main sources (*Derkzen et al., 2015*)
Runoff mitigation	Runoff avoided due to infiltration	Proxy based on the percentage of permeable areas
Food provision	Land suitability for agriculture	Proxy based on a combination of current crop typology and suitability factors

rationale:
ES supply reduced due replacement of existing green infrastructure



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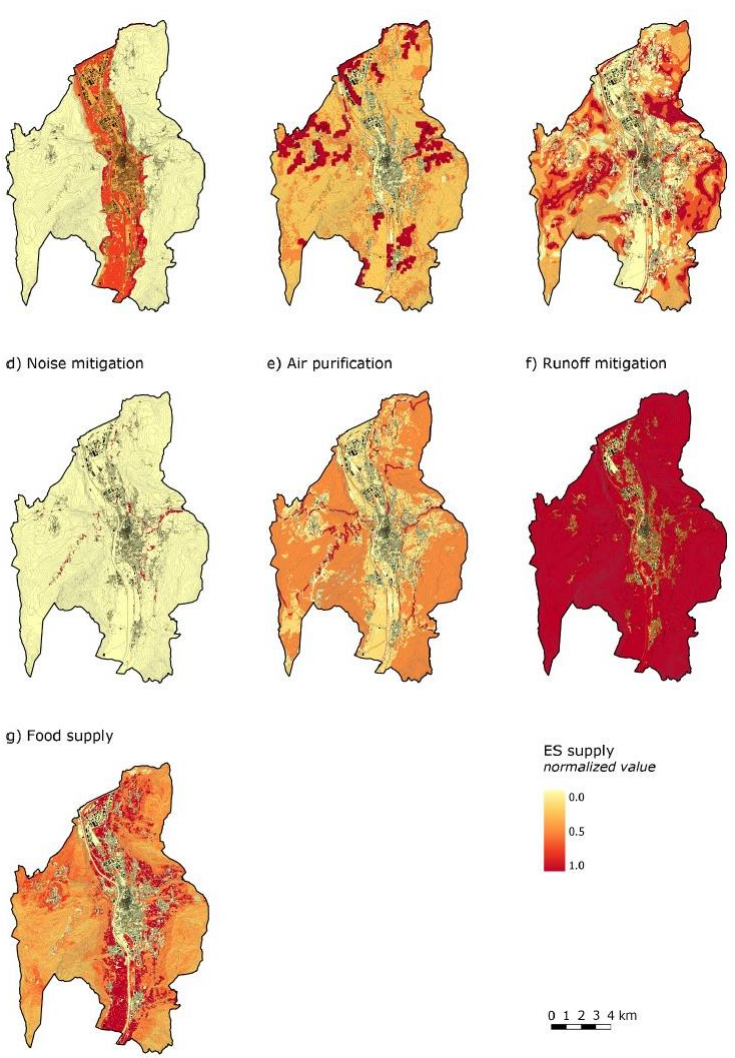
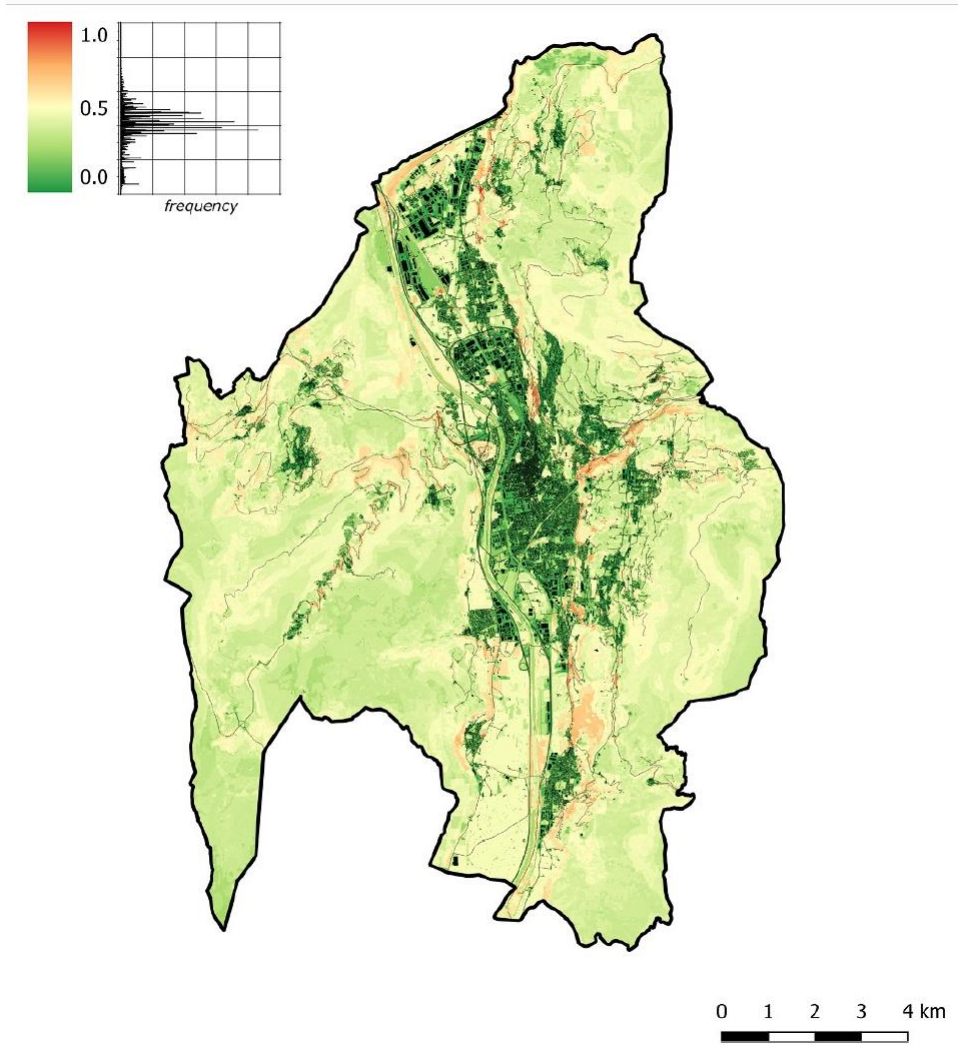
Assessing ecosystem services supply





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Assessing ecosystem services demand

Urban ecosystem service	Intensity of hazard / deprivation	Exposure and vulnerability	Benefitting area
Microclimate regulation	Class of cooling effect	Total population + vulnerable (children and elderlies)	100-m buffer around the cell
Recreation	Distance from the closest area offering high-level recreational opportunities	Total population	300-m buffer around the cell
Noise mitigation	Noise from roads and railroads above 65 dB	Residential buildings	Buildings shielded by green barriers
Runoff mitigation	Percentage of impermeable surfaces	Total population + areas for commercial, productive, and service use	Urban sub-watershed
Food provision	Distance from the closest community garden	Families without private garden	500-m buffer around the cell

rationale:
benefits produced by new NbS depend on the level of demand

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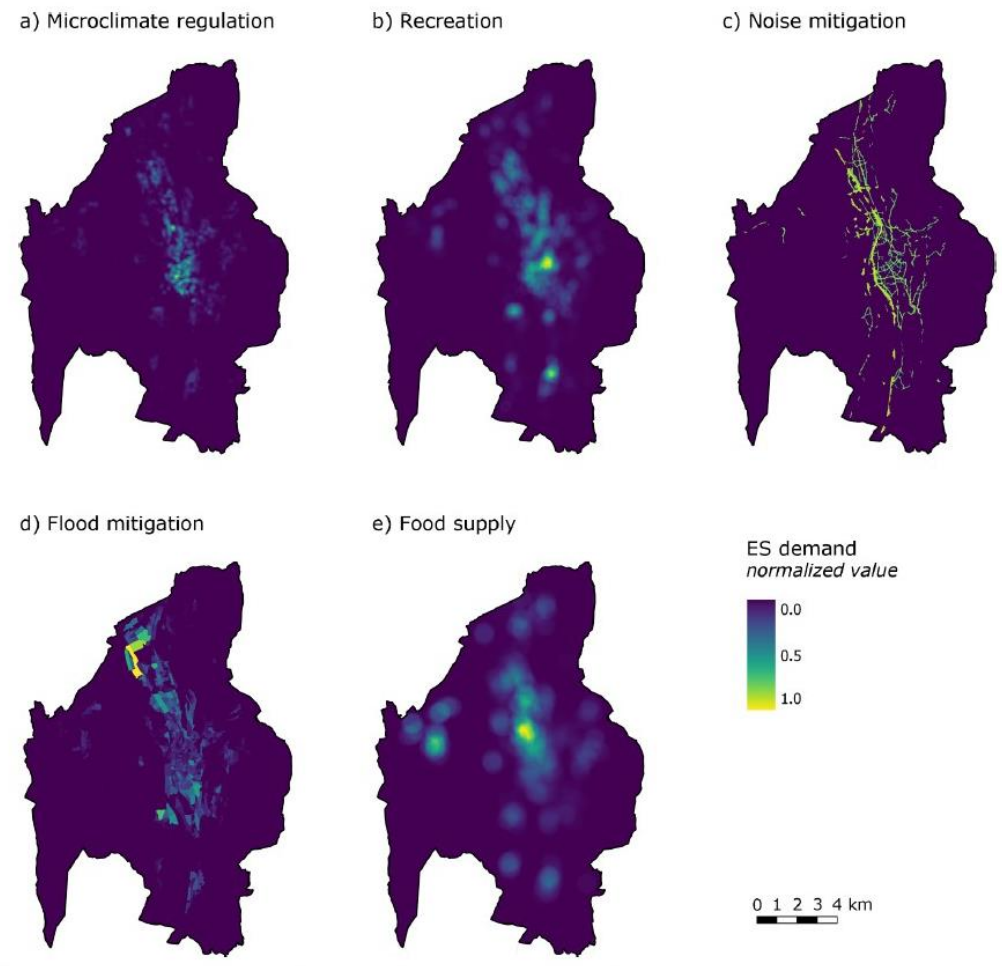
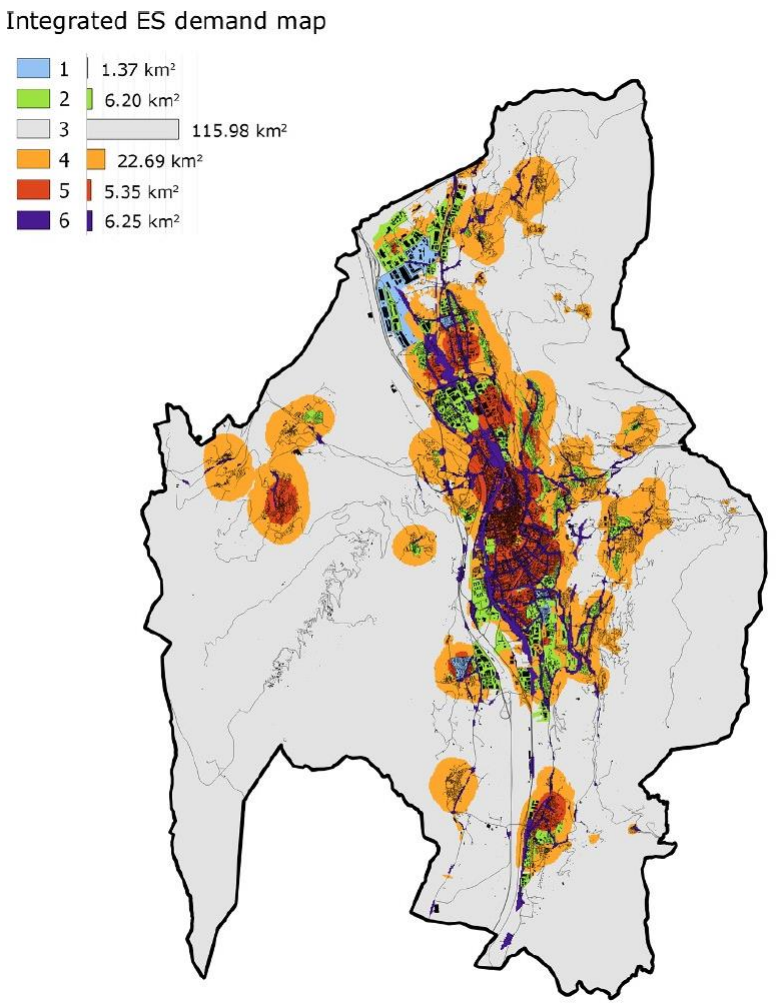
Assessing ecosystem services demand





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Defining the required performance

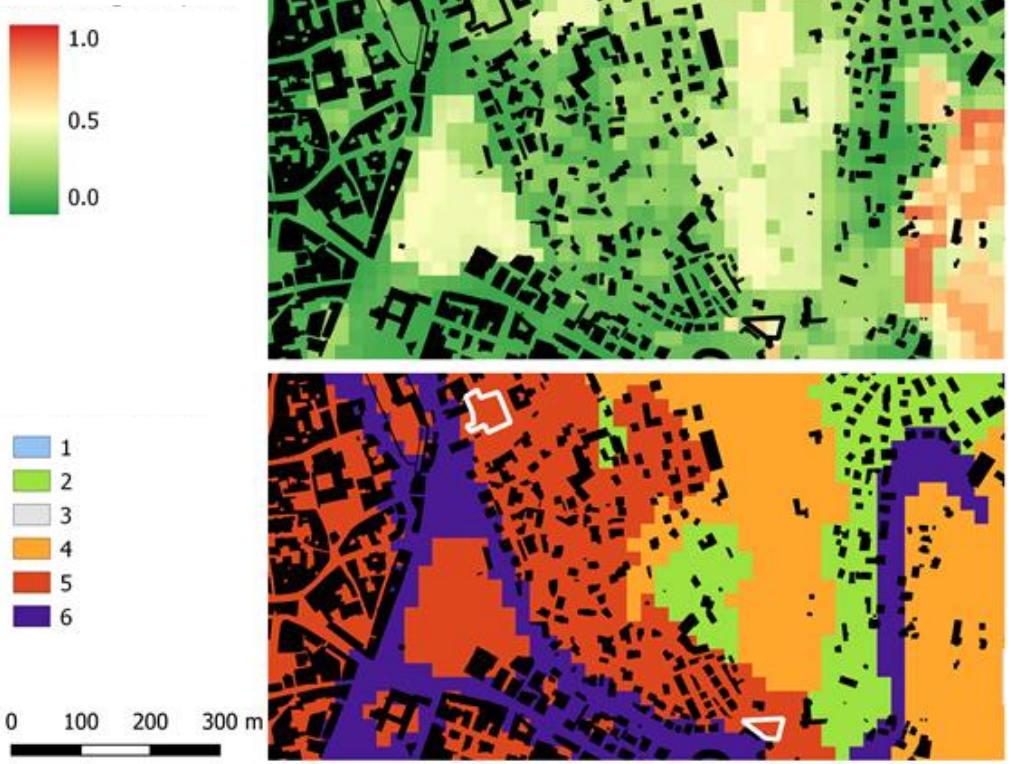
How much? = level of performance

relates to the **impact** of the development on the supply of ecosystem services

What? = type of performance

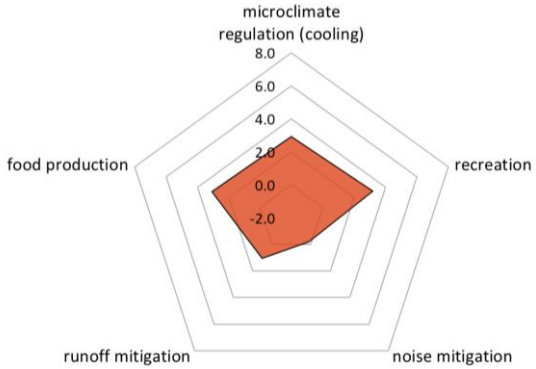
relates to the **demand** for ecosystem services in the affected area

test 1 - in-fill development in vacant lots



different level of impacts on existing supply
but same priorities due to similar demand profiles

- A -> 0,23 -> medium impact -> 4 points
- B -> 0,54 -> high impact -> 6 points



	cluster 5
noise mitigation	0 *(-0.2)*
microclimate regulation	4 *(2.9)*
runoff mitigation	2 *(1.0)*
food supply	4 *(3.1)*
recreation	4 *(3.2)*

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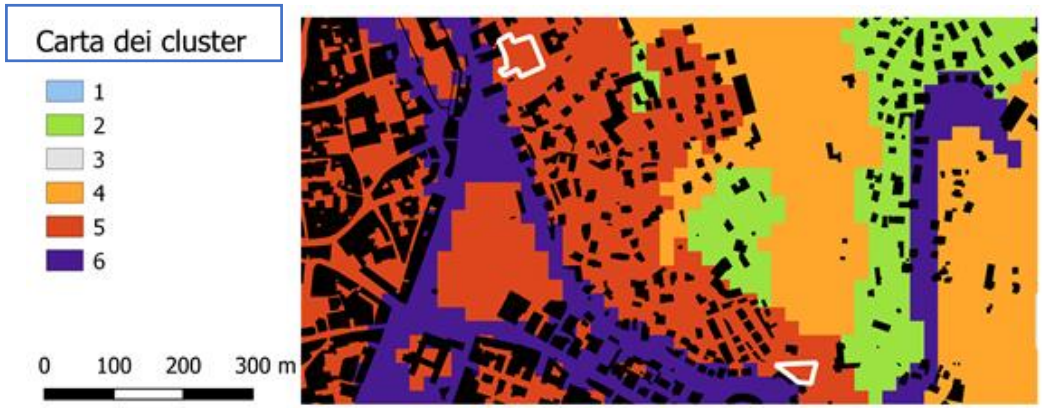
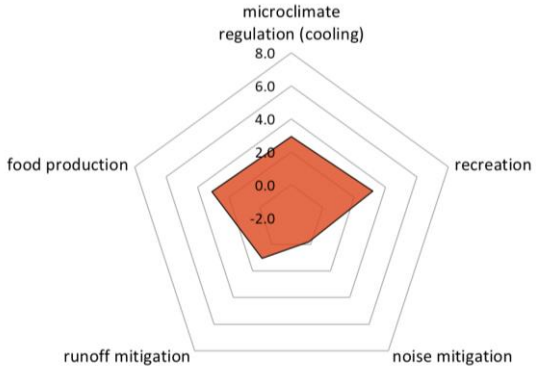
possible solution: urban green area + allotment garden





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microclimate regulation	4 *(2.9)*
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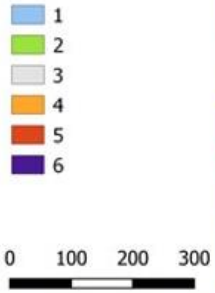
test 2 – large urban expansion



different priorities in different areas
> promoting efficiency in resource allocation

- C -> 0,41 -> high impact -> 6 points

	cluster 2	cluster 4	cluster 5	cluster 6
noise mitigation	0 *(-0.2)*	0 *(-0.2)*	0 *(-0.2)*	4 *(4.9)*
microclimate regulation	1 *(0.6)*	1 *(0.0)*	4 *(2.9)*	3 *(1.5)*
runoff mitigation	4 *(2.3)*	0 *(-0.1)*	2 *(1.0)*	2 *(0.8)*
food supply	1 *(0.6)*	2 *(0.7)*	4 *(3.1)*	3 *(1.5)*
recreation	2 *(1.0)*	1 *(0.3)*	4 *(3.2)*	3 *(1.7)*

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possible solution: floodable green area + green barrier for noise shielding

	cluster 2	cluster 4	cluster 5	cluster 6
noise mitigation	0 *(-0.2)*	0 *(-0.2)*	0 *(-0.2)*	4 *(4.9)*
microclimate regulation	1 *(0.6)*	1 *(0.0)*	4 *(2.9)*	3 *(1.5)*
runoff mitigation	4 *(2.3)*	0 *(-0.1)*	2 *(1.0)*	2 *(0.8)*
food supply	1 *(0.6)*	2 *(0.7)*	4 *(3.1)*	3 *(1.5)*
recreation	2 *(1.0)*	1 *(0.3)*	4 *(3.2)*	3 *(1.7)*

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Discussion points

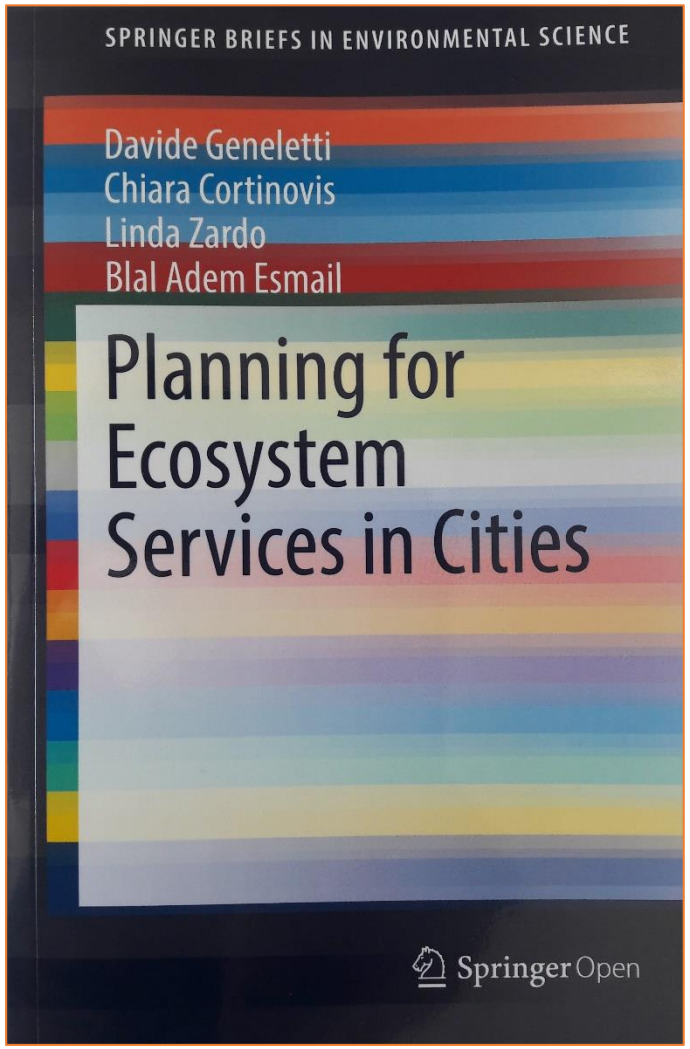
- A proof-of-concept. Municipal administration will have to take a key role in guiding the process:
  - ES selection and indicator weighting to reflect planning objectives
  - levels of complexity
  - acceptable ES trade-offs
  - Transparency of the information

- Innovative use of urban ecosystem service knowledge (demand and supply)

- Towards systematic integration of NbS in urban planning

references (open access)

https://link.springer.com/book/10.1007%2F978-3-030-20024-4



Landscape and Urban Planning 201 (2020) 103842

Contents lists available at ScienceDirect

Landscape and Urban Planning

journal homepage: www.elsevier.com/locate/landurbplan

A performance-based planning approach integrating supply and demand of urban ecosystem services

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https://doi.org/10.1016/j.landurbplan.2020.103842

References

- Cortinovis, C., & Geneletti, D. (2020). A performance-based planning approach integrating supply and demand of urban ecosystem services. Landscape and Urban Planning, 201. https://doi.org/10.1016/j.landurbplan.2020.103842

Thank you!

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