2016 ACES A Community on Ecosystem Services
Implementation Advances and Challenges

In partnership with
ECOSYSTEM MARKETS
Making Them Work
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LIVEABILITY MAPPING

BY INTEGRATING ECOSYSTEM AND URBAN SERVICES WITH STAKEHOLDERS' PERCEIVED IMPORTANCE

TRUSTEE

Towards RUral Synergies and Trade-offs between Economic development and Ecosystem services

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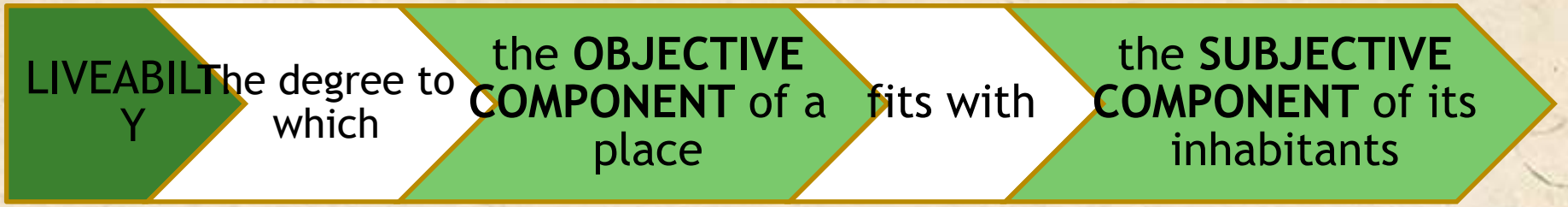
General background

- Systematic use of ecosystem services (ES) approach in policy-making is still poor
  (see e.g.: De Benedetto et al., 2013; Kaczorowska et al., 2015)
- This is mainly due to:
  1. **Low awareness** about the effectiveness of ES approach in supporting more sustainable land use policies *(see e.g. De Groot, 2010)*
  2. **Lack of operational methods for ES integration in current policy-making** *(Baró et al., 2016)*
- More effective, informative and operational tools, integrating multiple landscape services, are still needed

Place liveability

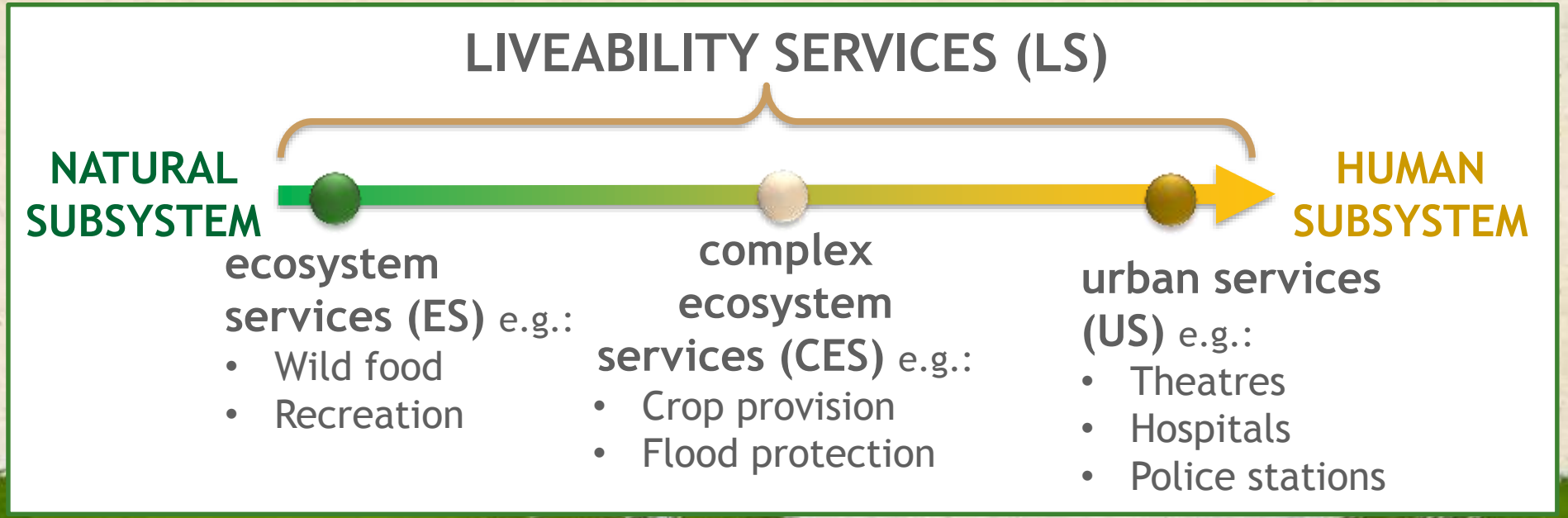


(modified from Veenhoven, 1996)

OBJECTIVE	SUBJECTIVE
PROVISIONS: supply of liveability services	NEEDS: preferences (or demand) of services
CONSTRAINTS: disservices (bad climate, high cost of living…)	CAPACITIES: ability of people to deal with constraints(resistance to bad climate, high income…)

Ecosystem and urban services

- Humans produce urban services to meet their own needs *(Leby and Hashim 2010)*
- Human subsystem interacts with natural subsystem to provide very different services *(Downing et al, 2014)*



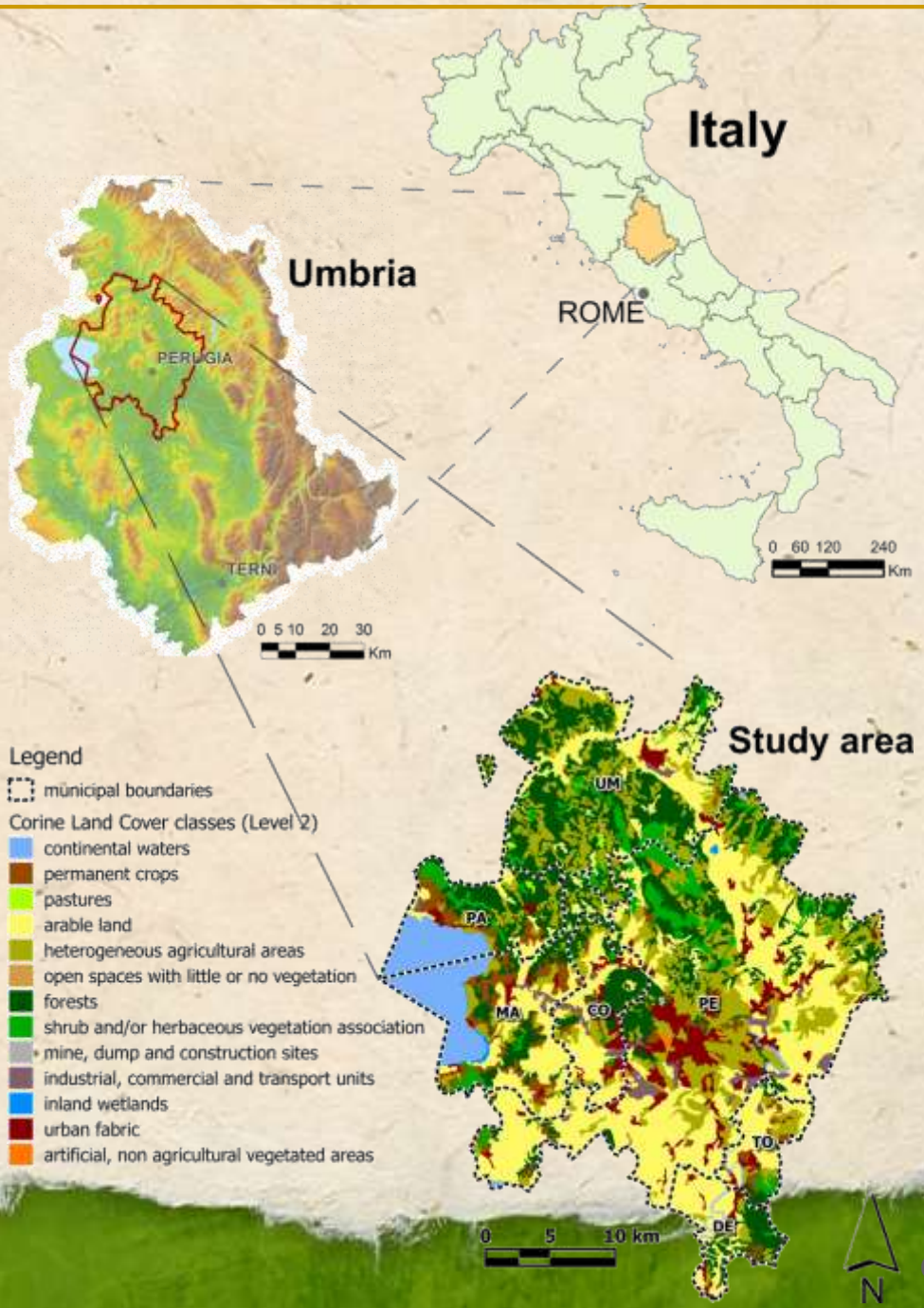
Objectives and methodological steps

1. Identify and classify all relevant LS (ES, CES, US)
2. Consider preferences of stakeholders (Potschin and Haines Young, 2013)
3. Produce synthetic, spatially explicit LS indices (Malczewski, 2006)

1. Development of a LS classification
2. LS weightening and ranking through stakeholder interviews
3. Calculation of LS spatial indices
   Integration of LS indices and related weights

Study area

- About 1000 km^2
- 7 municipalities
- Complex LULC → complex service flows



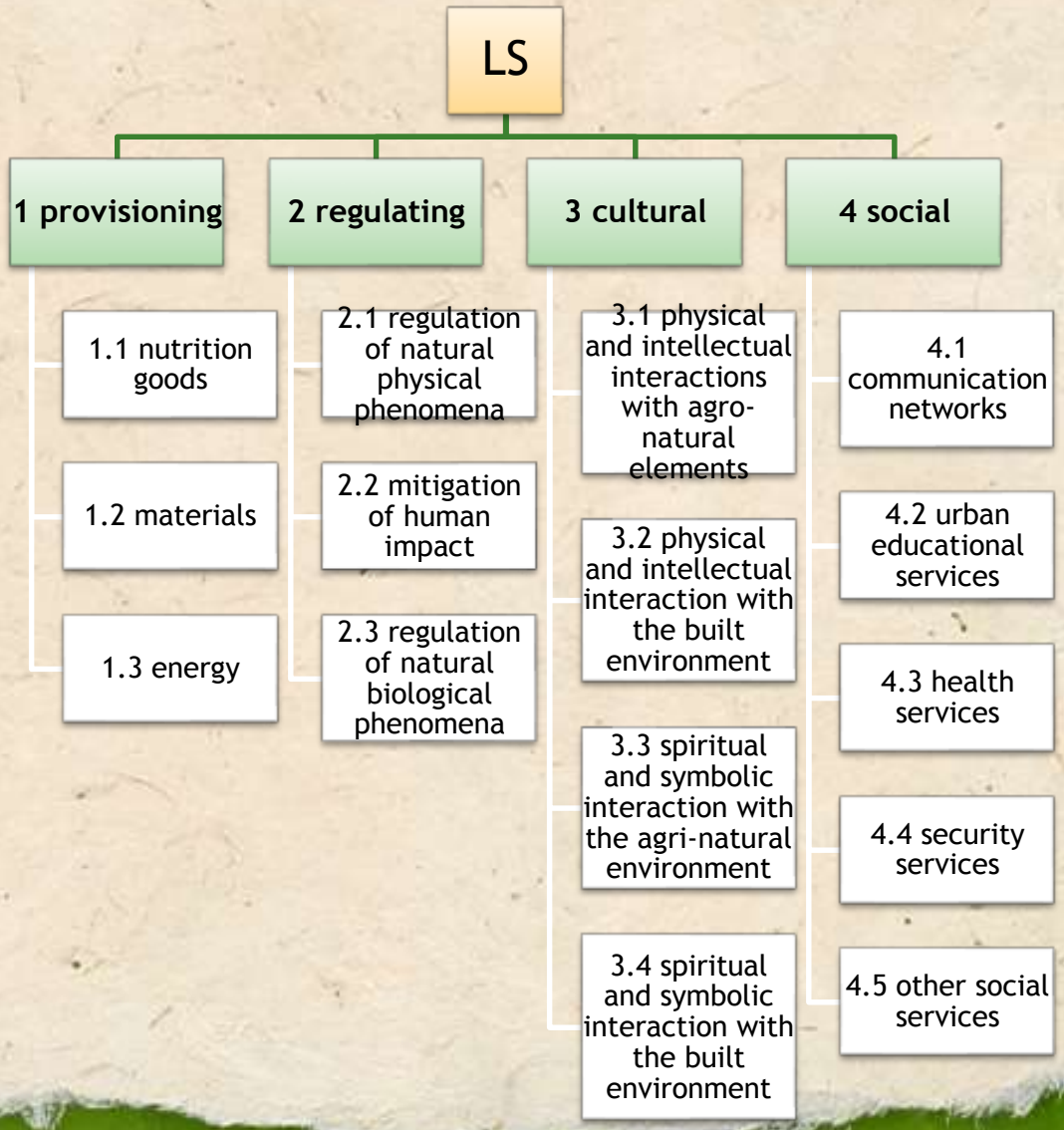
1) Liveability Services classification

- Starting from **Common European Classification of Ecosystem Services** (CICES)

simplification
- Reduction of hierarchical levels (from 4 to 3)
- Elimination of intermediate services (Saarikoski et al., 2015)

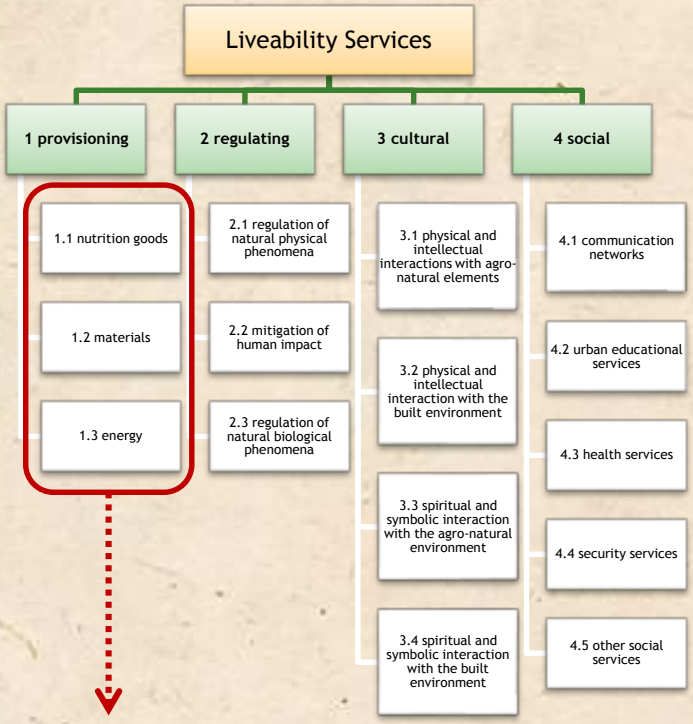
integration
- of urban services

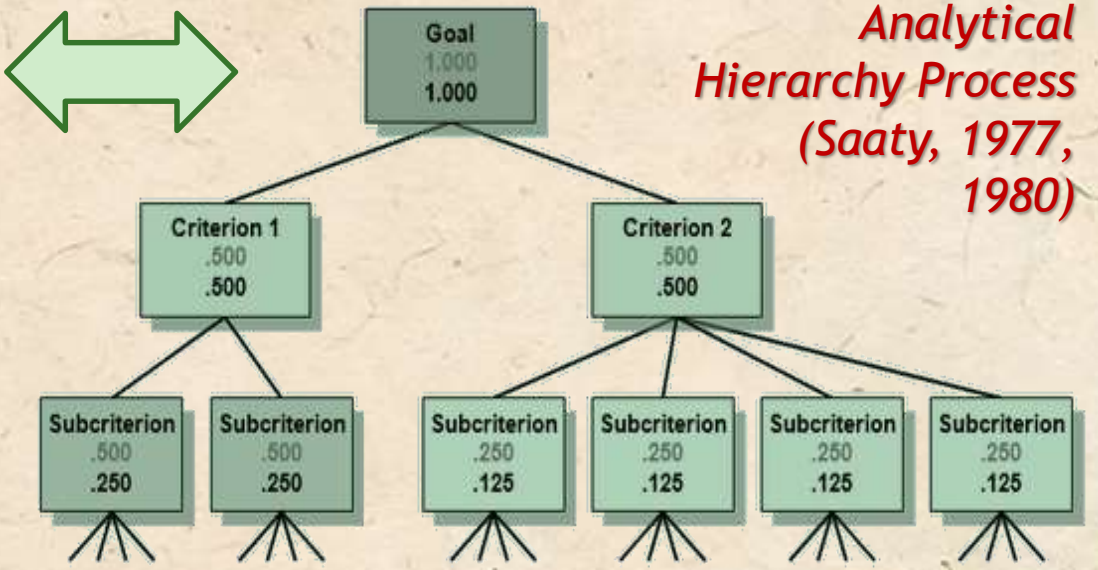
3 hierarchical levels
- 4 sections
- 15 divisions
- 67 classes (43 ES + 24 US)
- Including ES, complex ES and US



(see Antognelli & Vizzari, 2016)

2a) LS ranking using AHP (MCDA)





Analytical Hierarchy Process (Saaty, 1977, 1980)

PAIRWISE COMPARISON MATRIX (PCM)

	1.1	1.2	1.3	weight
1.1	1	1	3	0.44
1.2	1	1	2	0.38
1.3	0.33	0.5	1	0.16
				Sum=1

For each couple of **classes/divisions/sections** of services:

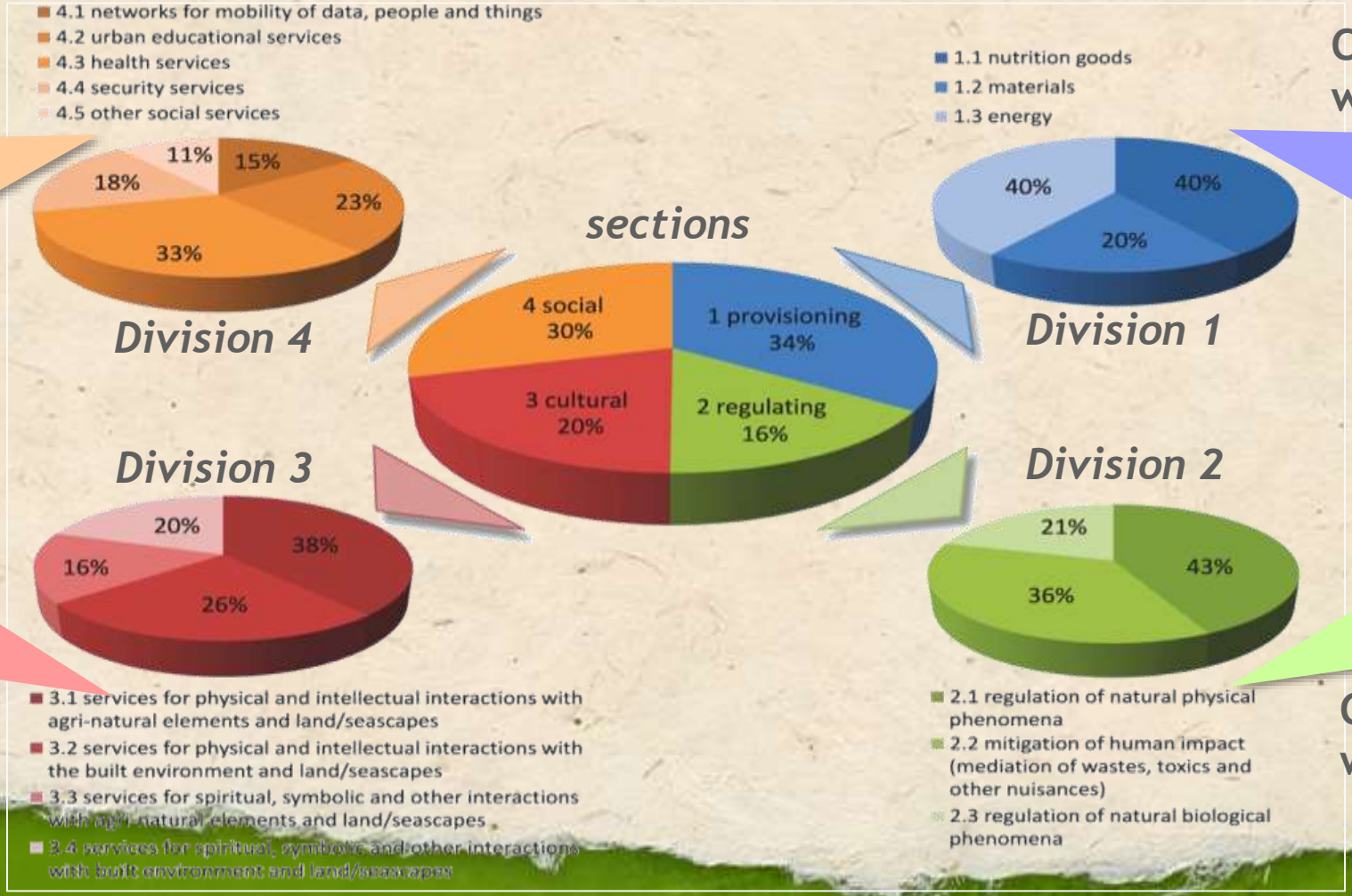
- **Which one** of the two services is **more important**?
- **How many times** is it more important on a scale from **1 to 9**? *(**1**=same importance, **9**=much more important)*

Stakeholder involvement

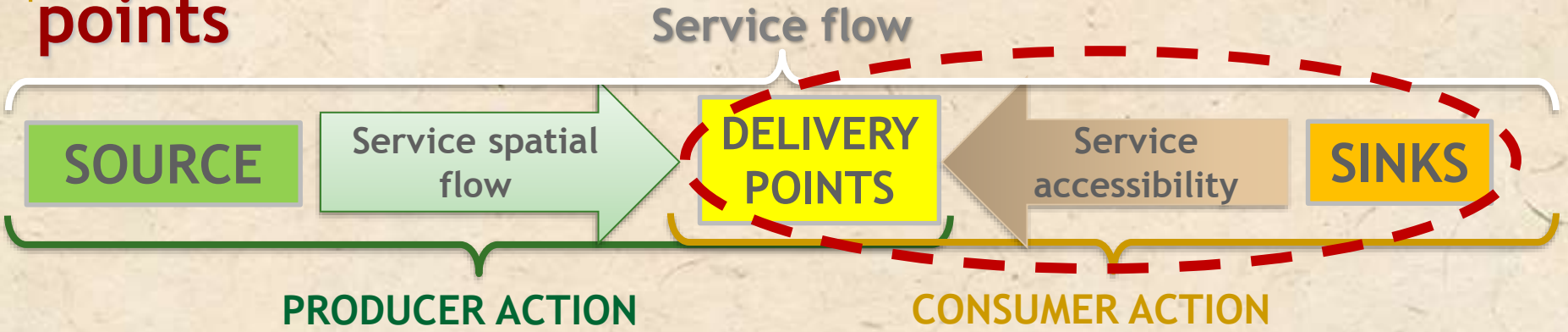
- 7 urban planner (one for each municipality)
- 5 experts
- One-to-one interviews:
  - 15 PCMs filled
- www.superdecisions.com
  (real-time consistency check)

2b) Final LS weights and ranking

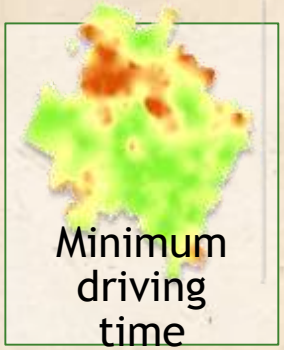
Weight = influence of service on liveability



3a) Modelling accessibility of service delivery points

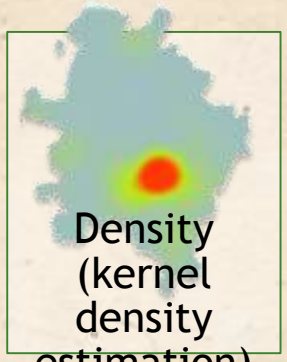


5 main spatial approaches:



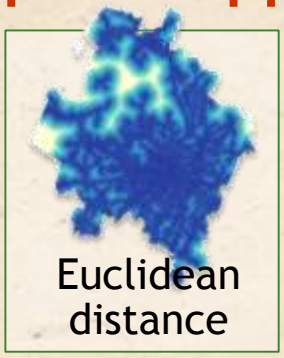
Minimum driving time

E.g. Pharmacies Police stations



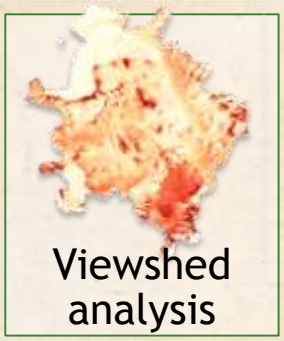
Density (kernel density estimation)

E.g. Urban entertainment services



Euclidean distance

E.g. Aqueducts, water and energy networks



Viewshed analysis

E.g. landscape aesthetic

LULC based indicators

E.g. flood protection

43/67 services were modelled (19/43 ES - 24/24 US)

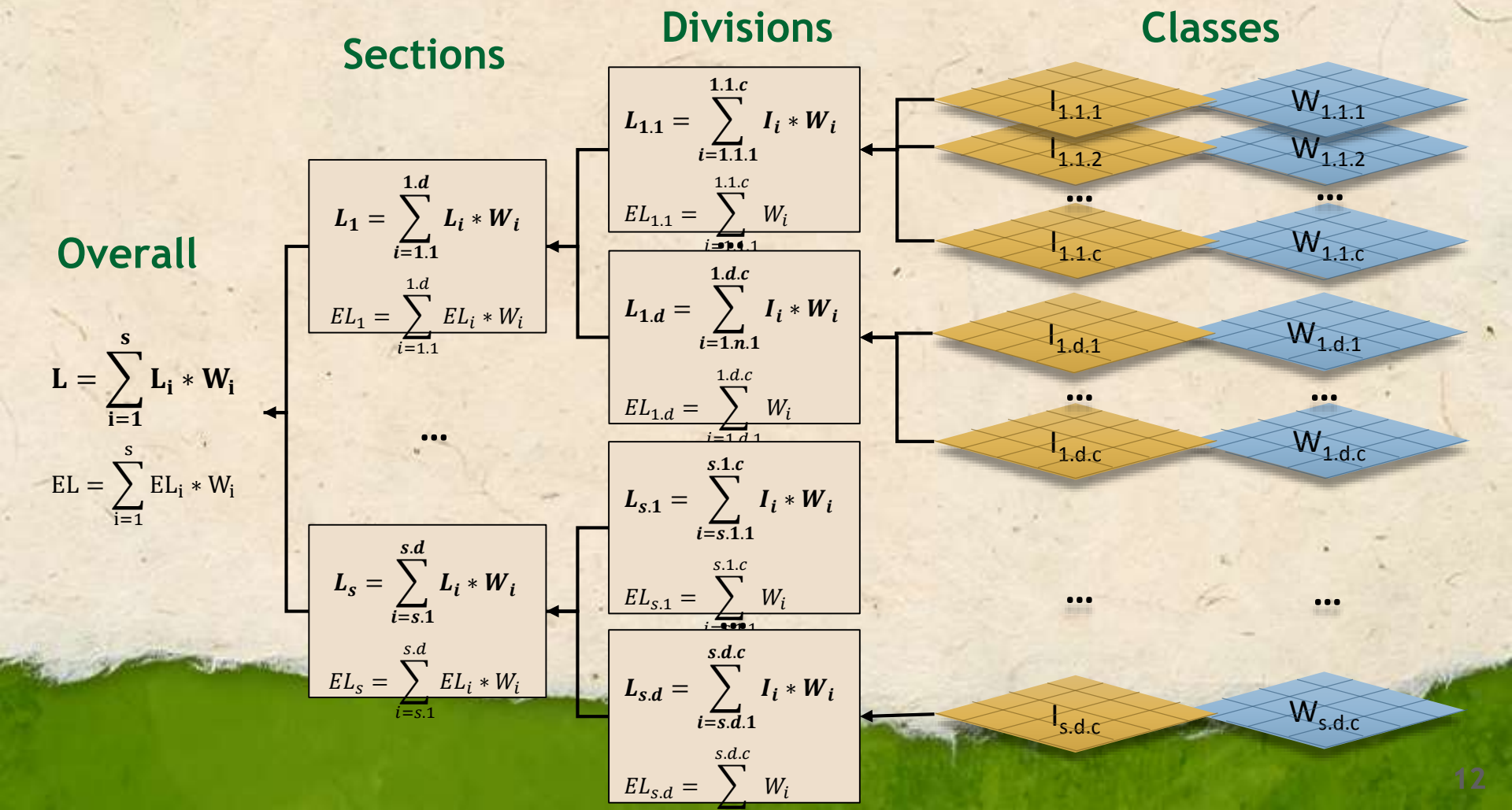
(see Antognelli & Vizzari, 2017)

3b) Liveability indices calculation

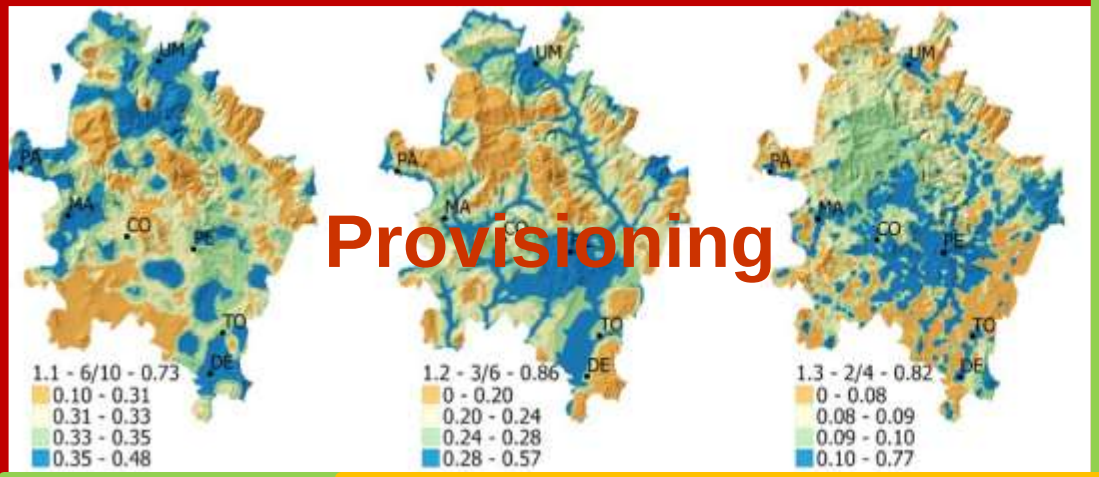
(S-MCDA, see Malczewski, 2006)

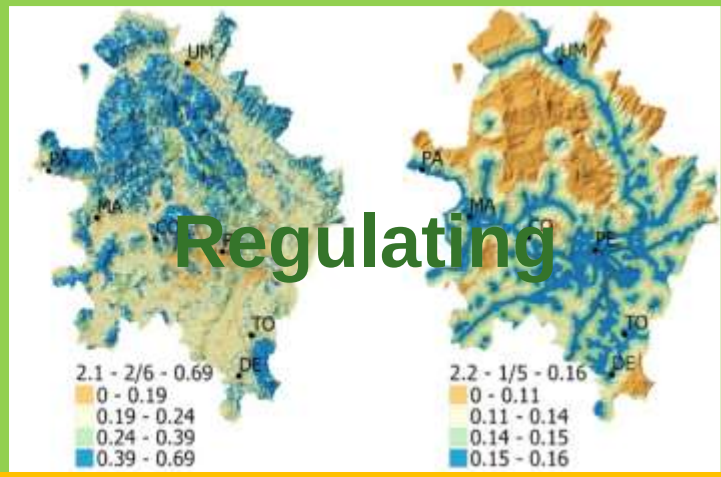
Weighted linear combination of service indices (0-1 range)

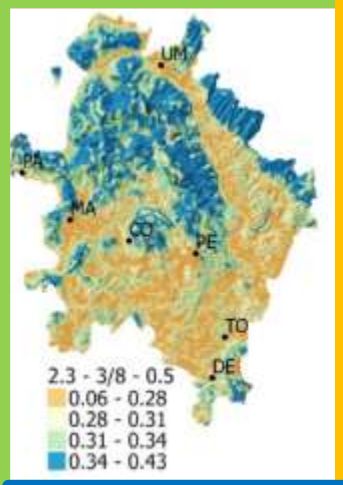
$$LIVEABILITY = \sum_{i=1}^{n} Service\ weight_i\ x\ Service\ quantity_i$$

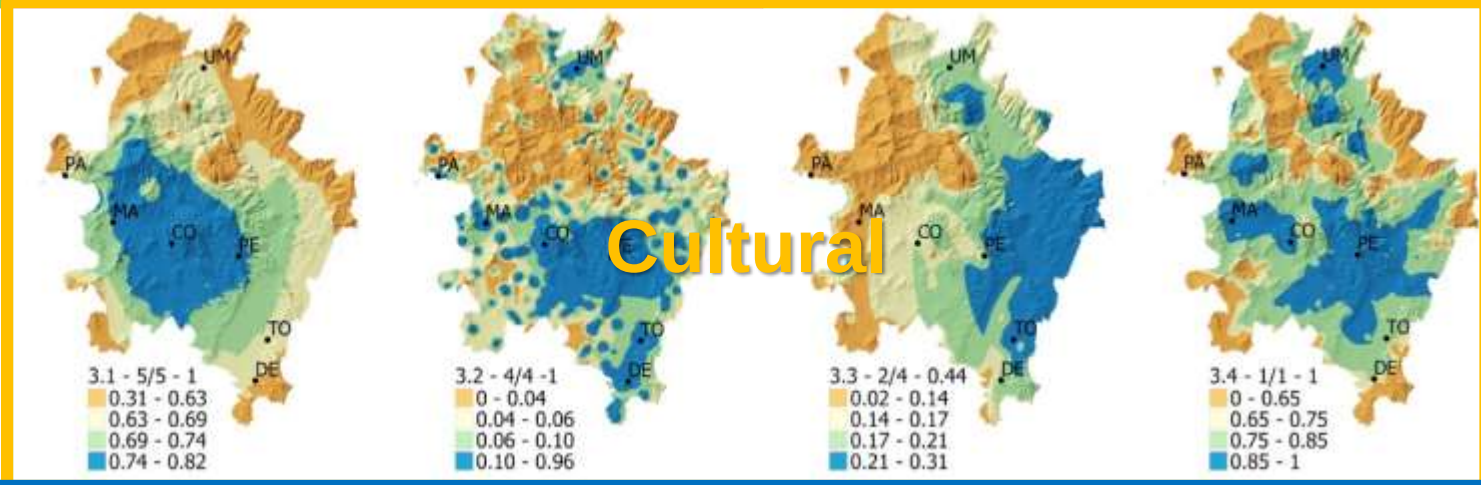


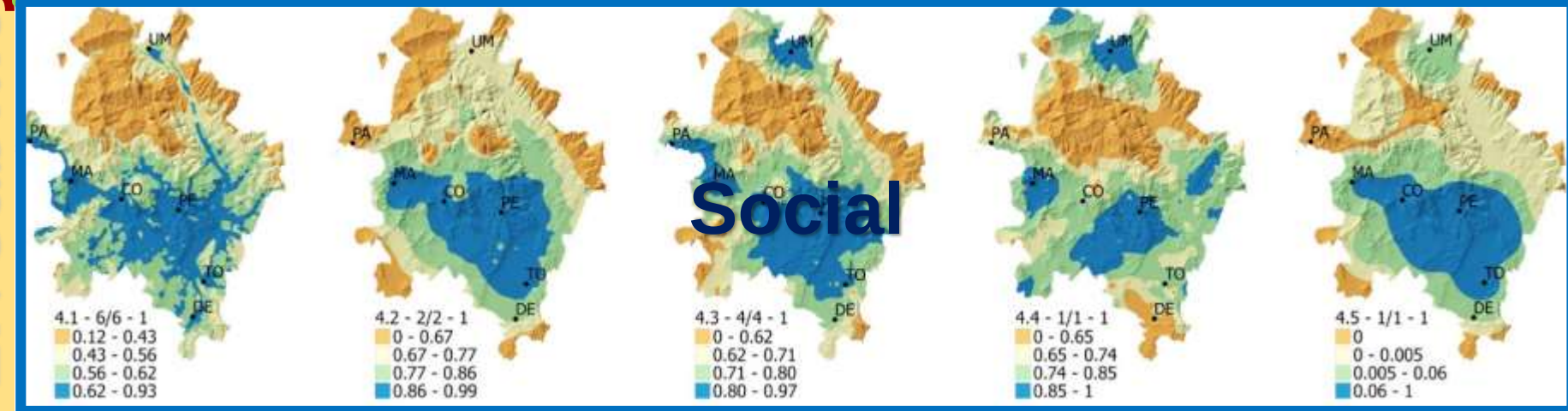
Liveability maps *(division level)*







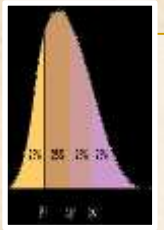




Liveability maps *(section level)*

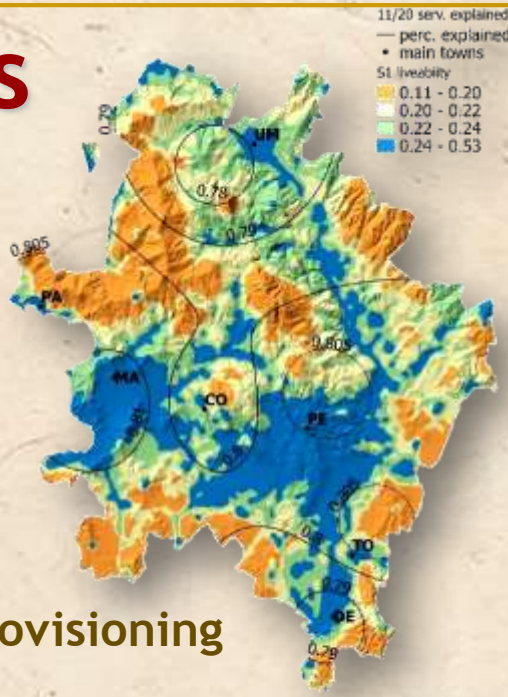
ISOLINES = % of liveability explained

- Cumulative percentage of importance of explained services

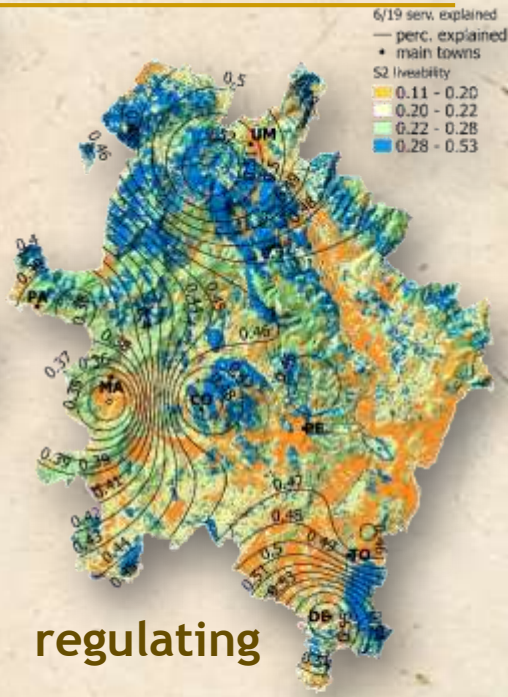


LEGEND = QUARTILES

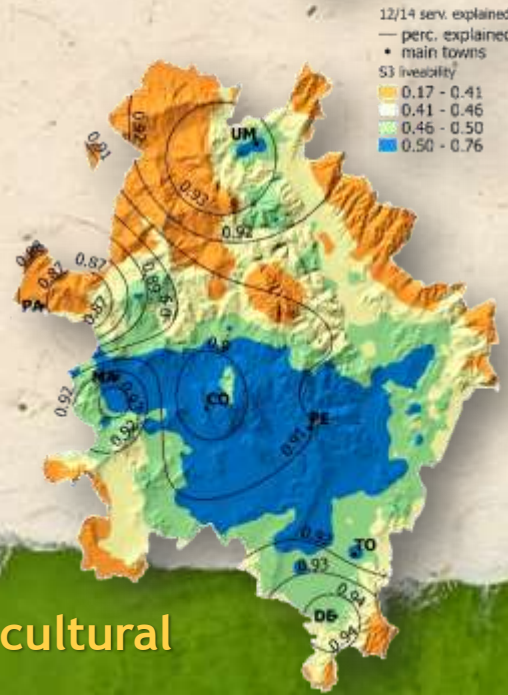
- Different data distributions



provisioning



regulating



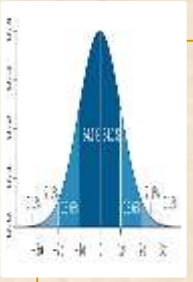
cultural

social

Overall liveability map

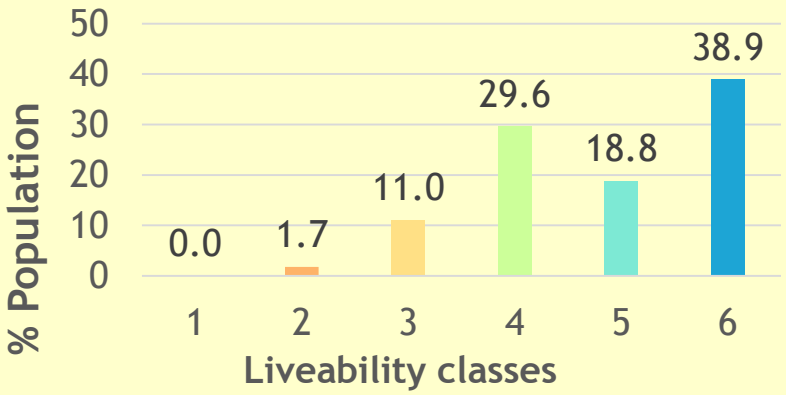
ISOLINES = % of explained liveability

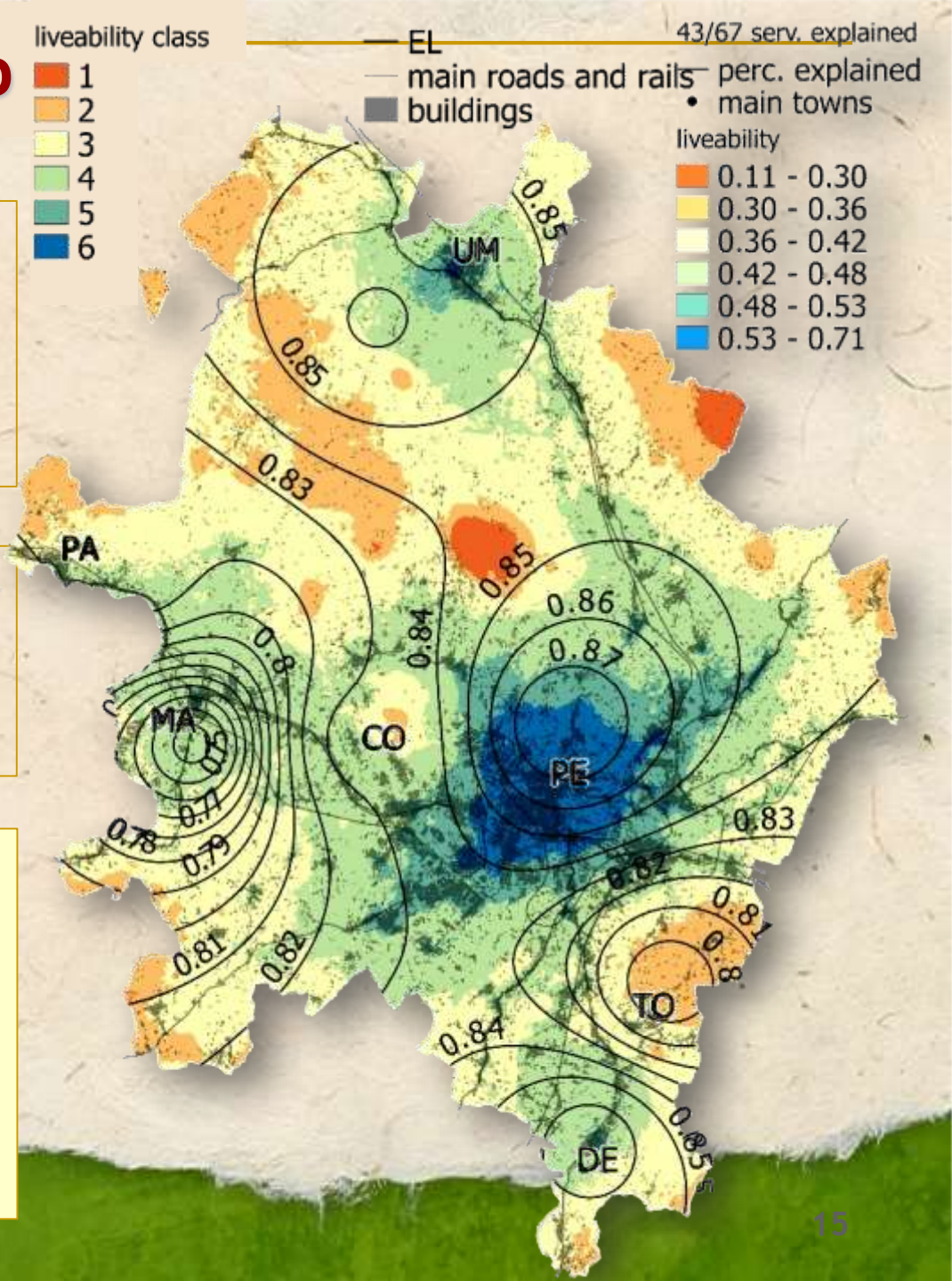
- Average LS weights:
  - ES 46% (63% exlp.)
  - US 54% (100% expl.)



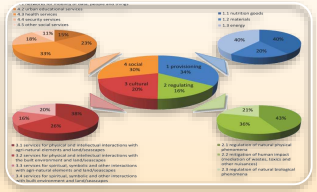
CLASSES = defined using mean (M) and standard deviation (SD):

- min – (M – 2SD), (M – 2 SD) – (M – 1SD), (M – 1 SD) – M, M – (M + 1SD), (M + 1 SD) – (M + 2 SD), (M + 2 SD) – max





Conclusions

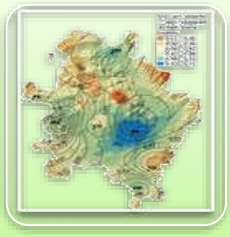


Service weights

- Support service policies and educational/functional communication
- *More stakeholders should be involved in future applications*

Service accessibility

- Supports service planning and management
- *Improve CES and regulating ES assessment and mapping*
- *Better define min - max levels for index normalization*



Liveability indices

- Support landscape planning and policy-making *(public purposes)*
- Support identification of most liveable places *(private purposes)*

Current and future developments

- Improve LS indices – model validation
- Land suitability maps through the maximization of services for specific activities
- Sensitivity analysis - diachronic analysis
- Inclusion of ecosystem and urban disservices

THANK YOU!

FOR ANY QUESTIONS OR SUGGESTIONS:

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