



Scenarios for Future Ecosystem Service Trade-offs in Lisbon

MIT Portugal - Sustainable Energy Systems

Thomas Elliot (thomas.elliott@list.lu)

Ecosystem services in Lisbon

Scope and Objectives

- As urbanisation increases land cover patterns in cities change to accommodate the growth of urban population and the associated socio-ecological impacts.
- Planning for future needs requires sophisticated modelling tools capable of predicting future impacts of urbanisation on ecosystem dynamics.
- To address this challenge, we investigate future trade-offs between urban ecosystem services (ES) capacities using a predictive spatially-explicit system dynamics land cover change (LCC) model. These steps are illustrated in Figure 1.

Urban System

- The study area is Lisbon municipality in Portugal
- Subdivided into 344 square grid cells measuring 500m by 500m
- Calibrated for Lisbon with 1990, 2000, 2006, and 2012 data.
- Model used to predict future LCC from 2012 to 2030.
- Land covers were used to estimate ES capacities using a lookup table.

Nine Ecosystem Services

- Local climate regulation (LCR)
- Global climate regulation (GCR)
- Flood protection (FP)
- Groundwater recharge (GWR)
- Air quality regulation (AQR)
- Nutrient regulation (NR)
- Water purification (WP)
- Pollination (P)
- Biodiversity (B)

Three Scenarios

- Commercial growth
- Population growth
- Green spaces growth

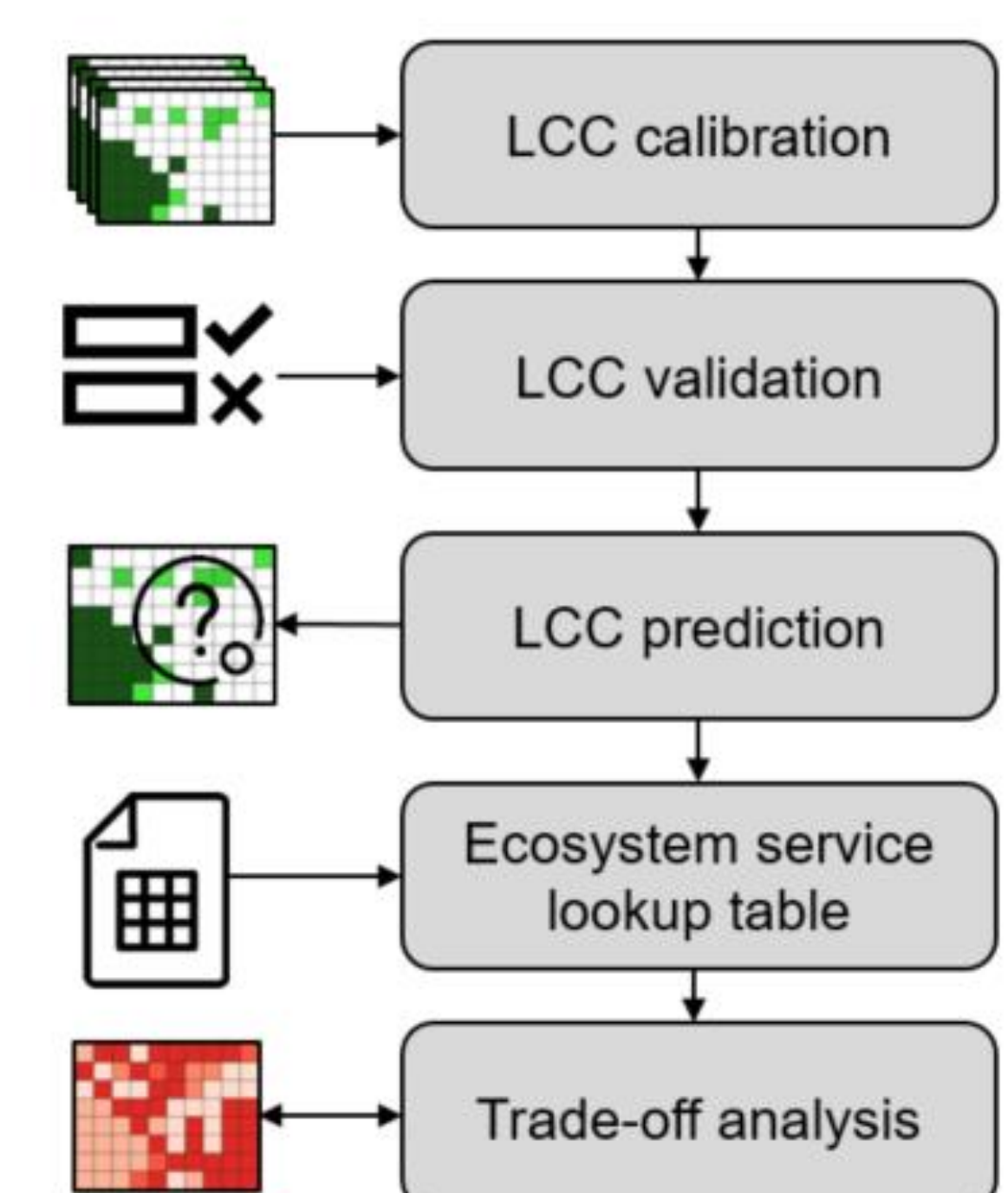


Figure 1: Method

Results

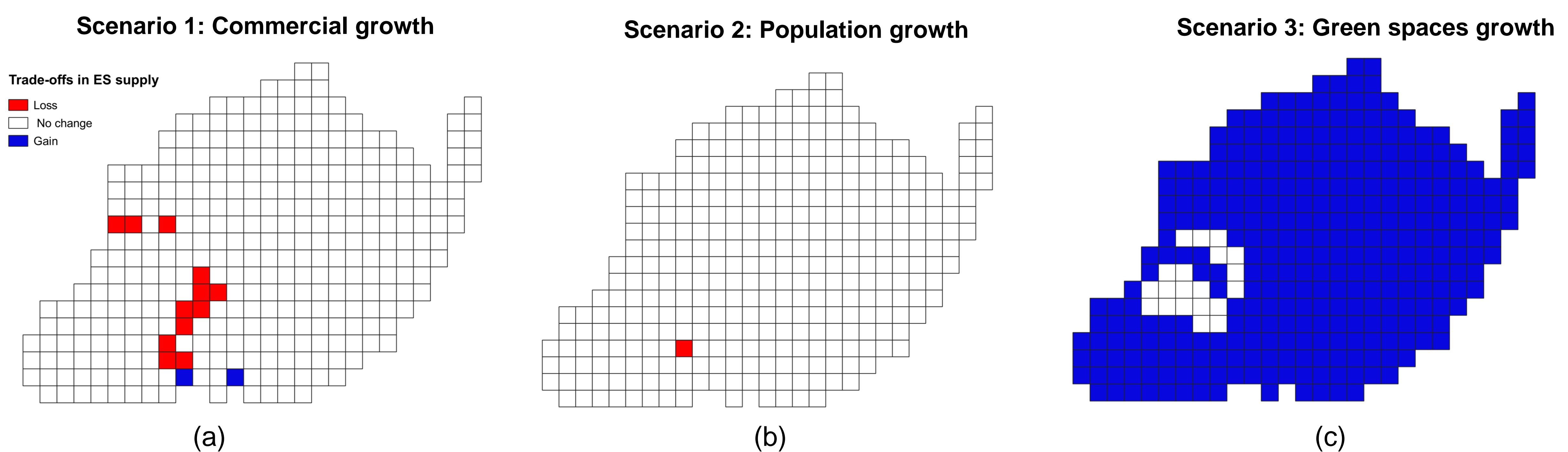


Figure 2: Spatial hotspots for ES capacity trade-offs

- Between 2012 and 2030 the total ES capacities will increase by 4% in the commercial growth scenario,
- Decrease less than 1% in the population growth scenario, and
- Increase 61% in the green spaces growth scenario.
- The observed and predicted total ES capacities are shown in Figures 2a, 2b, and 2c for the respective scenarios.
- Scenario 3 supplies many times more GCR, GWR, AQR, NR, WP and P. However, there is a loss of FP – one of the high-priority urban challenges in Lisbon. The relative trade-offs between each of the nine ES for the three scenarios are shown in Figure 3.

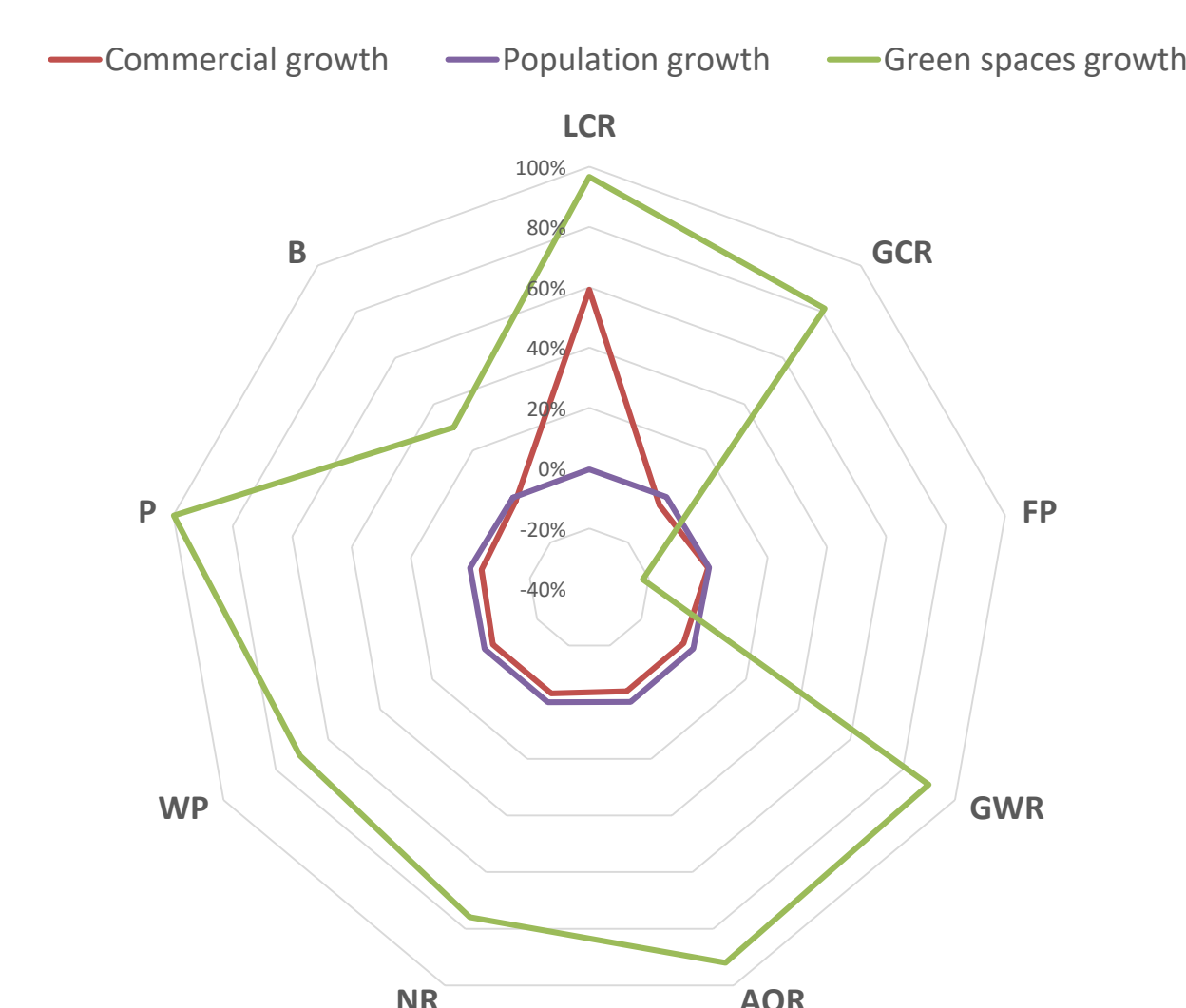


Figure 3: Relative ES trade-offs between 2012-2030

Conclusions

- Lisbon's ES capacities may be enhanced by land use management.
- Increasing green spaces improves all ES capacities except flood protection.
- ES are supplied in bundles; multiple ES capacities are affected by each LCC.
- Urban planning can be tailored to increase urban ES supplies even subject to socio-economic constraints on land cover.

Acknowledgements

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