



Global multifaceted urbanization and implications for sustainability using Earth Observation

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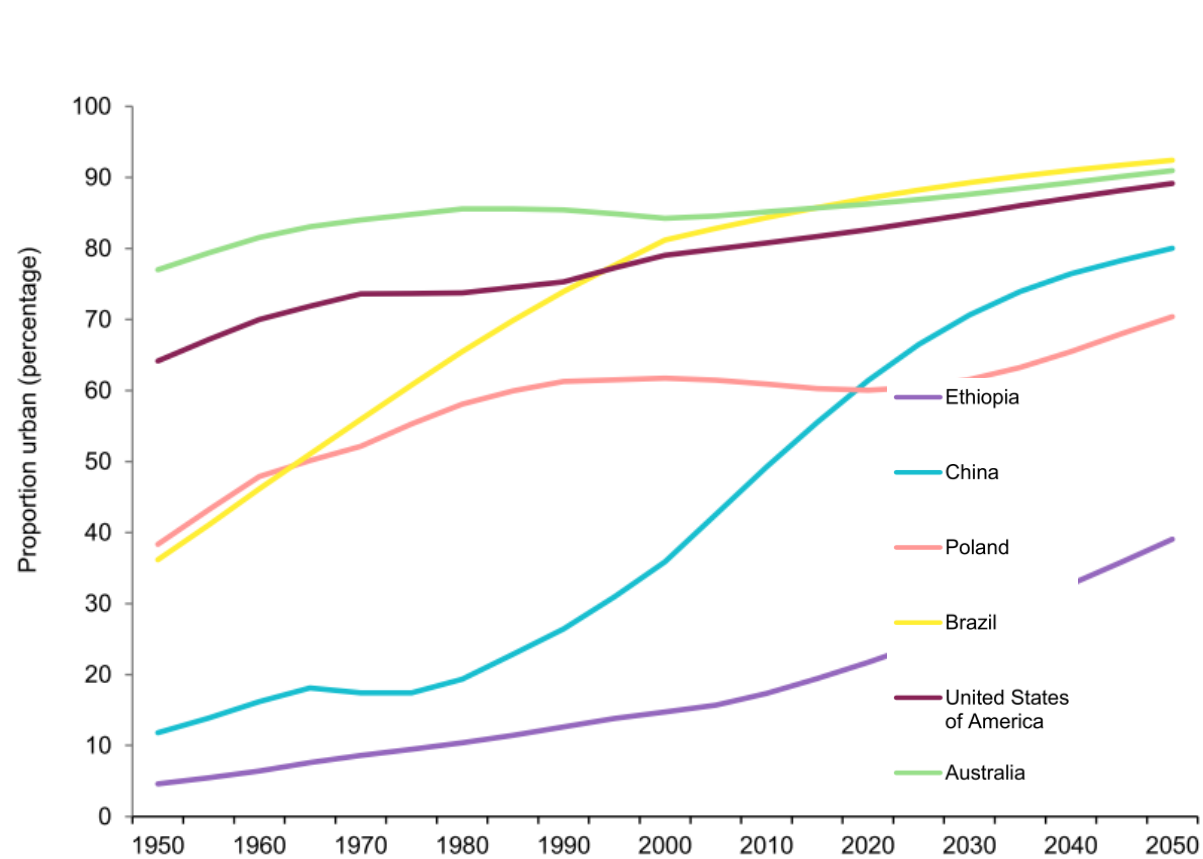
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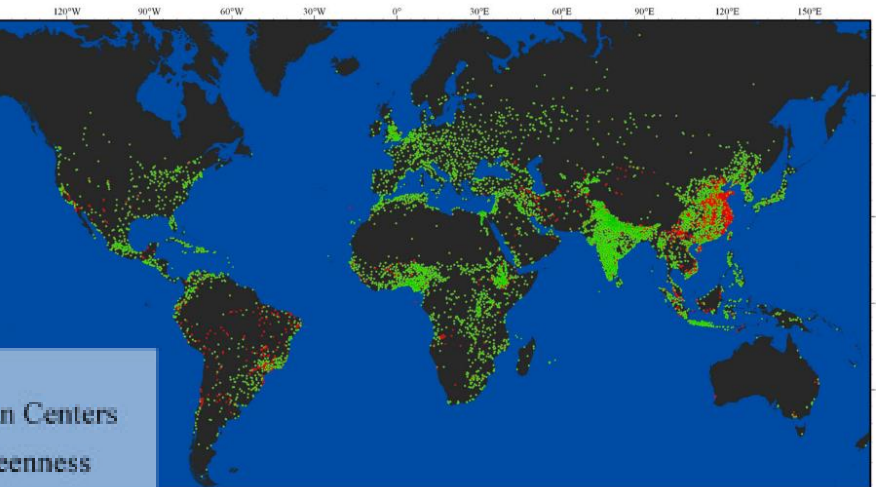
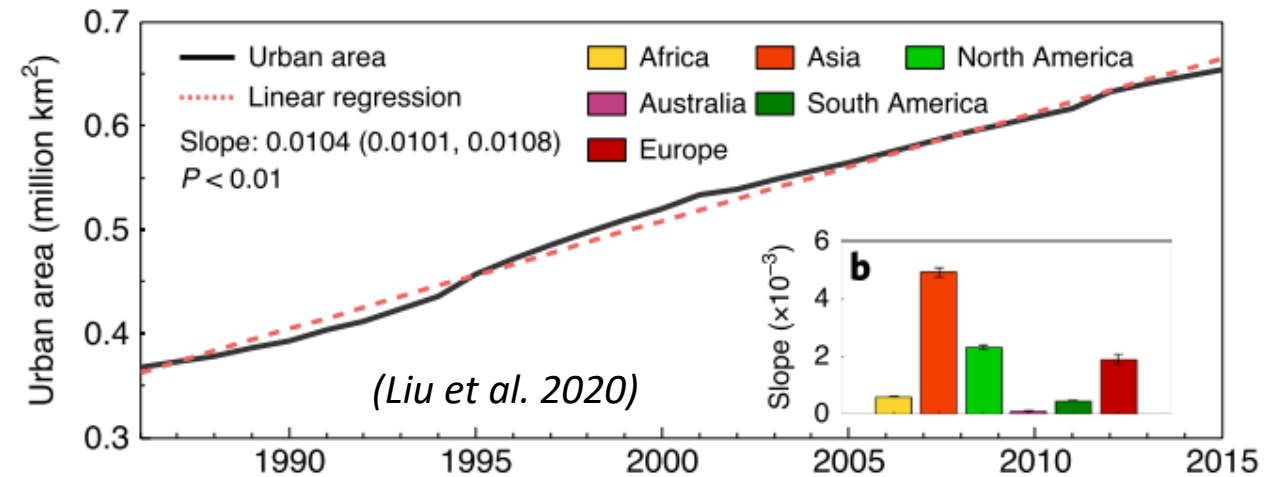


Background

- Urbanization as a global phenomenon is multifaceted, varies regionally, and poses a wide range of environmental and social challenges.



(World Urbanization Prospects 2018)

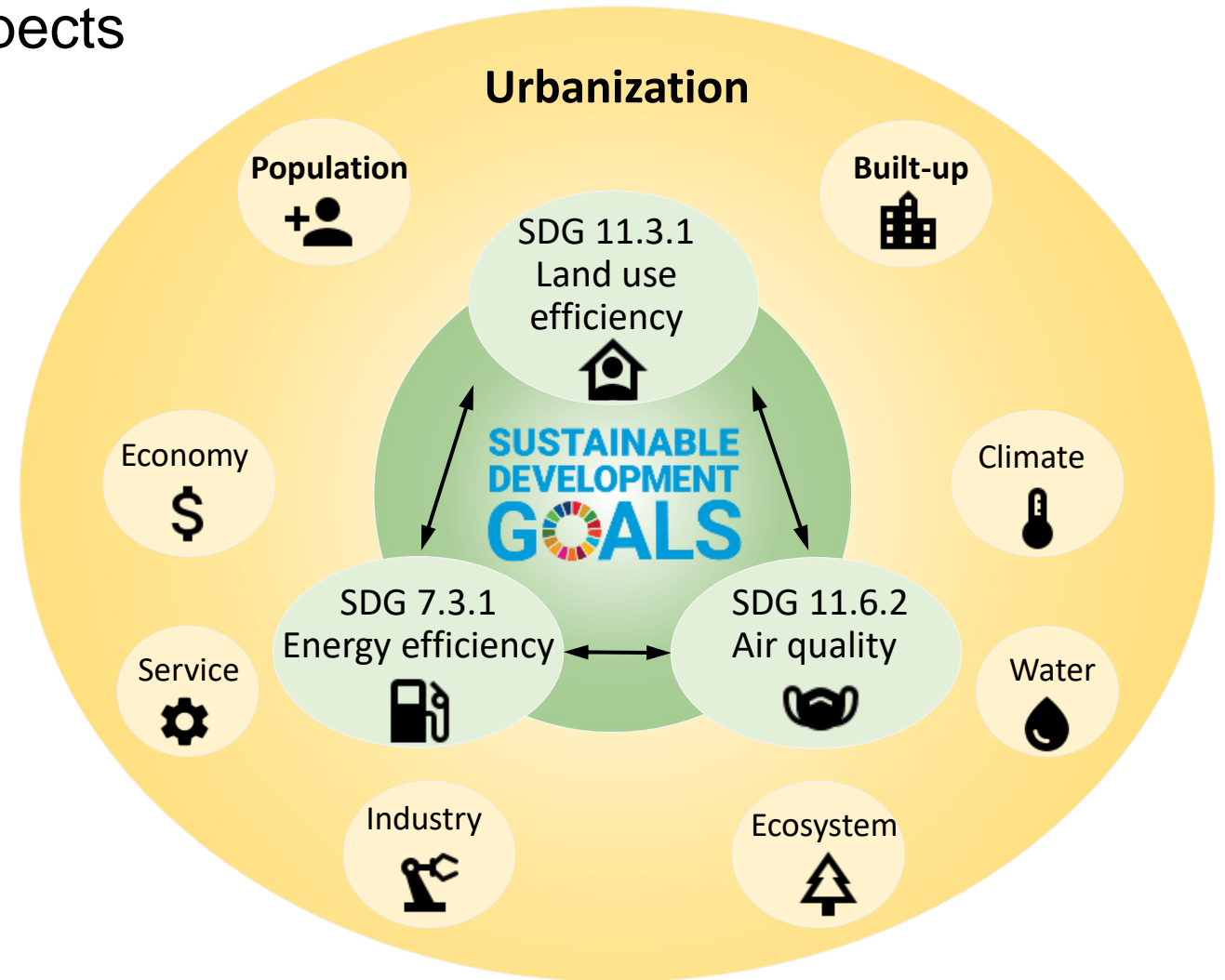
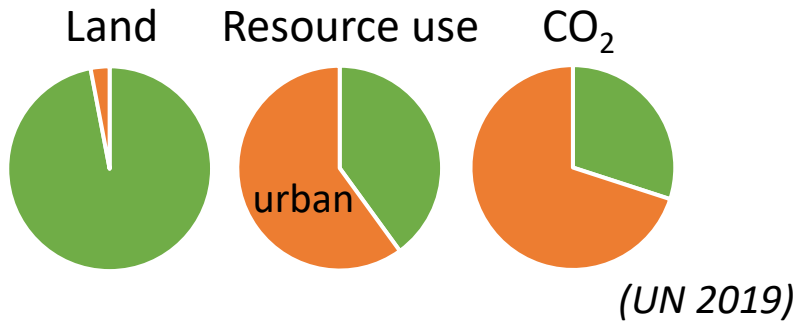


(Corbane et al. 2020)



Background

- Land-energy-air **SDGs** are key aspects for achieving sustainable cities.

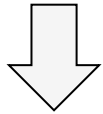




Research Gap & Objectives

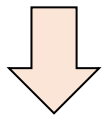
Multifaceted urbanization

- Little **comprehensive** analysis
- Little **global grid-level and long-term** study



Urban SDG assessment

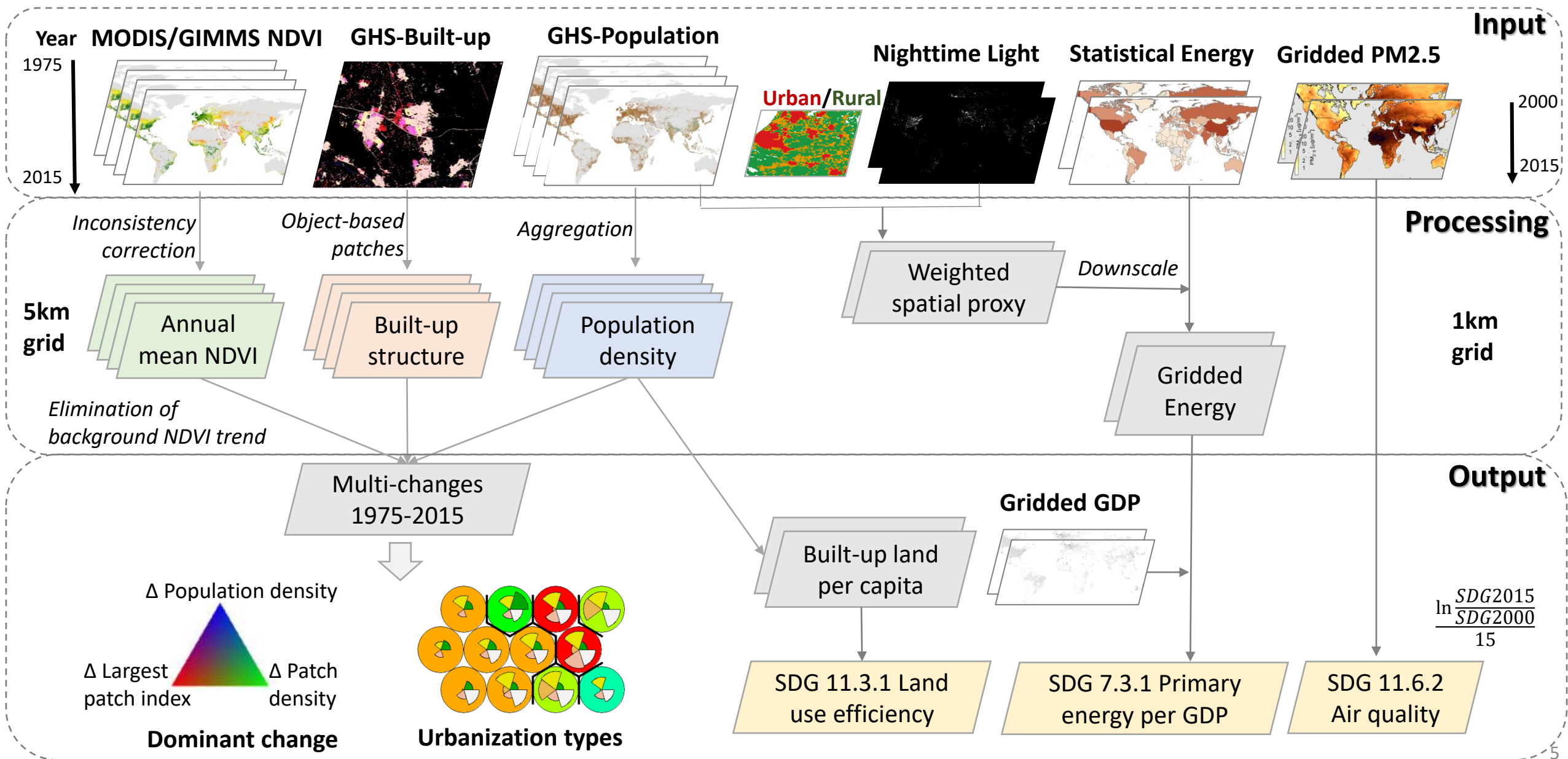
- Little global **fine-scale SDG monitoring** for data resolution
- Little knowledge of **urban land-energy-air** sustainability



Here we do the first global attempt using multiple EO-data to characterize the multifaceted urbanization (population, built-up structure, greenness) and to monitor urban land-energy-air SDGs at a grid level.



Workflow

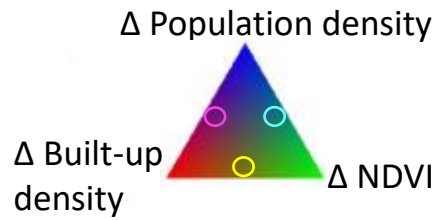
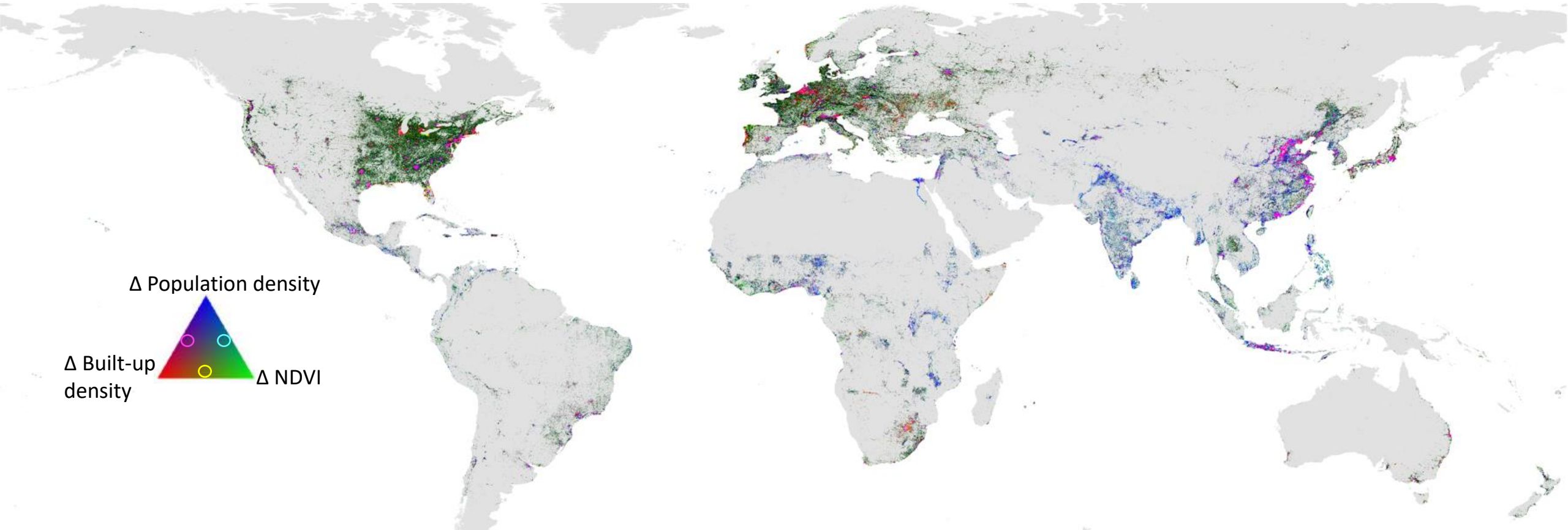




Results

Multifaceted urbanization

- Dominant increase in population, built-up land, greenness 1975-2015



Chicago

New York

Sao Paulo

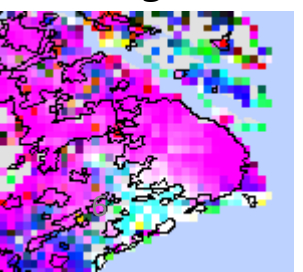
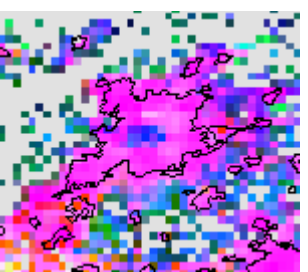
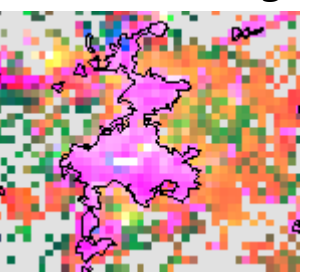
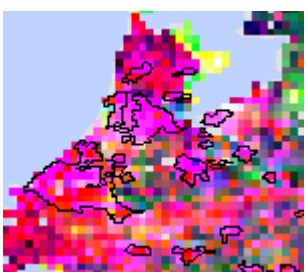
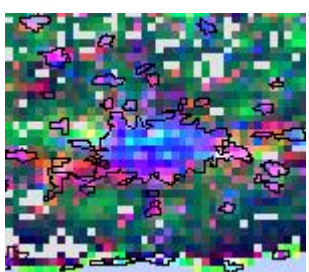
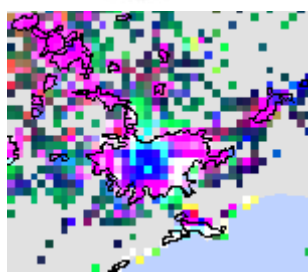
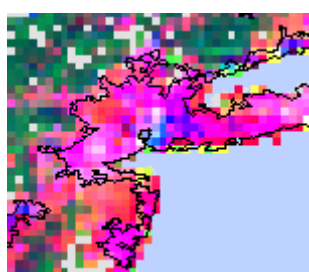
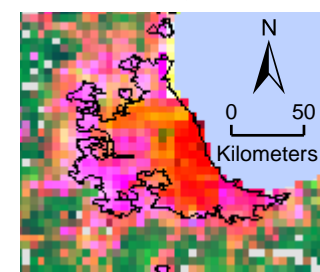
London

Netherlands

Johannesburg

Beijing

Shanghai

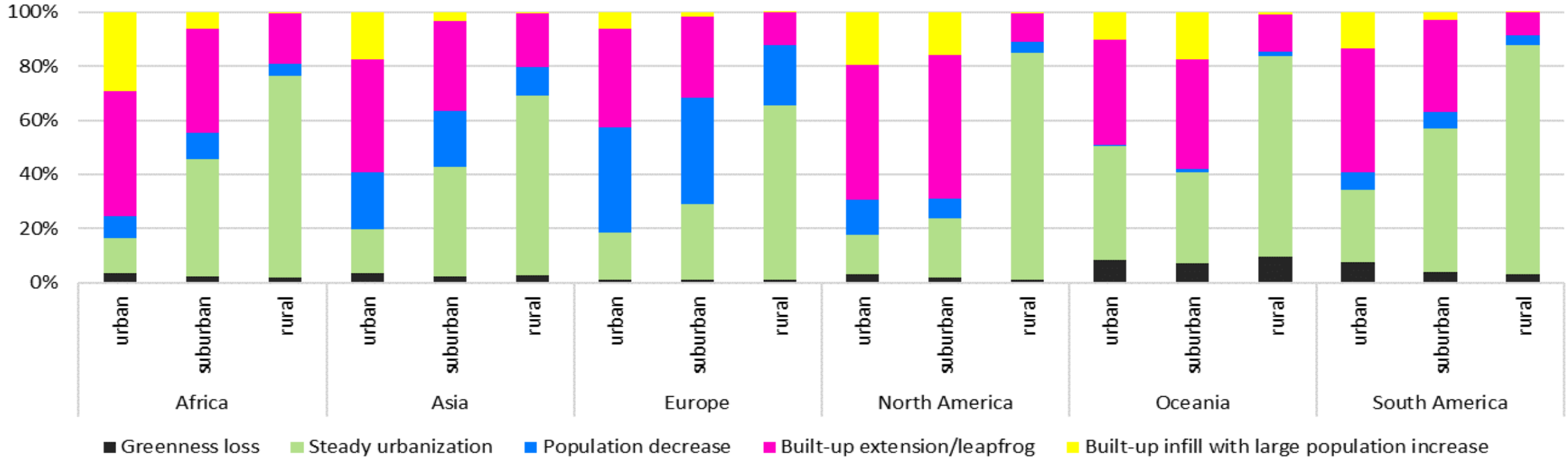




Results

Multifaceted urbanization

- Urbanization types based on changes in population, built-up structure, greenness

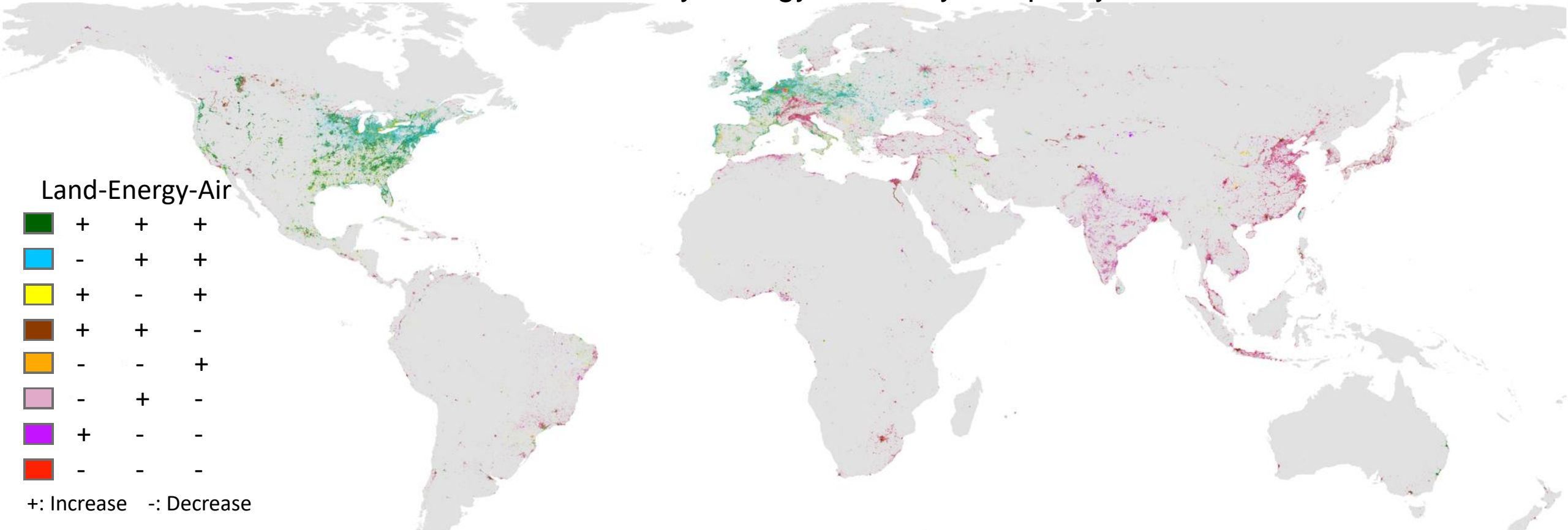


- (1) Greenness loss:** +PopD, -BuiD, ---NDVI
- (2) Steady urbanization:** -BuiD, -PatD
- (3) Population decrease:** ---PopD, +LPI
- (4) Built-up extension/leapfrog:** ++PopD/BuiD, +++PatD, +++LPI
- (5) Built-up infill with large population increase:** +++PopD/BuiD/LPI, ---PatD, -NDVI



Results

☐ Trends in urban SDGs: land use efficiency, energy efficiency, air quality 2000-2015



Chicago

New York

Sao Paulo

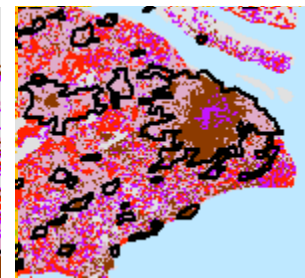
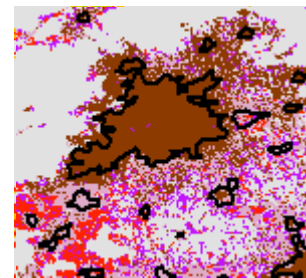
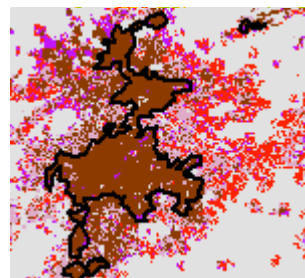
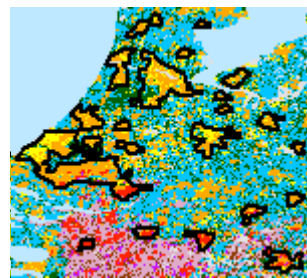
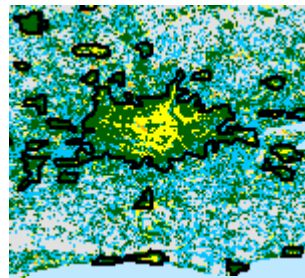
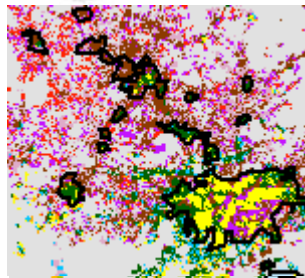
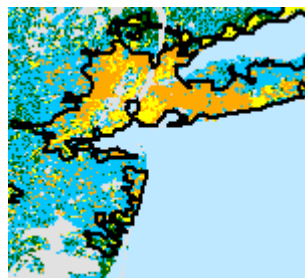
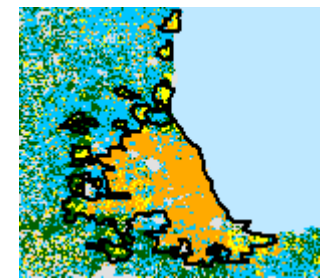
London

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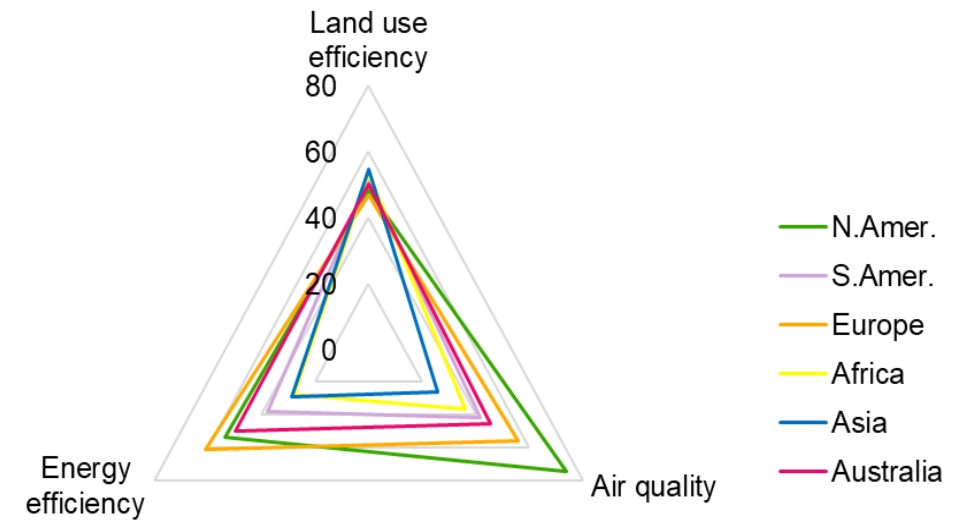
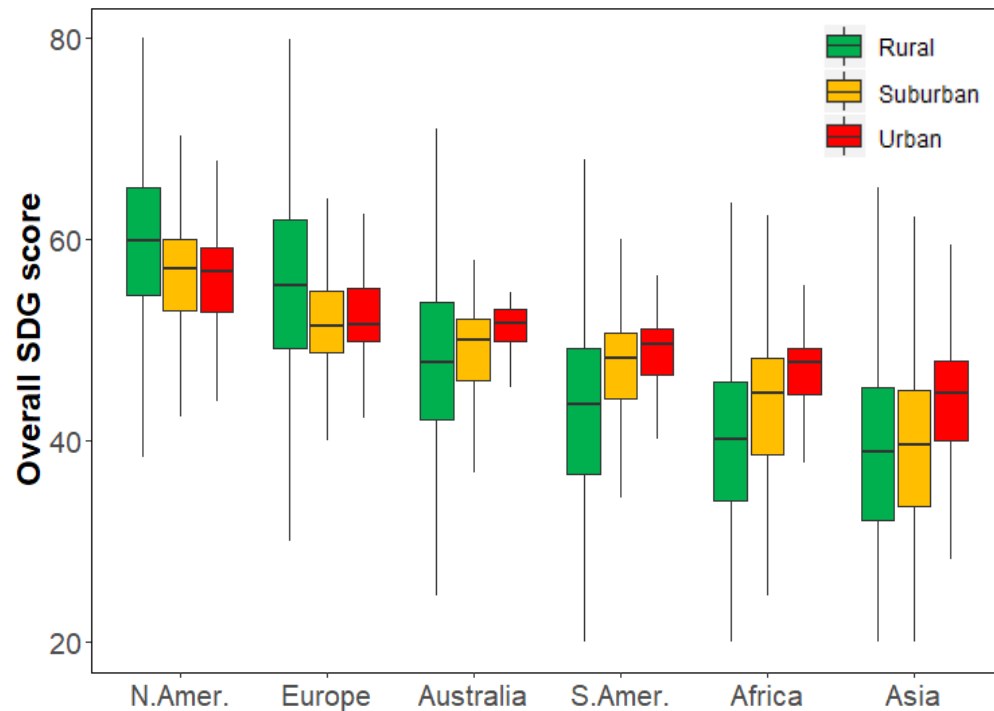
Beijing

Shanghai





- The least sustainable: rural areas in the Global South





Conclusions

- Compared to the Global North, the Global South was intensely urbanizing and less sustainable in energy efficiency and air quality, especially for rural areas.
- Context-specific strategies should be made within urban and rural areas.



Outlook

- **EO-data** implication: Include more satellite-based information (e.g., building height) to disaggregate social statistics for monitoring fine-scale urbanization and SDGs.
- **Mechanism** research: Explore interactions within and between urbanization and sustainability based on long-time-series data.



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Thank you & any questions

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