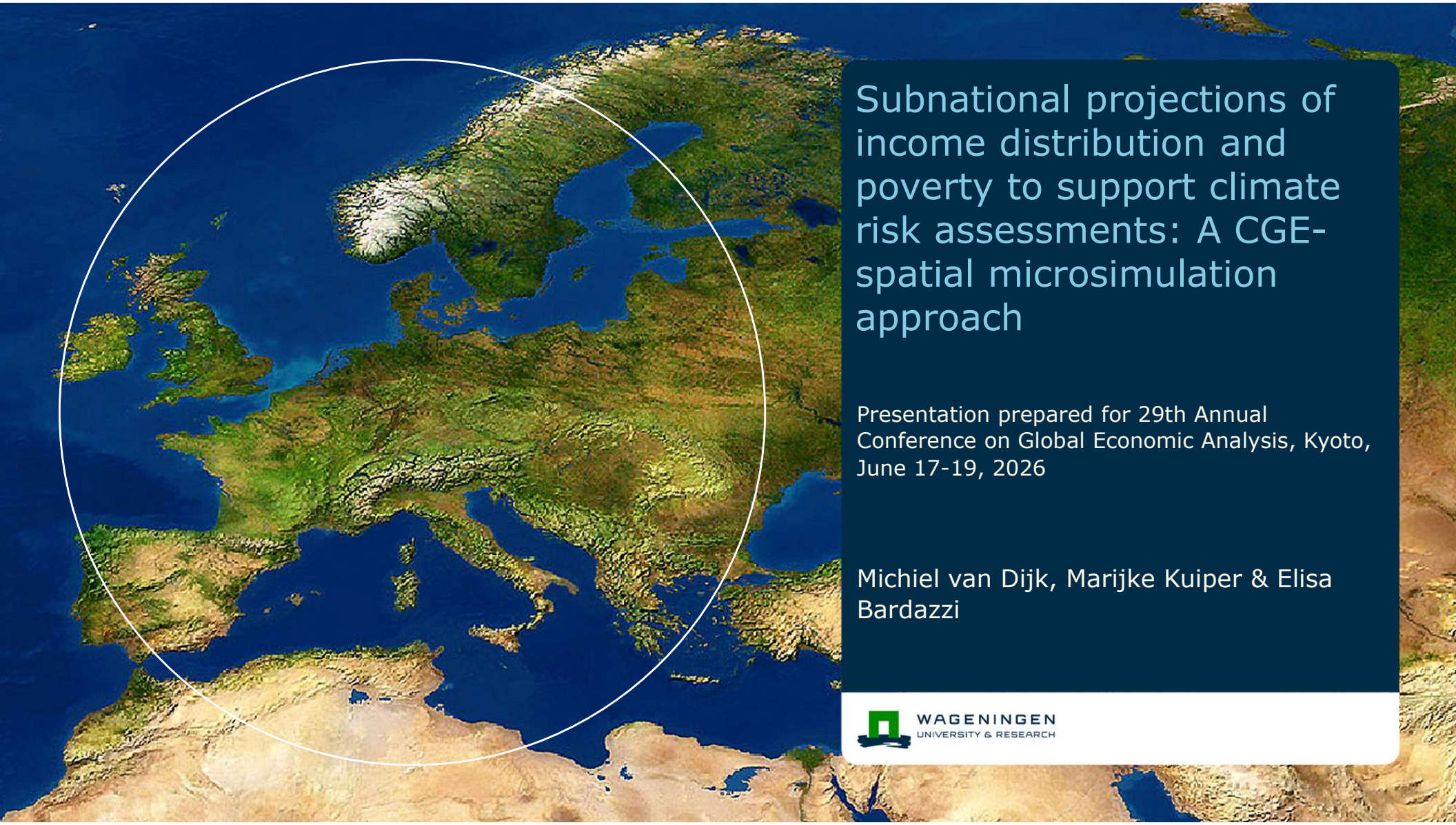


Subnational projections of income distribution and poverty to support climate risk assessments: A CGE-spatial microsimulation approach

Presentation prepared for 29th Annual Conference on Global Economic Analysis, Kyoto, June 17-19, 2026

Michiel van Dijk, Marijke Kuiper & Elisa Bardazzi

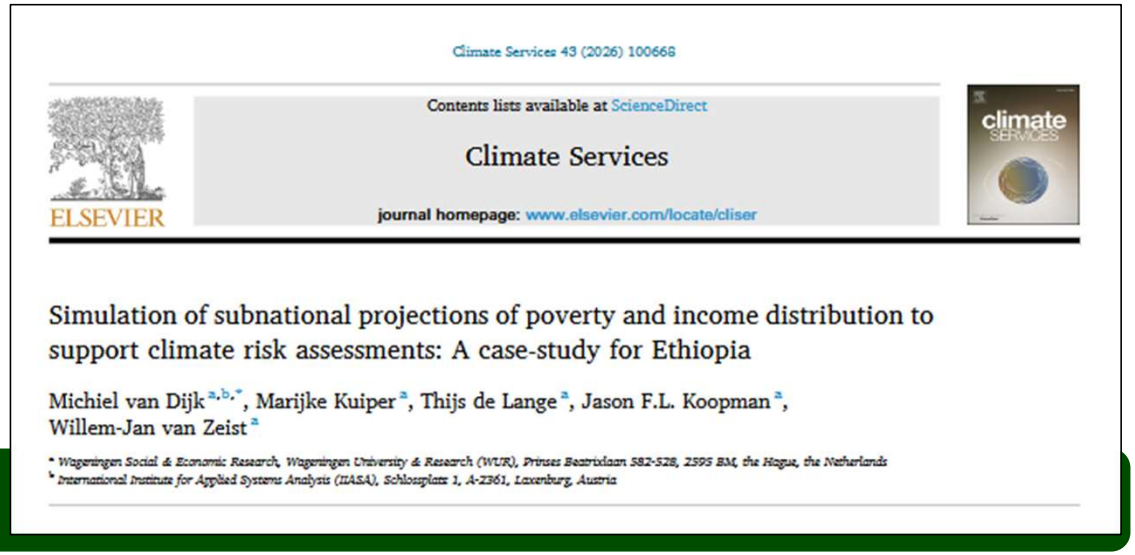
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Introduction

- There is ample evidence that the poor are the most vulnerable to climate hazards and extremes (Hallegatte et al., 2016, Sedova et al., 2019).
- Climate risk assessments identify which segments of the population are most vulnerable to the adverse impacts of climate-related hazards.
- State-of-the-art climate risk assessments combine **future** climate hazard maps with (a) population projections or (b) **current** poverty maps.
- No models that provide **future** and **spatially-explicit** poverty estimates although this has been considered as high-priority in climate scenario modelling (Piontek et al., 2021, Pirani et al., 2024).

Aim

- To demonstrate the Microsimulation of Income DynamicS (MIDS) Model.
- A modelling approach that combines a **global CGE model** output with **spatial microsimulation** to create subnational income distribution and poverty projections.
- Results can be combined with climate hazard maps to identify overlaps in climate and poverty hotspots and inform climate risk assessments.
- Pilot study for Ethiopia published



Climate Services 43 (2026) 100668

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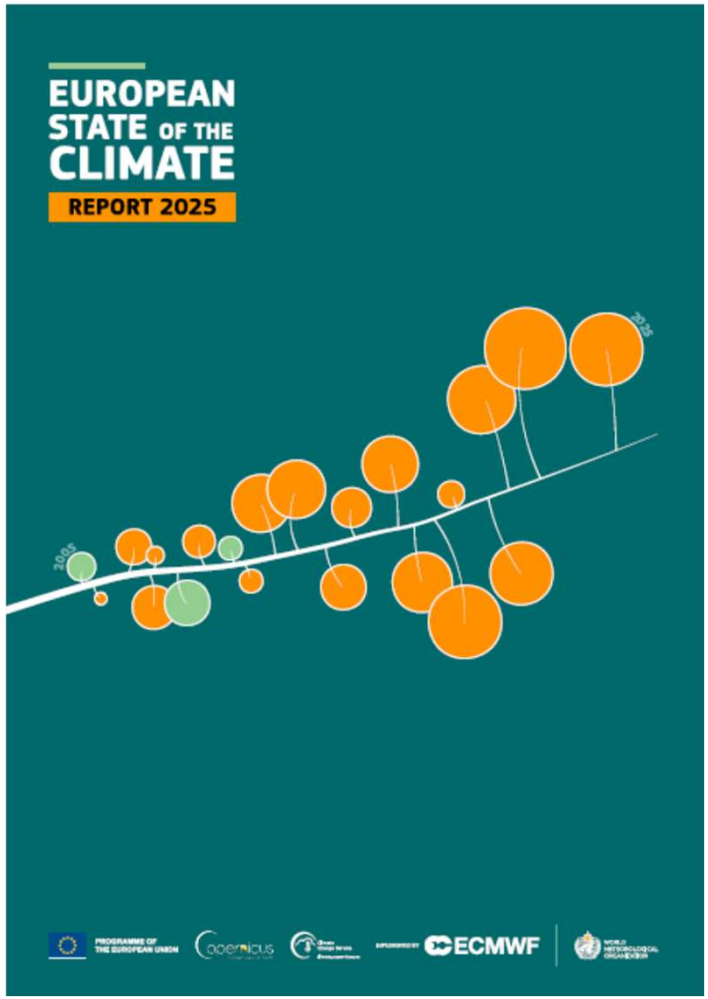
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Simulation of subnational projections of poverty and income distribution to support climate risk assessments: A case-study for Ethiopia

Michiel van Dijk [a,b,*], Marijke Kuiper [a], Thijs de Lange [a], Jason F.L. Koopman [a], Willem-Jan van Zeist [a]

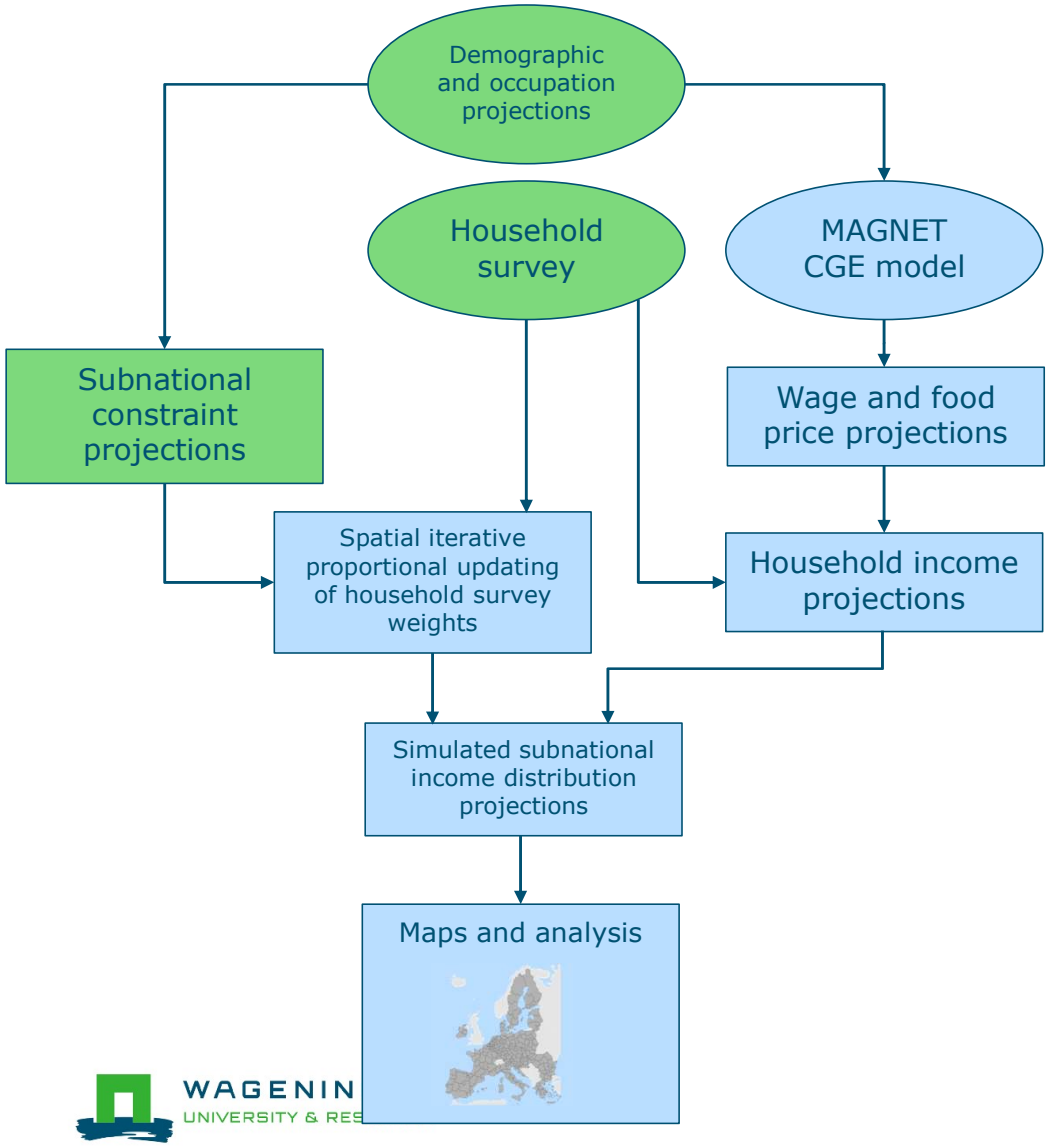
[a] Wageningen Social & Economic Research, Wageningen University & Research (WUR), Prinses Beatrixlaan 582-528, 2595 BM, the Hague, the Netherlands
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C3S/ECMWF and WMO, 2026: C3S-WMO European State of the Climate 2025, climate.copernicus.eu/ESOTC/2025, doi.org/10.24381/zy93-sb27

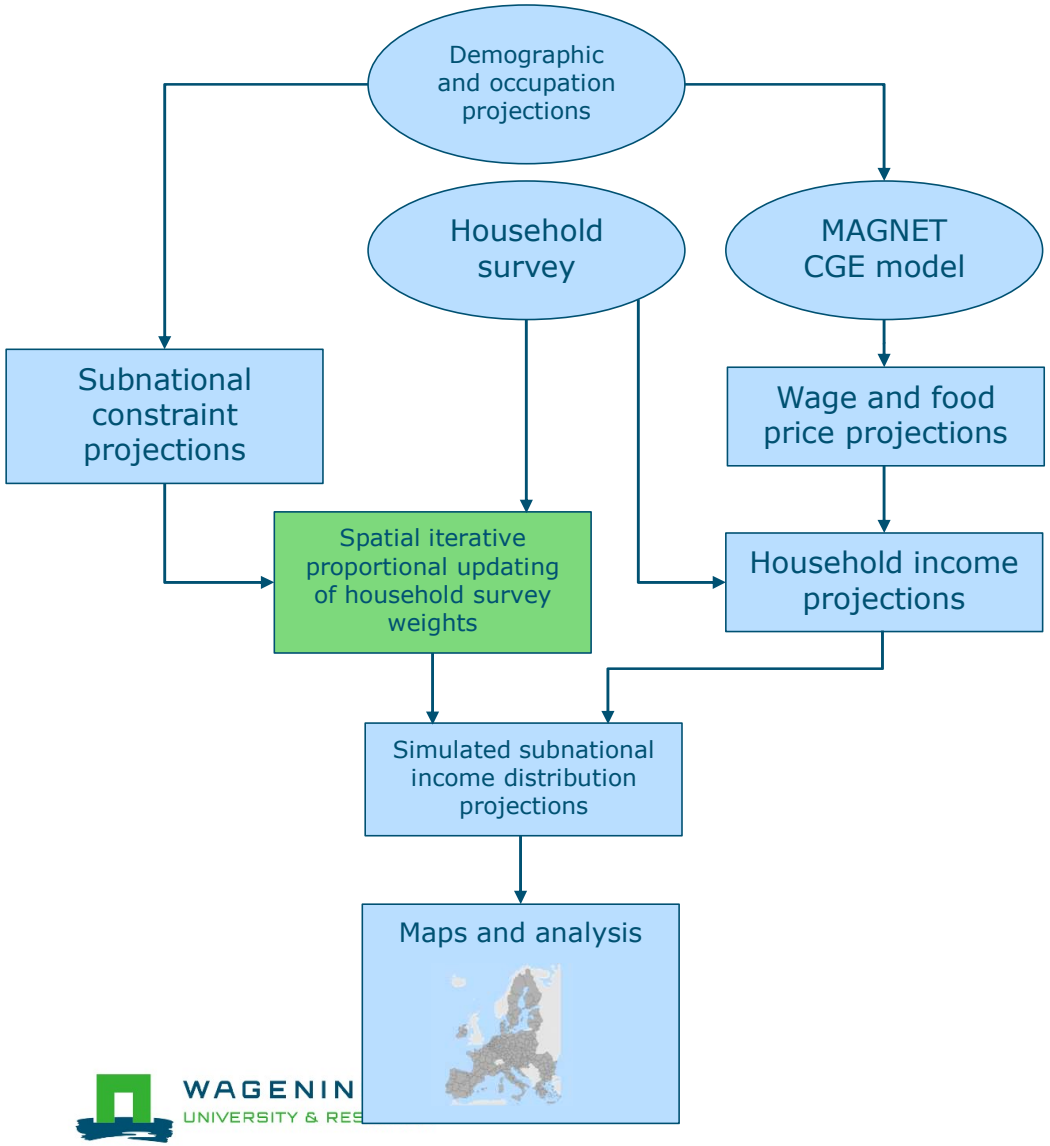
Since the 1980s, Europe has been warming twice as fast as the global average, making it the fastest-warming continent on Earth.

The continent saw its second most severe heatwave on record



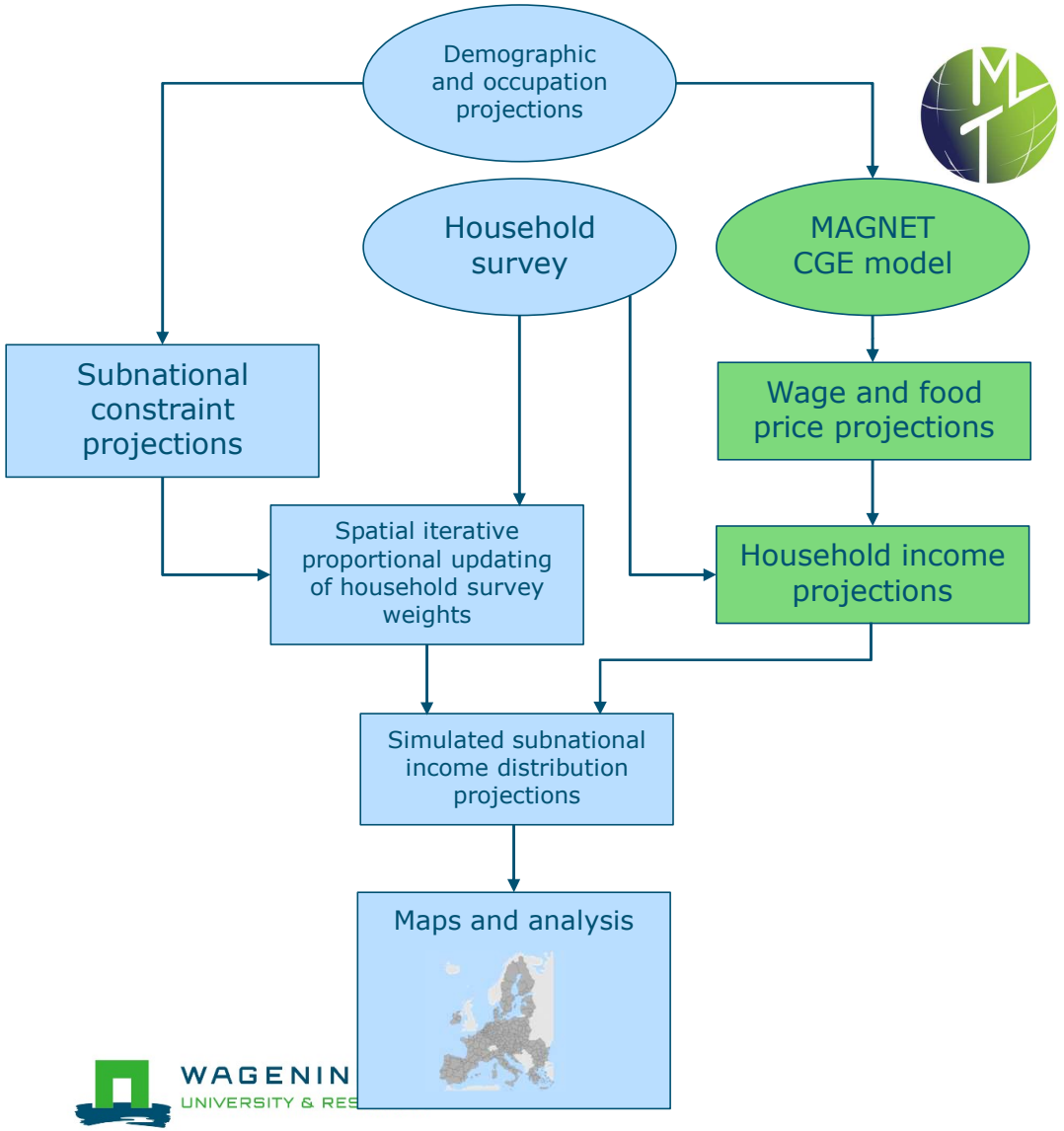
Input data

- Three scenarios based on Shared Socio-economic Pathways (SSPs).
- Subnational projections for major income drivers prepared for 236 NUTS2 regions and three SSPs from 2020-2050.
- Combined with 27 EU income surveys (EU-SILC) – 268,231 households.



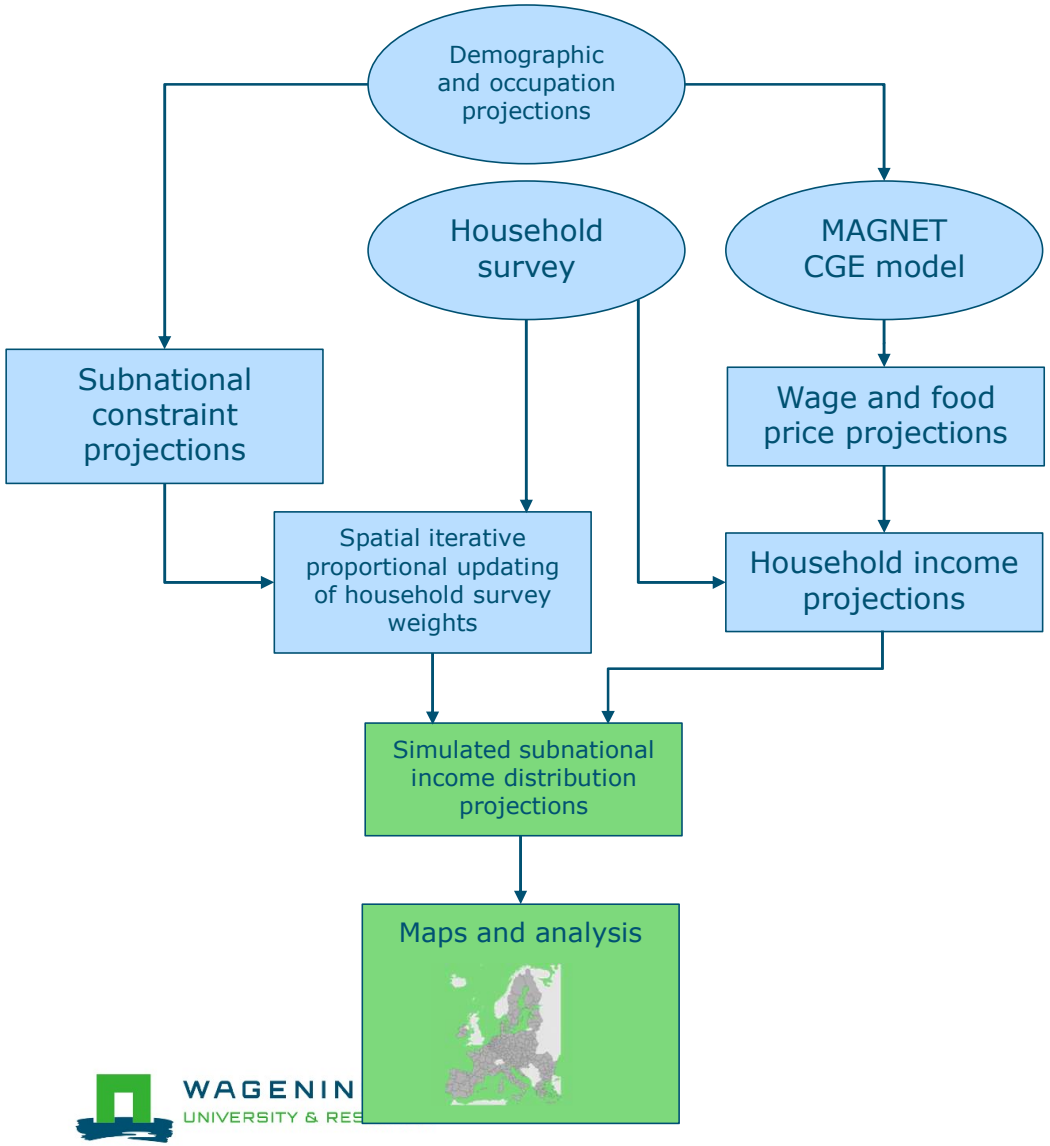
Microsimulation of Income DynamicS (MIDS) Model

- Pseudo dynamic spatial simulation model (Harding 2011, Tanton 2014).
- Spatial Iterative Proportional Updating (IPU) (Ye et al. 2009) algorithm to reweight household survey so they are consistent with subnational projections => small-area estimates.



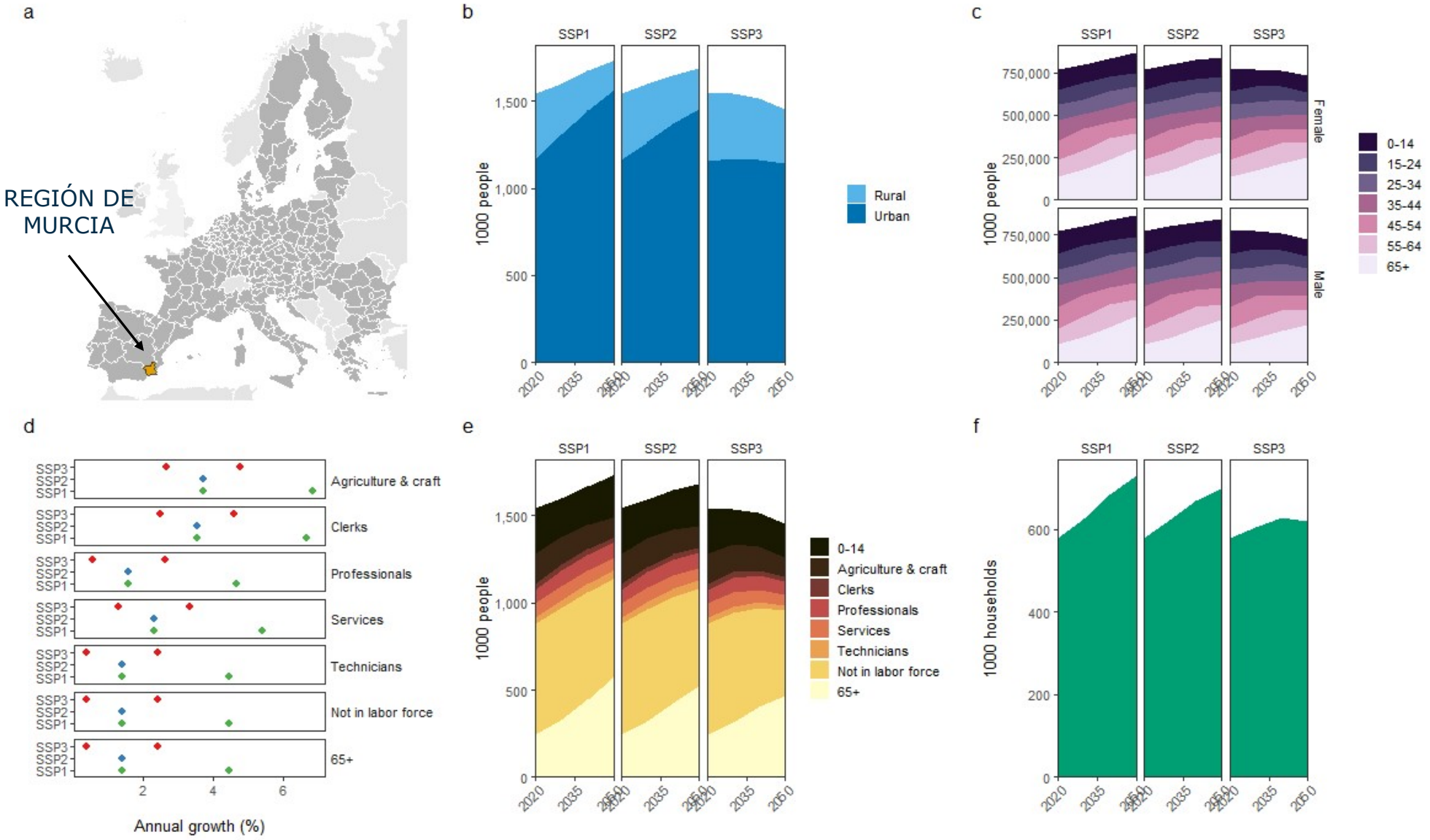
Link with CGE model

- Income/wages also change over time because of technical change and labour market dynamics.
- A global CGE model (MAGNET) provides wage projections for five different occupations.
- Wage projections are used to update household member and total household income.



Output

- Subnational weights are combined with updated household income to obtain subnational income distribution and poverty projections.
- Which can be visualized and analysed.

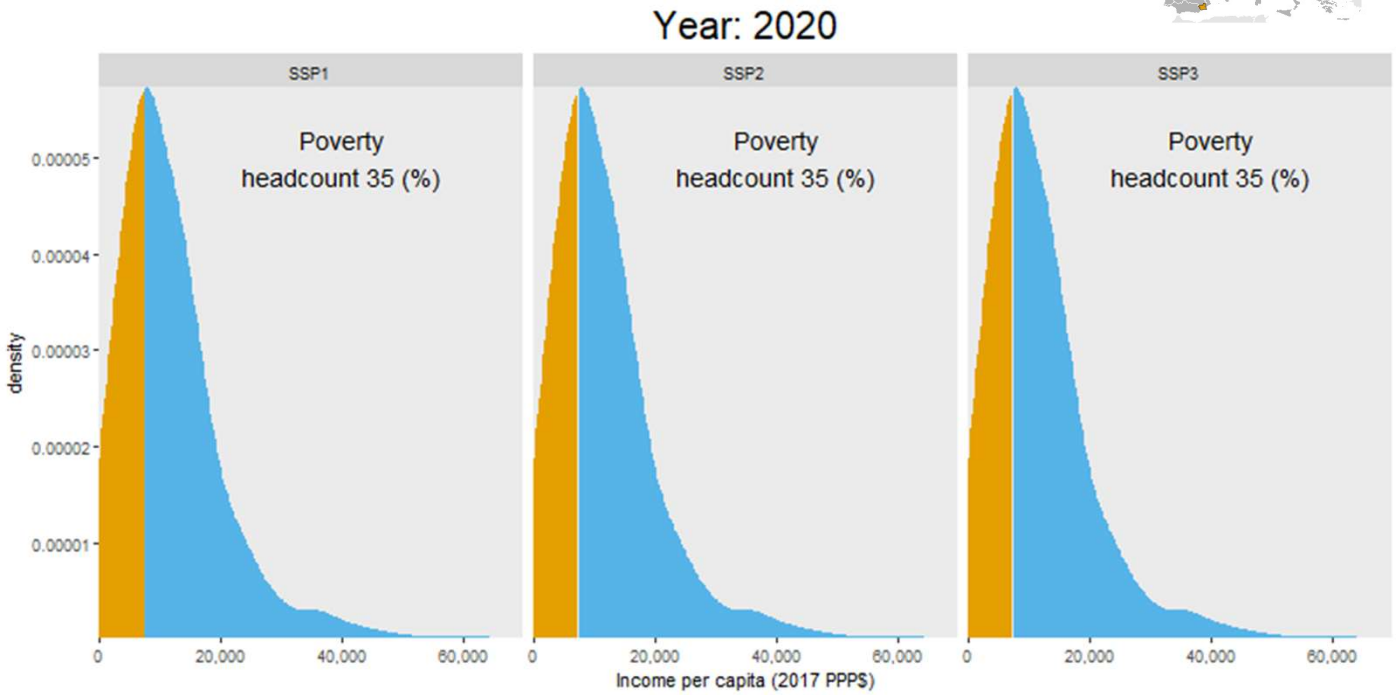

a
REGIÓN DE MURCIA
b
SSP1
SSP2
SSP3
1000 people
1,500
1,000
500
0
2020
2035
2050
Rural
Urban
c
SSP1
SSP2
SSP3
750,000
500,000
250,000
0
1000 people
Female
Male
0-14
15-24
25-34
35-44
45-54
55-64
65+
d
SSP3
SSP2
SSP1
Agriculture & craft
Clerks
Professionals
Services
Technicians
Not in labor force
65+
2
4
6
Annual growth (%)
e
SSP1
SSP2
SSP3
1000 people
1,500
1,000
500
0
2020
2035
2050
0-14
Agriculture & craft
Clerks
Professionals
Services
Technicians
Not in labor force
65+
f
SSP1
SSP2
SSP3
1000 households
600
400
200
0
2020
2035
2050

Region de Murcia:
Income distribution by scenario: 2020-2050



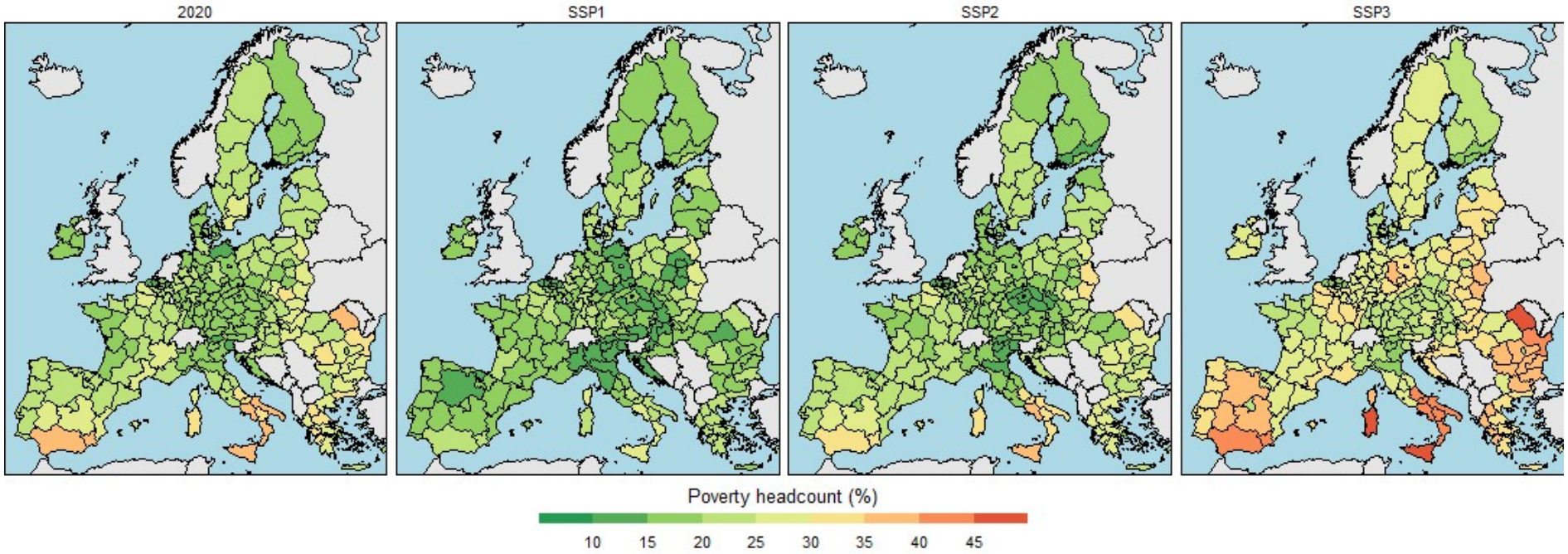
Regional distributional patterns determined by the combined effect of:

- Demographic change
- Urbanization
- Structural economic change
- Change in wages per occupation

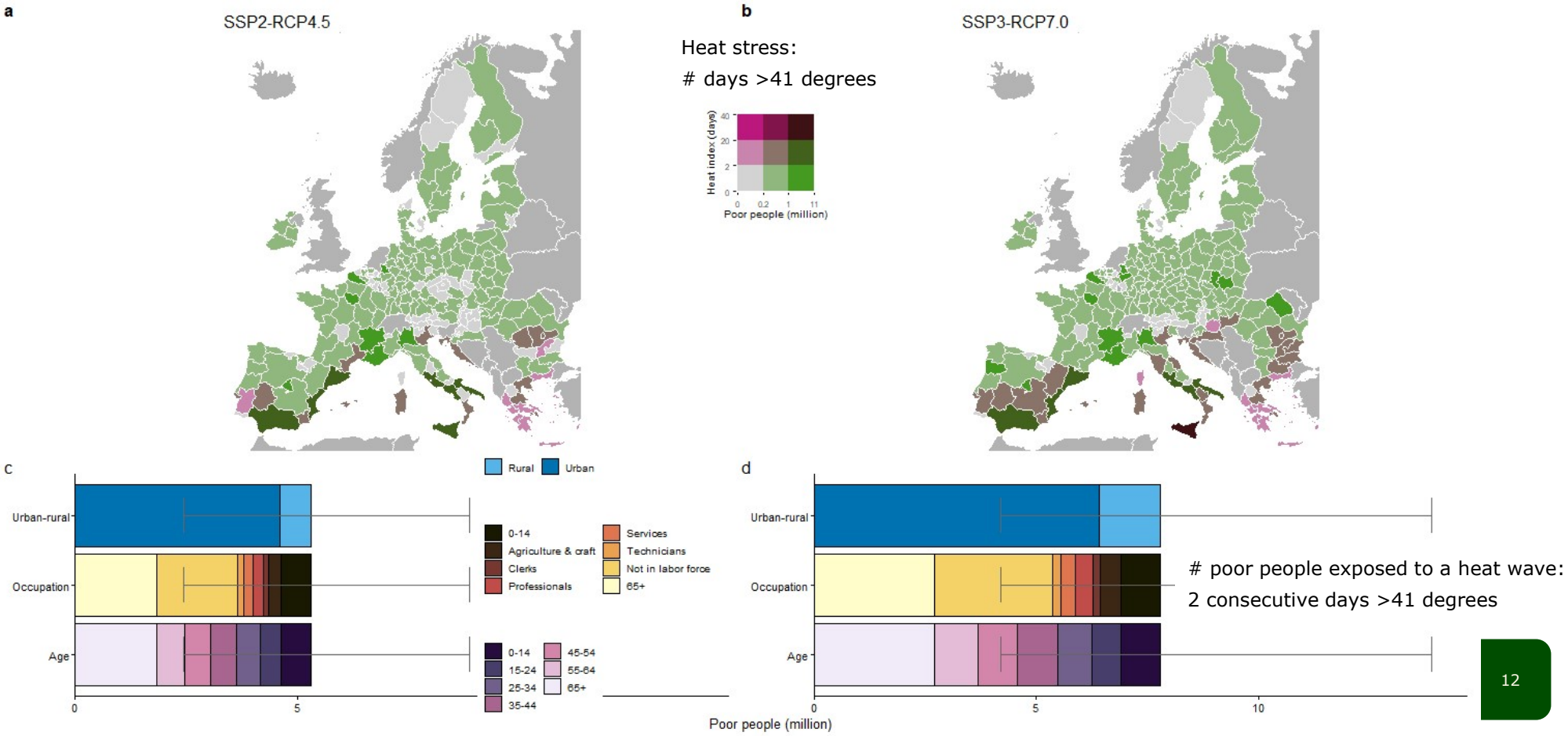


Poverty headcount (yellow): Income < 60% of median income

Subnational Poverty projections by scenario (2050)



Combining Poverty and heat stress maps for 2050 (preliminary results)



poor people exposed to a heat wave:
2 consecutive days >41 degrees

Limitations and next steps

Limitations

- CGE model wage projections are not spatially explicit.
- Top-down approach – no feedback loops from micro to macro.
- Household income change is driven by wage income change only.

Future research

- Incorporate climate impacts (e.g. loss in labor productivity) in CGE wage projections.
- Simulate impact of redistributive policies (taxes and subsidies) on future income distribution.
- Assess vulnerability to other climate hazards (e.g. floods).

Thank you!
Questions?

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