HARMONY

ICTR 2021

WP4: LAND-USE TRANSPORT-INTERACTION MODEL: THE CASE STUDY OF ATHENS GREATER AREA

Eleni Kalantzi

Fulvio D. Lopane

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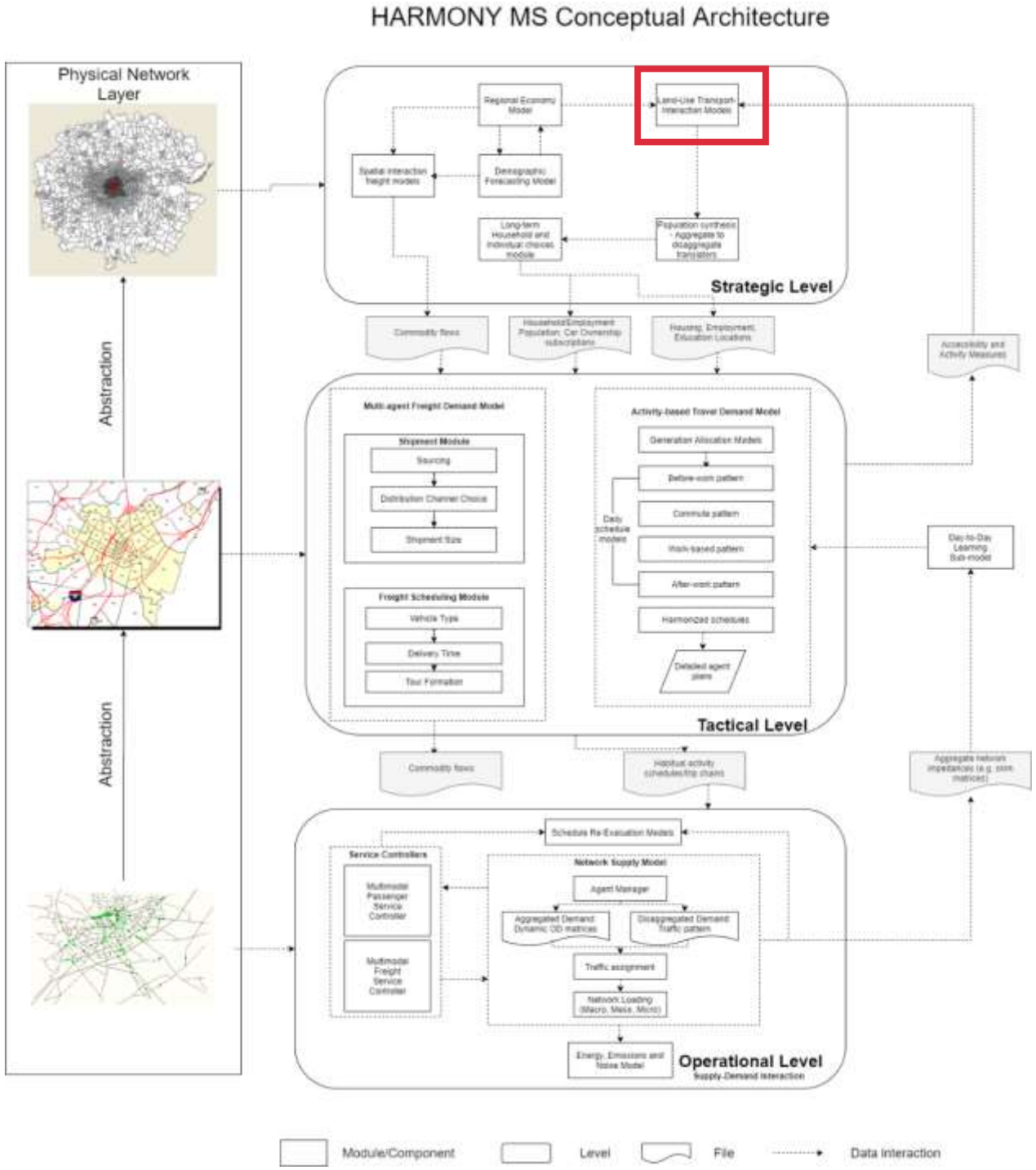
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 815269

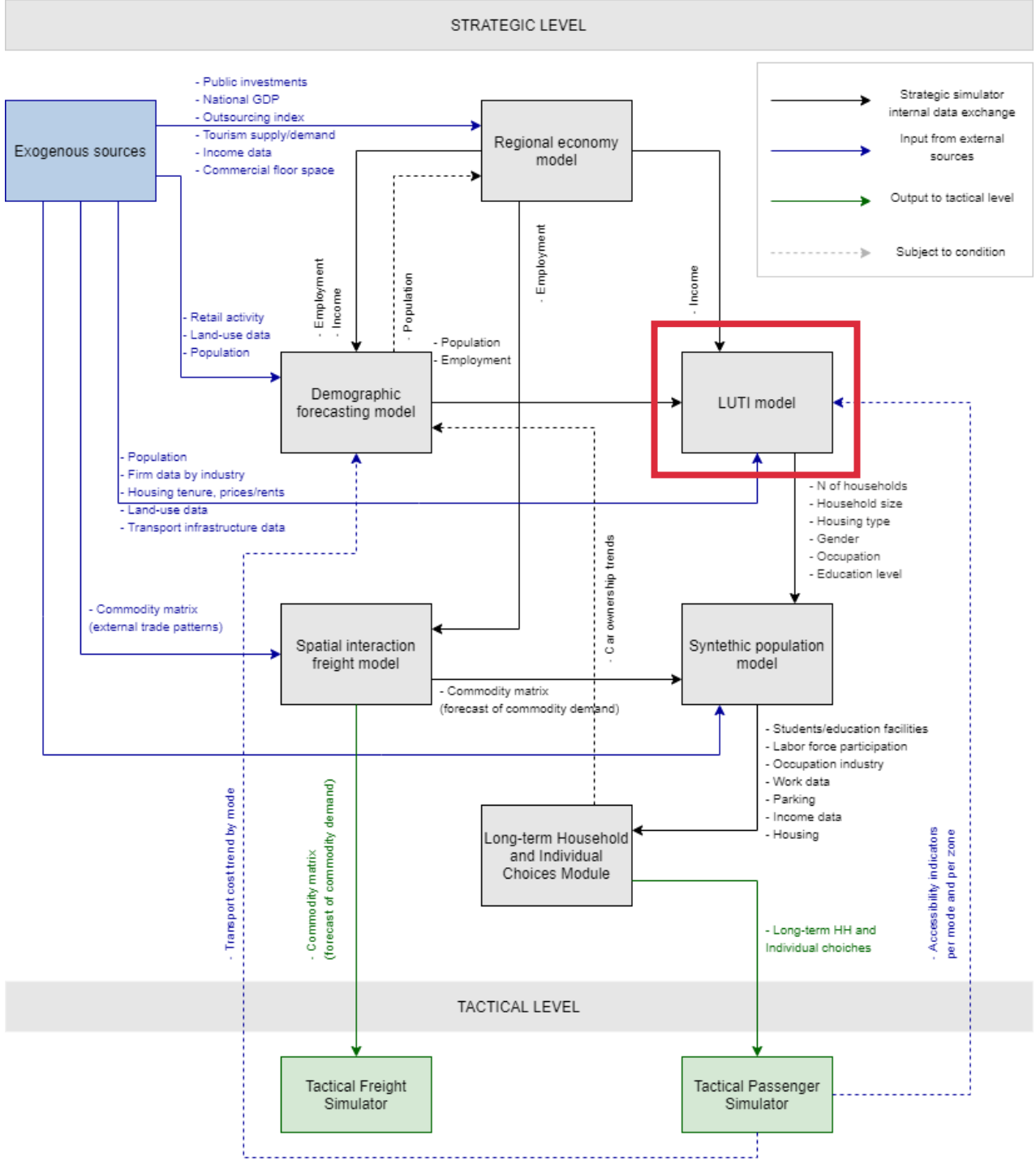
CIVITAS 2030

Sustainable and smart mobility for all

Structure of the HARMONY Model Suite



Workflow of the HARMONY Strategic Simulator



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LUTI Models

VS

Traditional Transport Models

- Aggregated models
- Assess the impact of transportation on land uses
- Multidimensional aspect in the planning processes
- Support policy making
- Address the complexity of urban systems

- Disaggregated models
- Obsolete and one-dimensional predictive tools
- Focus on predicting travel demand
- Do not take into account the impact of travel patterns on land uses

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Main Objectives

- Build a LUTI model for HARMONY's Athens case study (considering the whole Attica region)
- LUTI model (origin-constrained model) contains a Journey to work sub-model, which considers as:
  - origins: workplaces
  - destinations: homes.
- Assess the impact of one of the most important land use changes in Greece of the last decade, namely the renovation of the former airport in Elliniko into a metropolitan pole of attraction.
  1. Elliniko Scenario 2030 (50% of the time to complete Elliniko project)
  2. Elliniko Scenario 2045 (Elliniko project is fully completed)

Methodology – Base Model

The equation governing the model and was run in **Python** programming language is the following:

$$T_{ij}^{k} = E_i \left[\frac{A_j \exp\left(-\beta^k c_{ij}^k\right)}{\sum_j \sum_k A_j \exp\left(-\beta^k c_{ij}^k\right)} \right]$$

- Ei = number of jobs in the origin zone i (2011)
- Aj = residential floorspace density (floorspace/ total area of each zone) (2011)
- β^k = calibration parameter for each mode k (public / private)
- Cij = the travel time from i to j for public / private transport (2016)

All the data sets were obtained by Athens Urban Transport Organisation (OASA).

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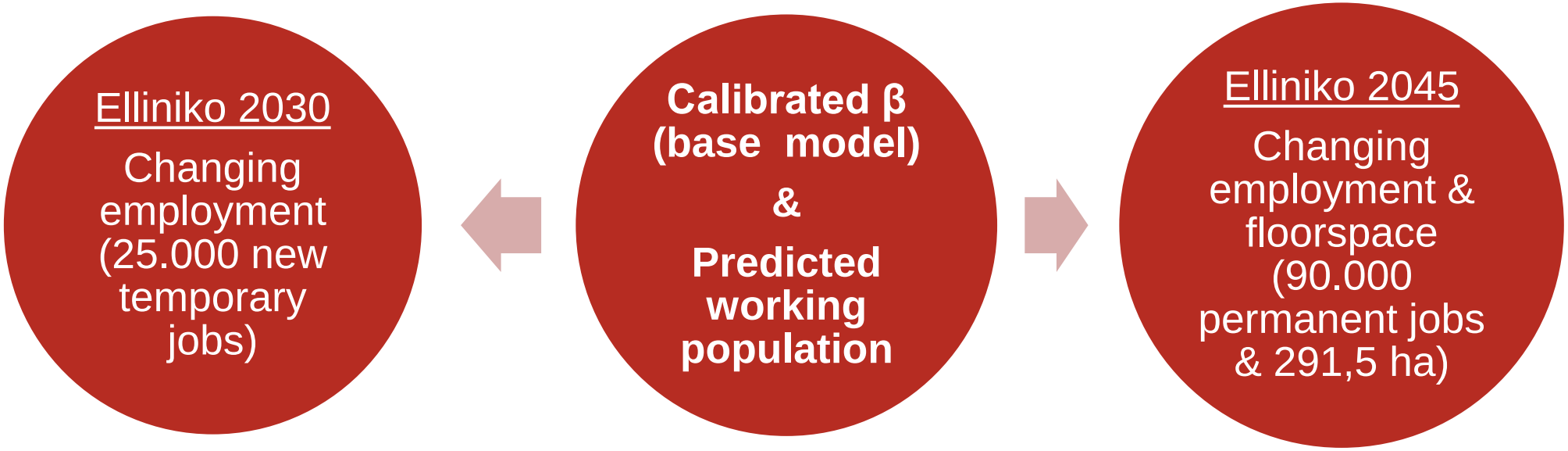
Methodology – Scenarios



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Results

- Average travel time of the commuters:
  - 47.35 min (public transport)
  - 37.37 min (private transport)
- calibrated parameter β = 0,0053 (public) and 0,0117 (private)
- 54.5% of the population use private transport and 45.5% public
- Predicted distribution of flows (Tij) in each zone
- Predicted working population at destination zone j
- Accessibility of jobs (the normalised number of jobs divided by the weighted average of travel time to get in the job location)

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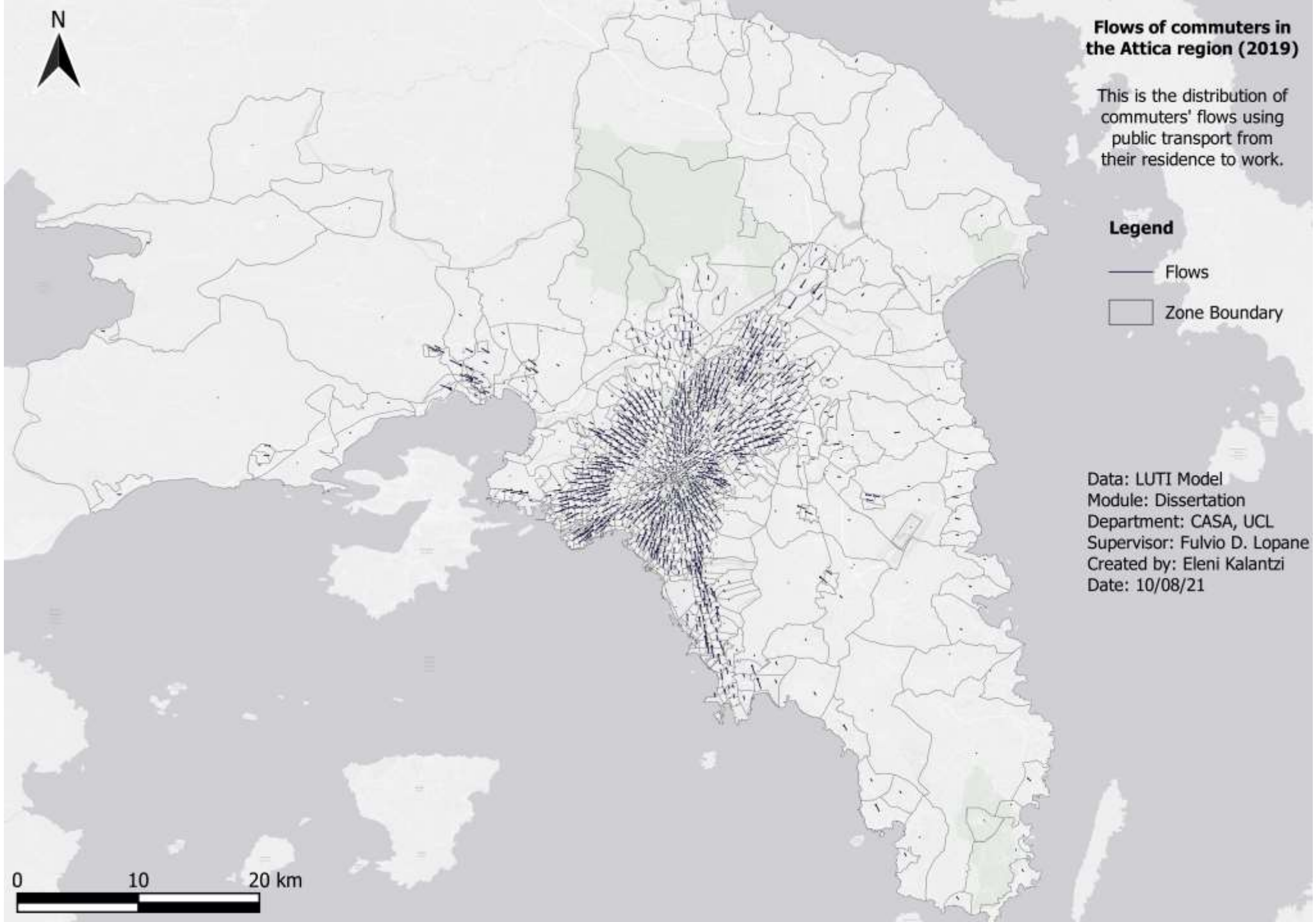
N
Flows of commuters in the Attica region (2019)
This is the distribution of commuters' flows using public transport from their residence to work.
Legend
Flows
Zone Boundary
Data: LUTI Model
Module: Dissertation
Department: CASA, UCL
Supervisor: Fulvio D. Lopane
Created by: Eleni Kalantzi
Date: 10/08/21
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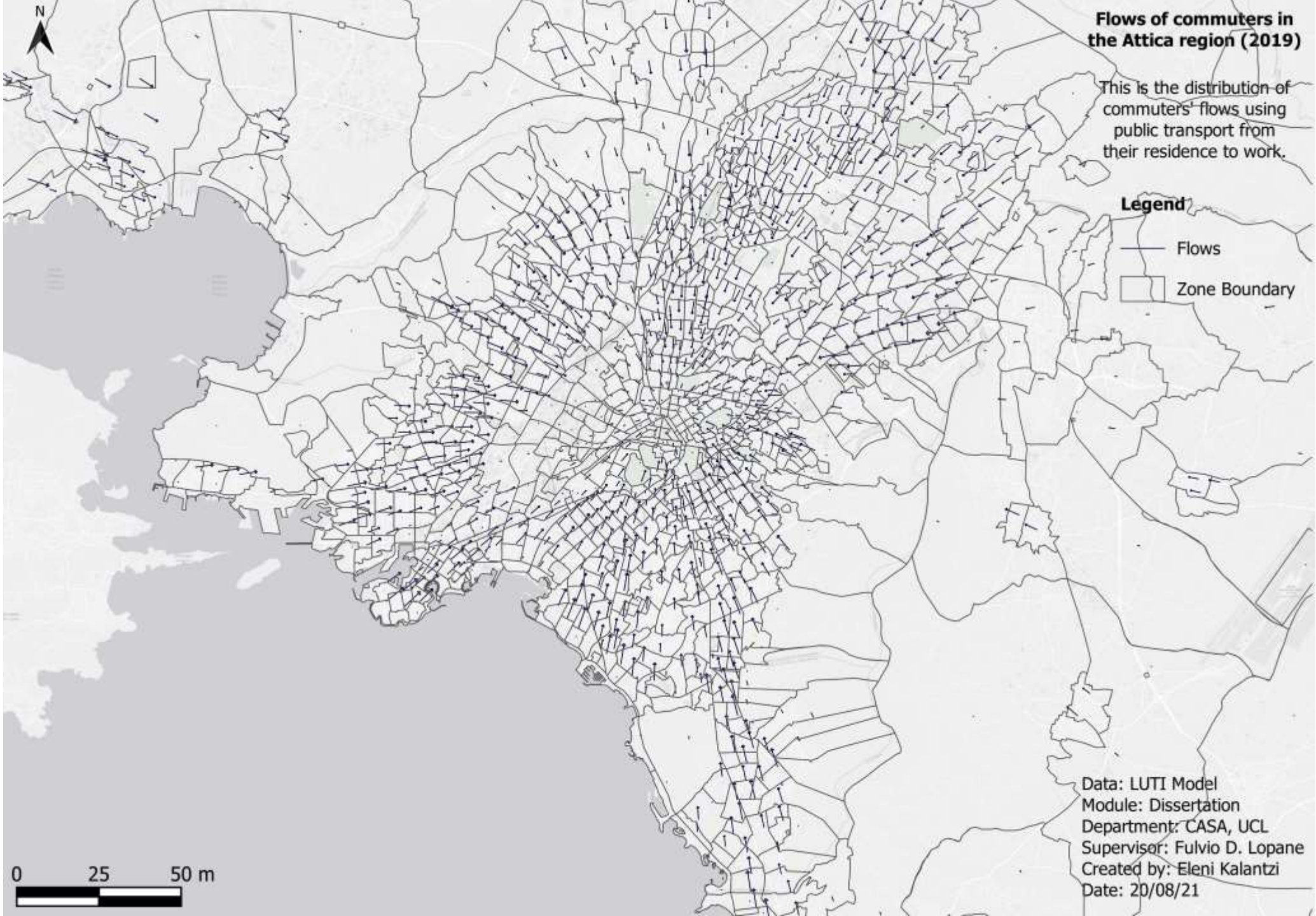
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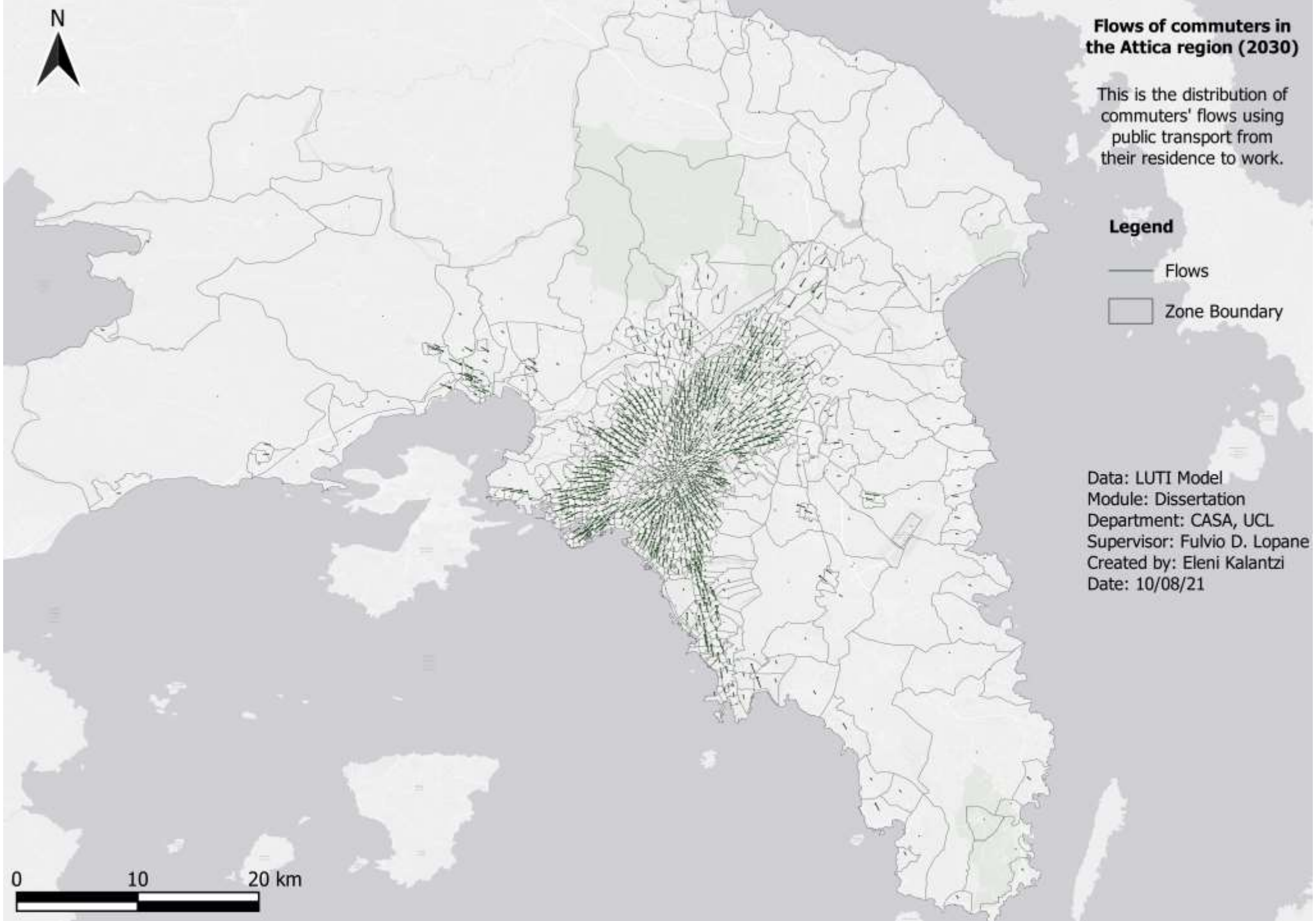
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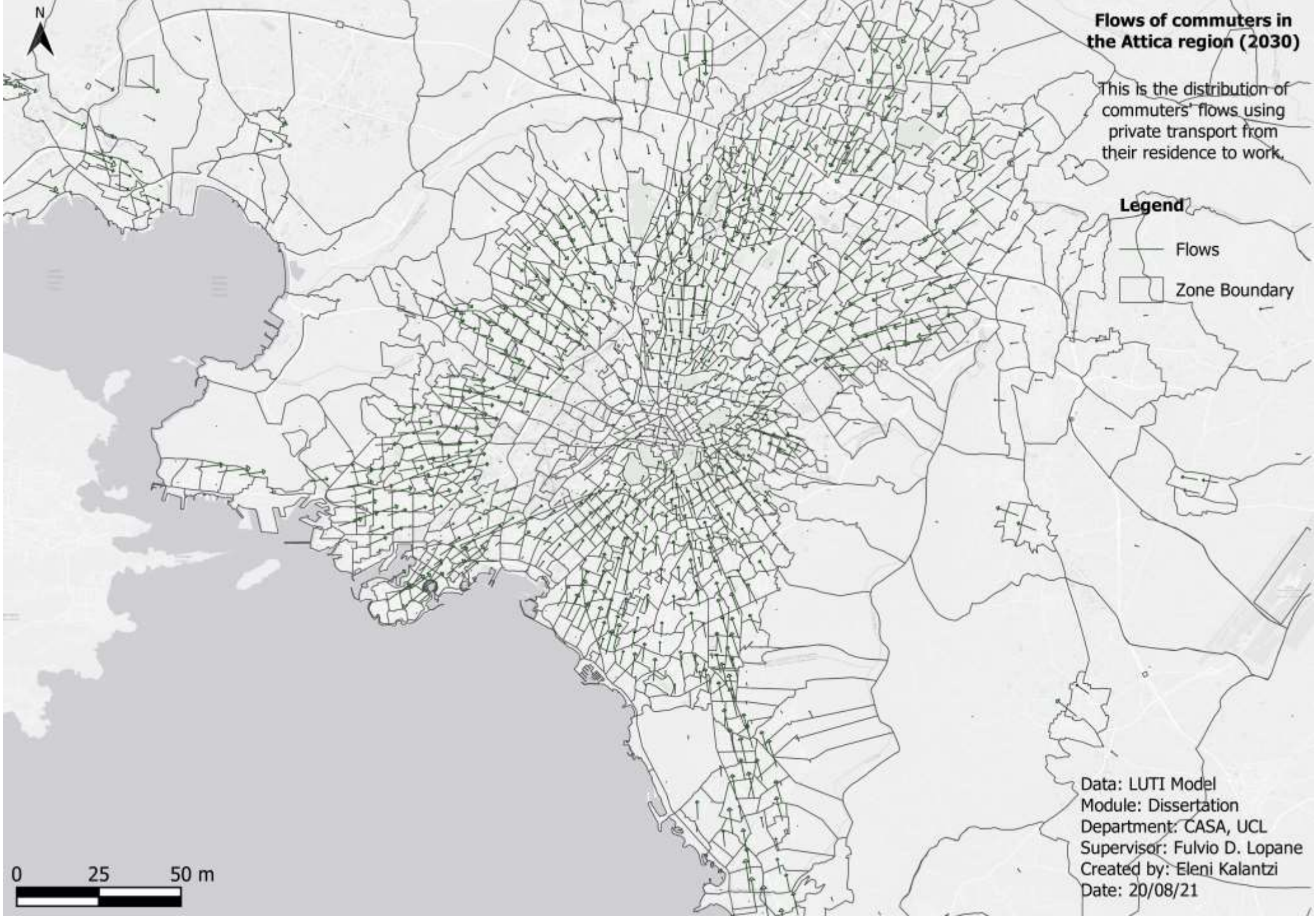
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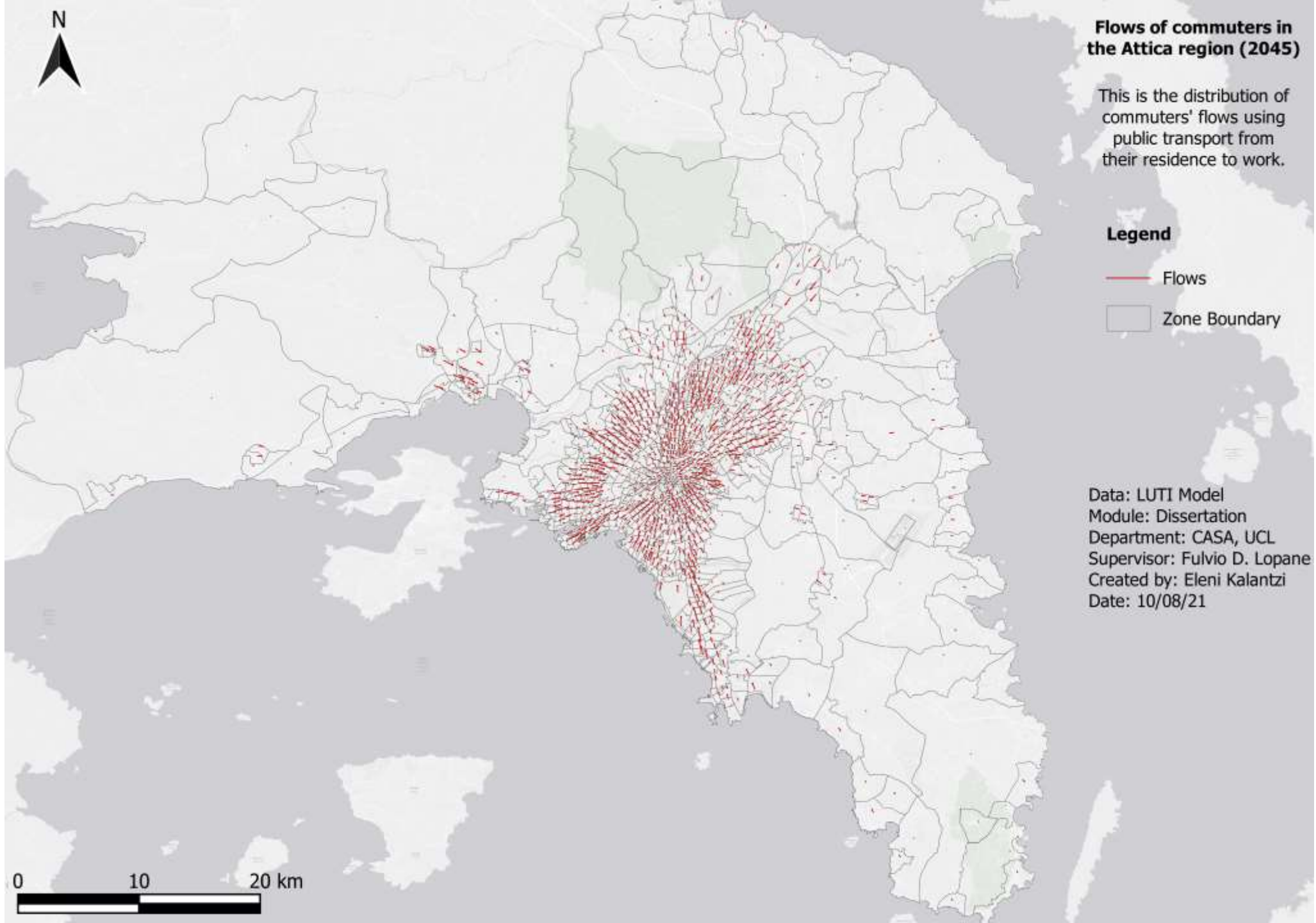
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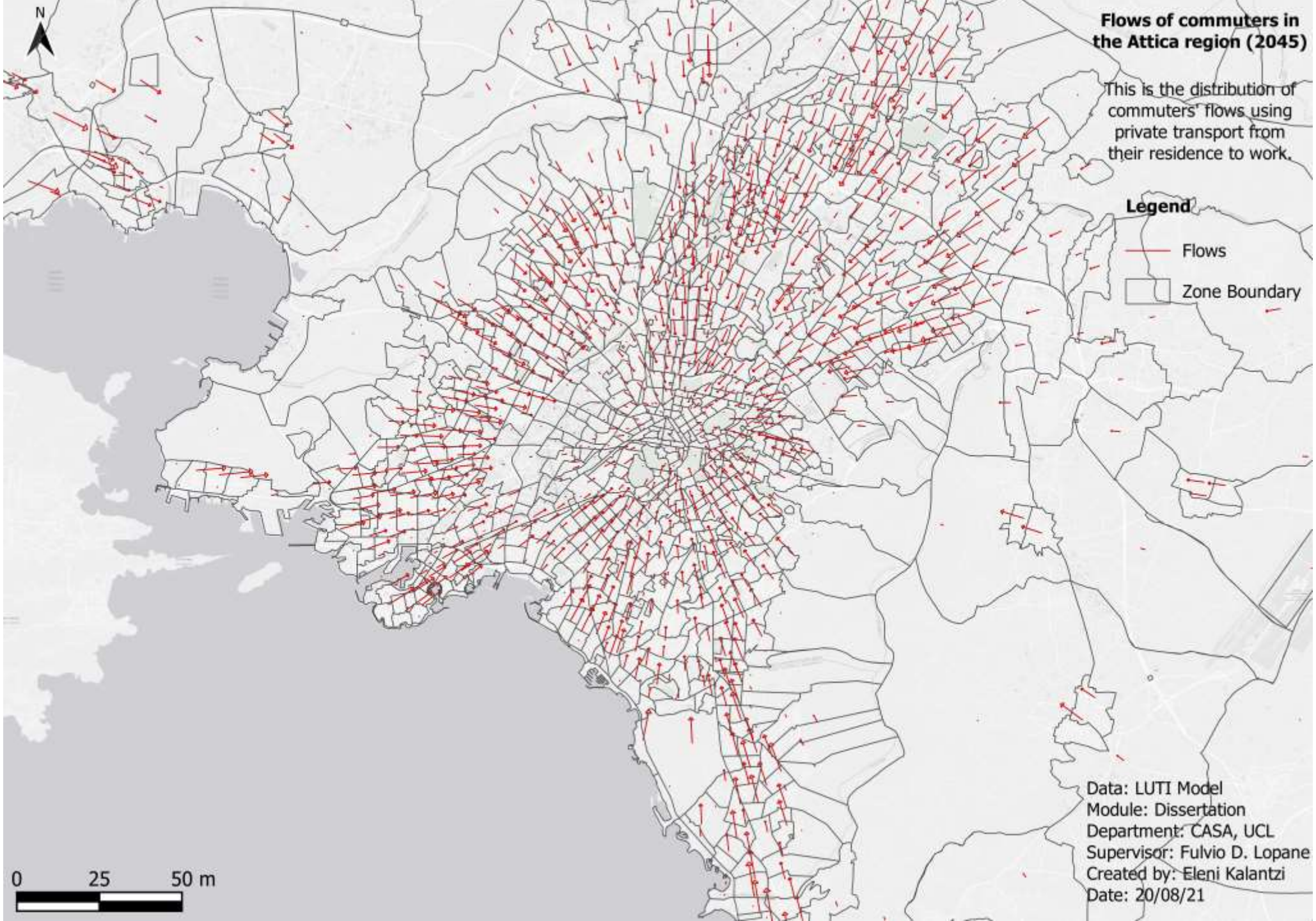
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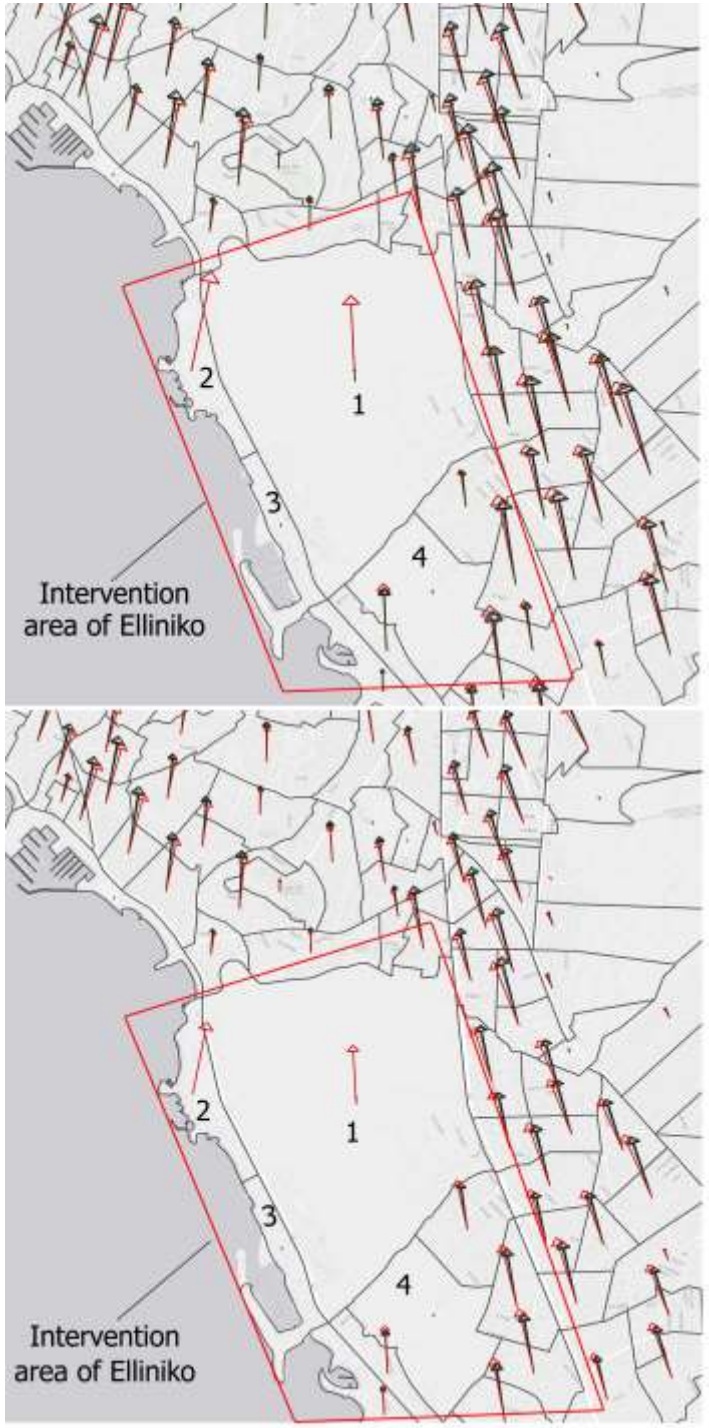
Comparison of commuters' flows using private (up) and public (down) transport in the intervention area of Elliniko (2019-2030-2045)

- Large increase in 2 zones of Elliniko, which include new dwellings
- Increase in the areas south and east of them
- The areas adjacent to the north area of Elliniko show a small decrease.
- The arrows in the western zones are rotating clockwise and the arrows in the eastern zones are rotating counter clockwise
- This means that the centre of gravity is shifting to another pole (except for city centre), namely the new metropolitan park of the Elliniko



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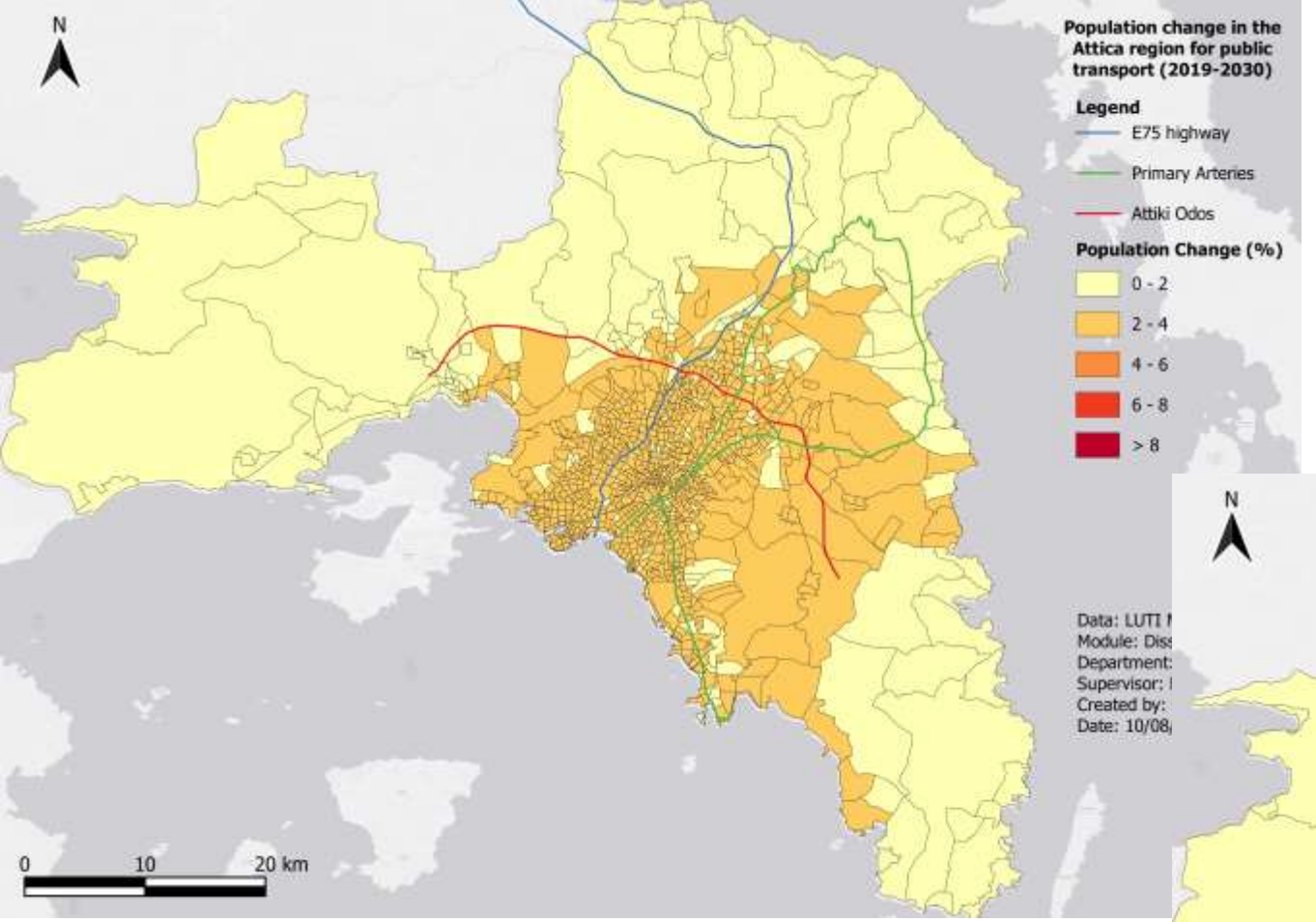
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Population change in the Attica region for public transport (2019-2030)
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E75 highway
Primary Arteries
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Population Change (%)
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2 - 4
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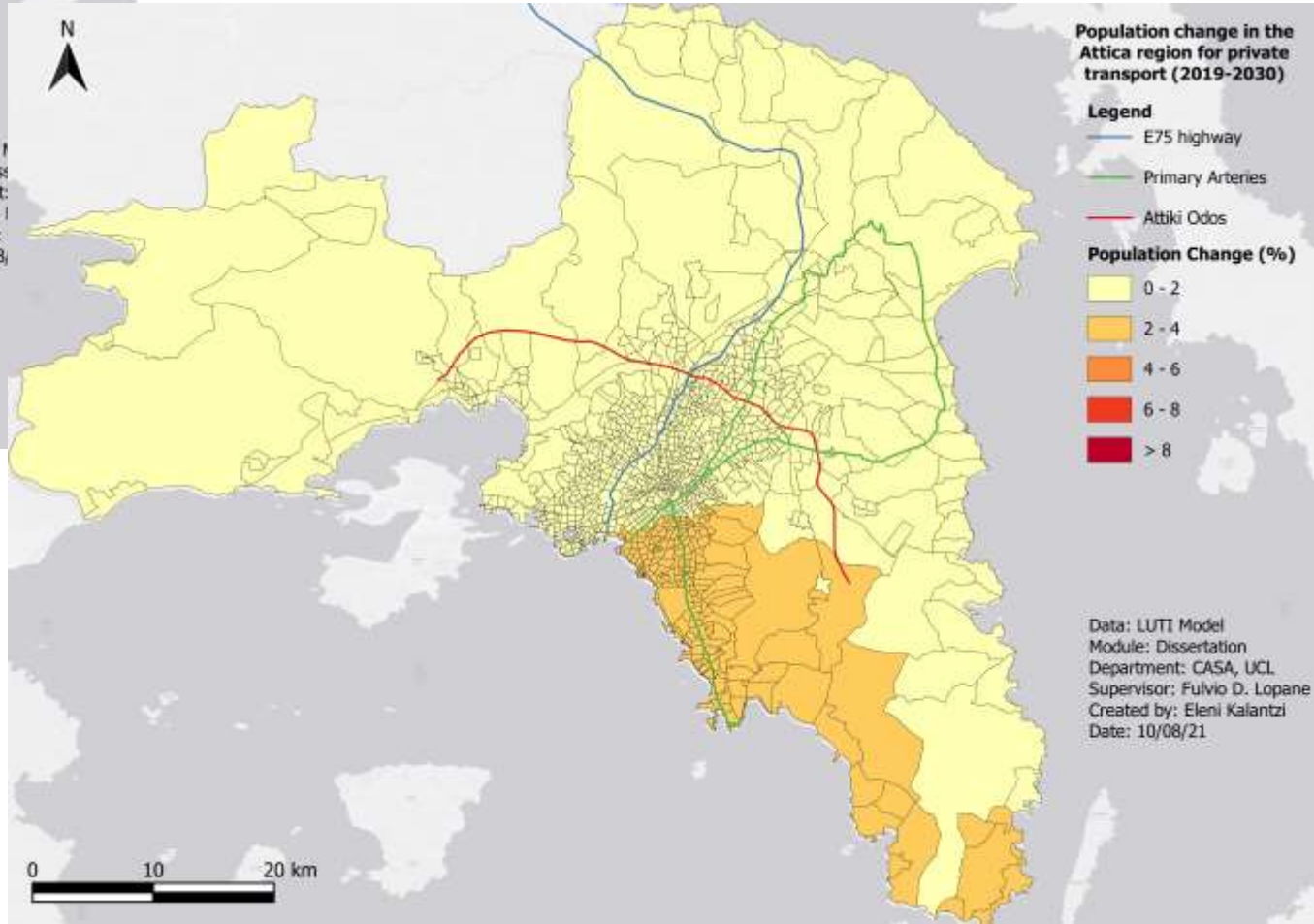
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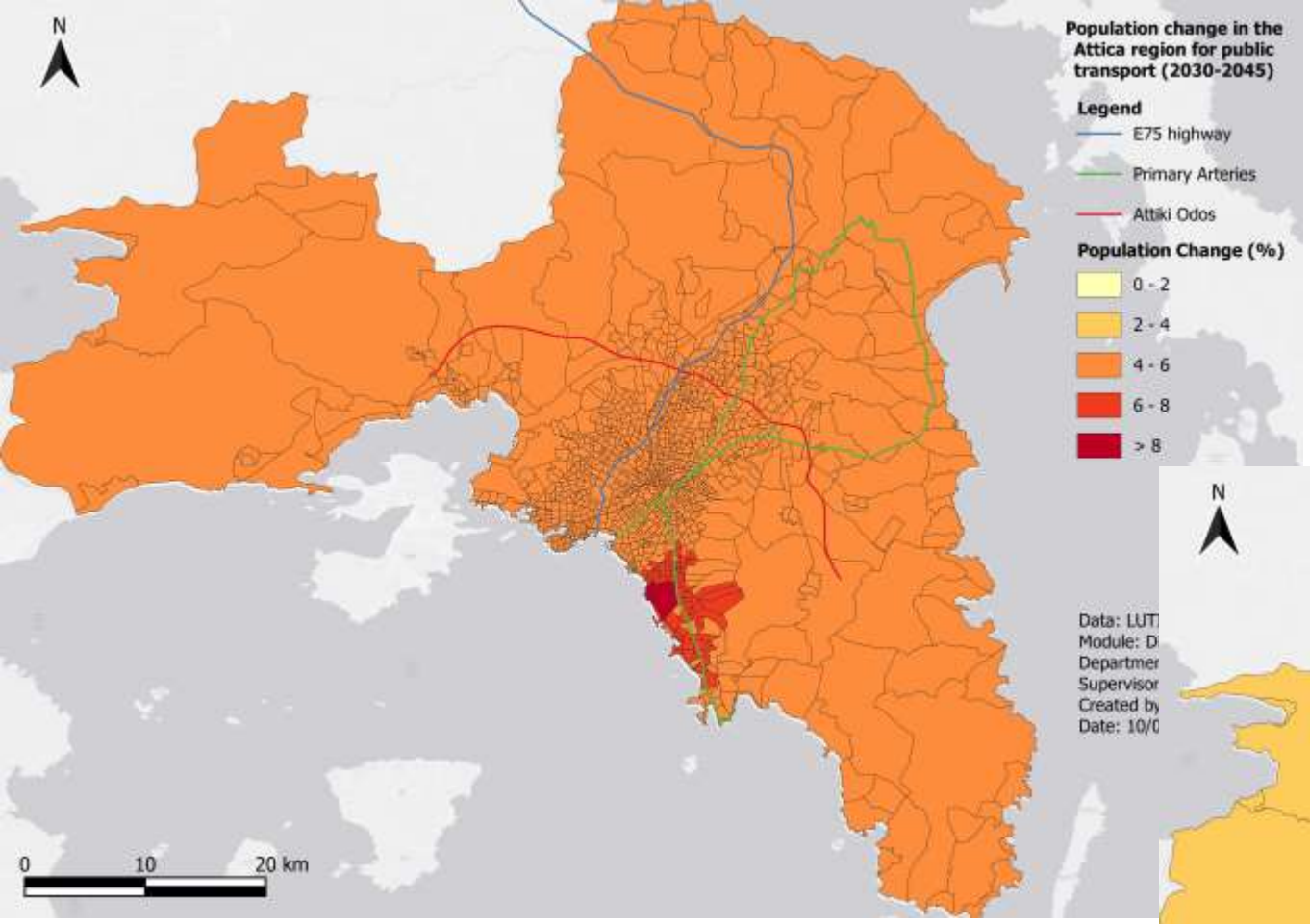
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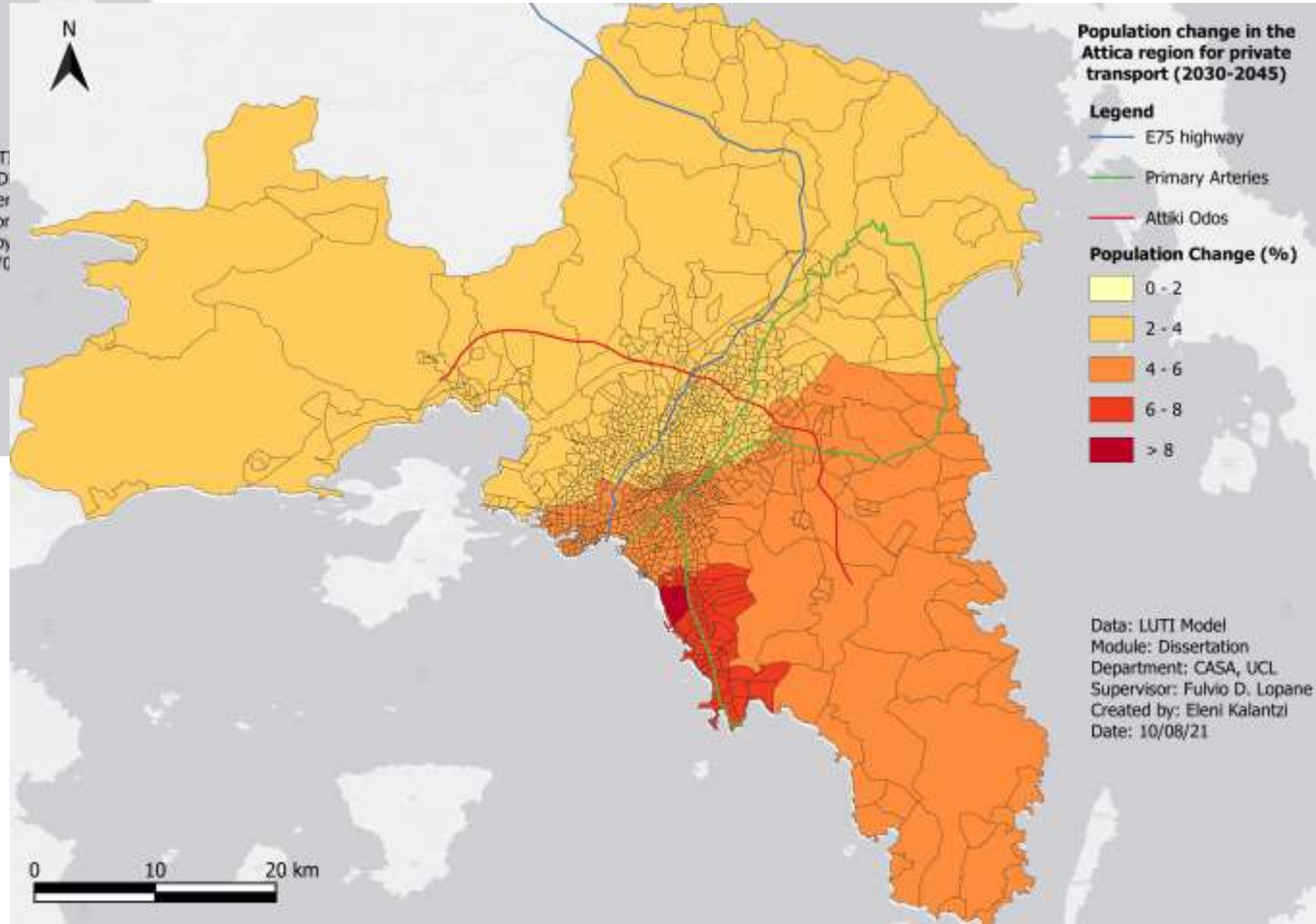
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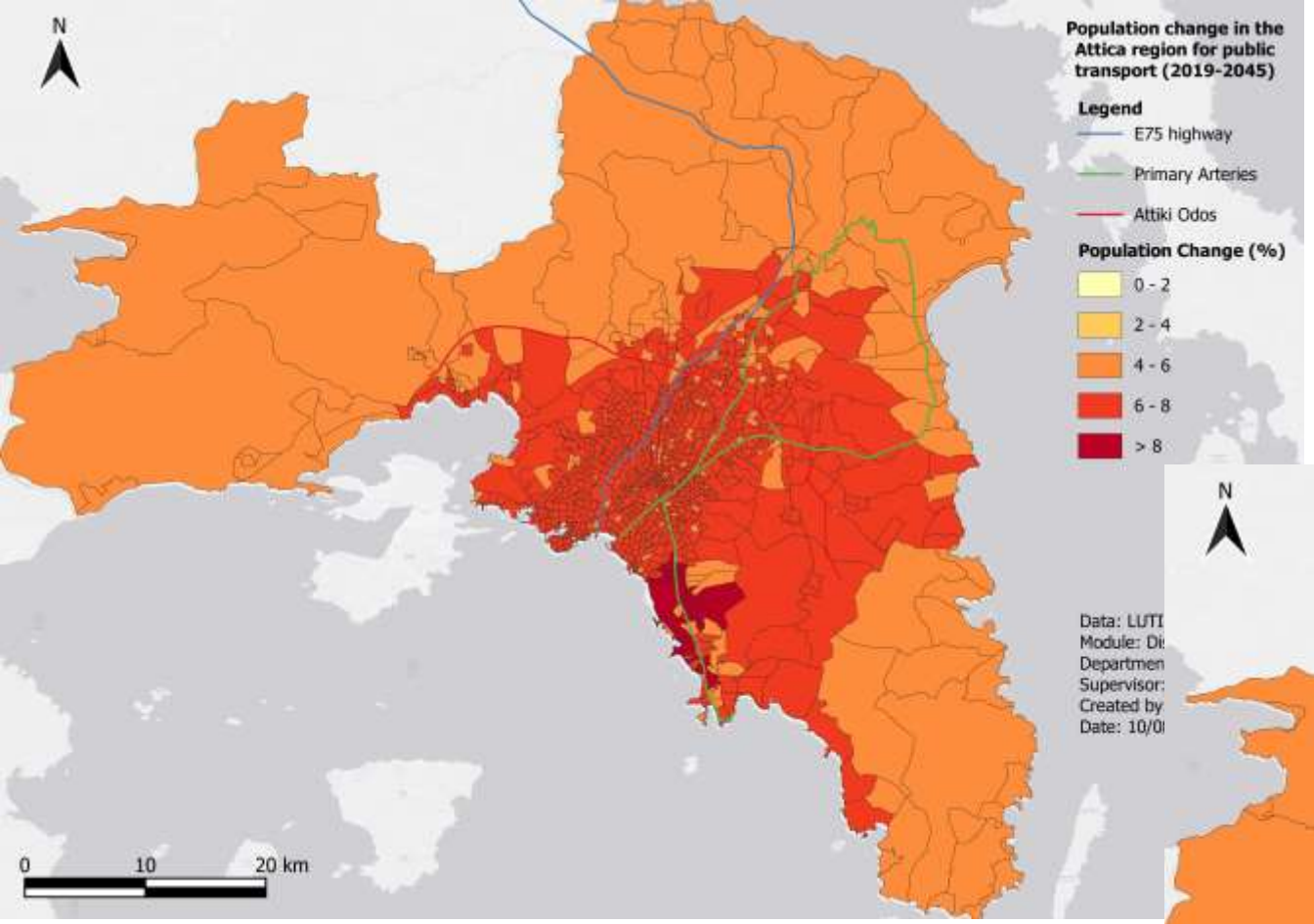
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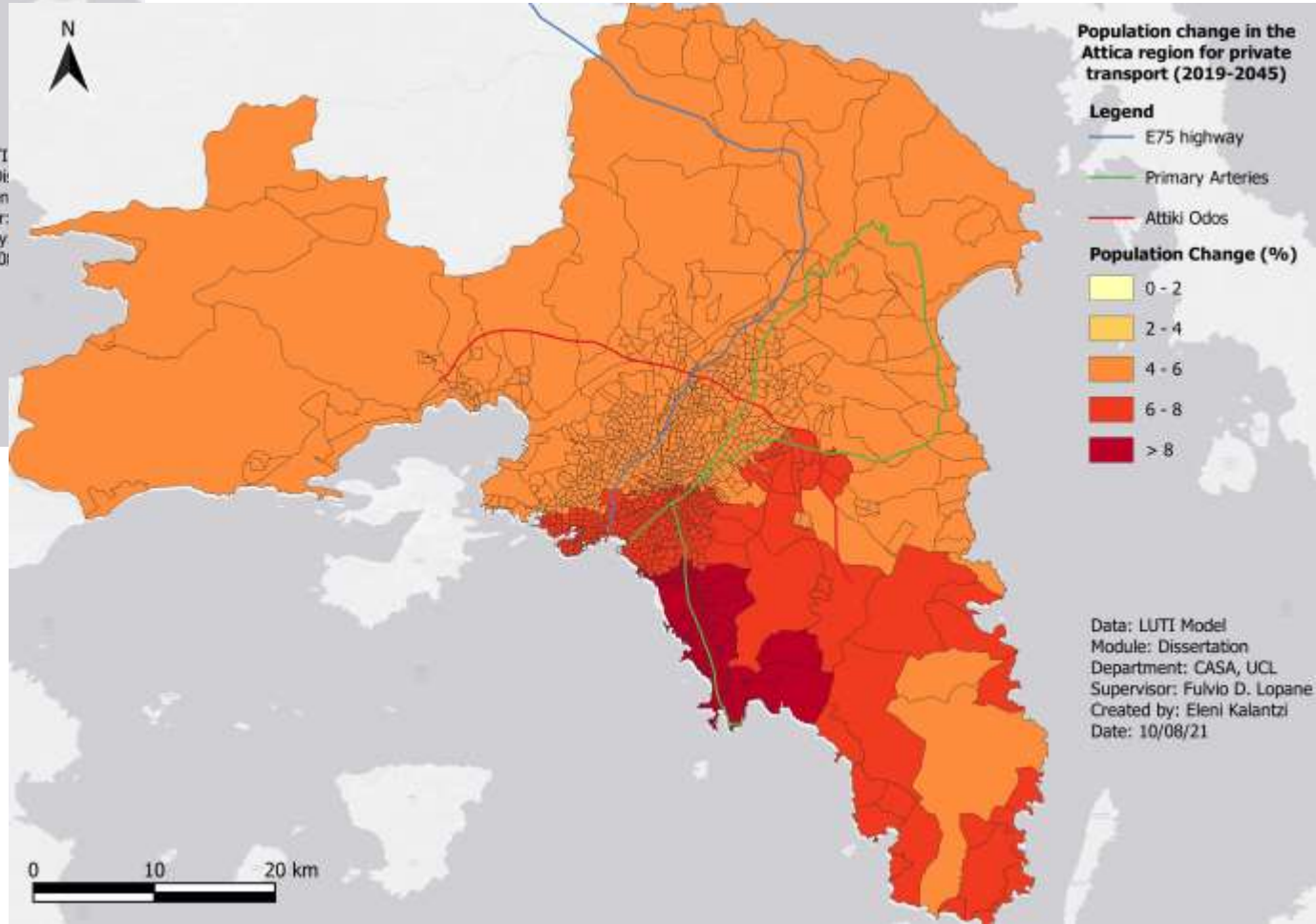
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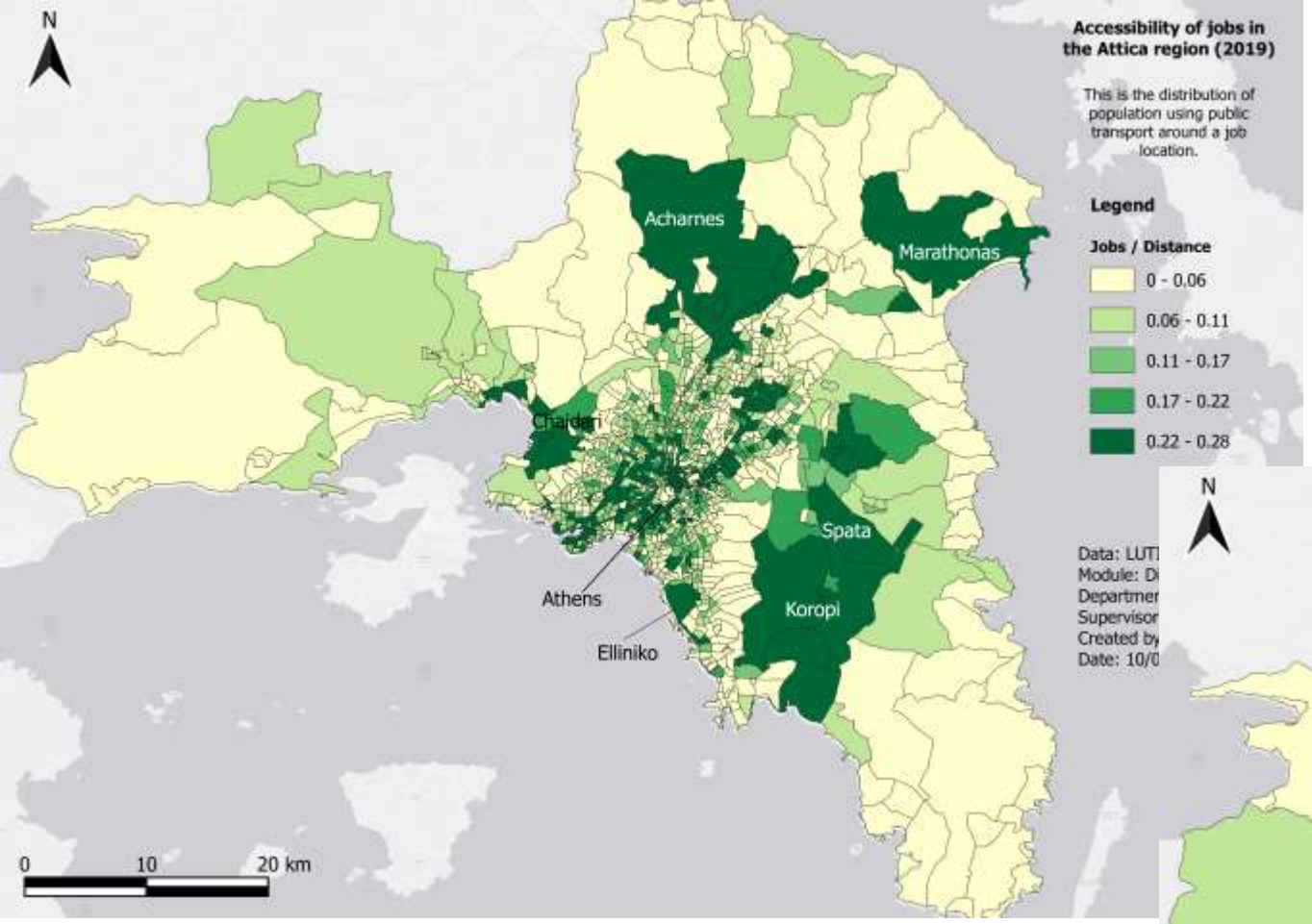
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Accessibility of jobs in the Attica region (2019)
This is the distribution of population using public transport around a job location.
Legend
Jobs / Distance
0 - 0.06
0.06 - 0.11
0.11 - 0.17
0.17 - 0.22
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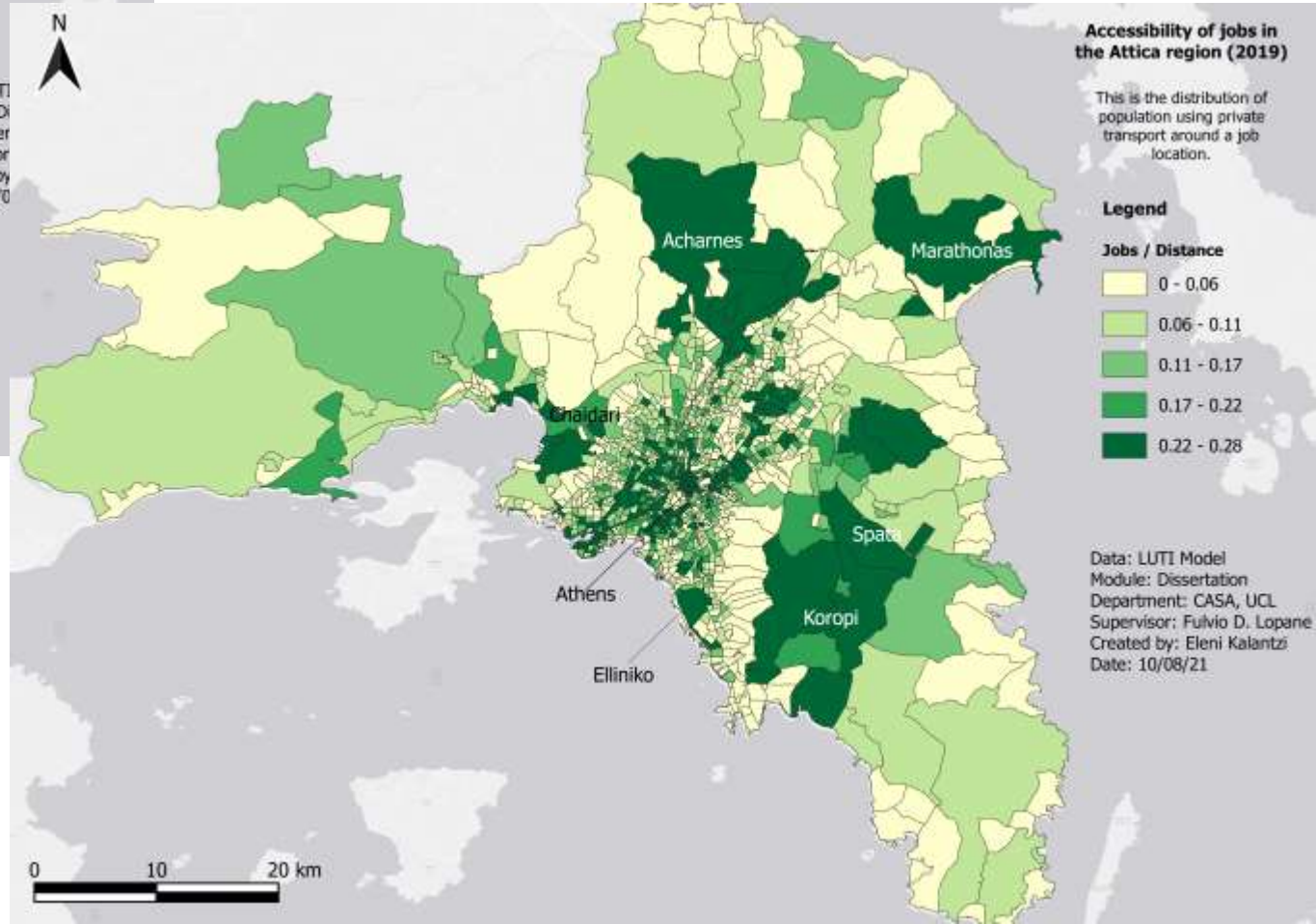
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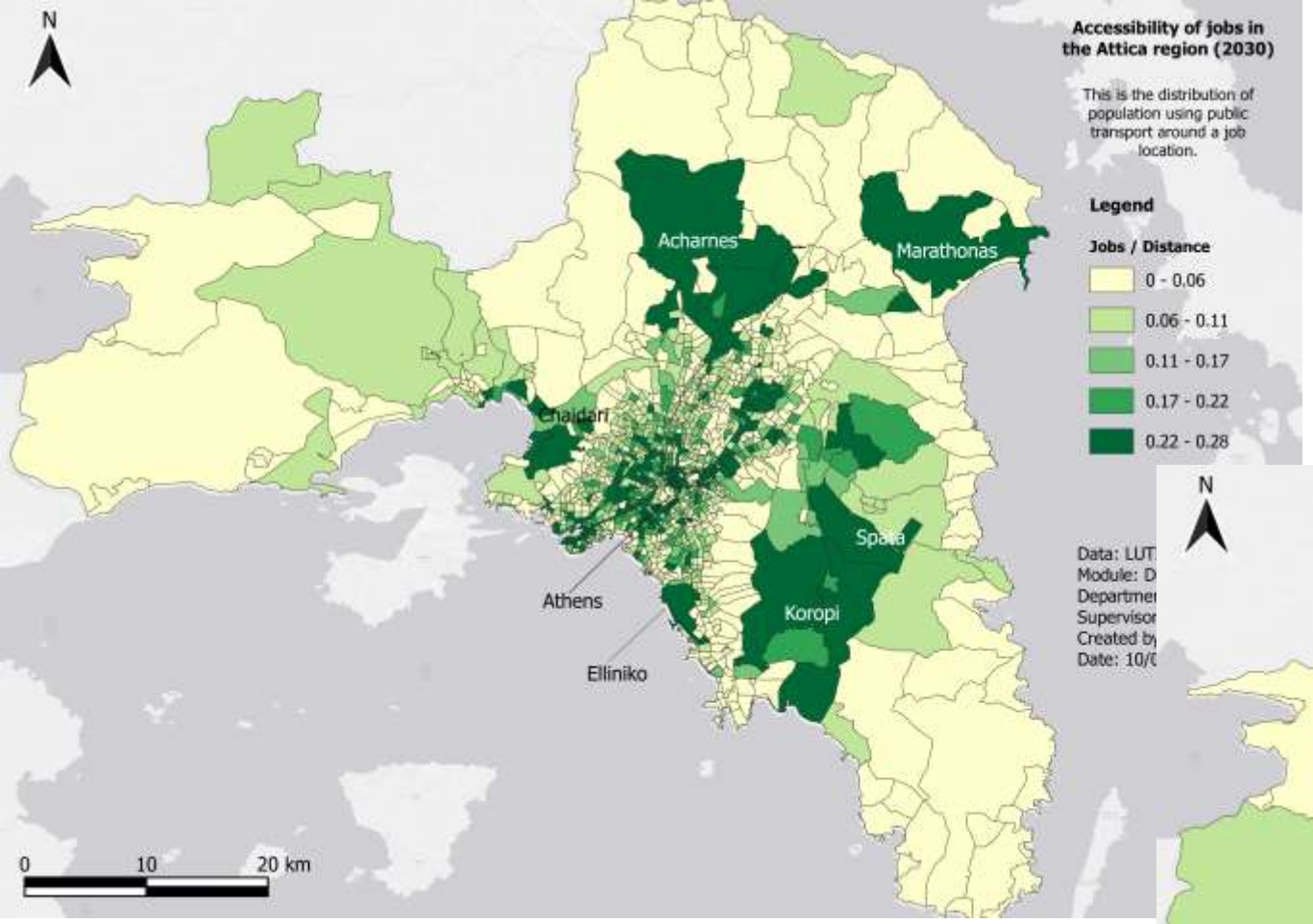
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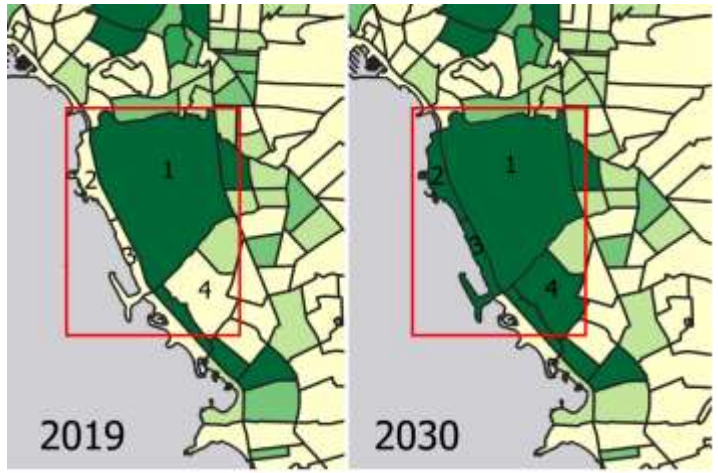
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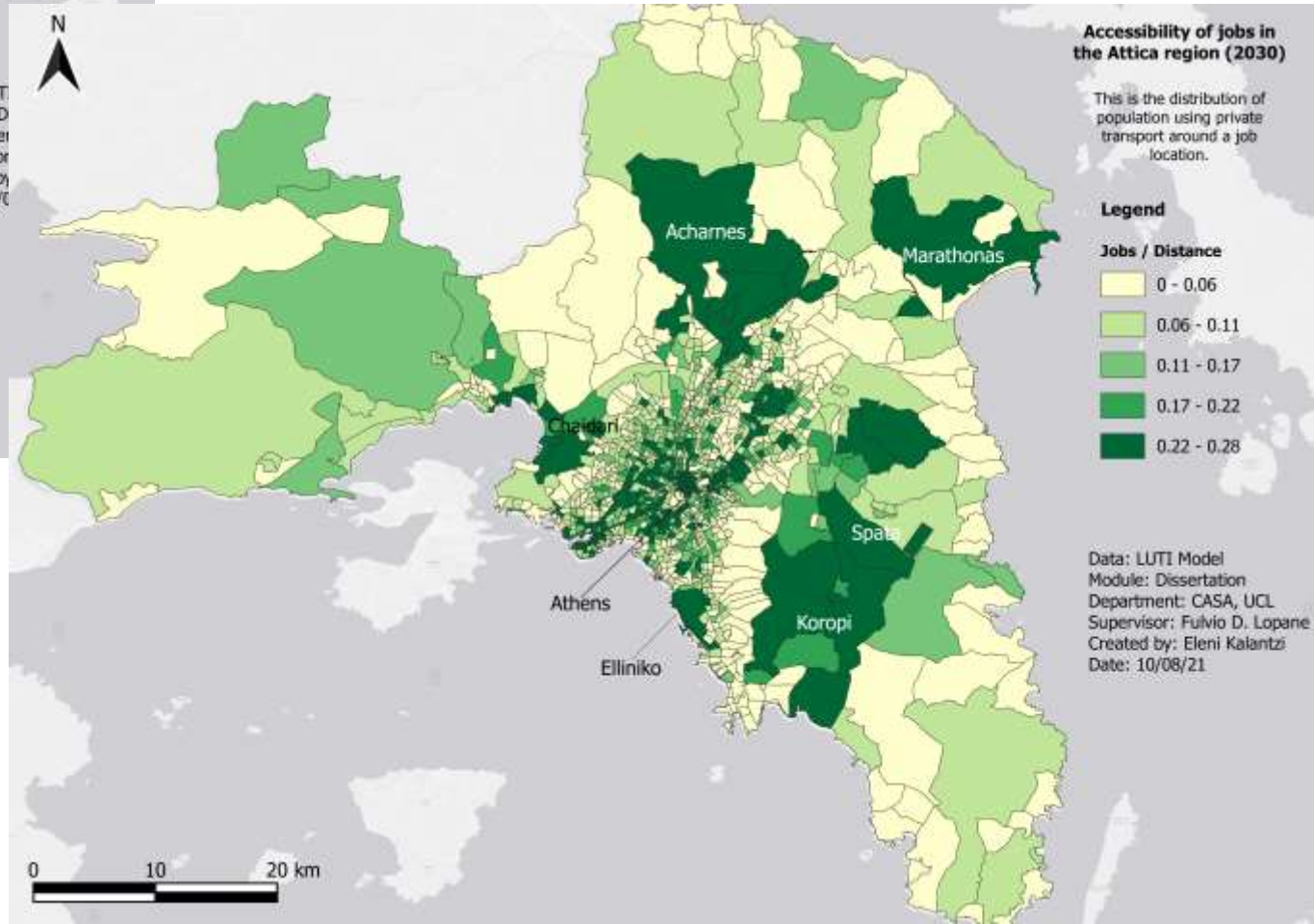
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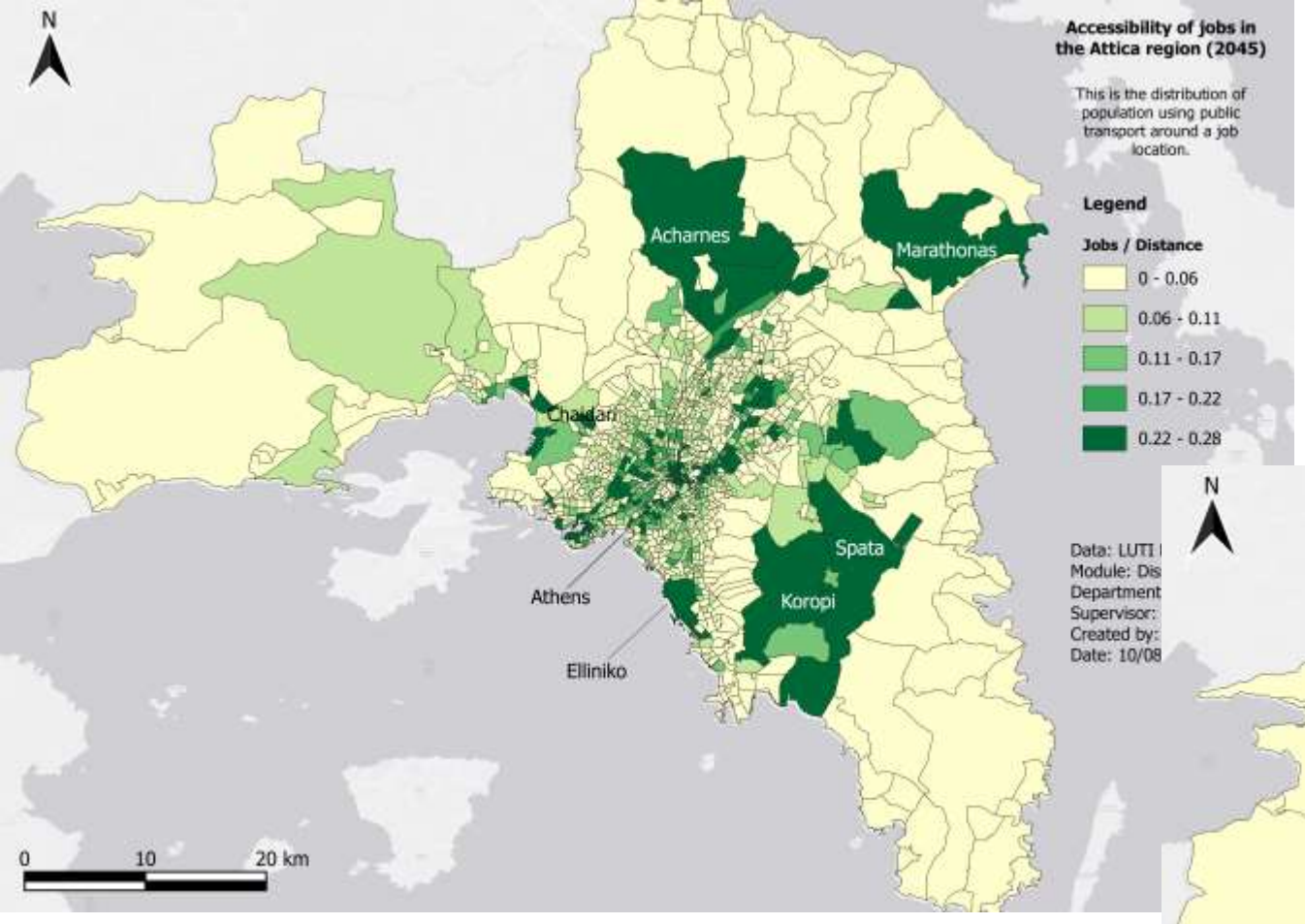
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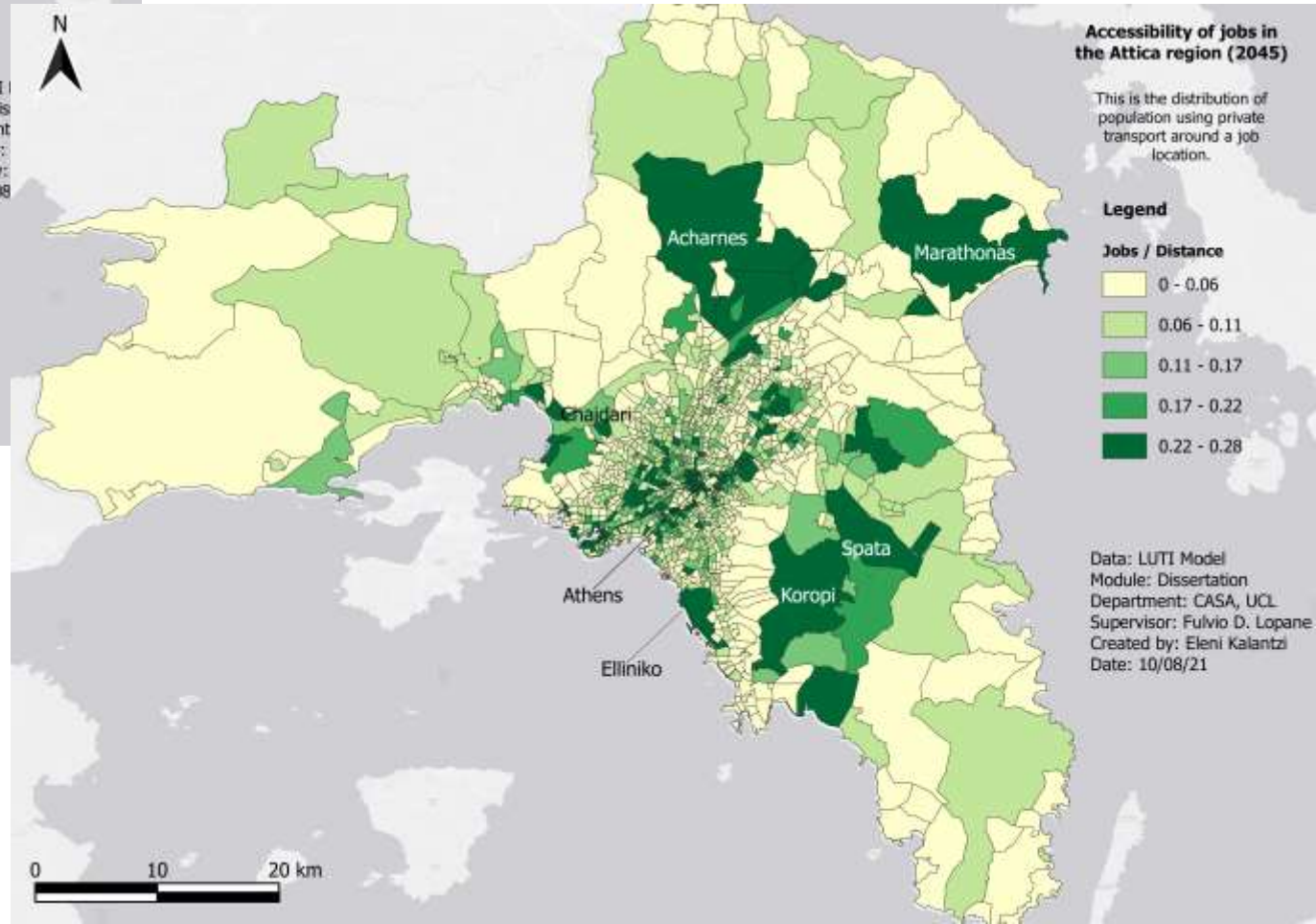
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Further Recommendations

- Develop other possible scenarios, such as the prediction of flows in case of remote working, due to the construction of the new metro line, etc.
- As an alternative approach, instead of travel time, travel monetary costs can be used as cij.
- A more complete version of the model could also take into account the regional unit of islands, which are not included in this model.
- Consider more than 2 modes of transport, like car, motorcycle, bus, railway, subway, tram, and ferry, i.e. k = 7.
- Instead of using the floorspace density as an attractor Aj, a more complete model should include the economic perspective, using rent prices per zone * m2 of residence floorspace as an attractor.
- Use more up-to-date data, such as from 2021 Census or Demographic Forecasting / Regional Economy Models

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