

Analysis of centers/subcenters via micro geospatial data

: Focusing on Andong in Korea

June 8, 2023

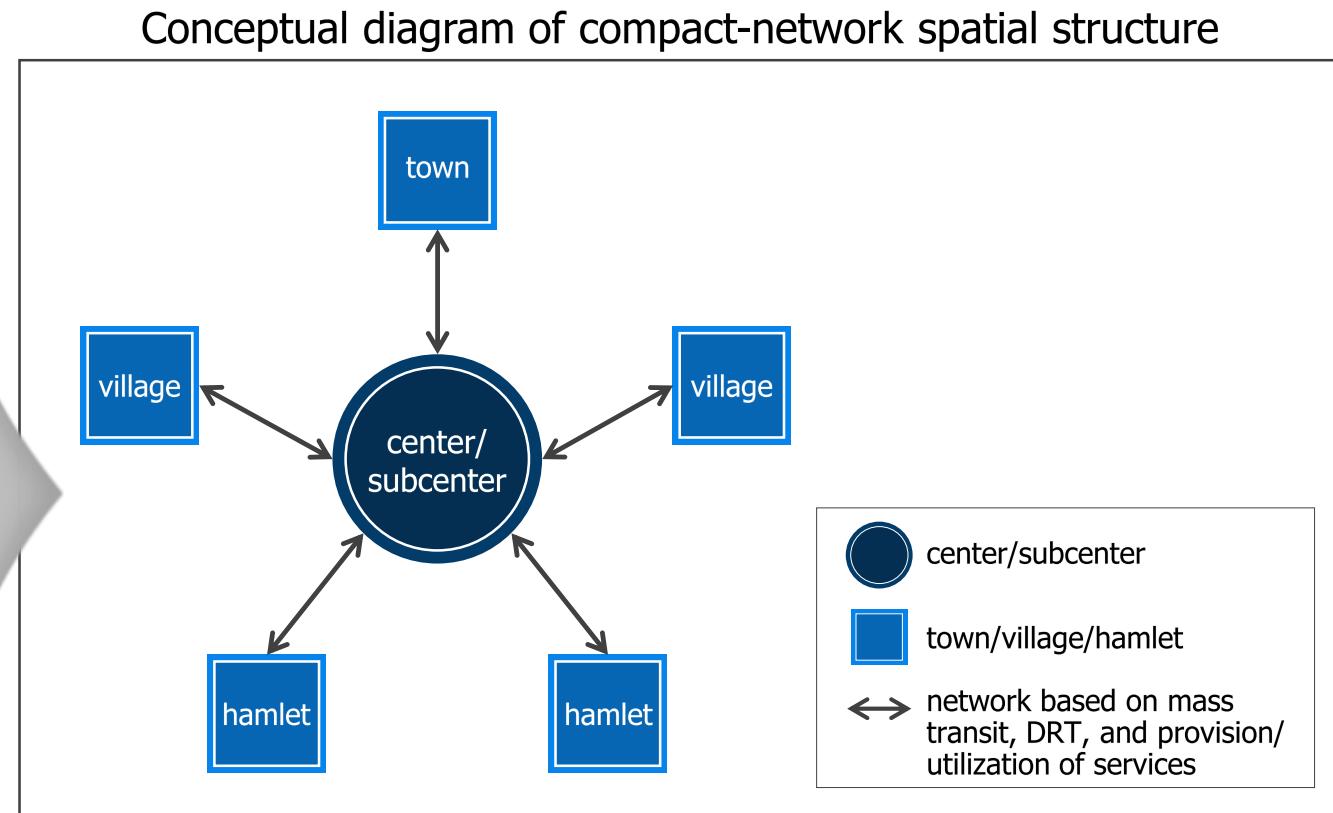
Youngmin Lee
Associate Research Fellow



KRIHS Datalab
Geospatial Analysis and Monitoring Center

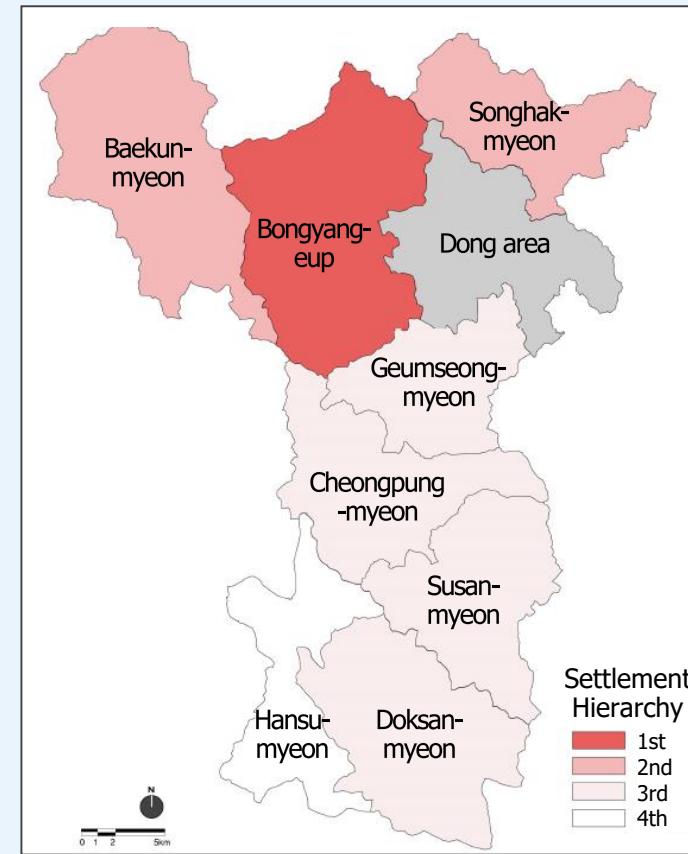
Andong

The growing importance of **compact-network** spatial development strategy in response to population decline

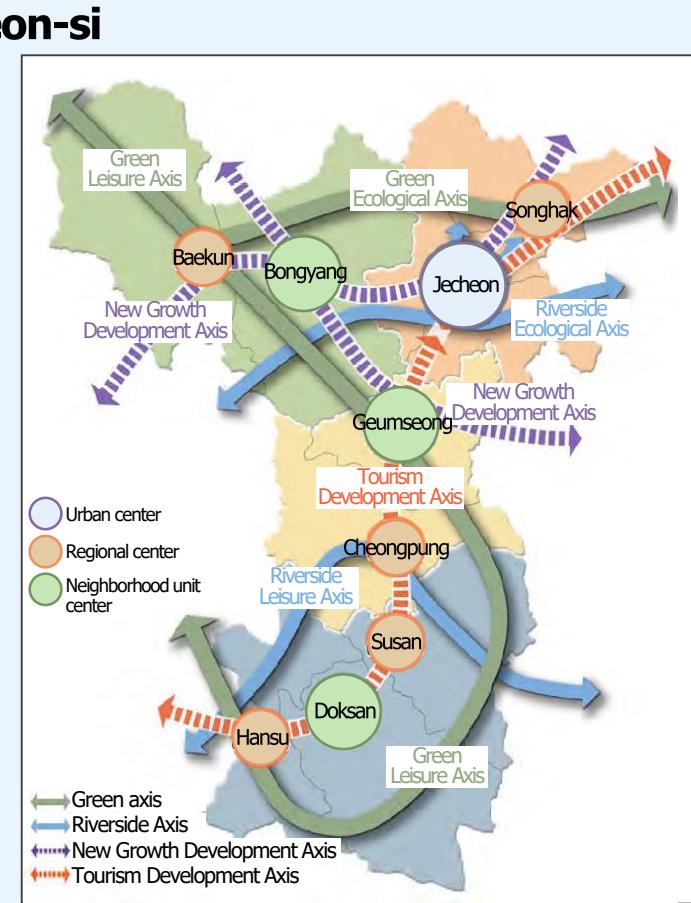


• Source: <https://deltabusinessjournal.com/loss-of-population-delta-leaders-working-to-offset-decline/>

Limitations in fine-grained understanding of spatial structures



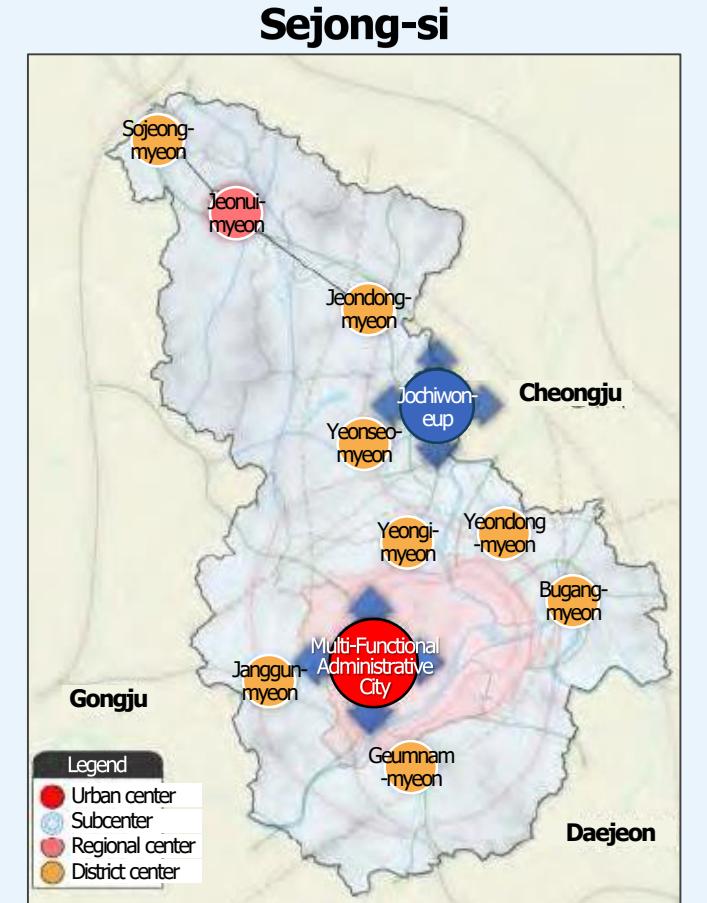
<Hierarchical map of central places>



<Conceptual diagram of spatial structure >

• Source: 2022~2041 Preliminary Plan for Jecheon City's Rural Spatial Strategy, p. 157.

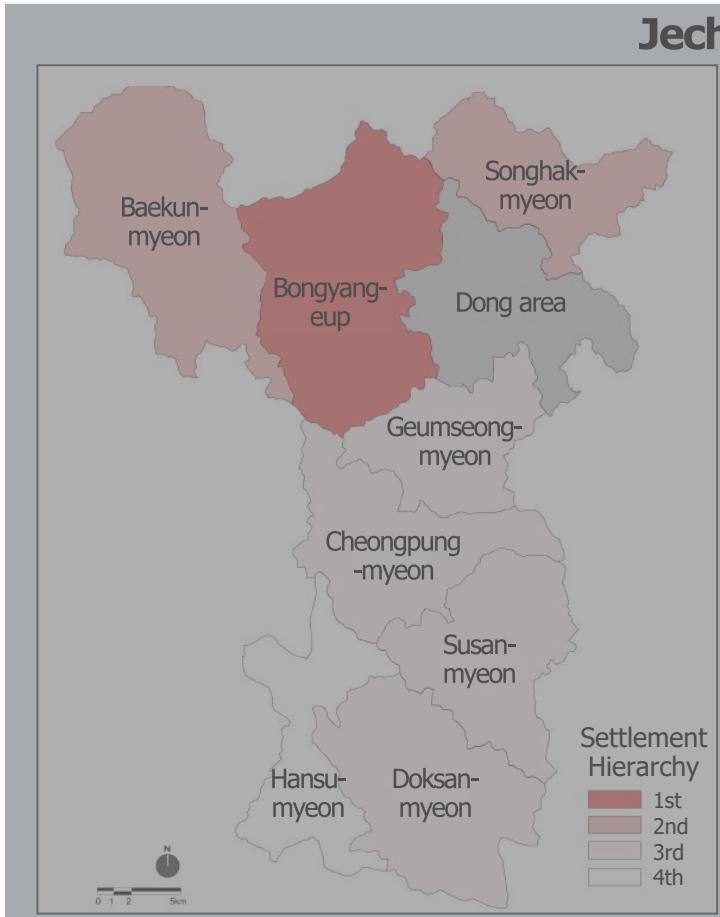
• Source: 2035 Jecheon City Master Plan, p. 157



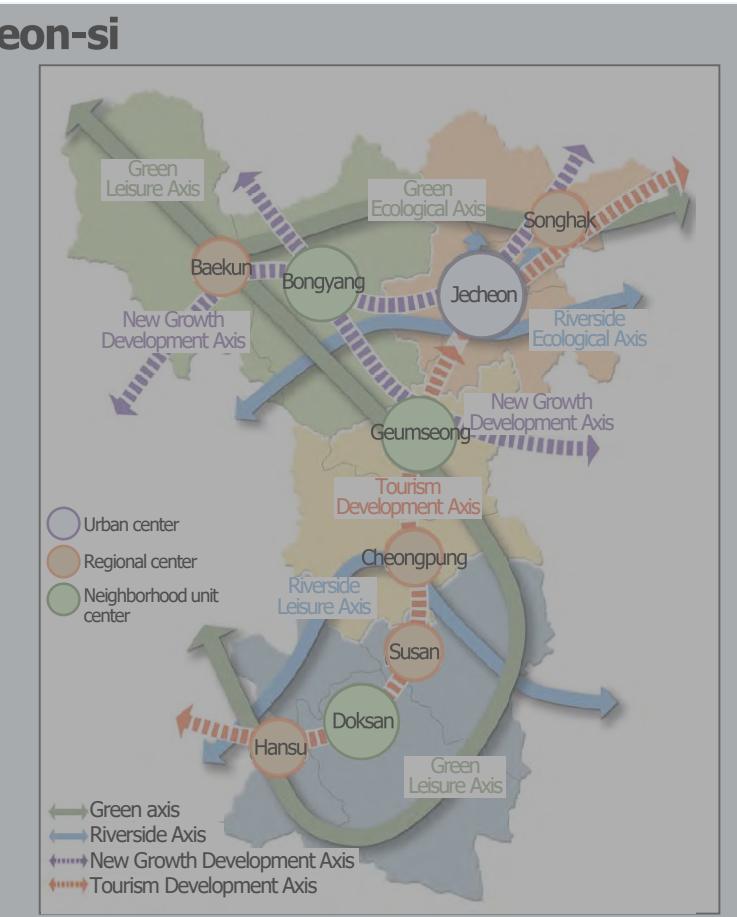
<Conceptual diagram of spatial structure >

• Source: 2030 Sejong City Master Plan, p. 70

Using micro geospatial data for fine-grained analysis of spatial structures



<Hierarchical map of central places>

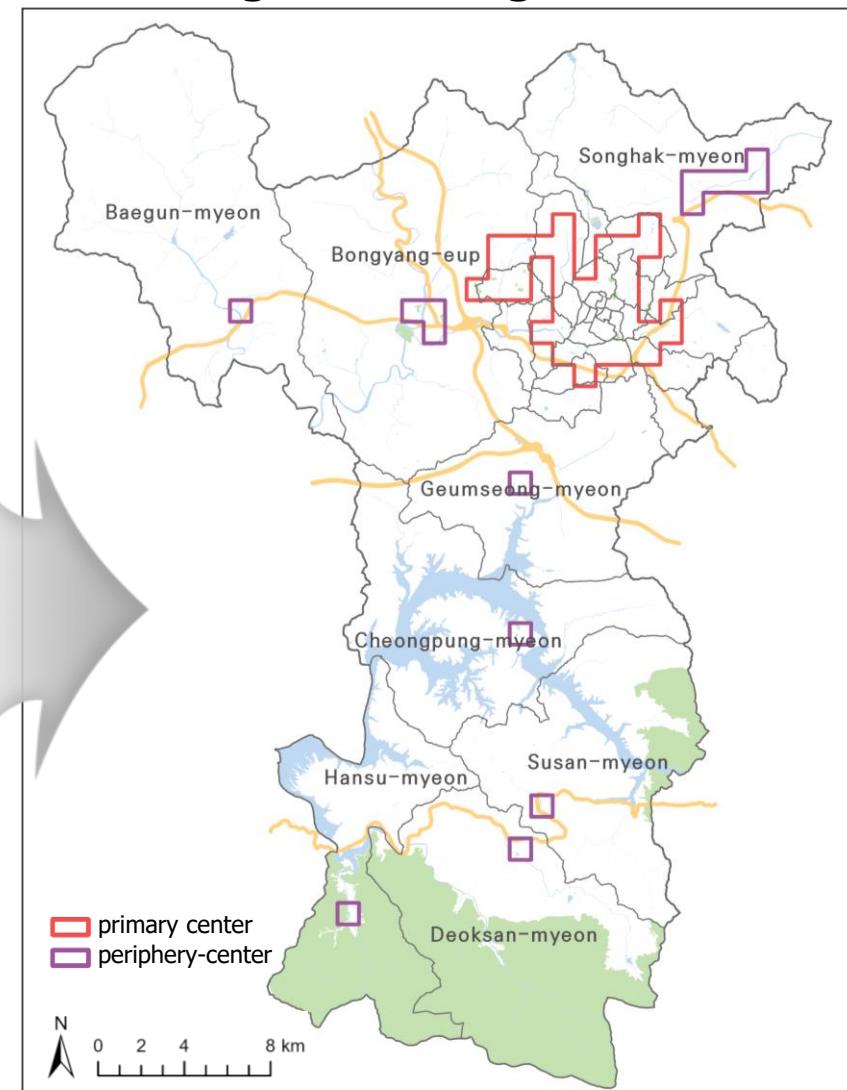


<Conceptual diagram of spatial structure >

• Source: 2022~2041 Preliminary Plan for Jecheon City's Rural Spatial Strategy, p. 157.

• Source: 2035 Jecheon City Master Plan, p. 157

An example of identifying centers/subcenters using 1kmx1km grid data



Overview

01 About **micro geospatial data**

We use 1kmx1km grid data

02 How to identify **centers/subcenters**

Based on the density approach

03 The result of **Andong** in Korea

Experiment and result

Overview

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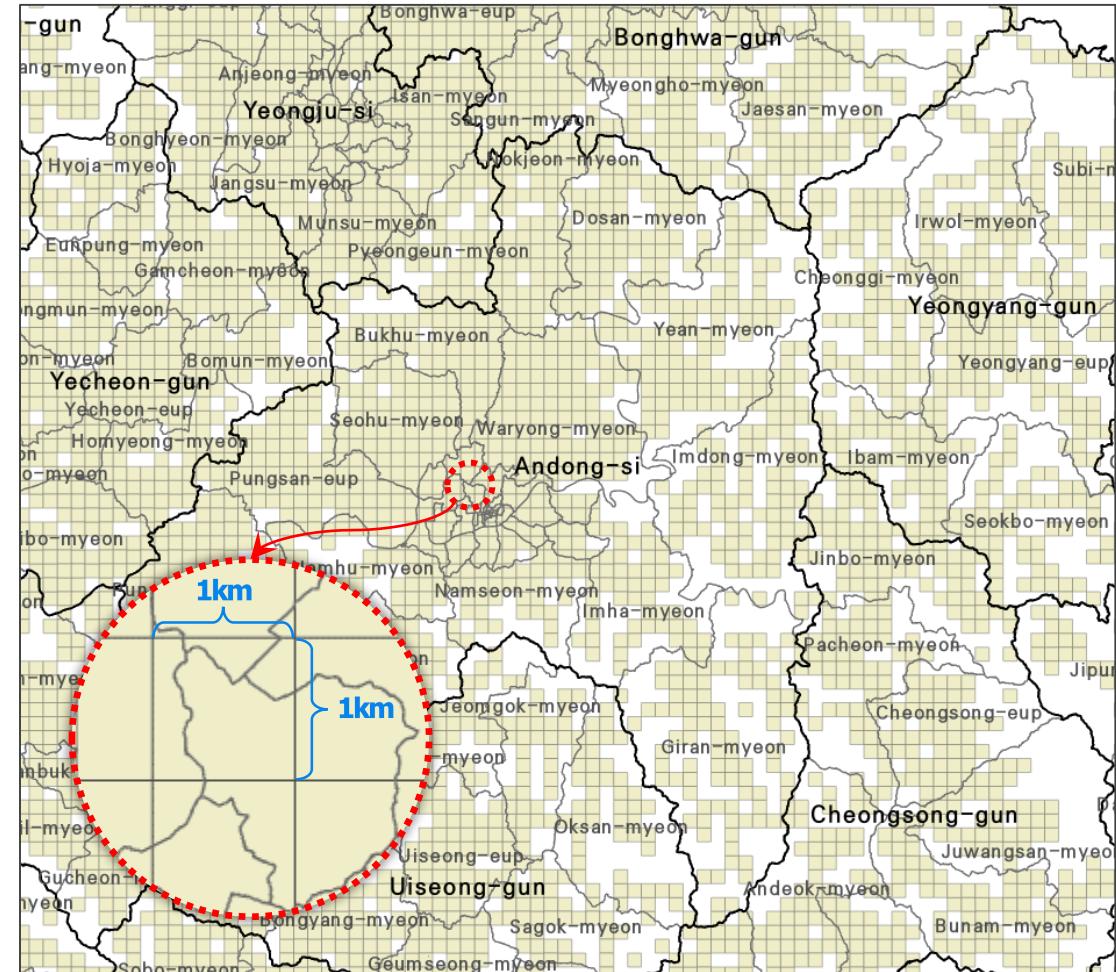
Experiment and result

About micro geospatial data

[Micro geospatial data used in this study]

Classification	Name of data	Year	Source
population	Census population by 1kmX1km grid	2021	SGIS (Statistics Korea)
employment	Population based on workplace address by 1kmX1km grid	2021	KCB (Korea Credit Bureau)
POI (Point-of-Interest)	<ul style="list-style-type: none">Administrative buildingElementary schoolPublic health centerPolice substation	2022	NGII (National Geographic Information Institute)

[Example of Grid data with total population > 0]



Overview

01

About **micro geospatial data**

We use 1kmx1km grid data

02

How to identify **centers/subcenters**

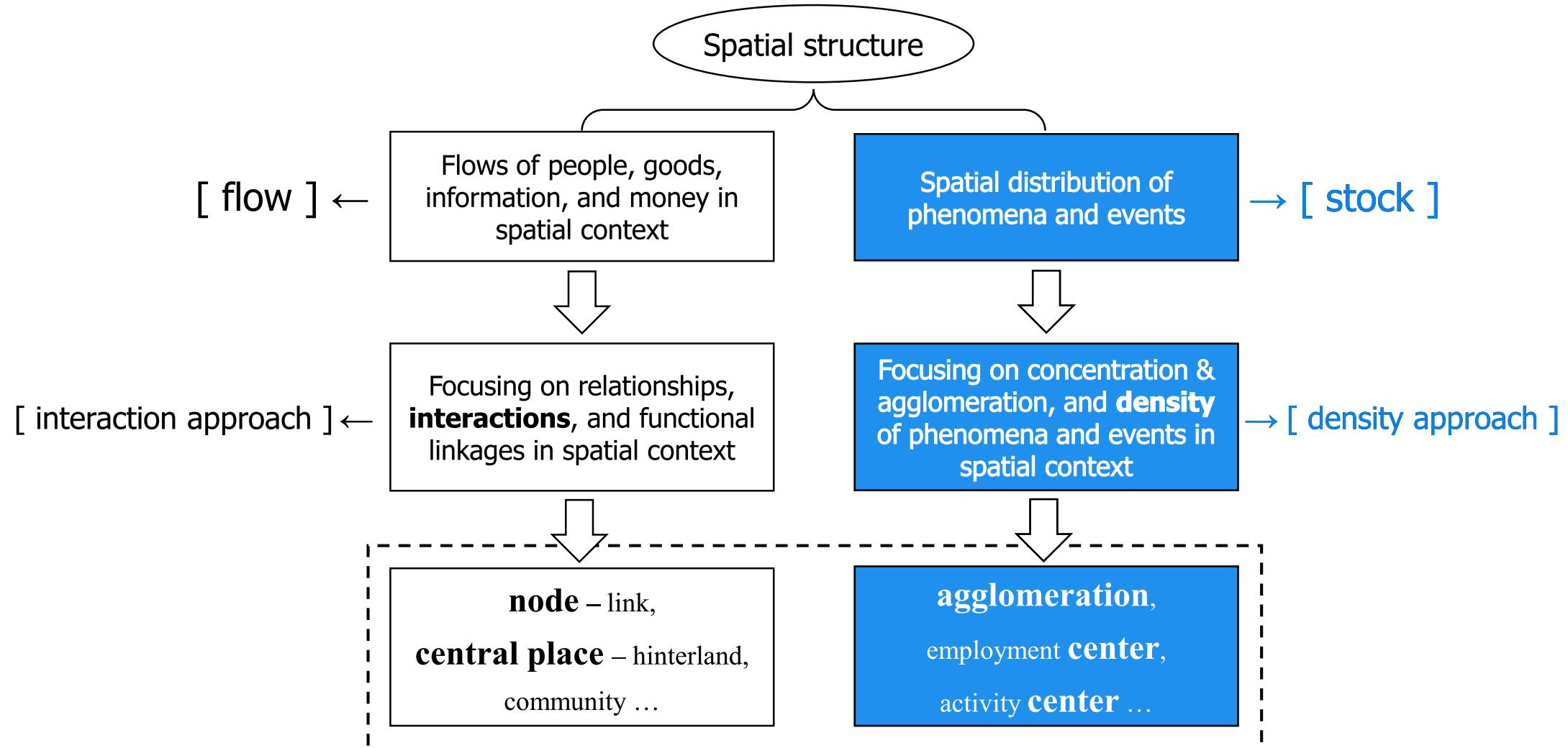
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The result of **Andong** in Korea

Experiment and result

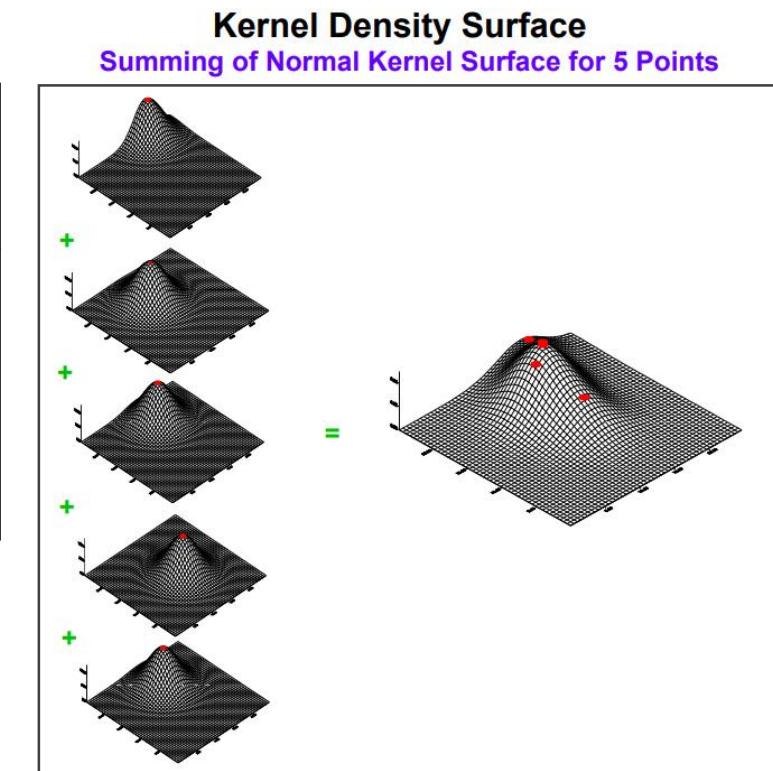
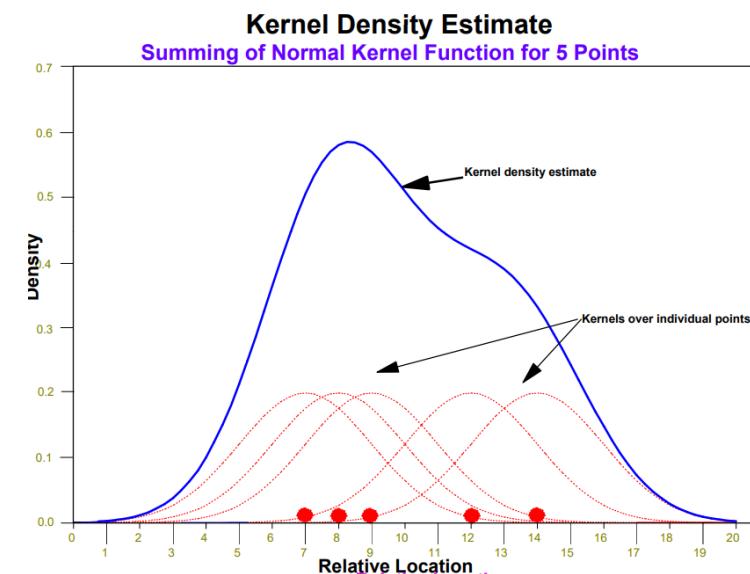
Spatial structure : flow and stock



• Source: Adapted from <Figure 3-1>(p. 25) in the 2022 National Land Monitoring Project Final Report.

Kernel Density Estimation

- Kernel Density Estimation(Kernel Density Interpolation) is a technique for **generalizing incident locations to an entire area**.
- They provide **density estimates for all parts of a region** (i.e., at any location).
- The density estimate is an intensity variable, a Z-value, that is estimated at a particular location.
- Consequently, it can be displayed by either **surface maps or contour maps that show the intensity at all locations**.



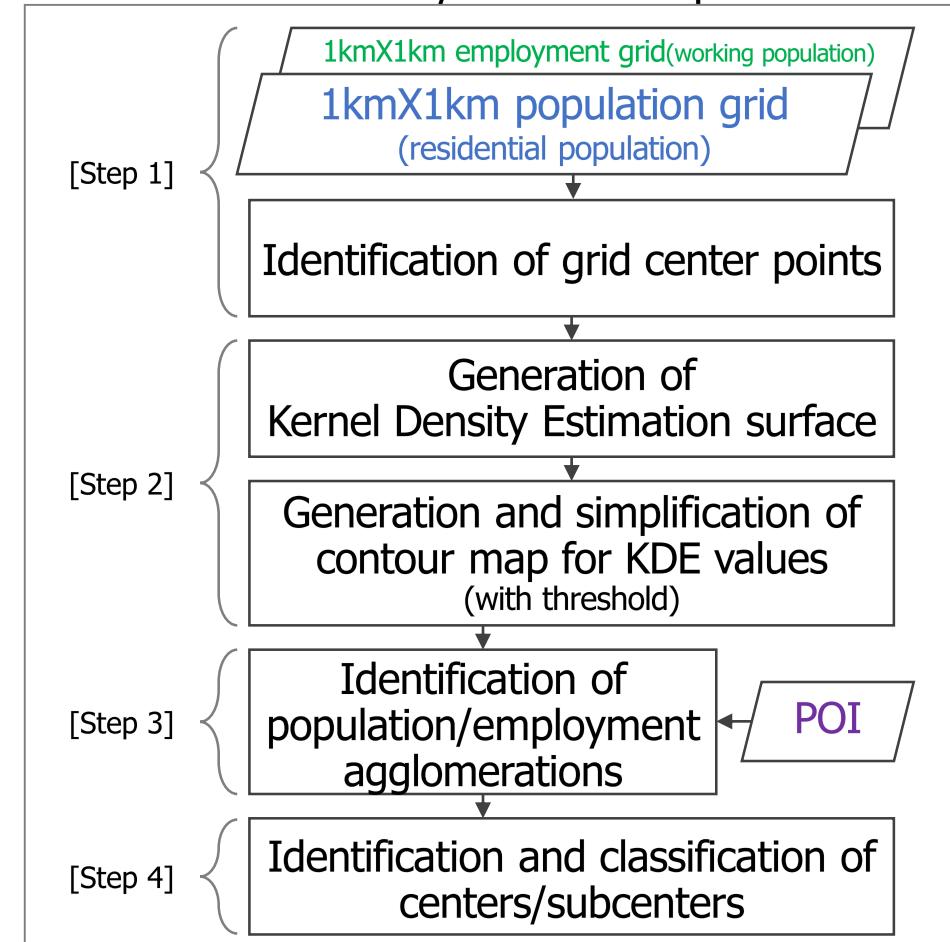
• Source: Ned Levine. 2013. CrimeStat IV: A Spatial Statistics Program for the Analysis of Crime Incident Locations, Version 4.0

How to identify centers/subcenters

[Micro geospatial data used in this study]

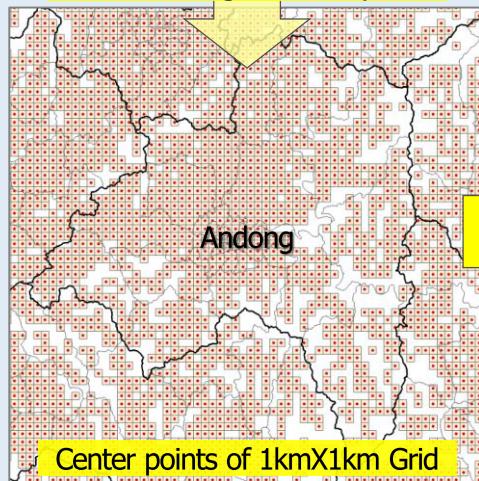
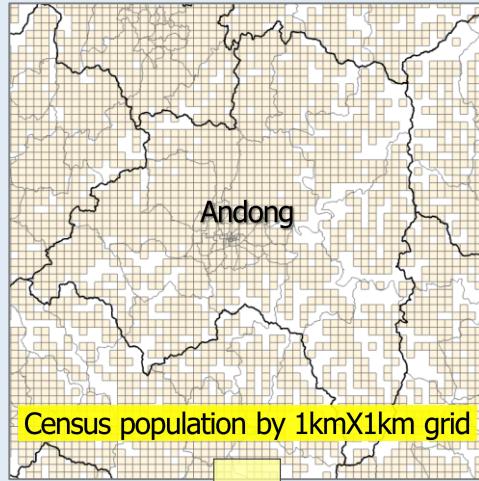
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[Identification and classification process of centers/subcenters]



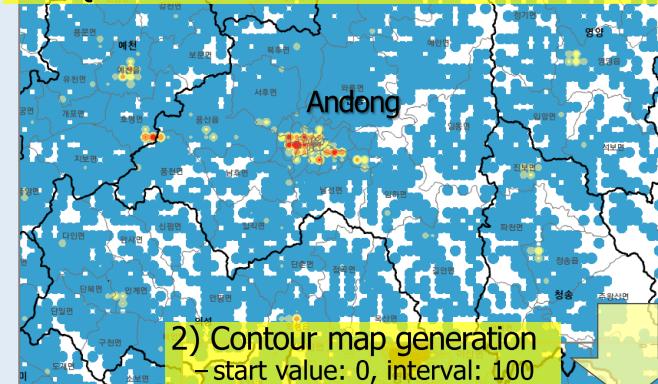
Identification and classification process of centers/subcenters (1/2)

[Step 1] Data transformation

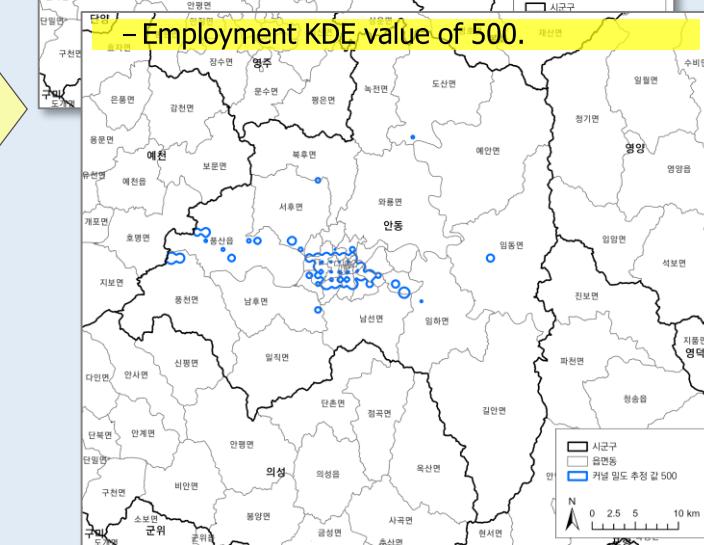
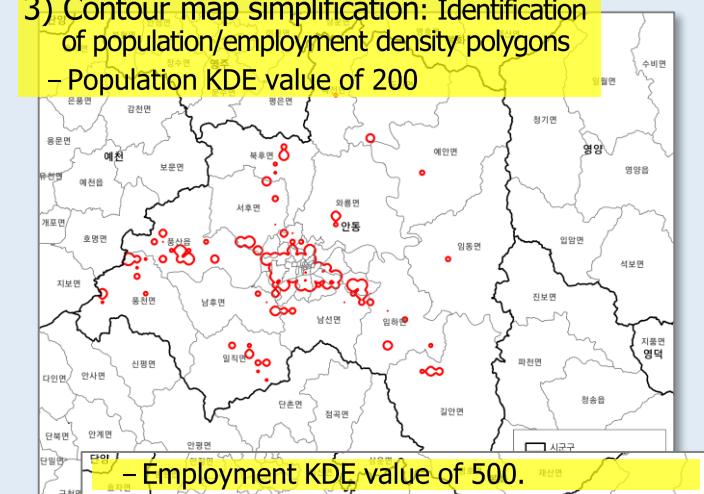


[Step 2] Kernel Density Estimation and contour map generation/simplification

- 1) Generation of Kernel Density Estimation surface
 - output cell size: 50mx50m
 - bandwidth: 750m
 - 5 Quantiles

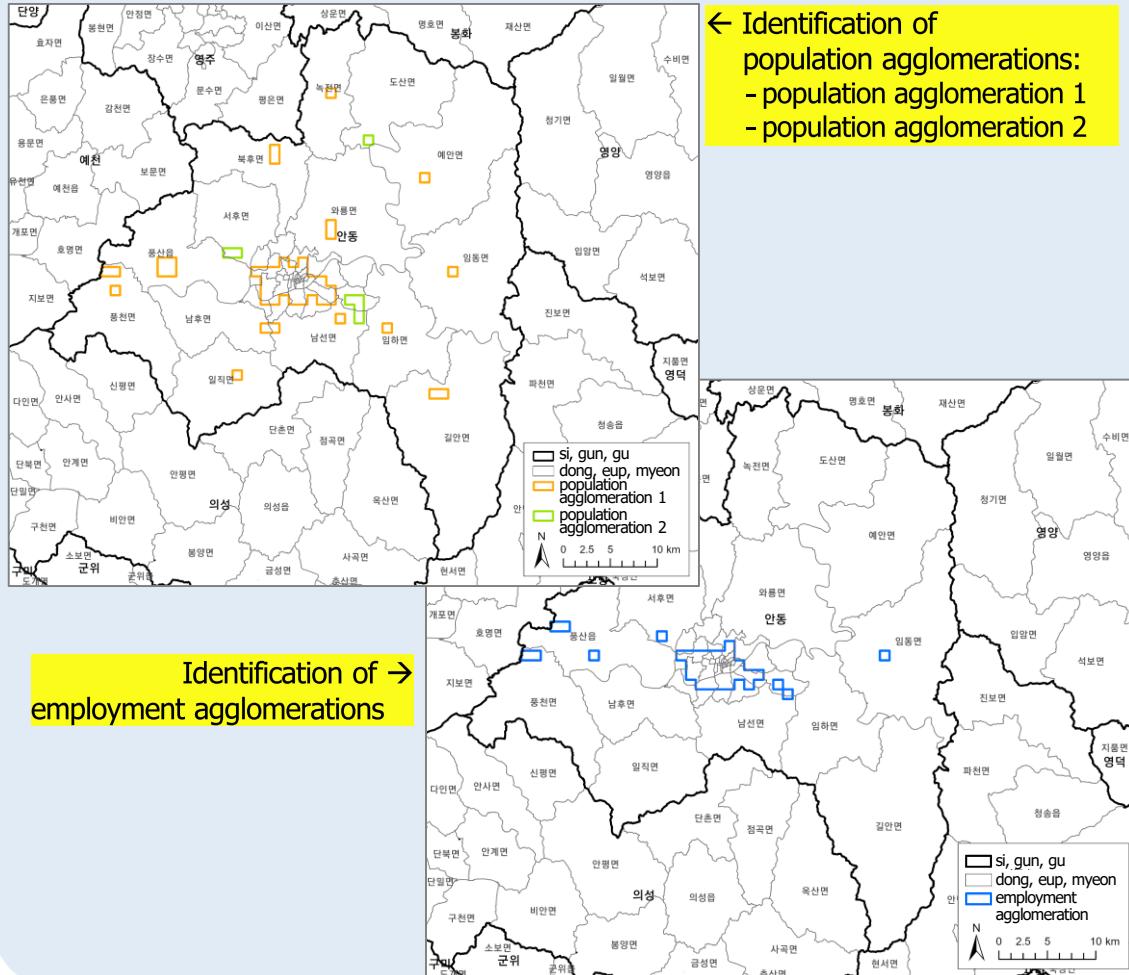


- 3) Contour map simplification: Identification of population/employment density polygons
 - Population KDE value of 200

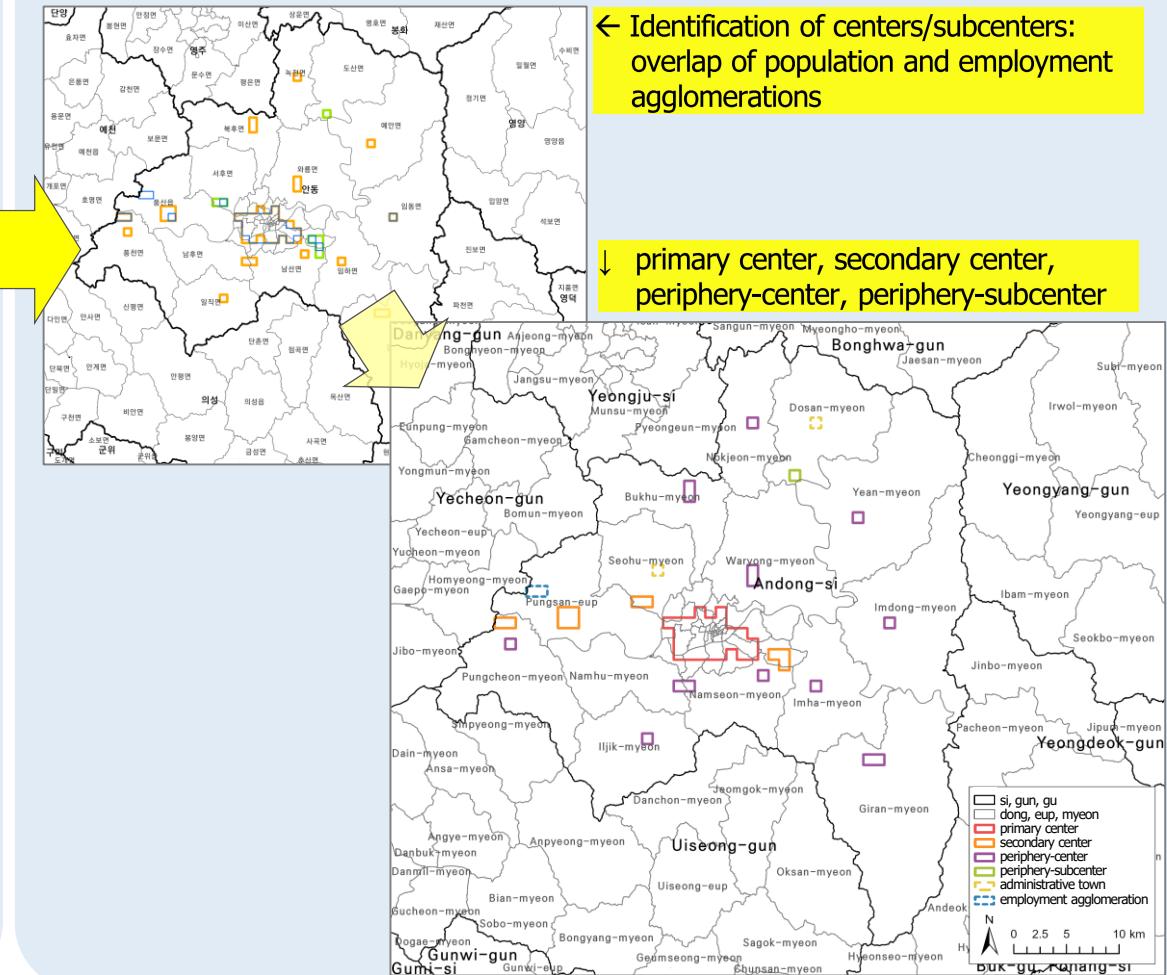


Identification and classification process of centers/subcenters (1/2)

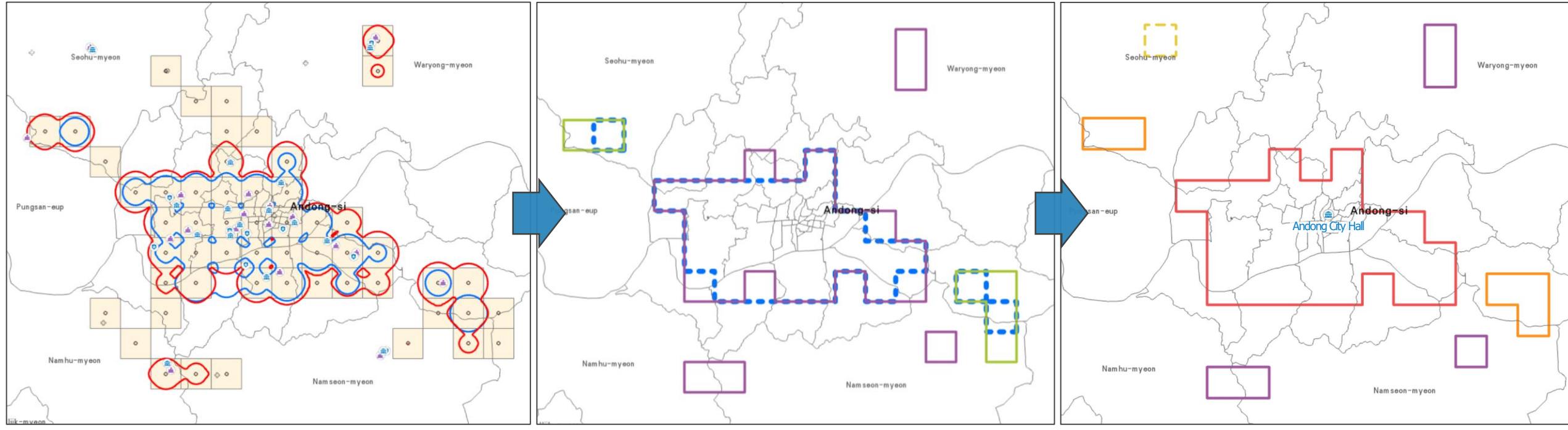
[Step 3] Identification of population/employment agglomerations



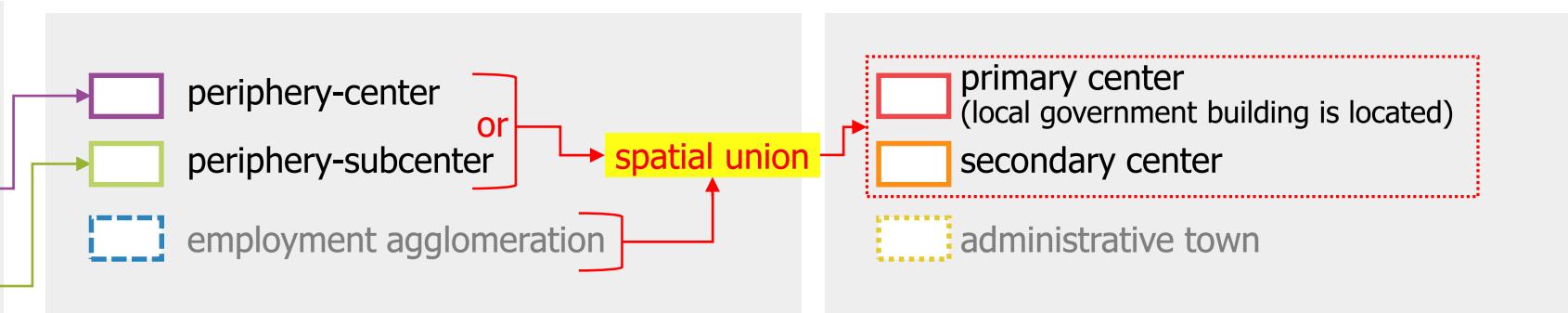
[Step 4] Identification and classification of centers/subcenters



How to classify centers/subcenters



- polygon that meets the population concentration criteria(kernel density estimate of 200)
- polygon that meets the employment concentration criteria(kernel density estimate of 500)
-  administrative building
-  elementary school
-  public health center
-  police substation
- public service facilities

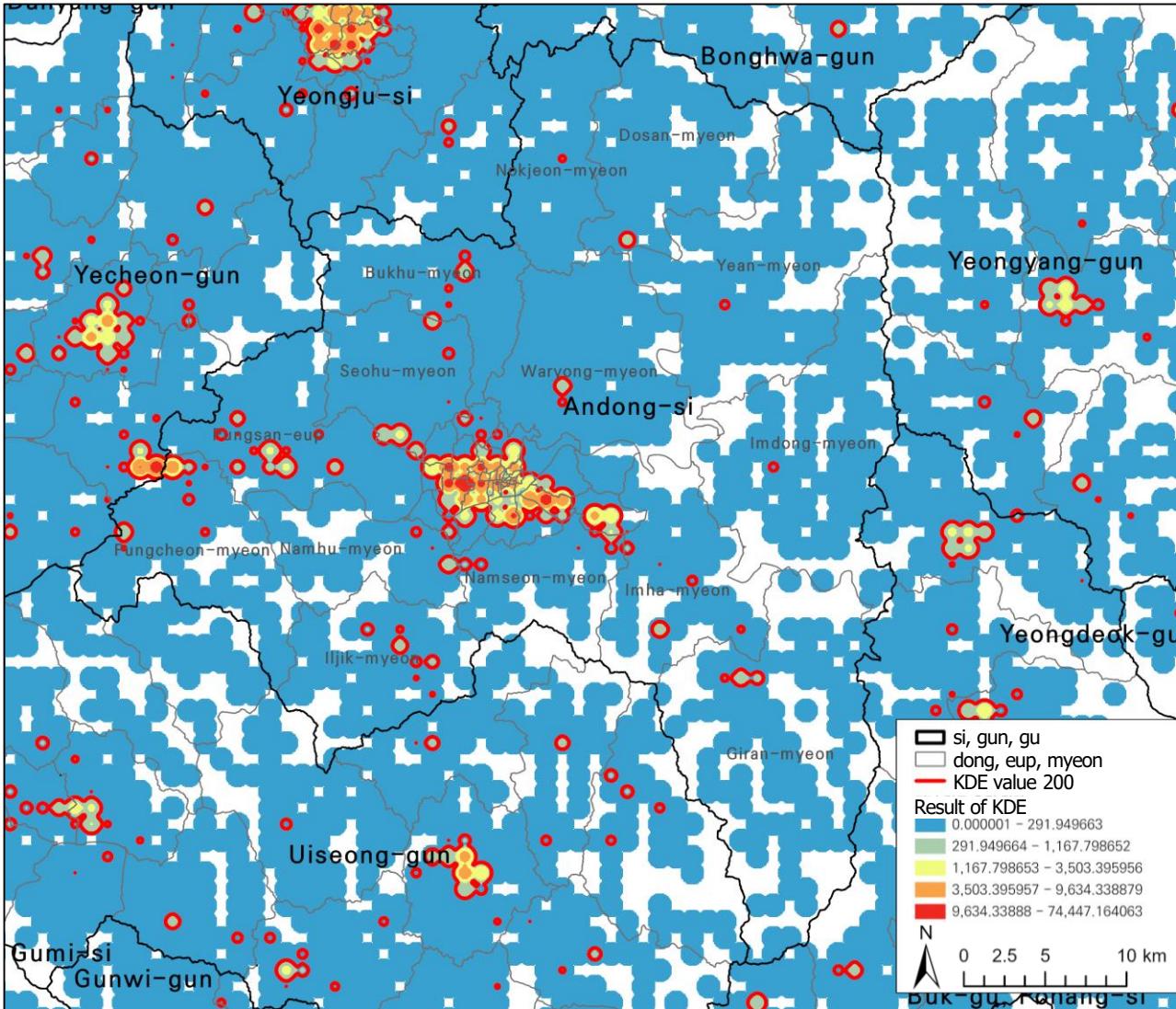


Overview

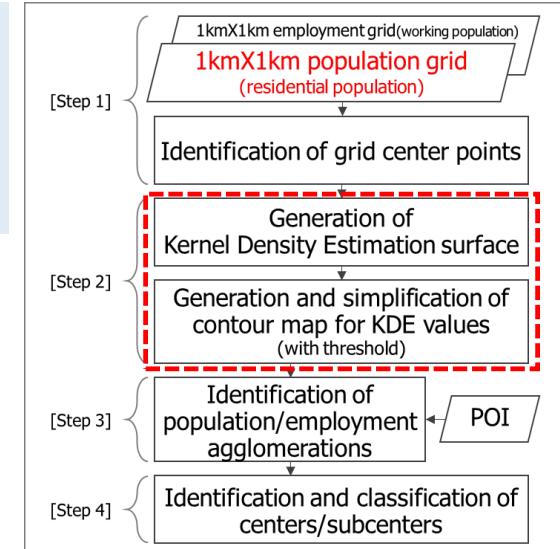
- 01** About micro geospatial data
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Experiment and result

[Andong] Population concentration map

- Data: Census population by 1kmX1km grid from SGIS(Statistics Korea) for the 2021
- Kernel density estimation with an cell size 50m ; bandwidth 750m
- Contour map generation start value: 0, interval: 100
- Extraction of population KDE value of 200.

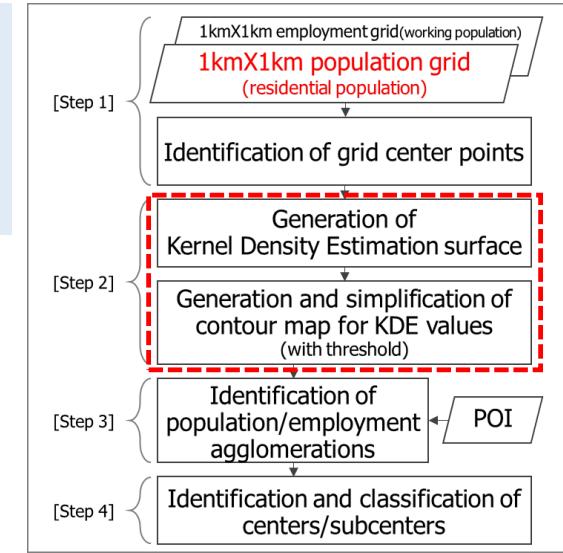
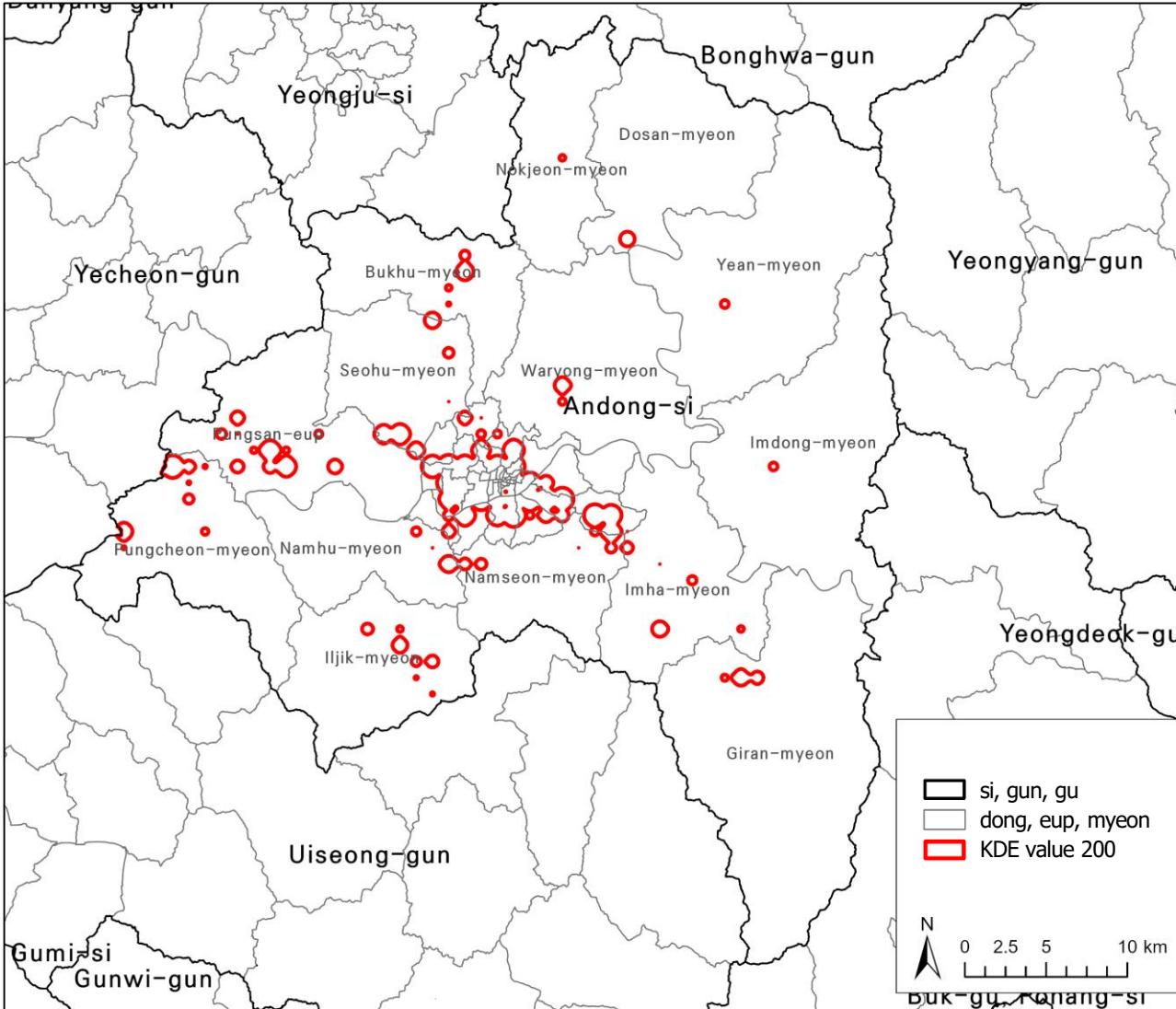


※ Visualization of KDE values with 5 levels of quantiles, excluding the value 0.



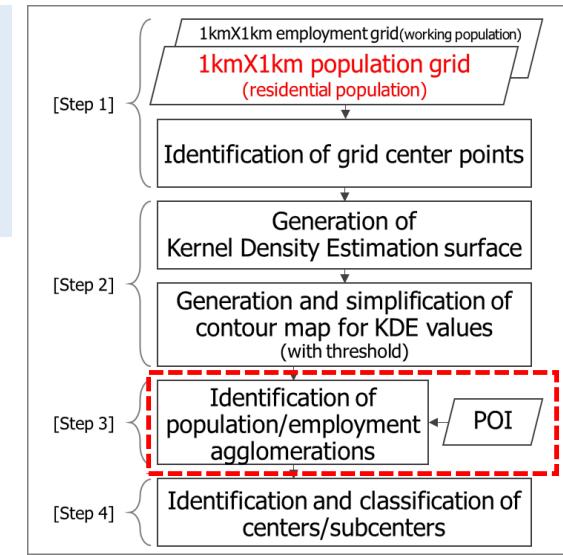
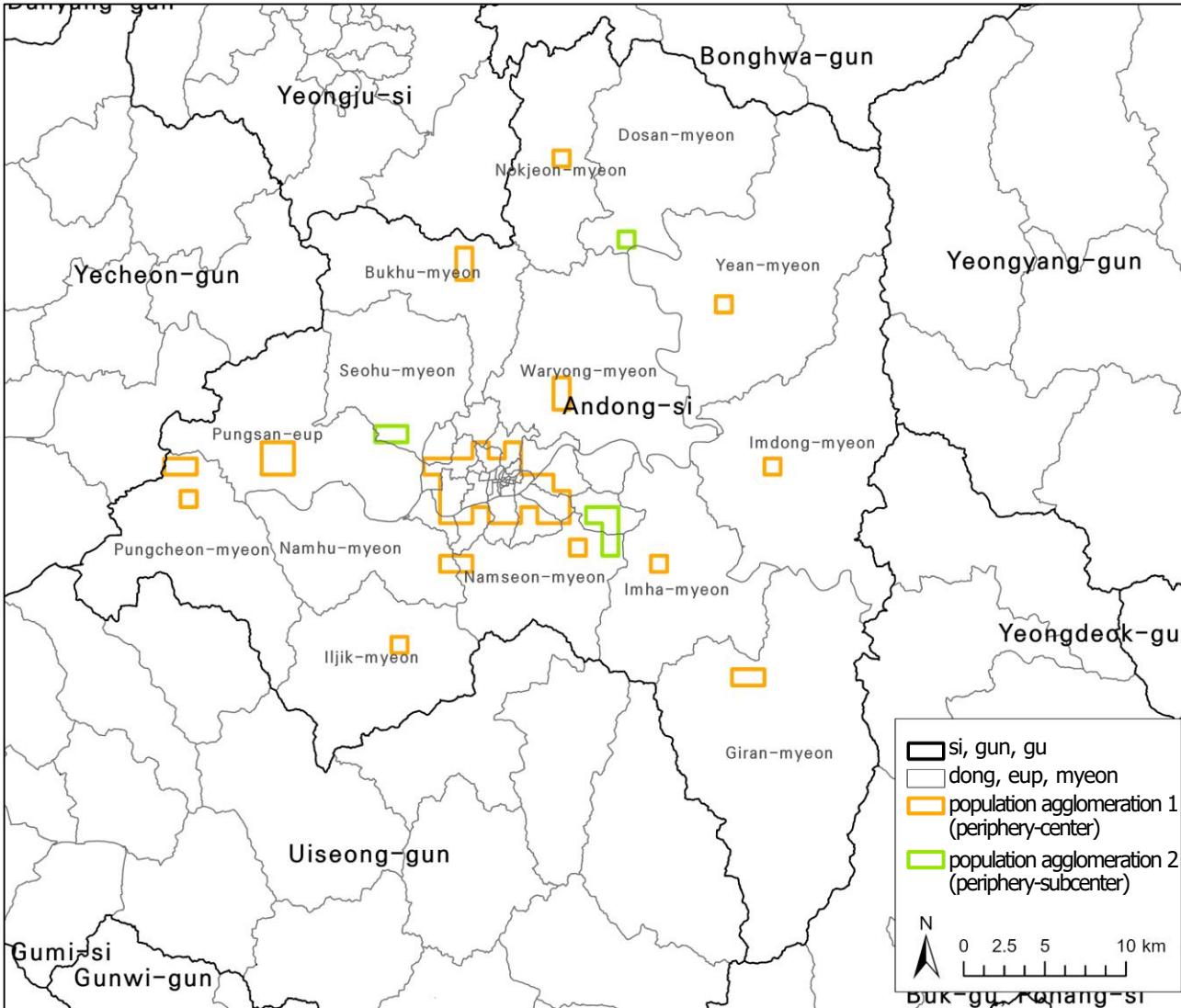
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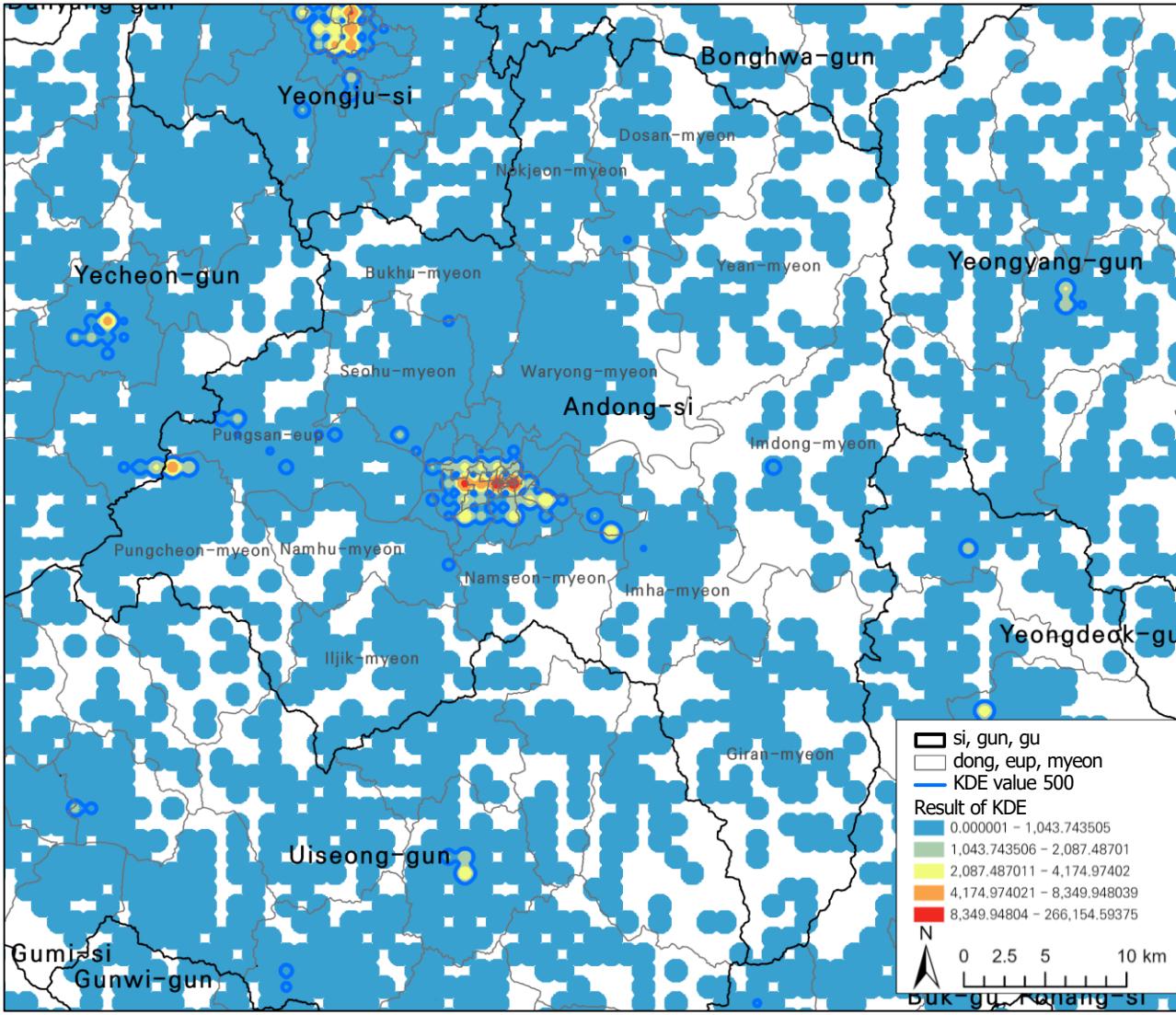
[Andong] Population agglomeration 1 & 2

○ Data: Census population by 1kmX1km grid from SGIS(Statistics Korea) for the 2021

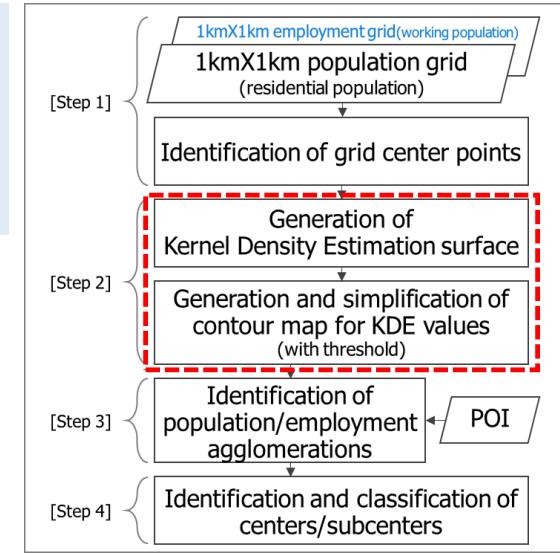


[Andong] Employment concentration map

- Data: Population based on workplace address by 1kmX1km grid from KCB(Korea Credit Bureau) for the 2021
- Kernel density estimation with an cell size 50m ; bandwidth 750m
- Contour map generation start value: 0, interval: 100
- Extraction of employment KDE value of 500.

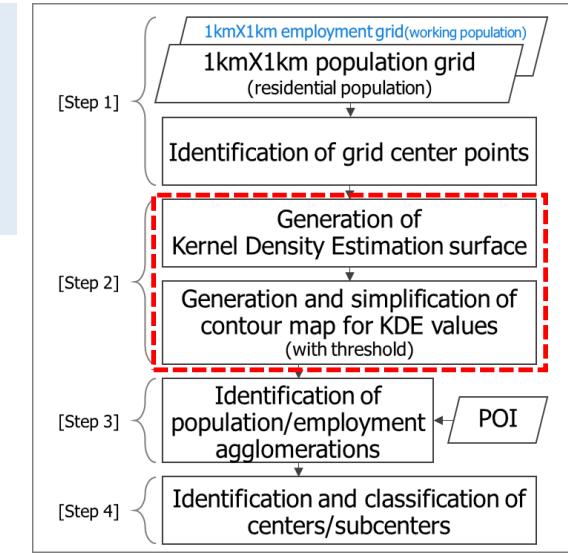
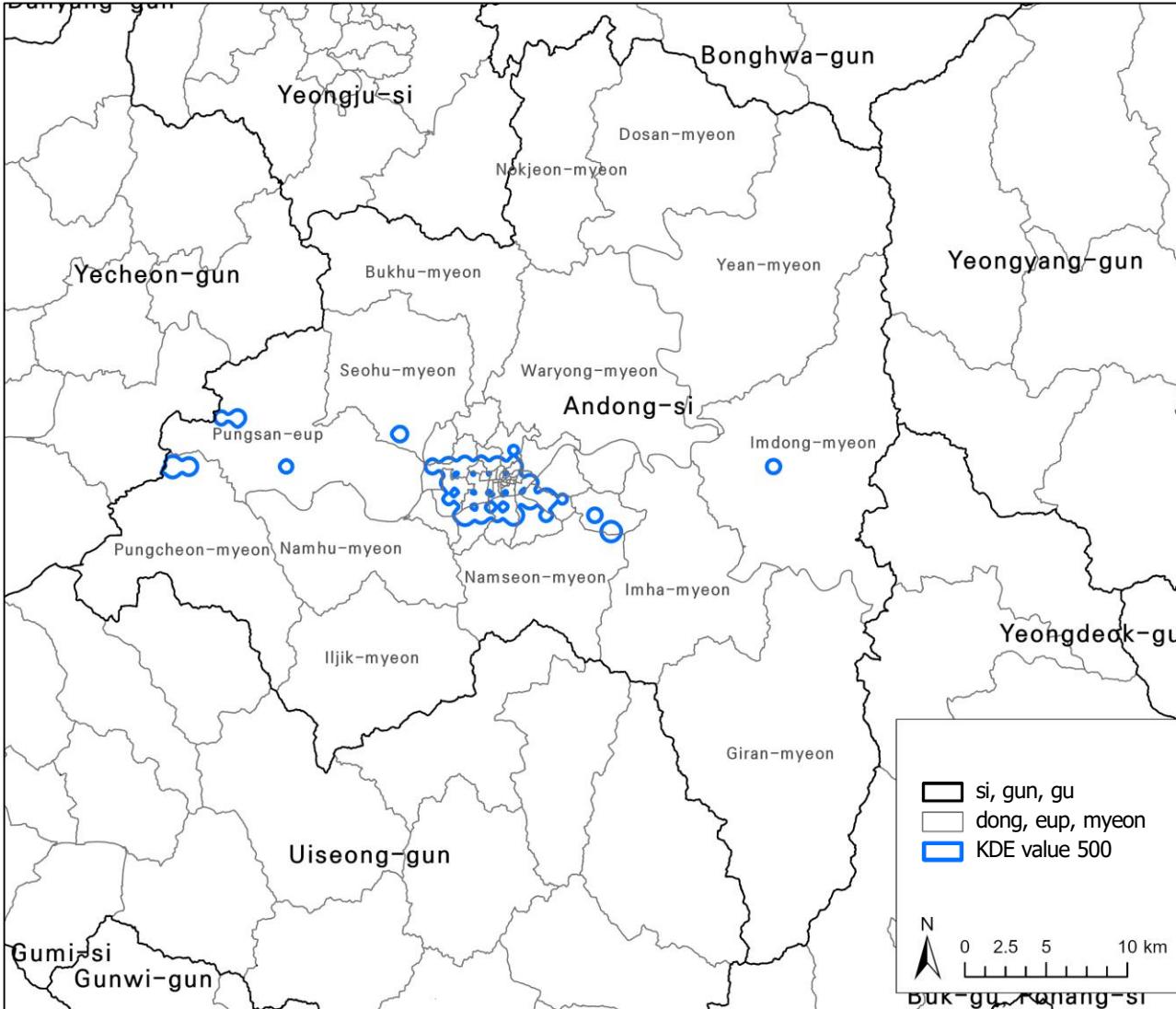


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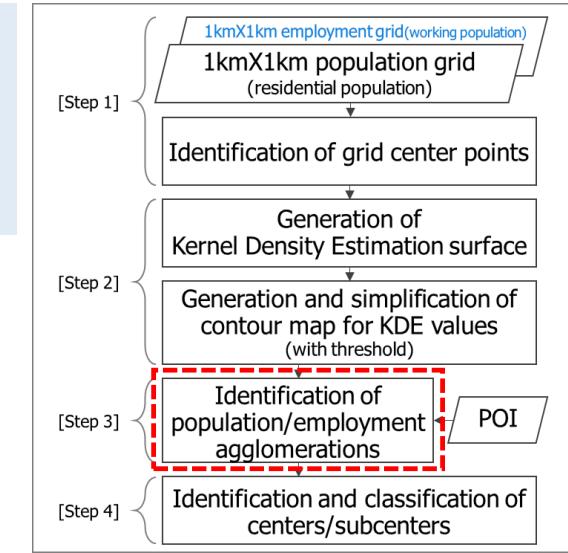
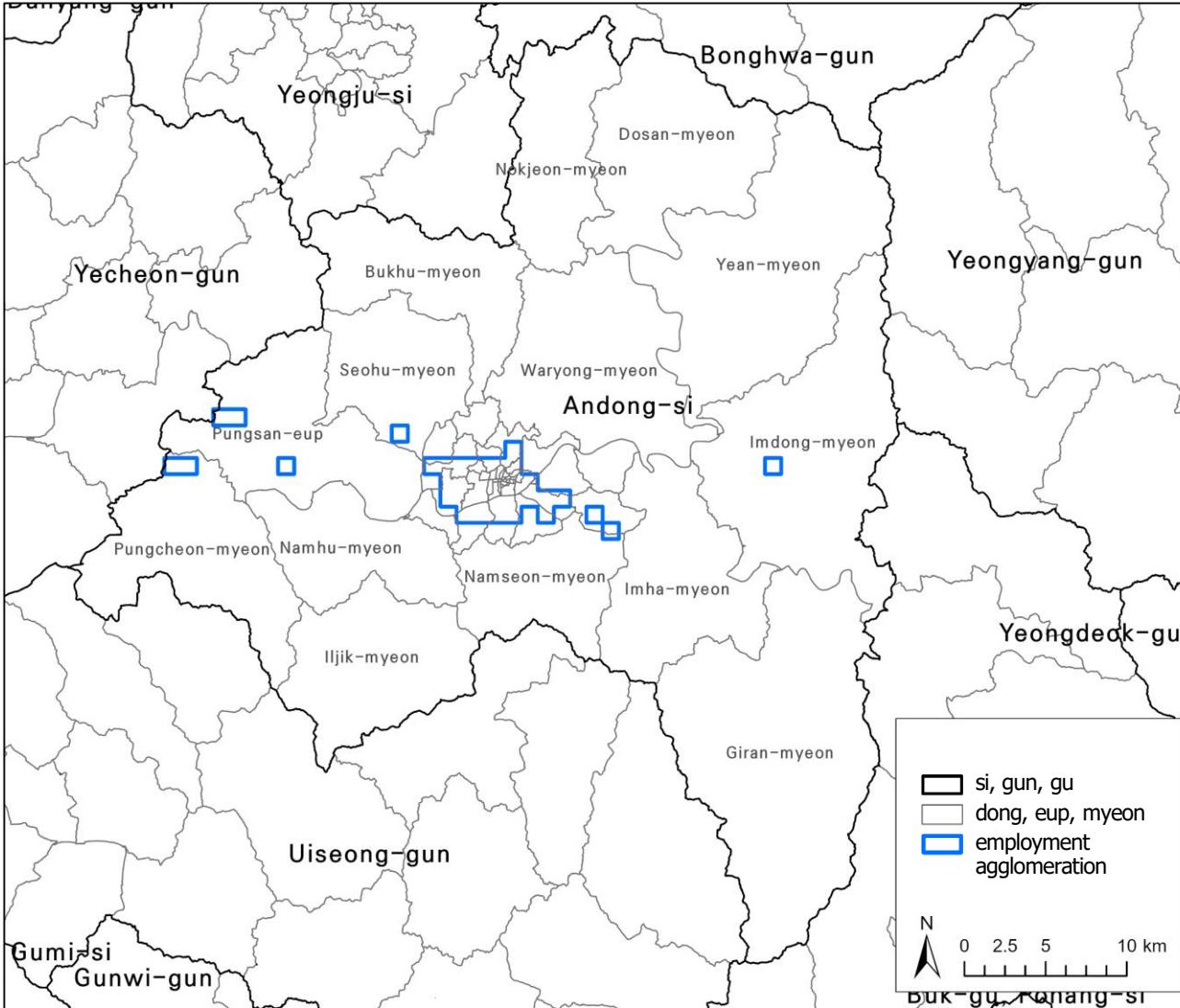
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[Andong] Employment agglomeration

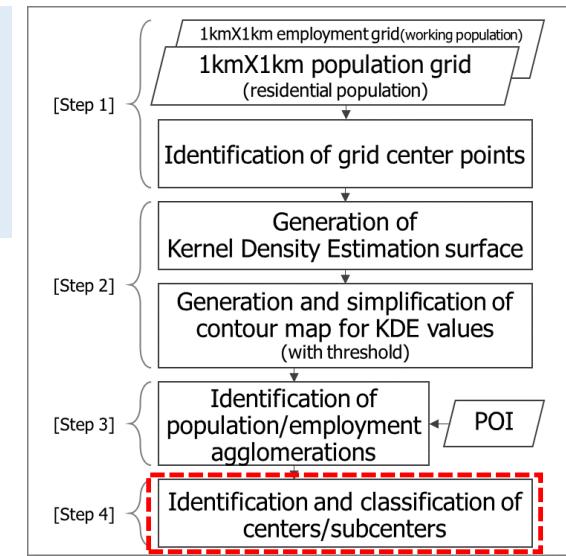
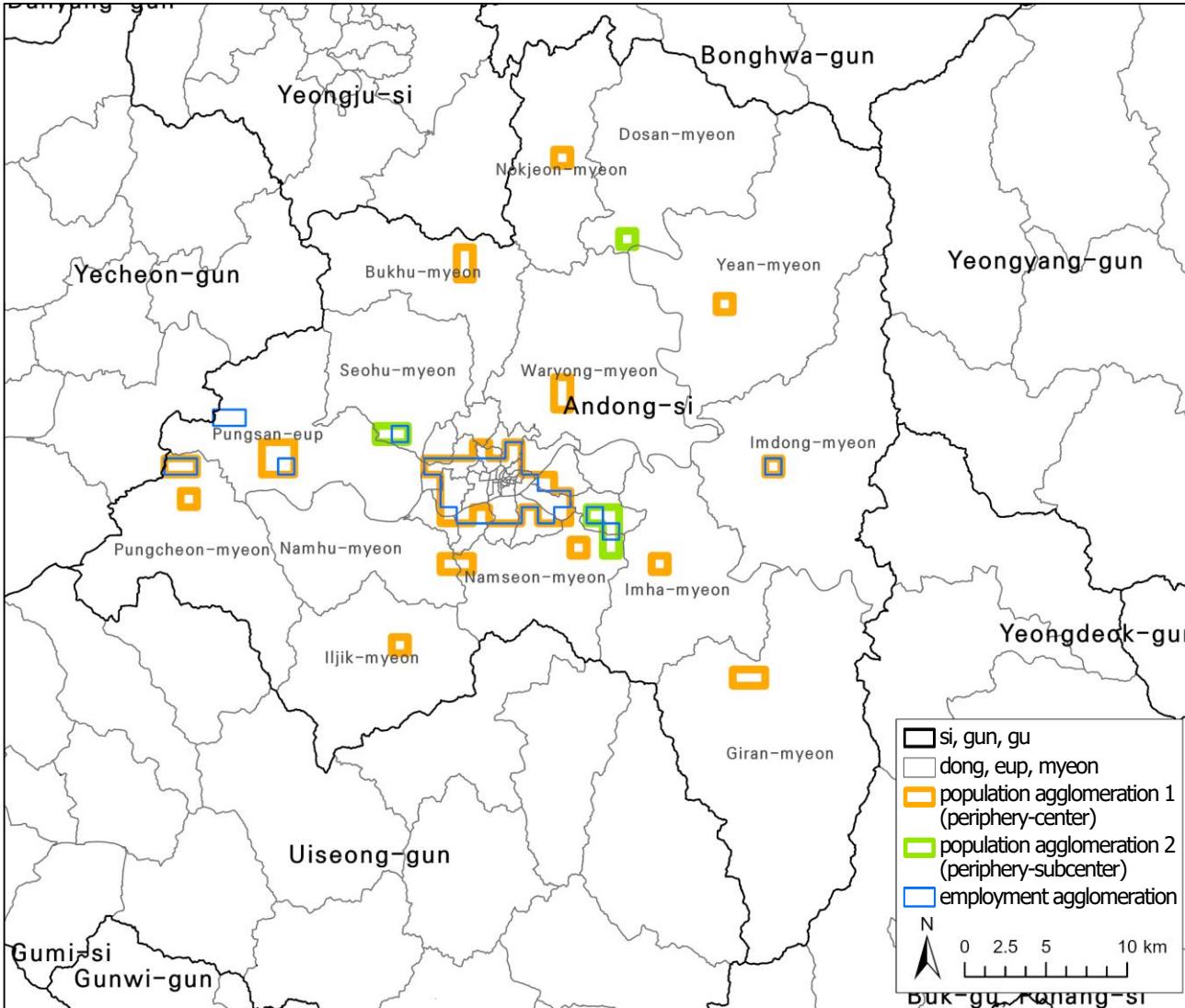
○ Data: Population based on workplace address by 1kmX1km grid from KCB(Korea Credit Bureau) for the 2021



[Andong] Overlap of population agglomerations and employment agglomerations

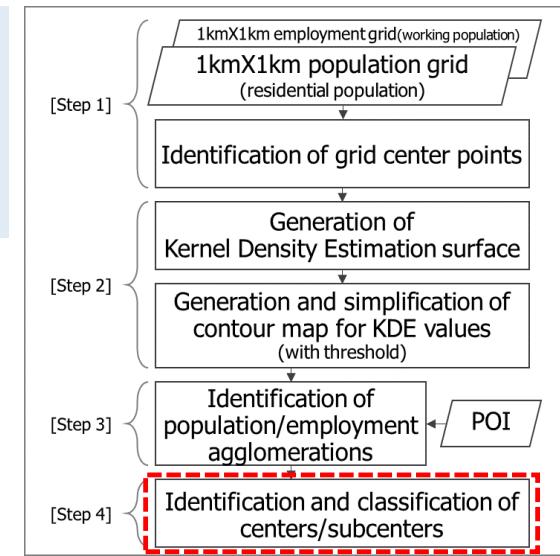
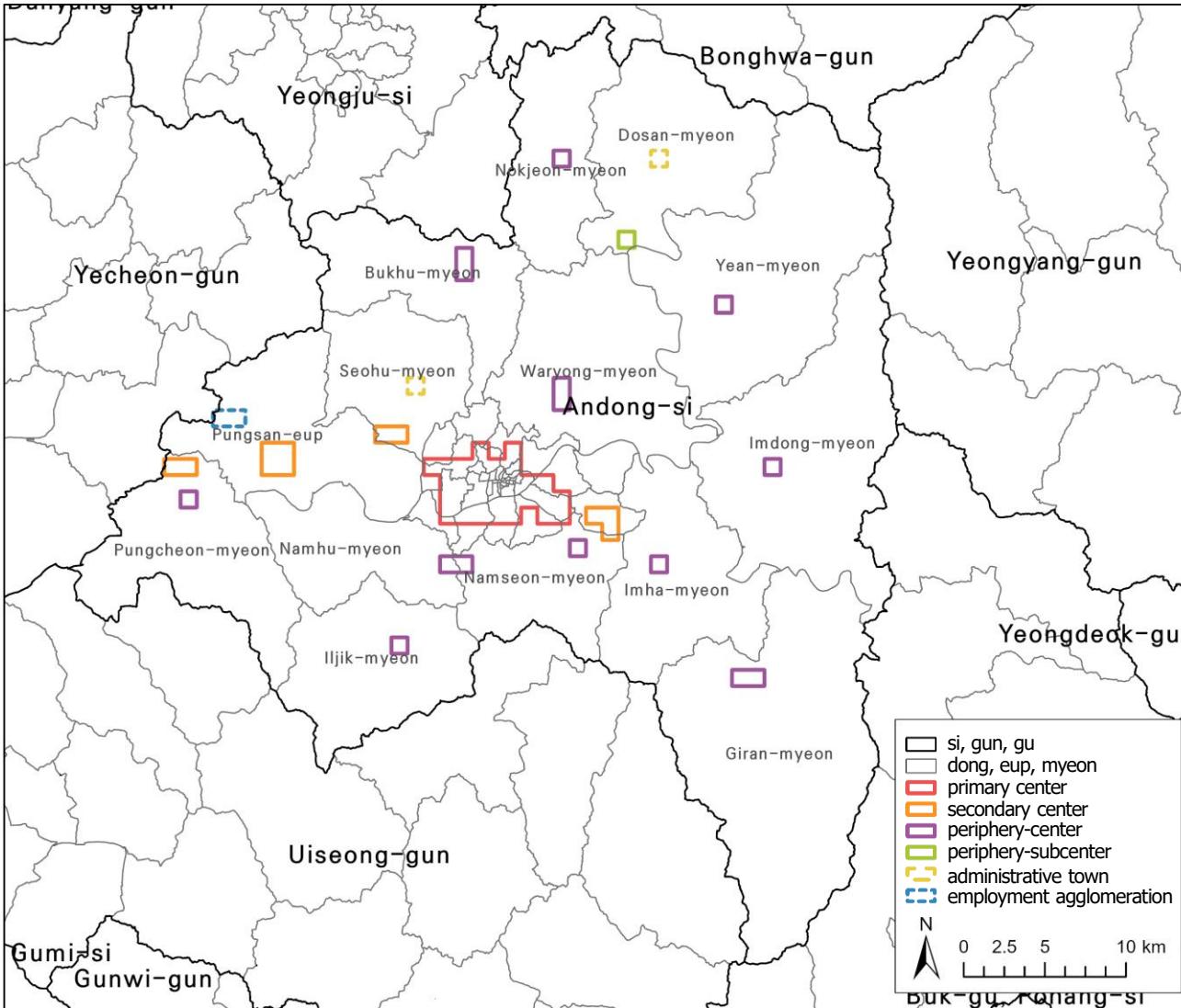
Data

- Census population by 1kmX1km grid from SGIS(Statistics Korea) for the 2021
- Population based on workplace address by 1kmX1km grid from KCB(Korea Credit Bureau) for the 2021



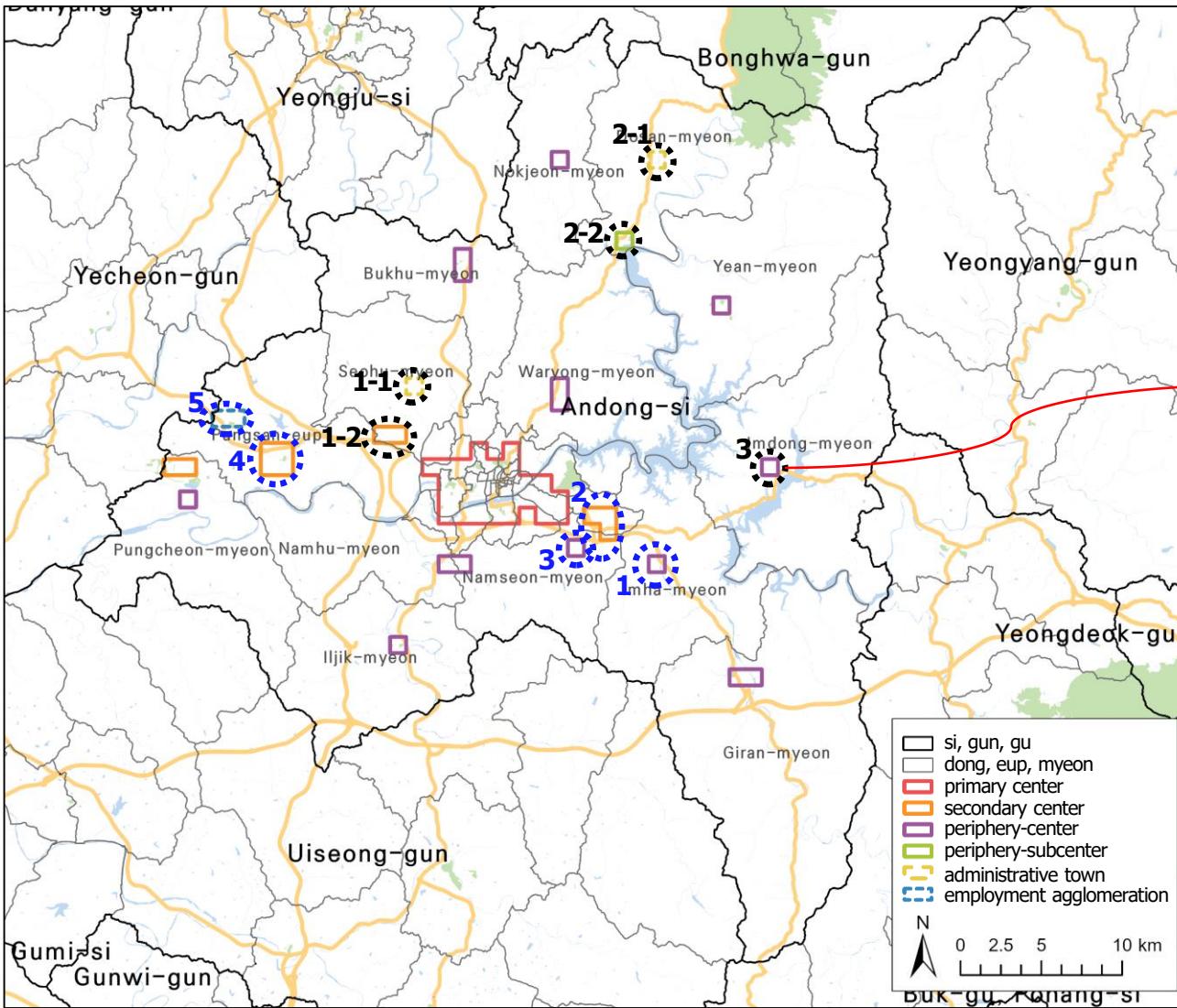
[Andong] Identification of centers/subcenters

- If the population agglomeration(population agglomeration 1 or 2) overlaps with the employment agglomeration, the corresponding group of grids is merged(spatial union) to form 'centers/subcenters'.
- The remaining 'population agglomeration 1, 2' and 'employment agglomeration' are not classified as 'centers/subcenters'.
- The criteria for identifying centers and the spatial connectivity criteria of the grids(groups) constituting the centers/subcenters have been enhanced through on-site surveys.



On-site surveys

May 11~12, 2023



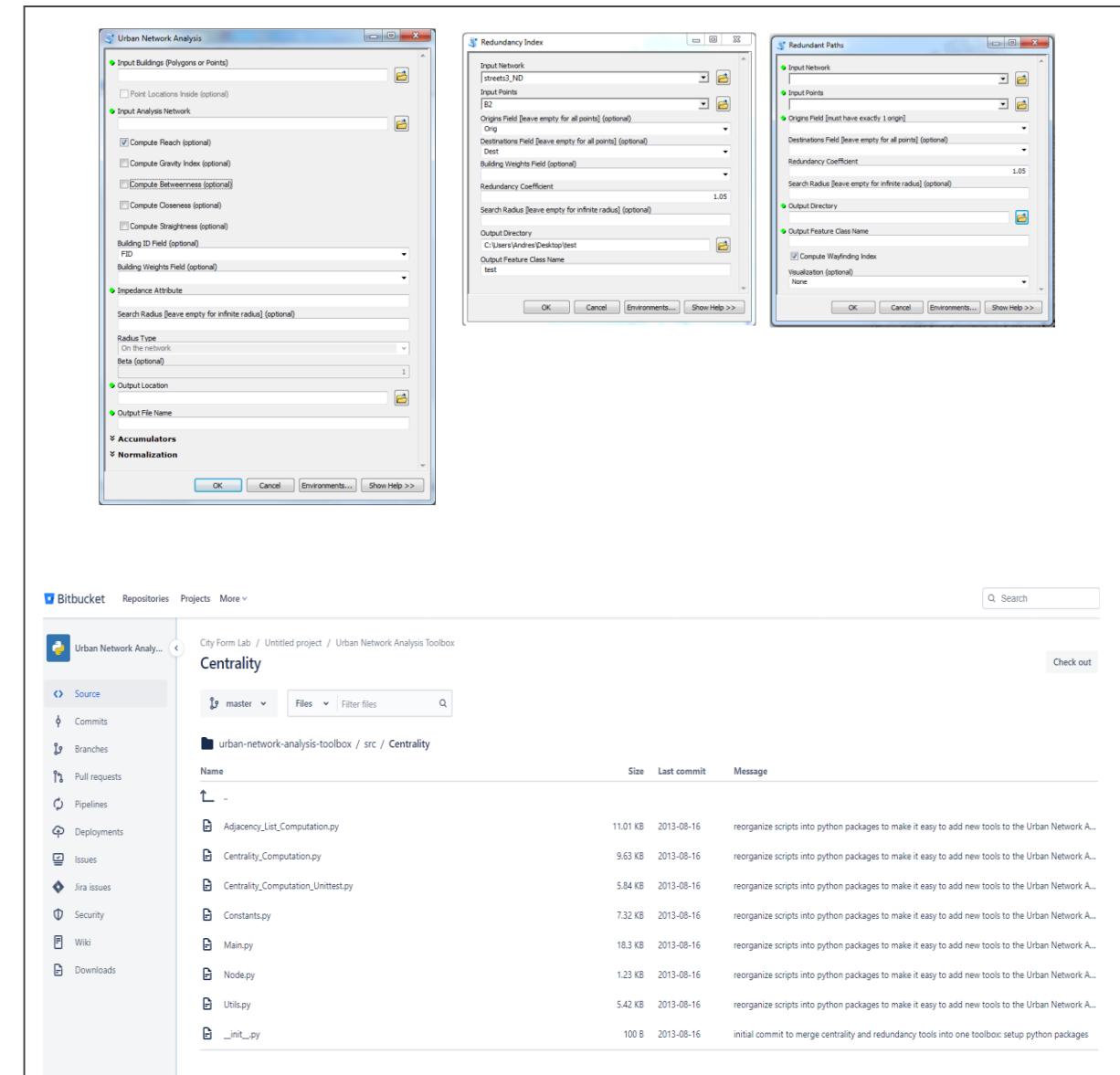
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Upcoming Project Overview

- We are currently conducting research to develop centers/subcenters analysis tool.

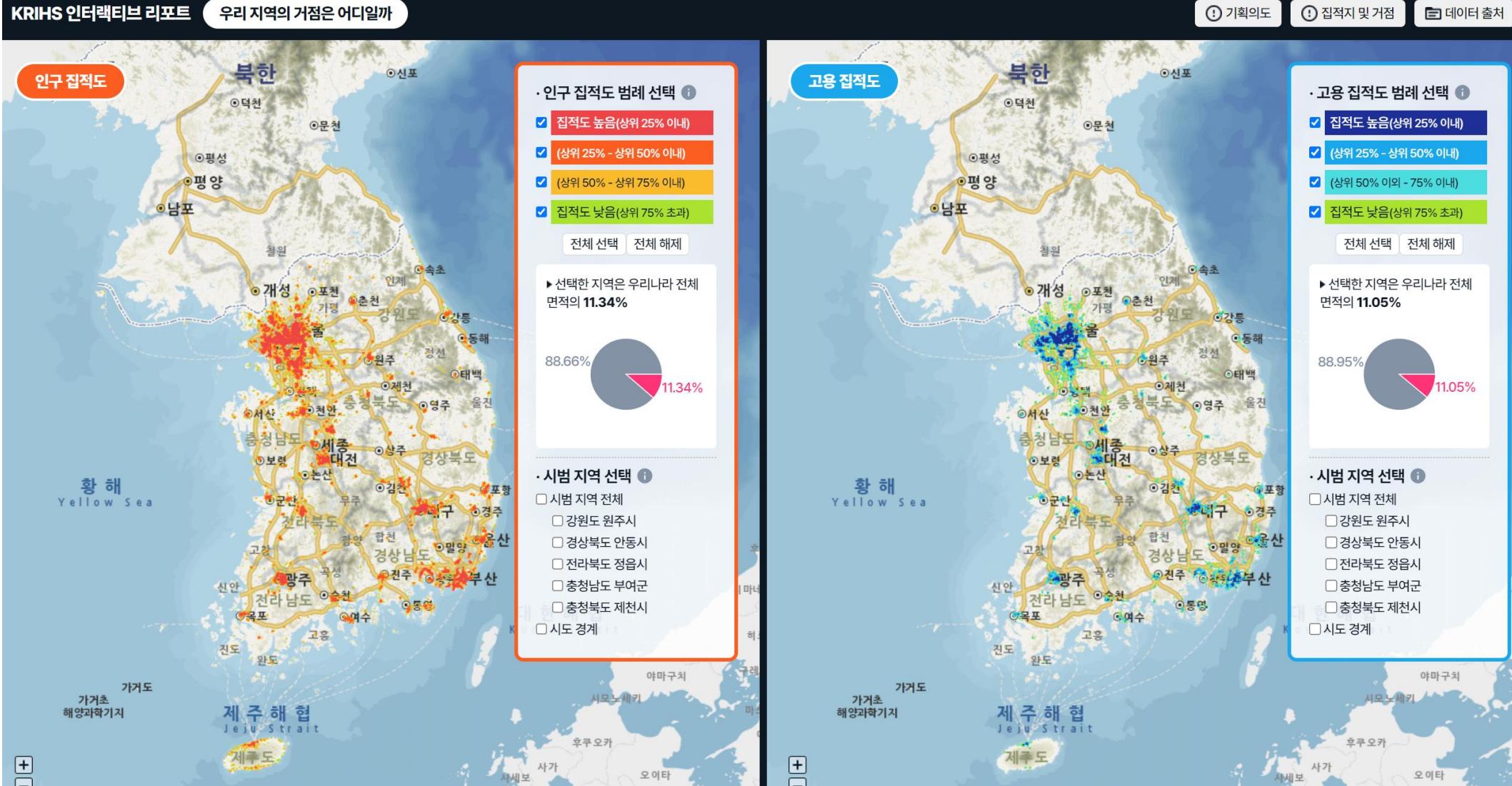


<Analysis Tool ALT 1: Dashboard type>



<Analysis Tool ALT 2: Toolbox and open source code type>

Interactive report: Where is the center of our region?



Thanks



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