

Analysis of the urban development in Odsherred over the past 30 years

Mauk Hillewaert, Lennert Devriendt, Emile
Roels, Juliet Steffen, Ward Van Cauwenberge
and Sven Vercauteren



Problem statement and objectives

Context

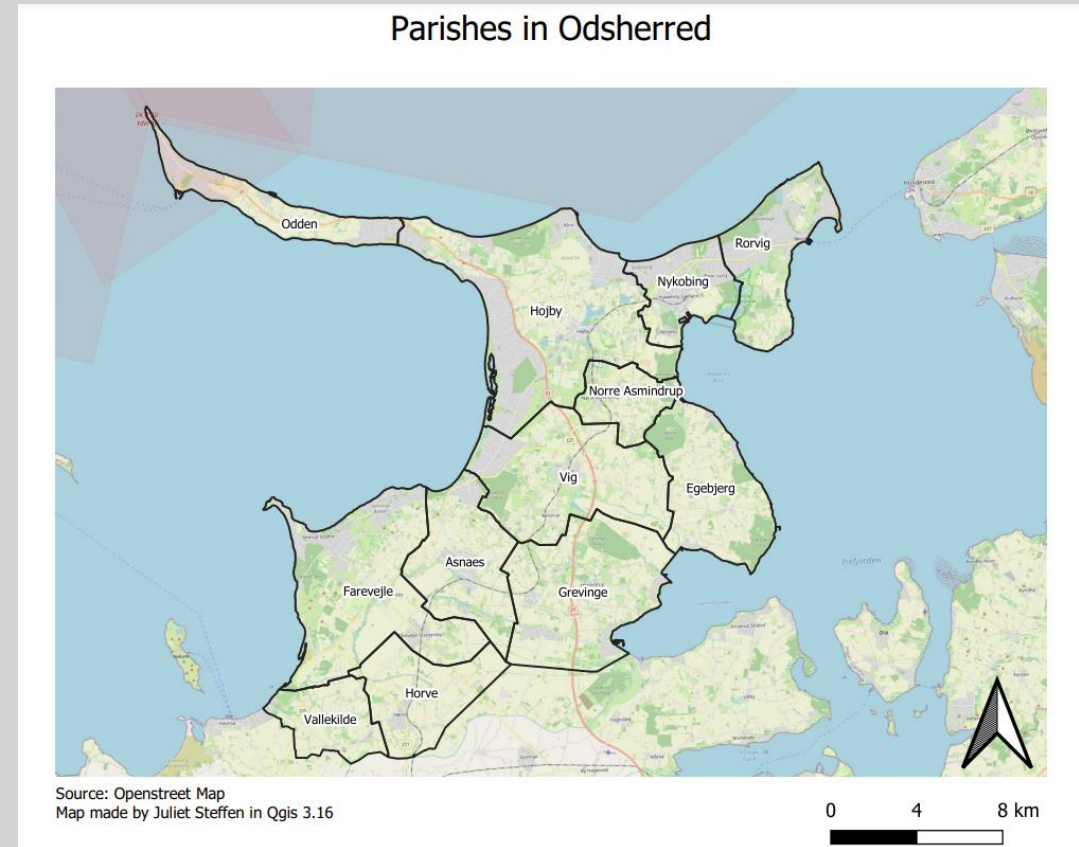
- Urban development in the municipality of Odsherred
- Focus on the parishes (12 in Odsherred)

Importance of this research

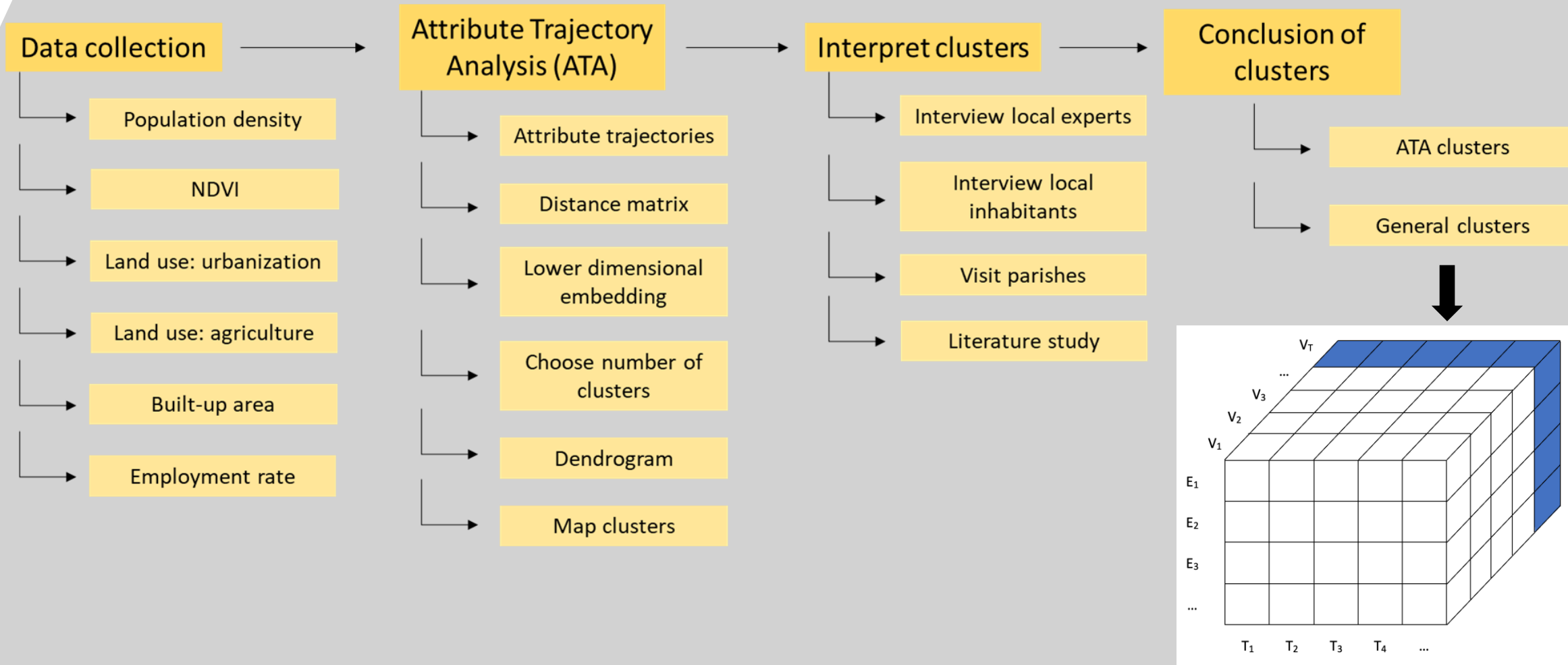
- Get insight in the urban development of Odsherred over the past 30 years
- Predict future urban development of Odsherred
 - Important to spatial planners
- Validate if Attribute Trajectory Analysis can be used to explain socio-economic processes in urban development

Research questions

- How does the urban environment change over time?
- What socio-economic and demographic factors have an influence on the evolution of urban areas?
- What patterns can be seen in the development of the different parishes?
- What are the causes and effects of the found patterns?

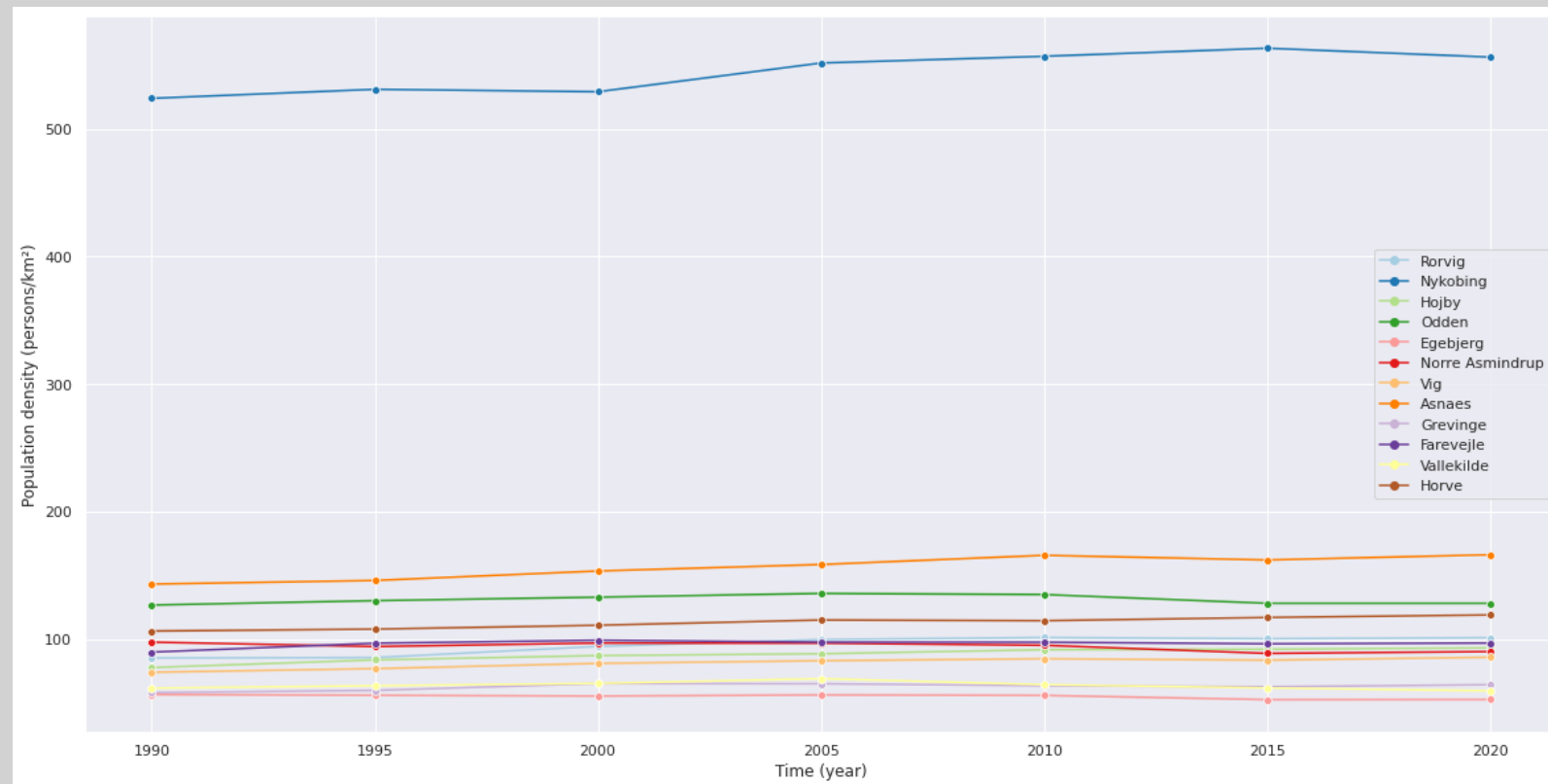


Method - Workflow



Method - ATA

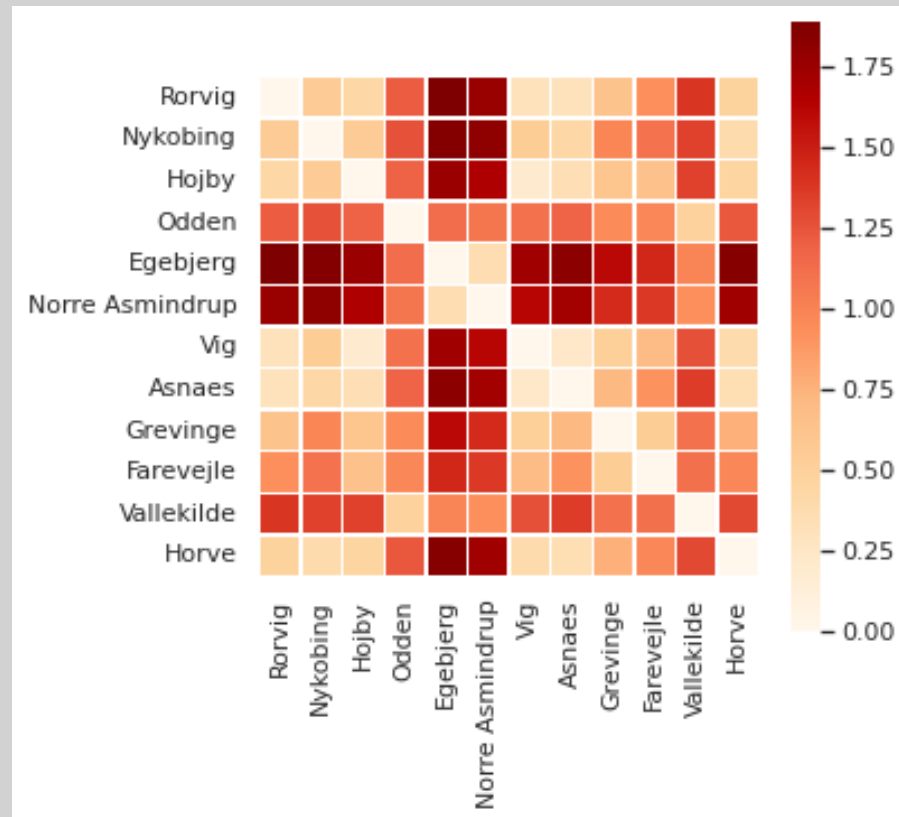
- Attribute Trajectory Analysis of population density over the past 30 years in Odsherred



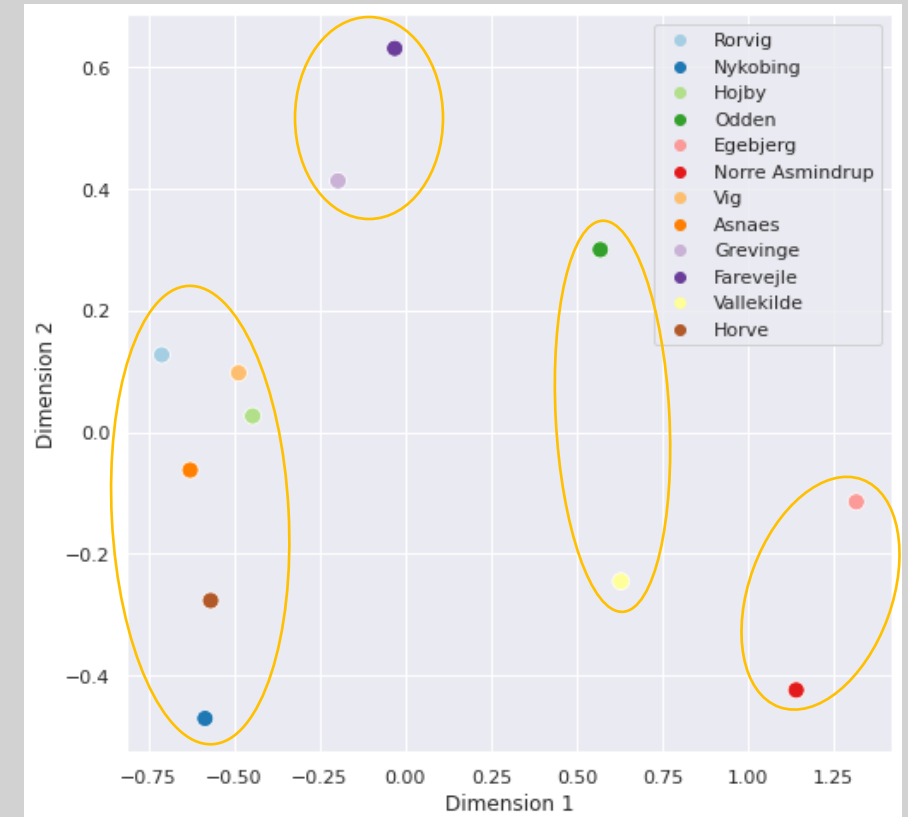
Attribute trajectories

Method - ATA

- Attribute Trajectory Analysis of population density over the past 30 years in Odsherred



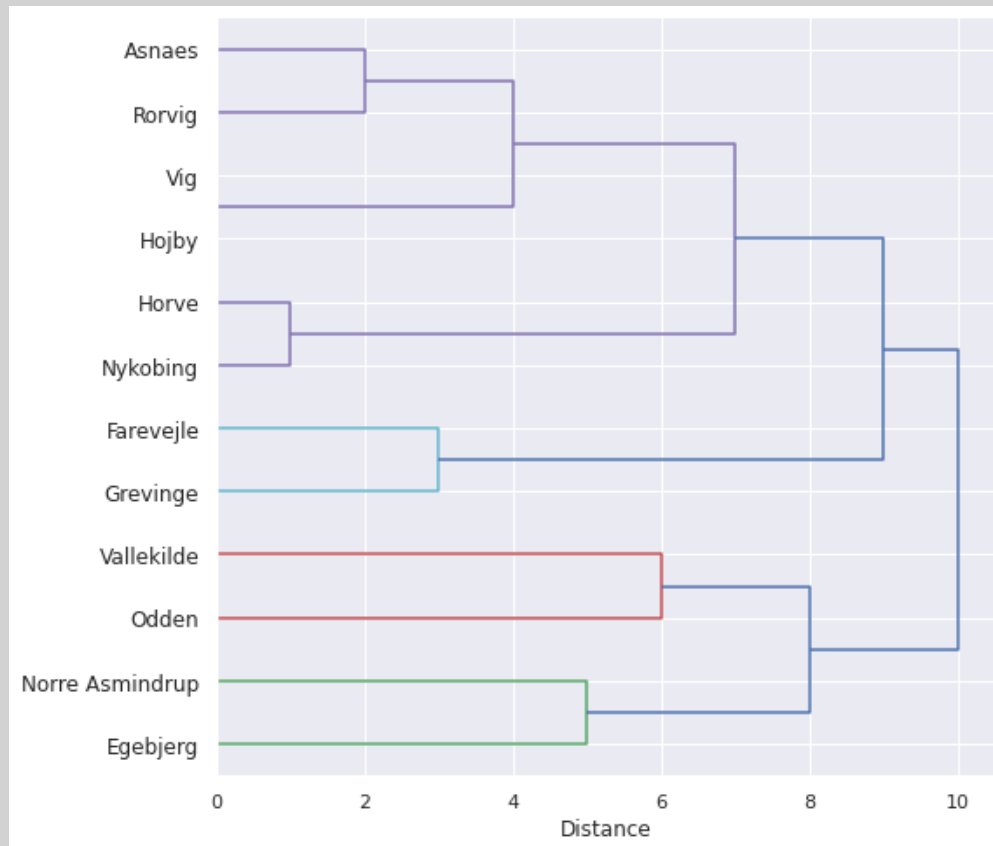
Distance matrix



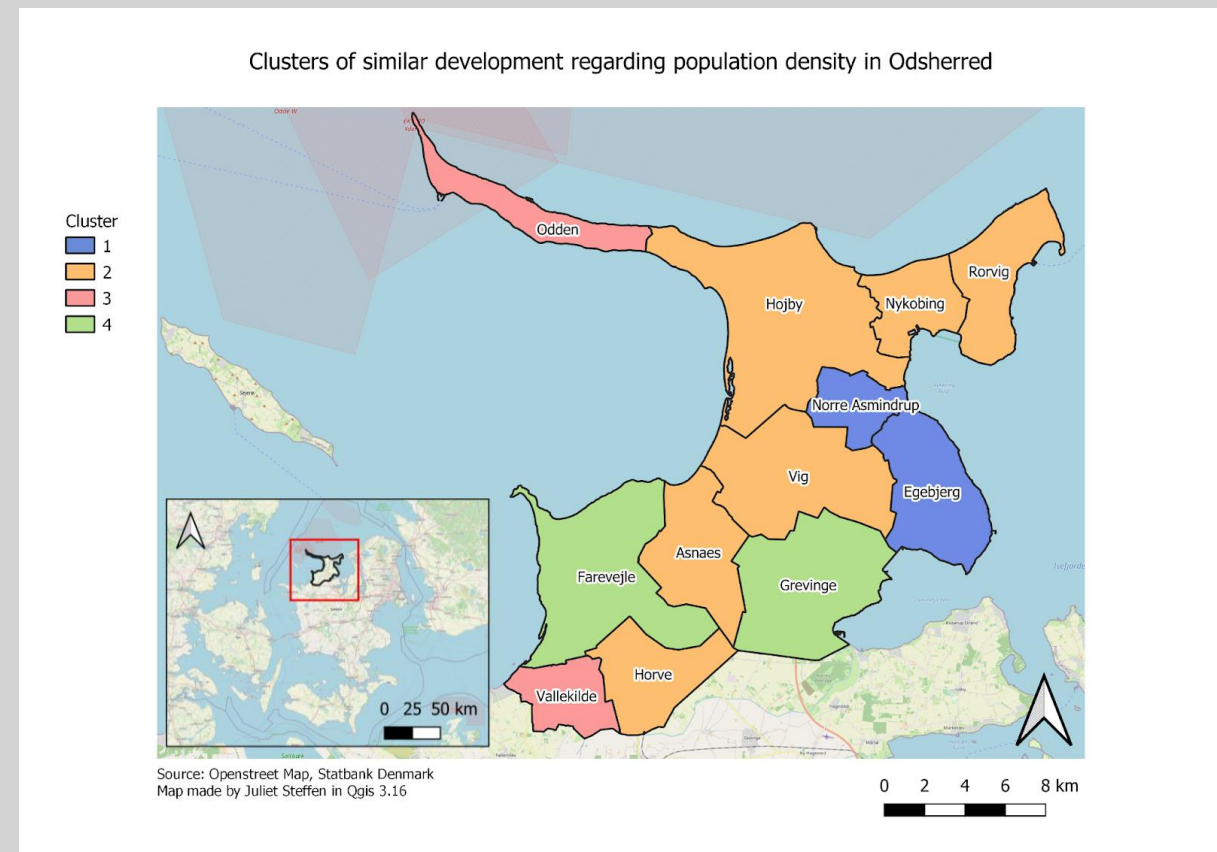
Lower dimensional embedding

Method - ATA

- Attribute Trajectory Analysis of population density over the past 30 years in Odsherred



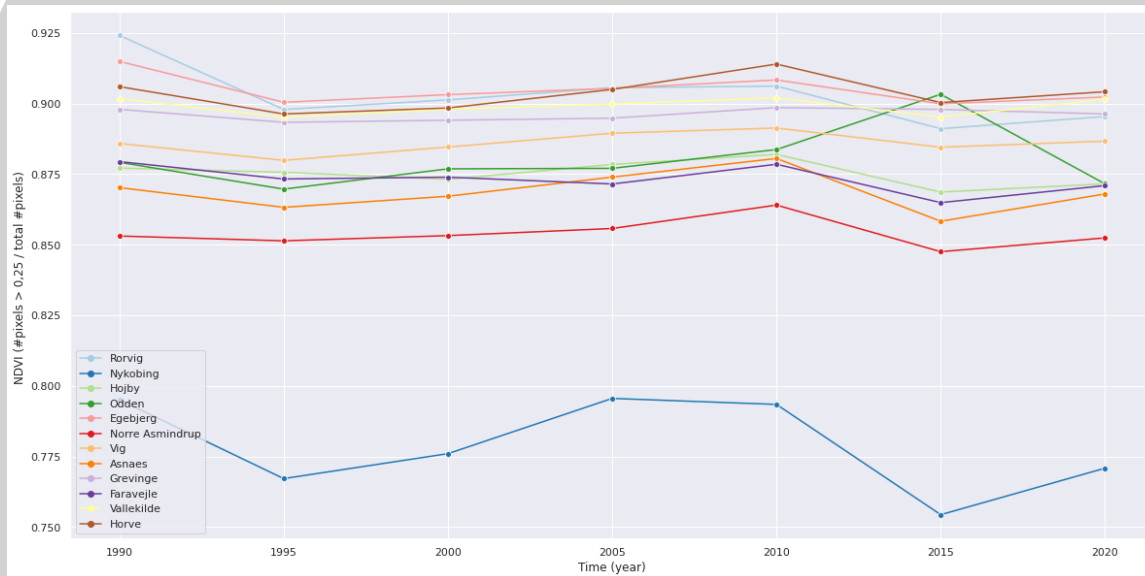
Dendrogram



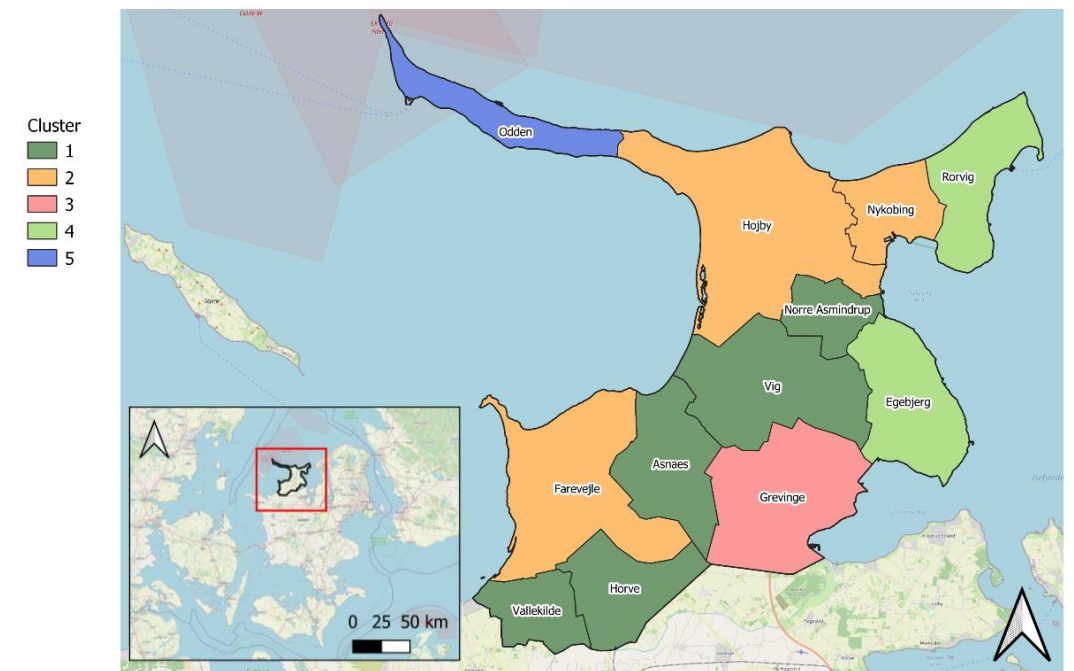
Map the clusters

Attributes- Normalized Difference Vegetation Index (NDVI)

- Percentage of healthy vegetation
- Nykøbing outlier
 - Small parish and 'big' urban centre



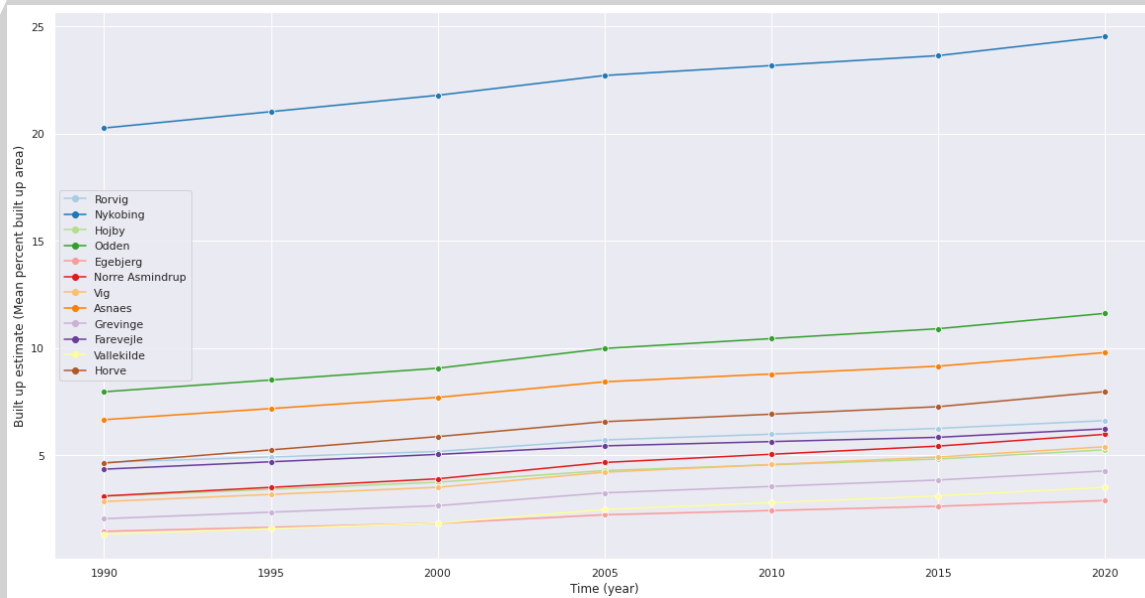
Clusters of similar development regarding NDVI in Odsherred



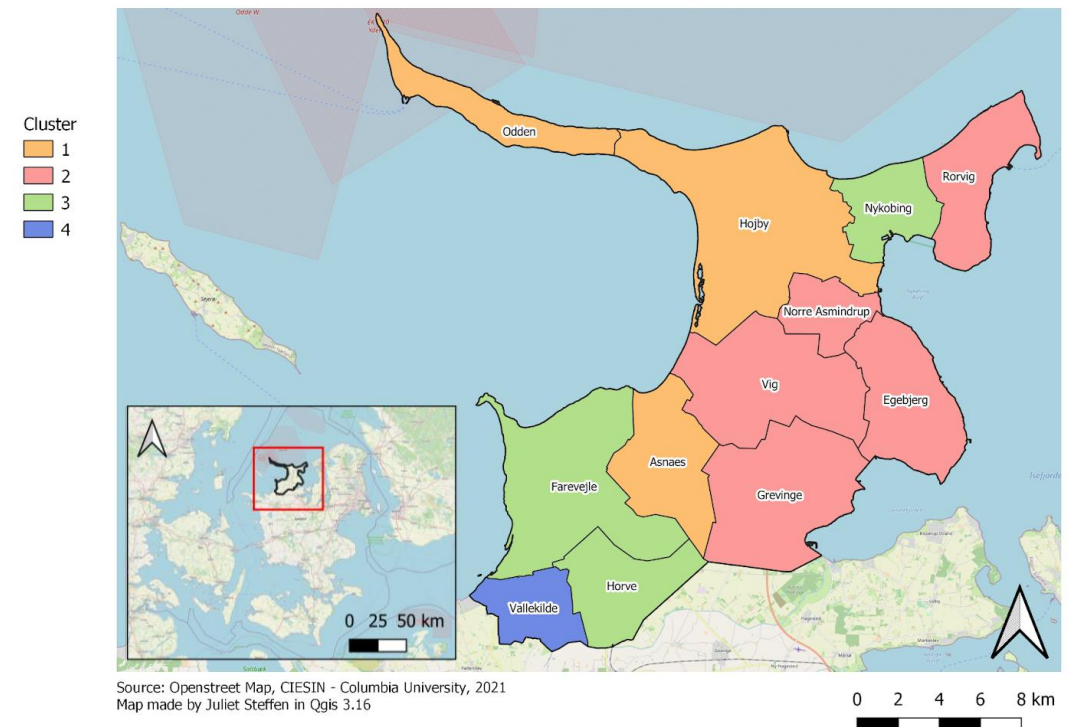
Source: Openstreet Map, Landsat 5 and Landsat 8
Map made by Juliet Steffen in Qgis 3.16

Attributes– Built environment

- Mean percentage of built up area

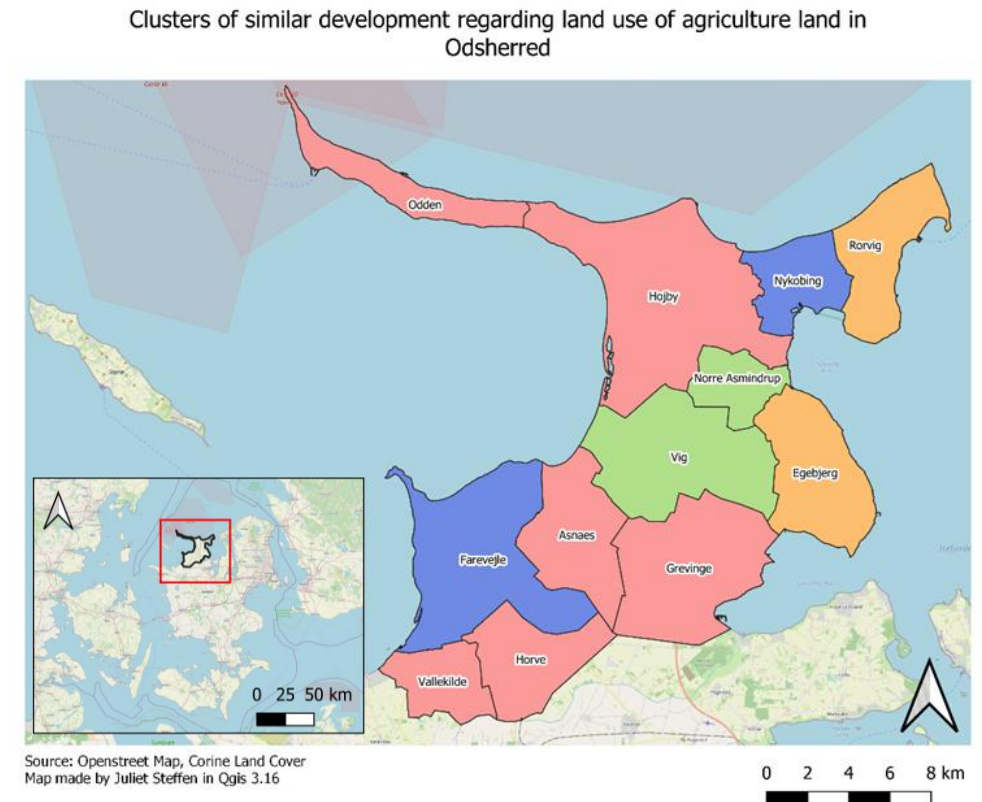
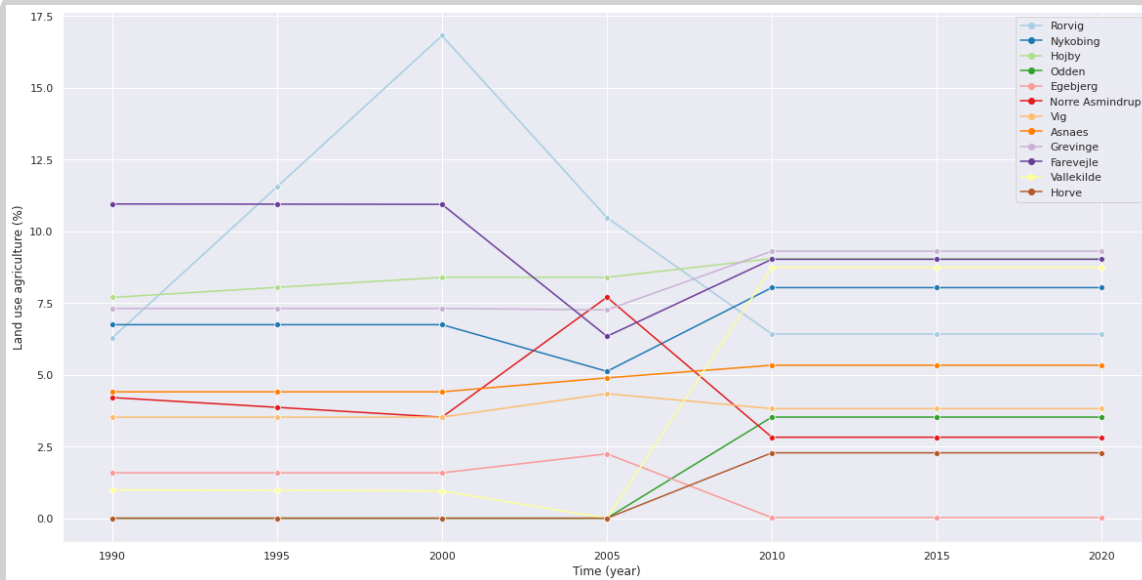


Clusters of similar development regarding built environment in Odsherred



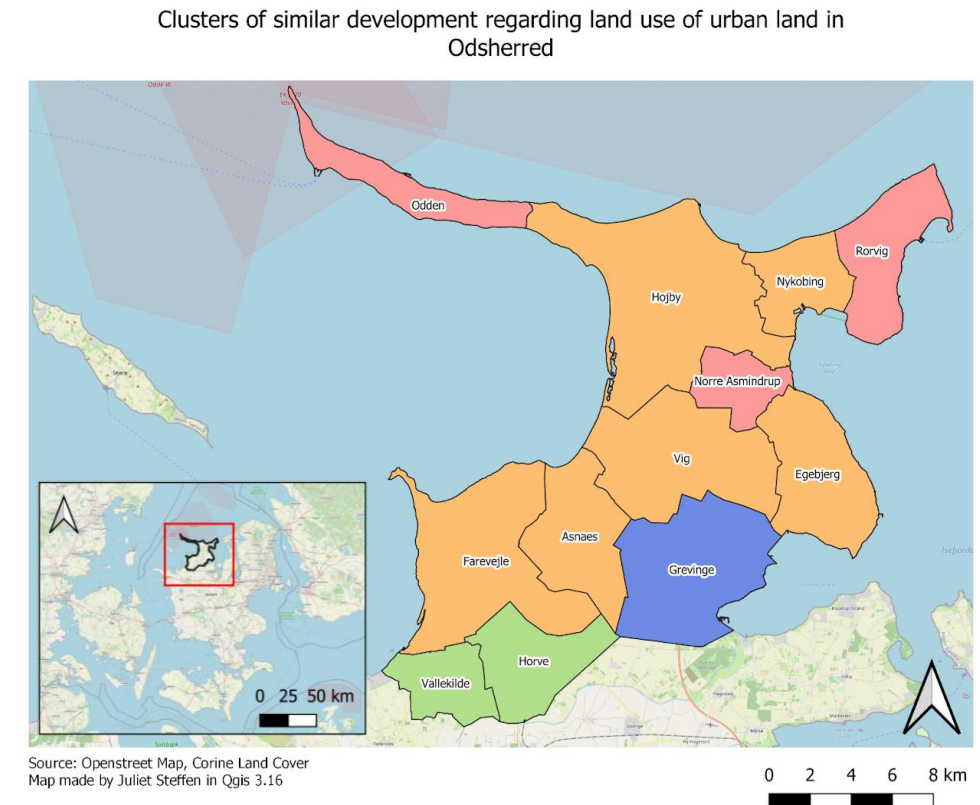
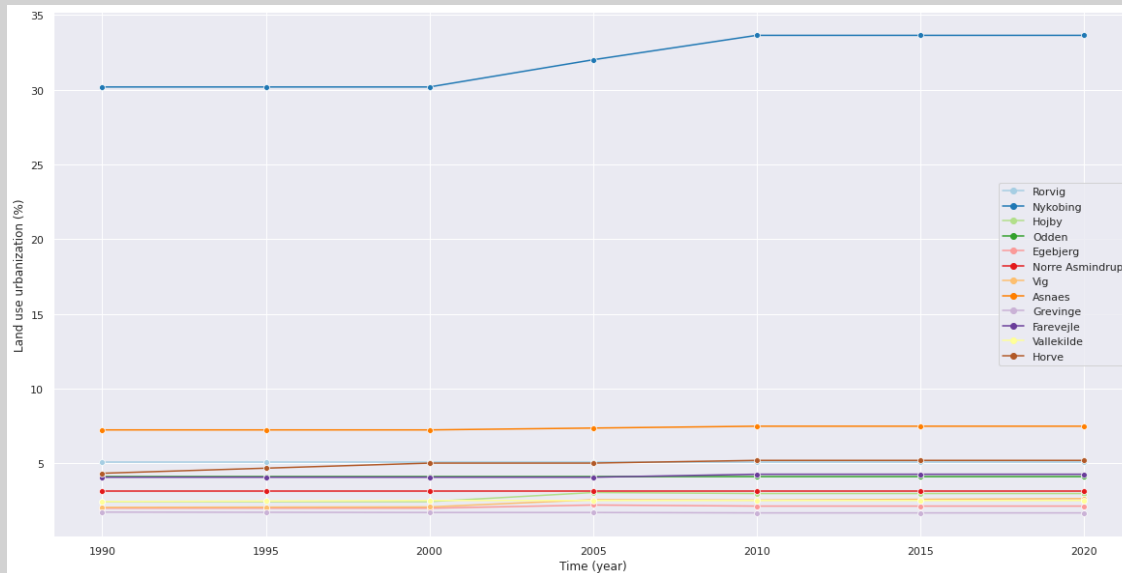
Attributes – Land use agriculture

- Percentage of agriculture land use



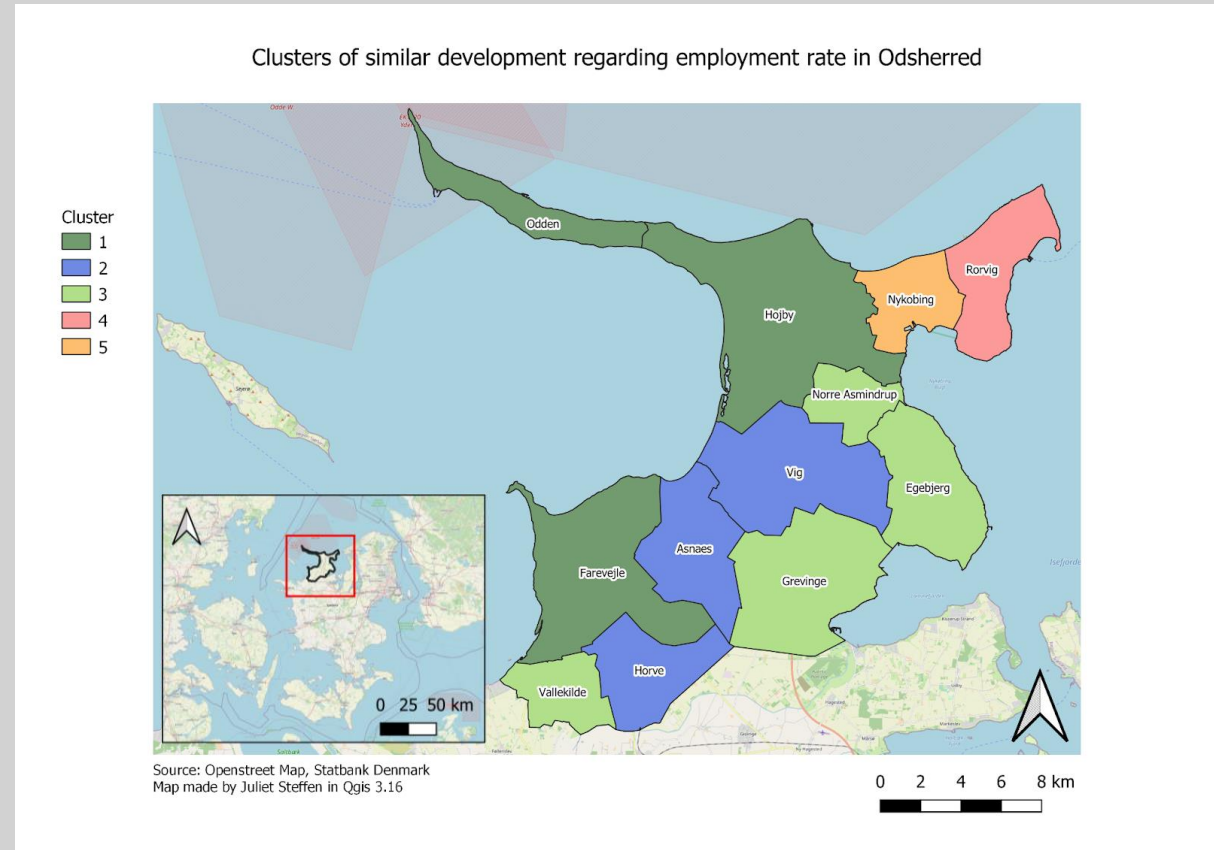
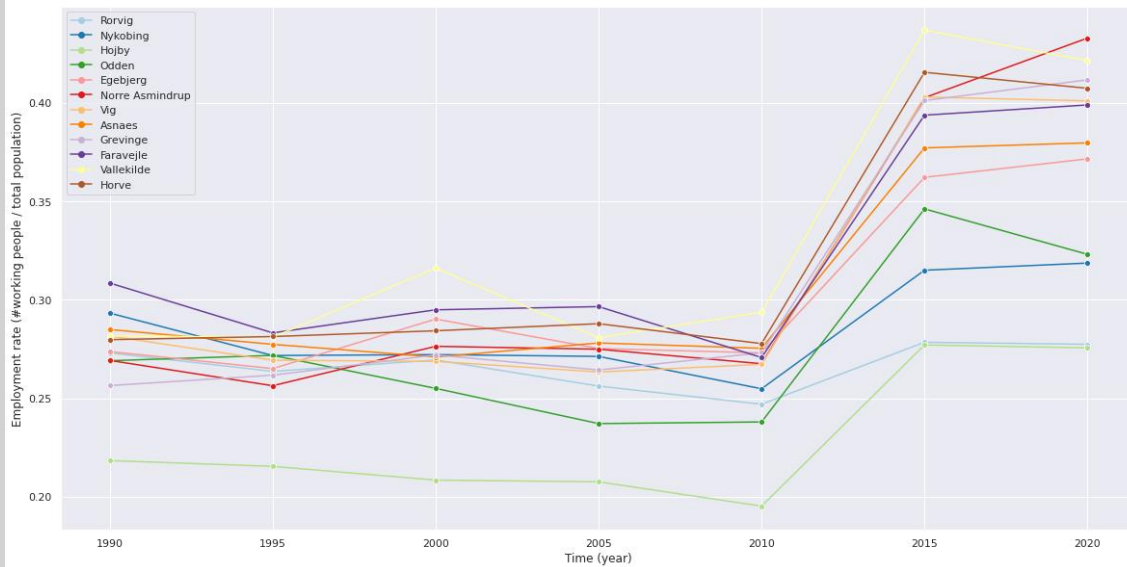
Attributes – Land use urbanization

- Percentage of urban land use



Attributes – Employment rate

- Amount of working people divided by total population
- Højby lowest:
 - Big surface and small amount of jobs



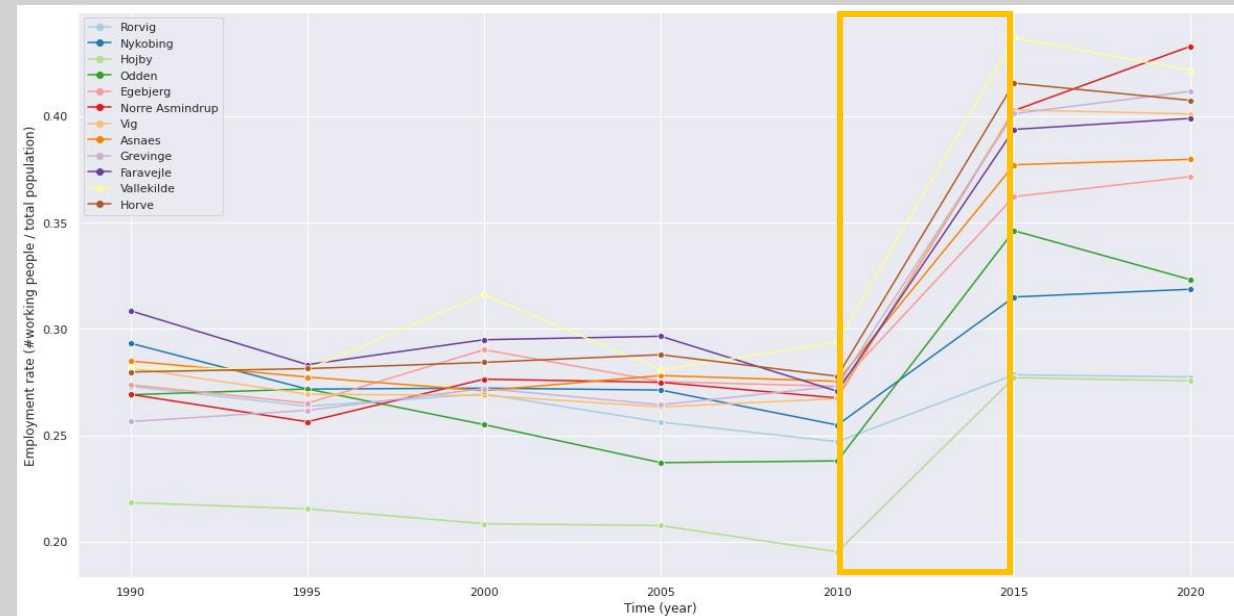
Attributes – Employment rate

Why has there been a high rise in employment rate between 2010 and 2015?

- The follow-up of the financial crisis in 2008
 - Lower housing prices and more internal immigration into Odsherred (Christensen, 2022)?

Netto-migration	2005	2010	2015	2020
Working people	-159	-187	-201	-203
Not working people	20	-81	19	13

- Large group of relatively low educated people, but they're highly educated in craftsmanship
 - New business since recently and more appreciation for their work (Paludan, 2022)
- Changes in the data gathering since 2015



Results - Clusters

- Number of times a parish is in the same cluster with another parish
- Examples:
Asnæs/Vig/Hørve or
Højby/Asnæs

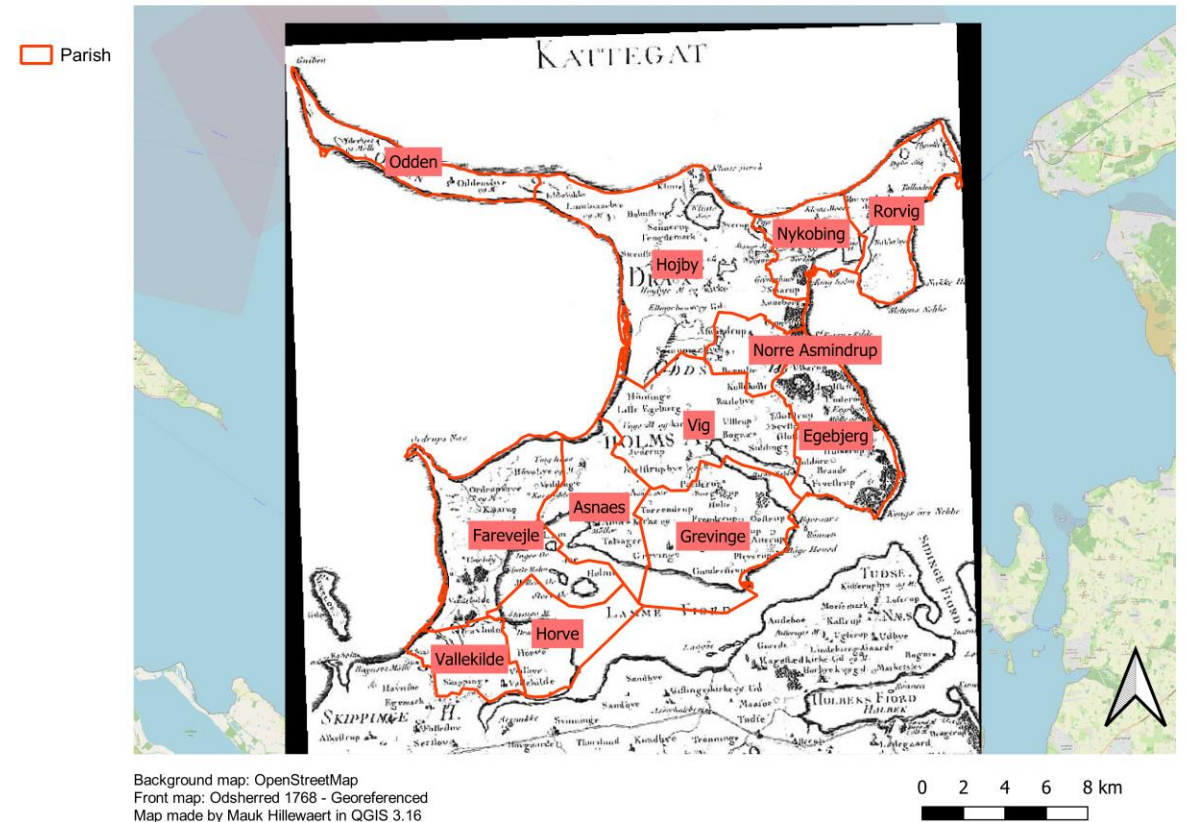
	Rorvig	Nykobing	Højby	Odden	Egebjerg	Norre Asmindrup	Vig	Asnaes	Grevinge	Farevejle	Vallekilde	Horve
Rorvig		1	1	1	3	2	2	1	1	0	0	1
Nykobing	1		3	0	1	0	2	2	0	3	0	2
Højby	1	3		3	1	0	2	4	1	3	1	2
Odden	1	0	3		0	1	0	2	1	1	2	1
Egebjerg	3	1	1	0		3	2	1	2	1	1	0
Norre Asmindrup	2	0	0	1	3		3	1	2	0	2	1
Vig	2	2	2	0	2	3		4	1	1	1	3
Asnaes	1	2	4	2	1	1	4		1	1	2	4
Grevinge	1	0	1	1	2	2	1	1		1	2	1
Farevejle	0	3	3	1	1	0	1	1	1		0	1
Vallekilde	0	0	1	2	1	2	1	2	2	0		3
Horve	1	2	2	1	0	1	3	4	1	1	3	

Results - Vallekilde/Hørve

Similar development according to NDVI, land use of urban land and agricultural land

- Villages at dam of Lammefjord
- Embanked and drained in the 19th century
- Fertile area with intense agriculture
- Similar evolution with few urban development and a lot of agricultural activities

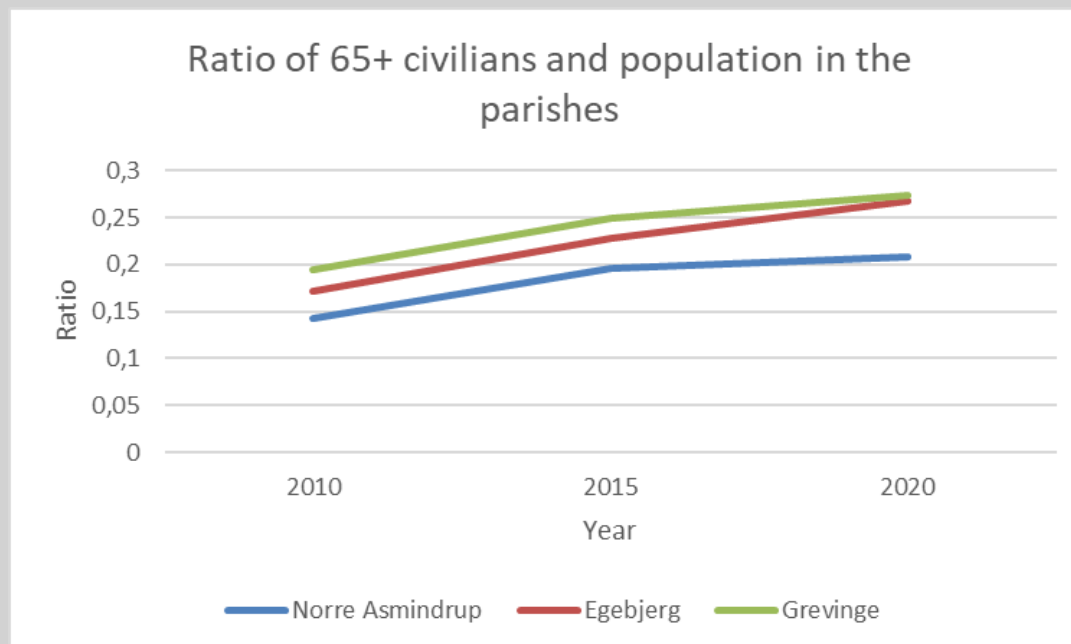
Parishes of Odsherred (2022) visualized on map of Odsherred from 1768



Results - Egebjerg / Nørre / Grevinge

Similarity in population density, NDVI and employment rate

- Eastern parishes, nothing much to do
- Abandonment of schools and buildings
- Eldery people
- Development mostly around church



Results - Egebjerg / Nørre / Grevinge

Future: communities like Fri & Fro

- Collection of self-built houses with sustainable materials
- Artists, teachers and other likeminds
- Law regulation
- Odsherred also wants to implement this in Norre Asmindrup and Grevinge to revive these “boring” parishes



Results - Vig/Asnæs/Hørve

Similarity in population density, NDVI and employment rate

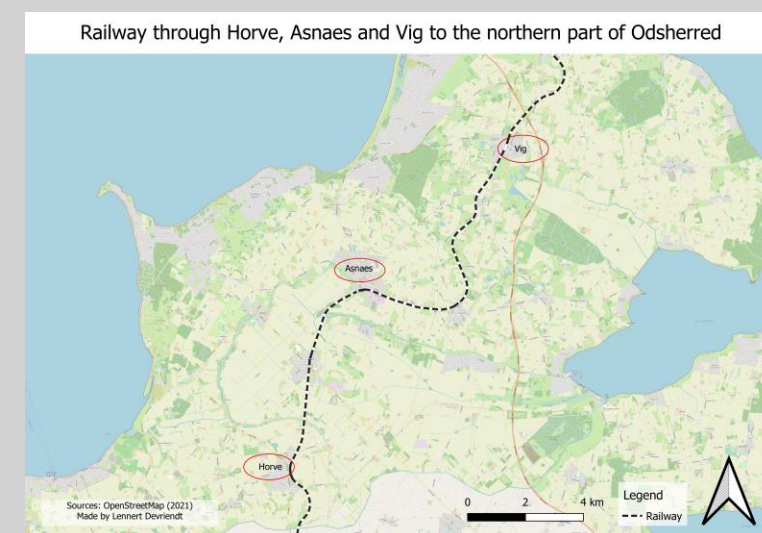
- One transport vector to the North (train)
 - Most development around this corridor
- Sidenotes (Paludan):
 - New residents coming to Asnæs (Gymnasium) and Vig (new housing projects)
 - But: hard to attract people due to summerhouses



High class neighbourhood in Asnæs

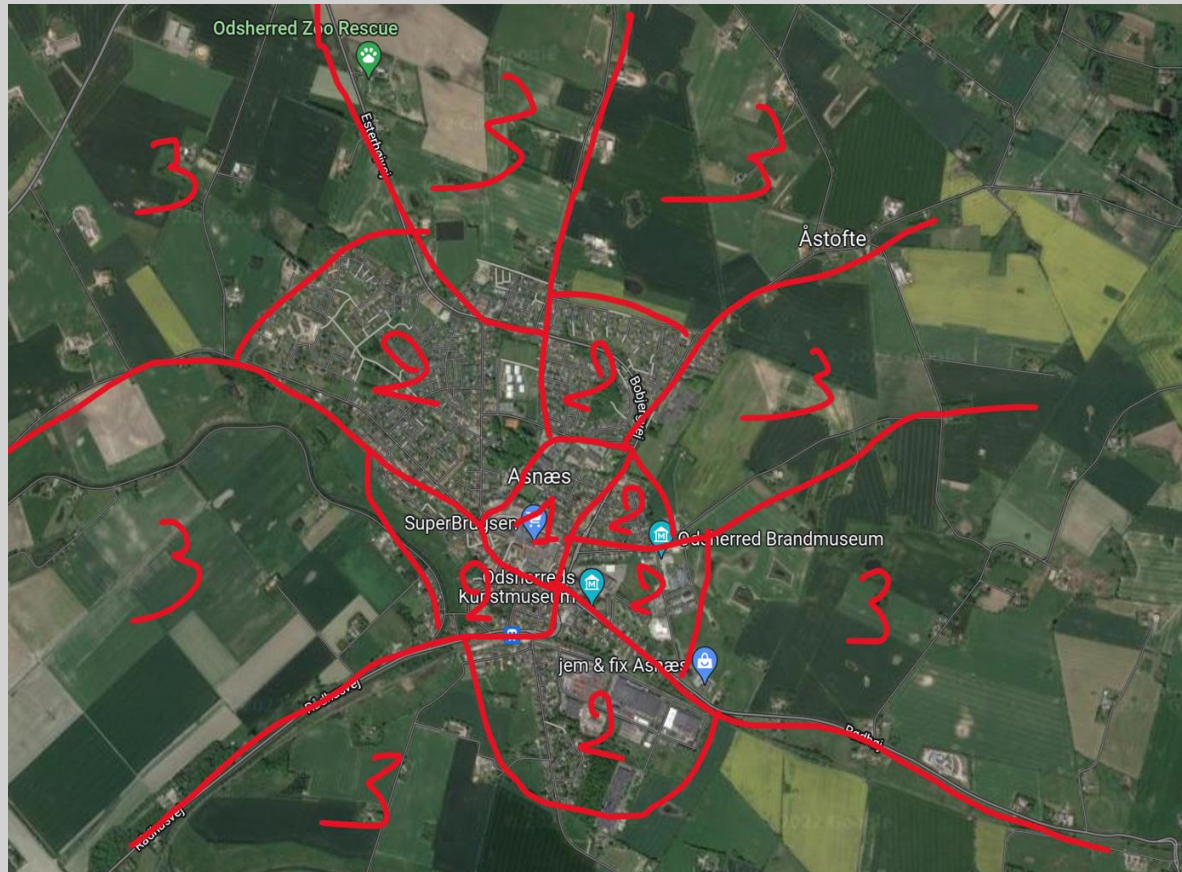


New neighbourhoods in Vig



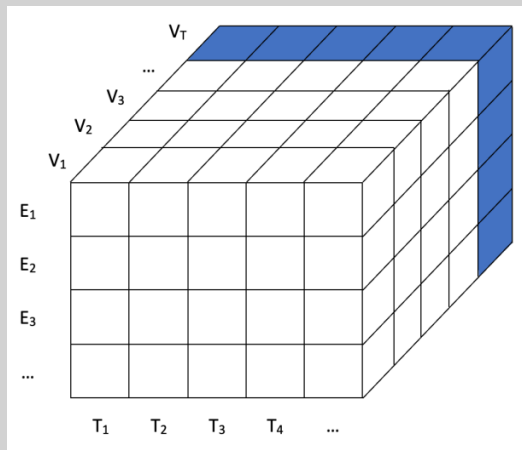
Results - Asnæs/Højby

Similarity in population density, urbanization grade, agricultural land and built environment

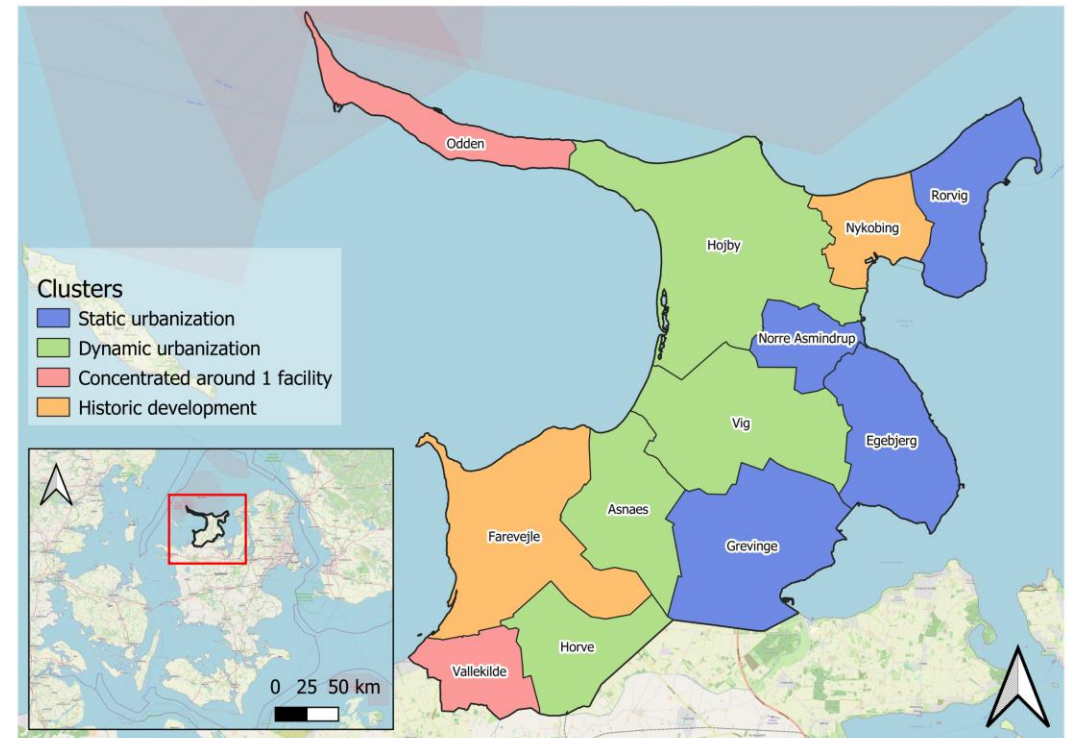


Results - General clusters

- Clustering of all the attributes between all parishes
- Different classes with generalised characteristics



Clusters of similar development regarding all attributes in Odsherred



Source: Openstreet Map
Map made by Juliet Steffen and Lennert Devriendt in Qgis 3.16

0 2 4 6 8 km

Discussion

Possible follow up research

- Alternative similarity measures for Euclidean distance metric
 - E.g. correlation distance, Manhattan distance, DTW ...
- Other applications (attributes) for the ATA
- Spatio-temporal clustering of urban development on a different spatial scale + granularity
 - E.g. All municipalities in Denmark
- Further investigate the importance of traffic connections
 - Train and education seem to be an important factor regarding the growth of urbanization

Conclusion

- Difficult to interpret clusters without knowledge of local inhabitants and experts
- Some parishes have similar evolutions in multiple urbanization factors
 - Better to analyze them separately because of small changes in evolution
- Importance of traffic connections and education
- In general: **gradual rise of urbanization in all parishes**
 - Validated by field work
 - Urban expansion project in Vig and Nykøbing
 - Urban community in Egebjerg





Questions?