Green Infrastructure
in
Métropole du Grand Paris

Green Infrastructure is Important for Sustainable Development

- GI is the network of natural and semi-natural areas that*:
  - provides eco-system services: clean air, pollination, recreation, etc.
  - preserves biodiversity
  - e.g. parks, gardens, rivers, playgrounds, pools, plazas, bike trails, bridges, etc.
- Maintaining and developing GI have a spatial dimension:
  - networked nature of this infrastructure must be assured at different scales
  - spatial dist. of GI is related with spatial-equity, ecological balance, and territorial cohesion.
- Location-Based-Social-Networks (LBSN) permit analyzing GI from user point of view and guide GI management and planning Marti et al. (2020).

Green Infrastructure Definitions. Retrieved from: https://www.interreg-central.eu/Content.Node/Definitions.html (Accession date: 21.06.2020)
Marti et al. (2020) Meaningful Spaces through Foursquare User's Preferences. *Land Use Policy*, 97: 104641

GI in Métropole du Grand Paris

- Métropole du Grand Paris is the largest urban region in the European Union.
  - already faces the effects of global warming
  - aims to improve resilience of the area via sustainability transition.
  - maintaining and developing GI is thus crucial for the area.
- The objective of this study is:
  - to explore the spatial pattern of GI in Métropole du Grand Paris by taking user's preferences into account
  - and shed some light on the spatial-equity dimension of the current GI in the area.

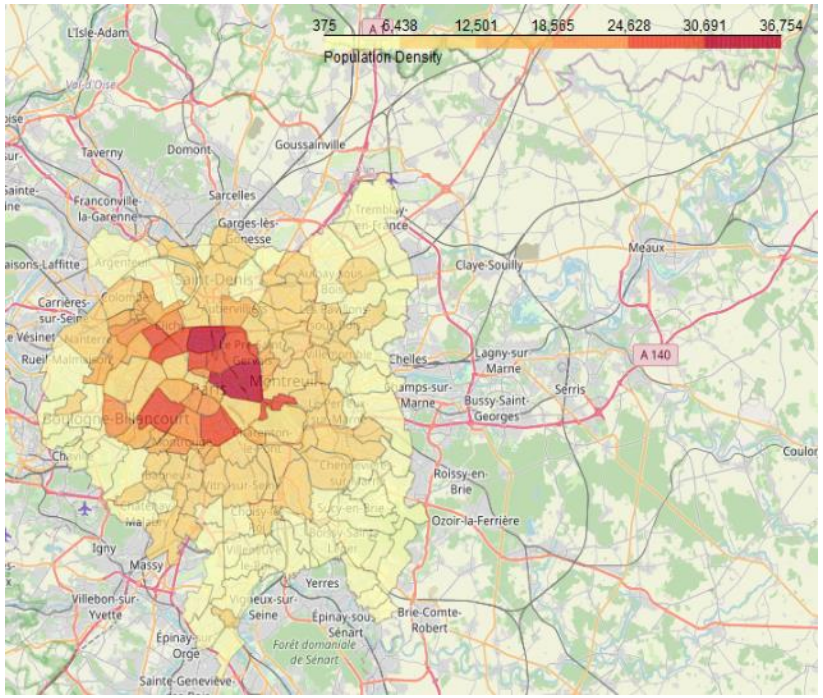
Data: Sources and Description of Data

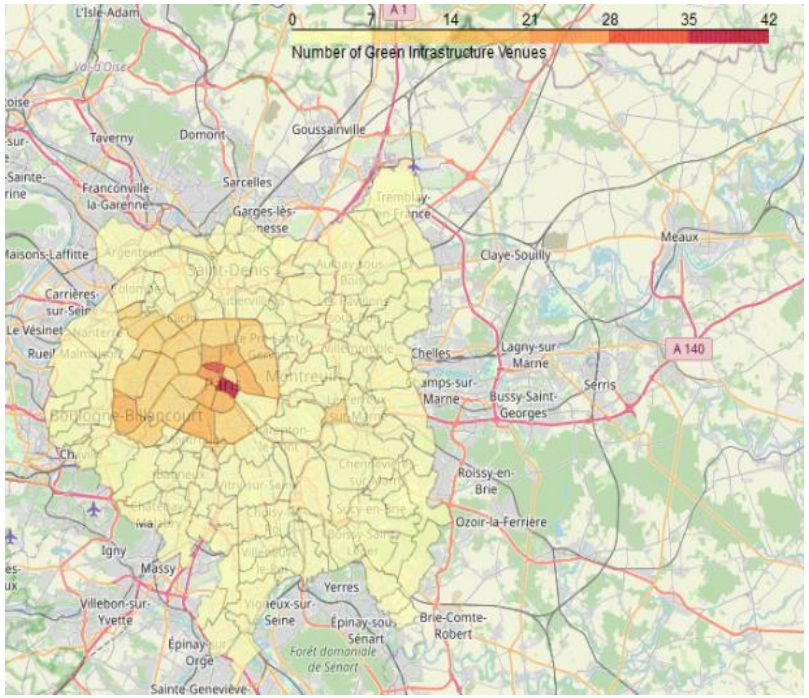
- Métropole du Grand Paris consists of 150 neighborhoods:
  - the city of Paris (20 arrondissements), inner and outer suburbs (130 communes)
- From INSEE: the list of arrondissements, their population and surface area
- From an open platform for French public data (https://www.data.gouv.fr):
  - the list of communes, and their population and surface area
  - polygonal representation and geographical coordinates of the neighborhoods
- From Marti et al. (2020) : the list of Foursquare categories that can be considered as GI
- From Foursquare: data on GI venues.

Methodology

1. Choropleth maps to describe spatial distribution of population density and GI venues.
2. Testing for correlation between population density and GI:
   - Pearson correlation coefficient between population density and number of GI venues.
   - Null hypothesis: population density and number of GI venues in neighborhoods are not correlated.
3. k-means clustering to analyze (user-based) GI in Métropole du Grand Paris.
   - Most neighborhoods have very few GI elements
   - Only neighborhoods with more than 7 venue categories are clustered according to top 5 venue categories (to be revisited in discussion)

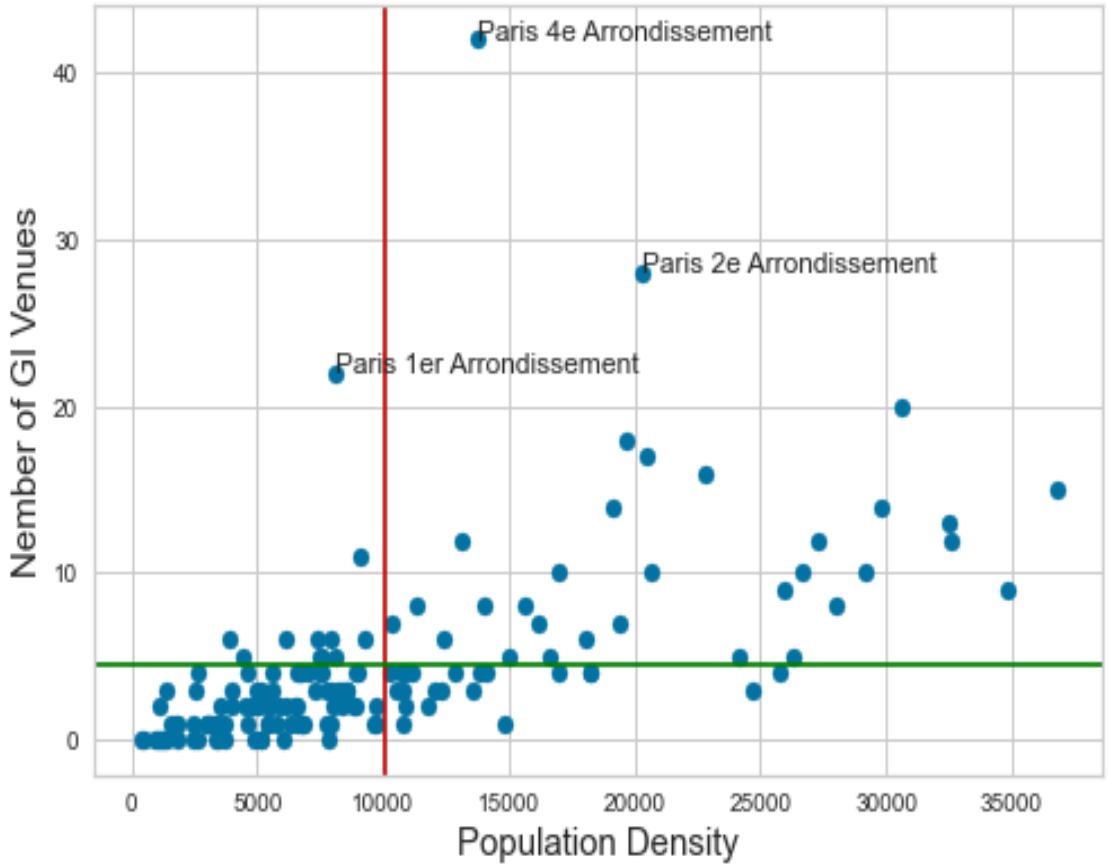
Results: Spatial distribution of population density and GI venues





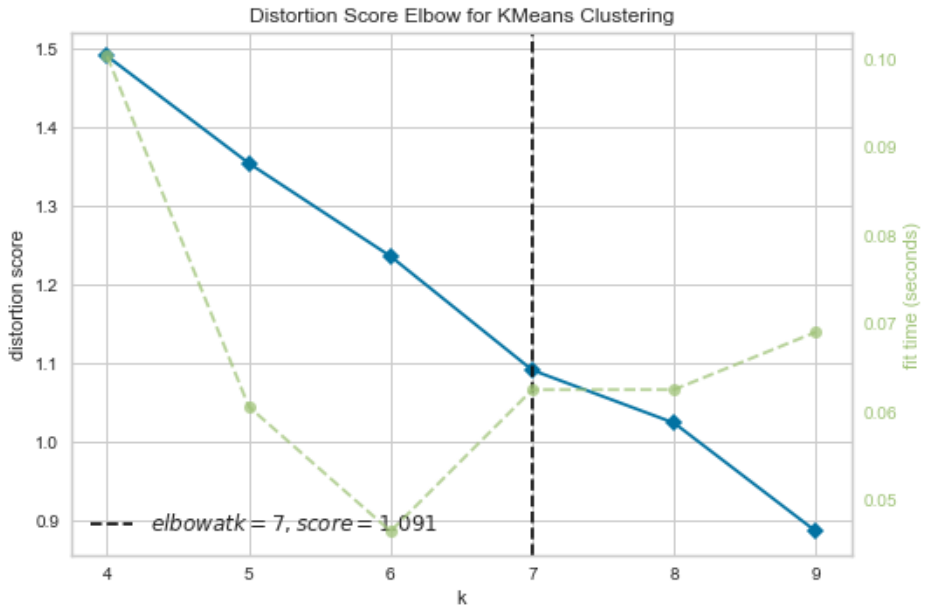
- Moving from the city to outer suburbs, population both population density and number of GI venues decrease
- Less spatial heterogeneity in GI distribution as compared to population density
  - Strong assumption in measurement of GI: Foursquare check-ins are representative of the preferences of the whole population.

Results: Correlation between population density and GI venues



- Statistical evidence on moderate level of correlation
  - The Pearson corr. coeff: 0.594 (p-value= 0.000)
- 1st arrondissement differs from other neighborhoods.
  - population density is less than the average but more GI venues than the average.

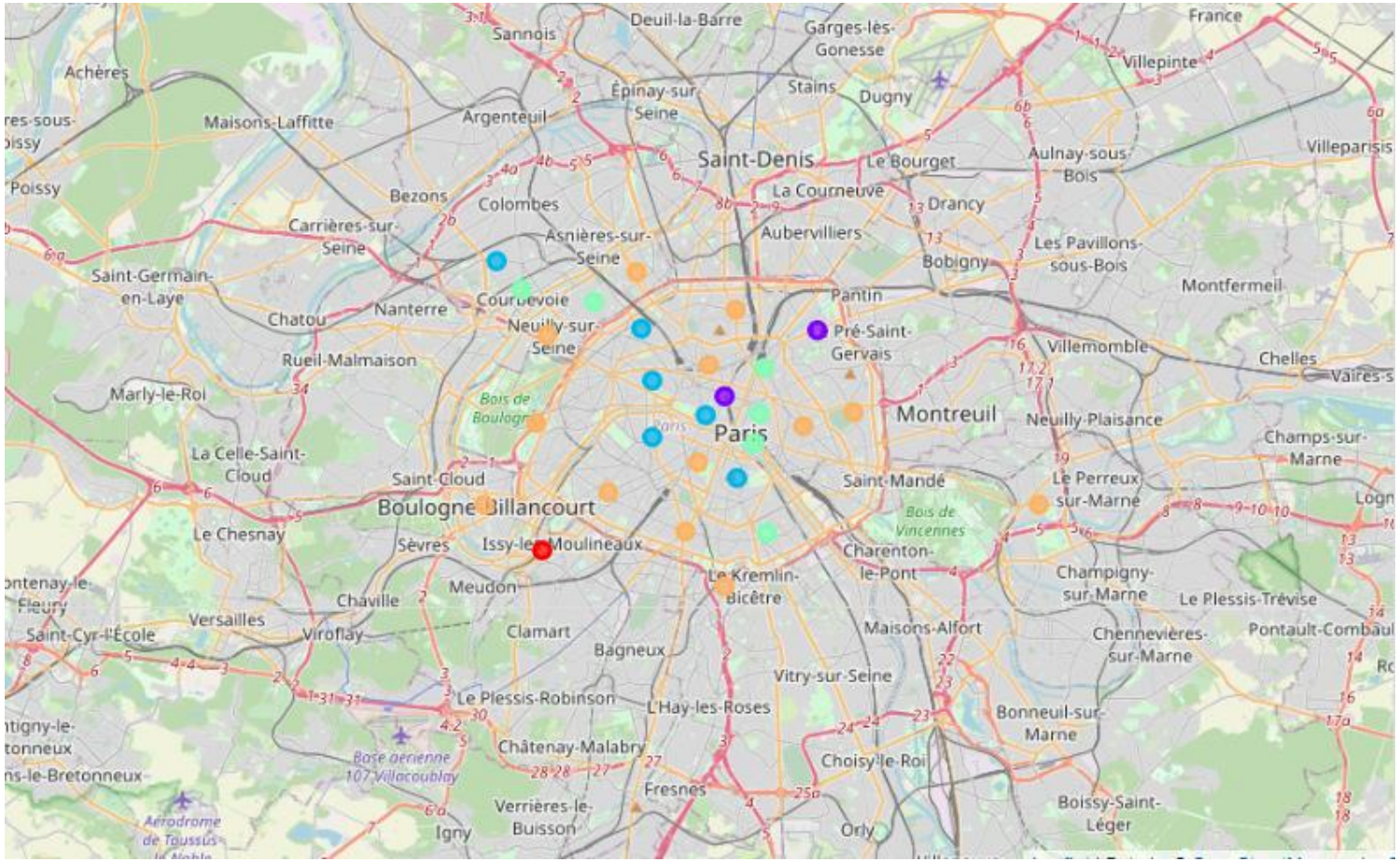
Results: Clustering neighborhoods with respect to top GI categories



- the Elbow heuristic suggests 7 clusters
- It is difficult to come-up with a cluster typology, but:
  - 3rd cluster: Plazas is the top category
  - 4th cluster: Public places such as parks, plazas, gardens are top venue categories.
  - 5th cluster: either parks and plazas as first rank categories and then sports facilities.
  - 6th cluster: similar to the 5th cluster except that sports facilities are more highly ranked.

	Cluster ID						
	1	2	3	4	5	6	7
Number of Neighborhoods	1	2	6	4	7	7	1

Results: Clustering neighborhoods with respect to top GI categories



- differences between clusters are not sharp.
- similarly, no specific spatial pattern is observed in distribution of clusters.

Discussion and Conclusion

- These results should be taken with great care for at least two main reasons:
  - possible selection bias resulting from the use of Foursquare data: particular age cohorts with particular ICT usage patterns??
  - complementing this analysis with data from urban plans would be essential to draw conclusions for GI management and planning.
- Clusters identified in the study are overly sensitive to certain methodological choices.
  - small increases in the sample size or in the number of top venue categories lead to vastly different results
  - data triangulation and integrating theoretical insights from spatial planning can help.
- The results are far from being robust, and experimental in nature. Still, the exercise illustrates a Location-Based-Social-Networks (LBSN) approach to inform GI management and planning.