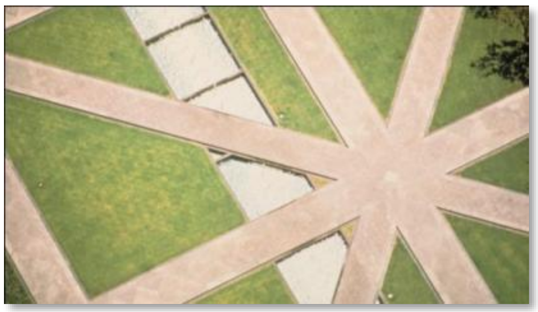
January 10, 2018, Mobile Cartography

Development of a custom mapping technique
Spatio-temporal Tag Clouds (Tag Maps)

Dr.-Ing. Alexander Dunkel, TU Dresden,
Lecture for the International Master "Cartography" & the Master in "Geoinformation Technology" (GIT)
Department of Geosciences, Cartographic Communication

3 Pillars of Knowledge
Map Development

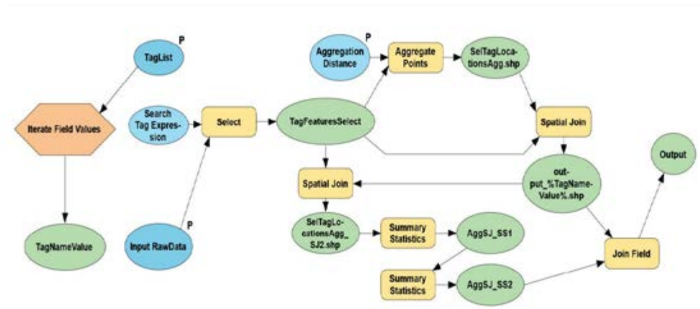
Who is the audience?
What are the goals?



Theoretical Knowledge
(Framework)

STEP 1

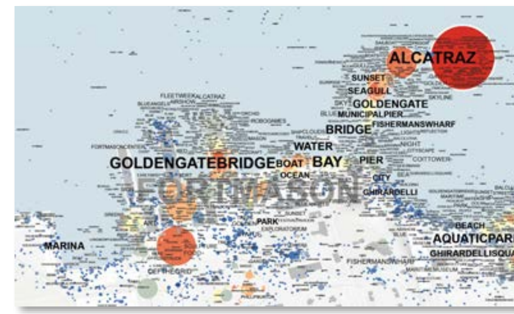
Implementation?



Technical Knowledge
(Data processing)

STEP 2

How to visualize results?



Visualization
(Graphics)

STEP 3

PART 1

Theoretic Background

EU Landscape Convention:

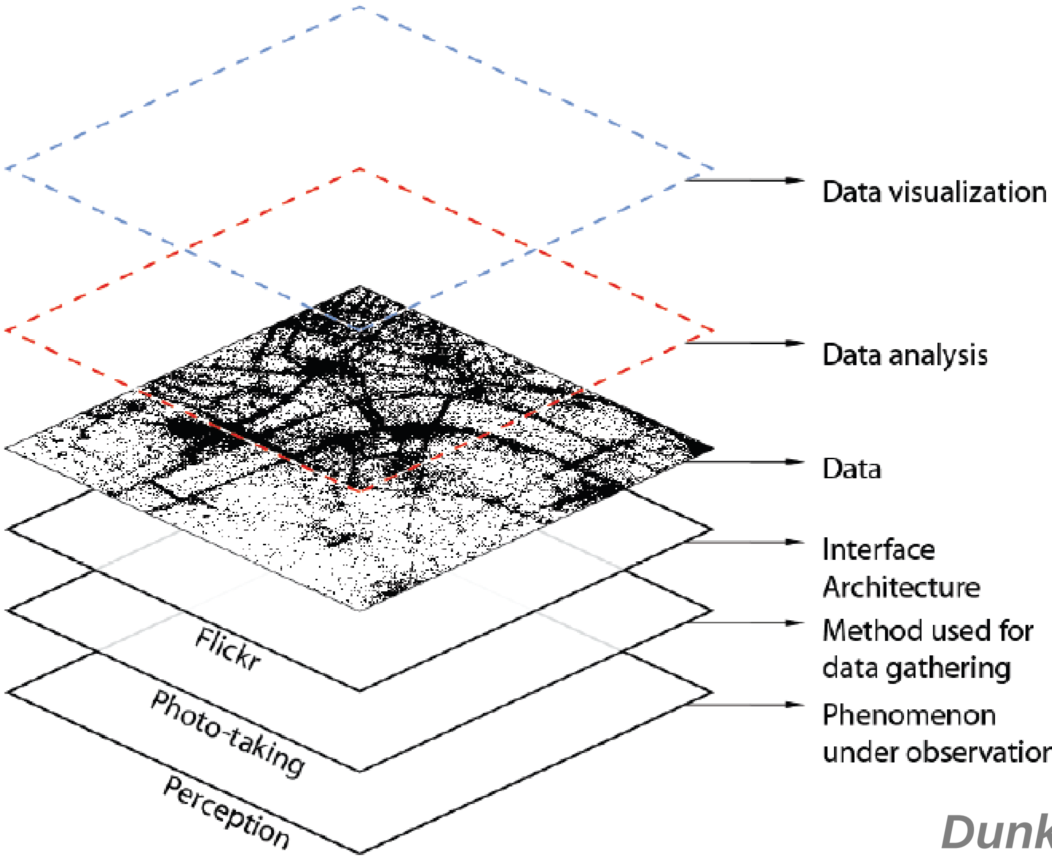
… landscape "as a zone or area as perceived by local people or visitors" (ELC art. 1, para. 38).

Social Media Photo Data:
A source for understanding
Collective Human Perception

72 Million Photo Locations in Europe

A. Dunkel, Source: Flickr, 2007-2017

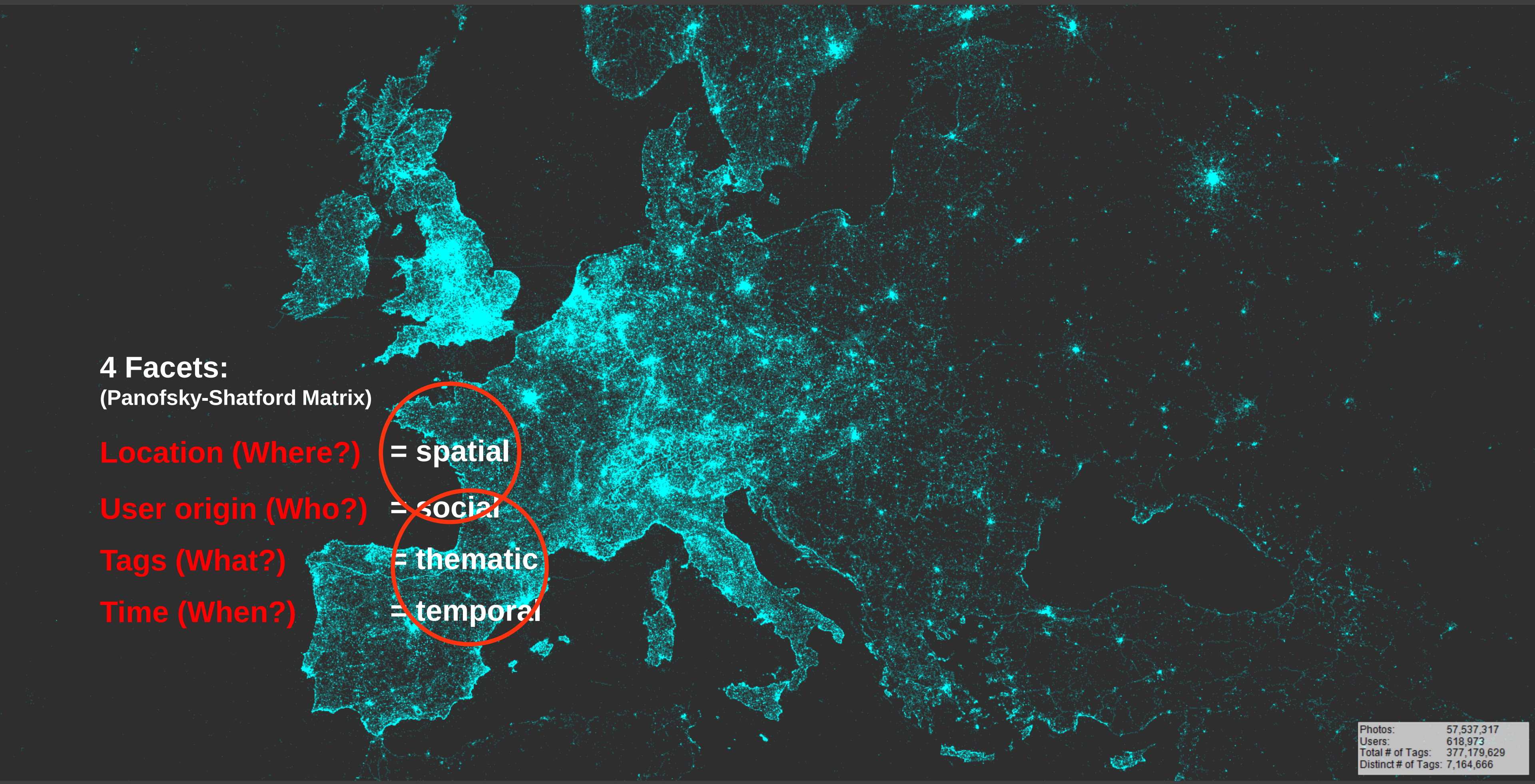
Approach: Data Processing



Dunkel (2016)

Fig. 2: Approach illustrated as a multi-layered process of analysis.

Data Selection



4 Facets:
(Panofsky-Shatford Matrix)

Location (Where?) = spatial

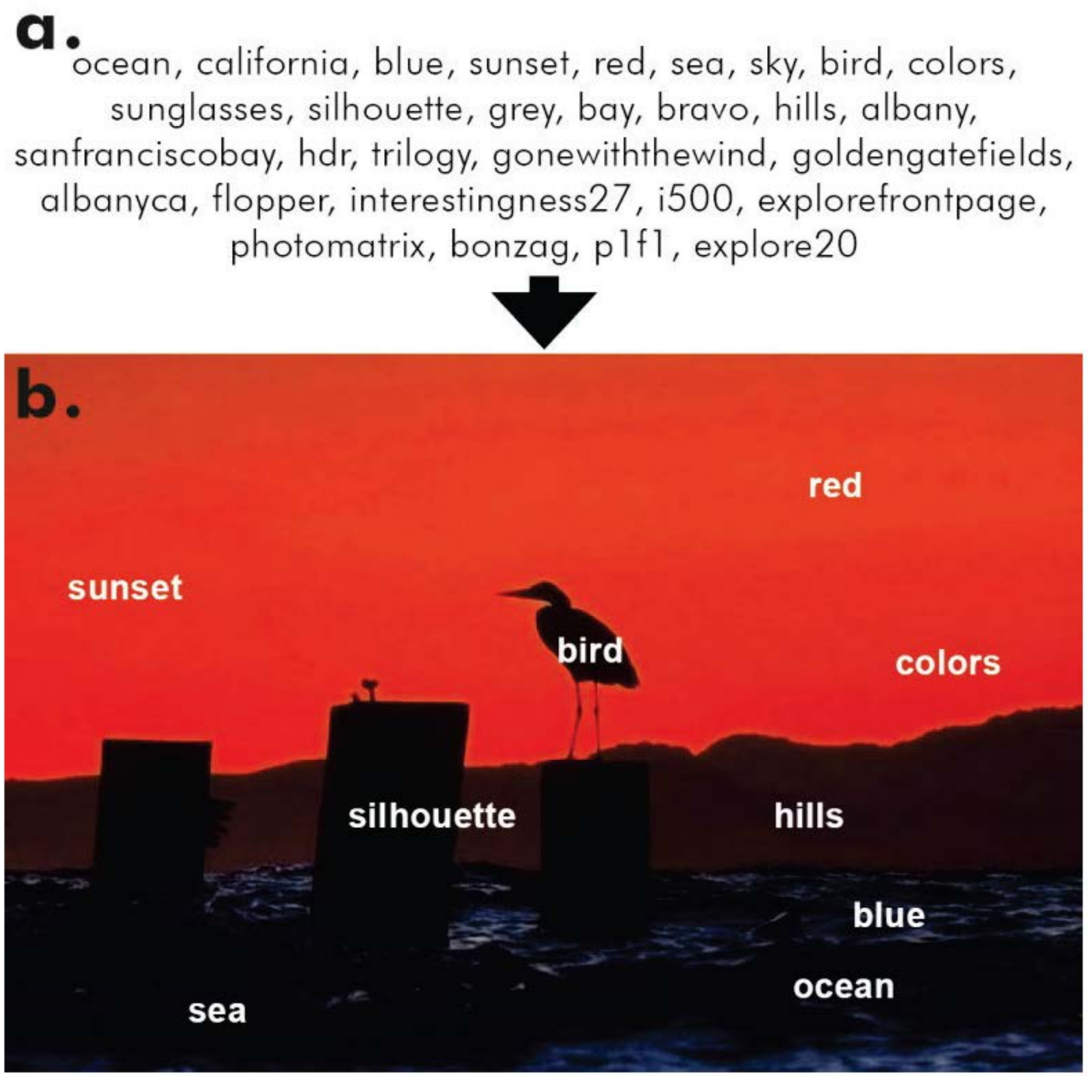
User origin (Who?) = social

Tags (What?) = thematic

Time (When?) = temporal

Perception, Photo Taking and Tagging

Tagging

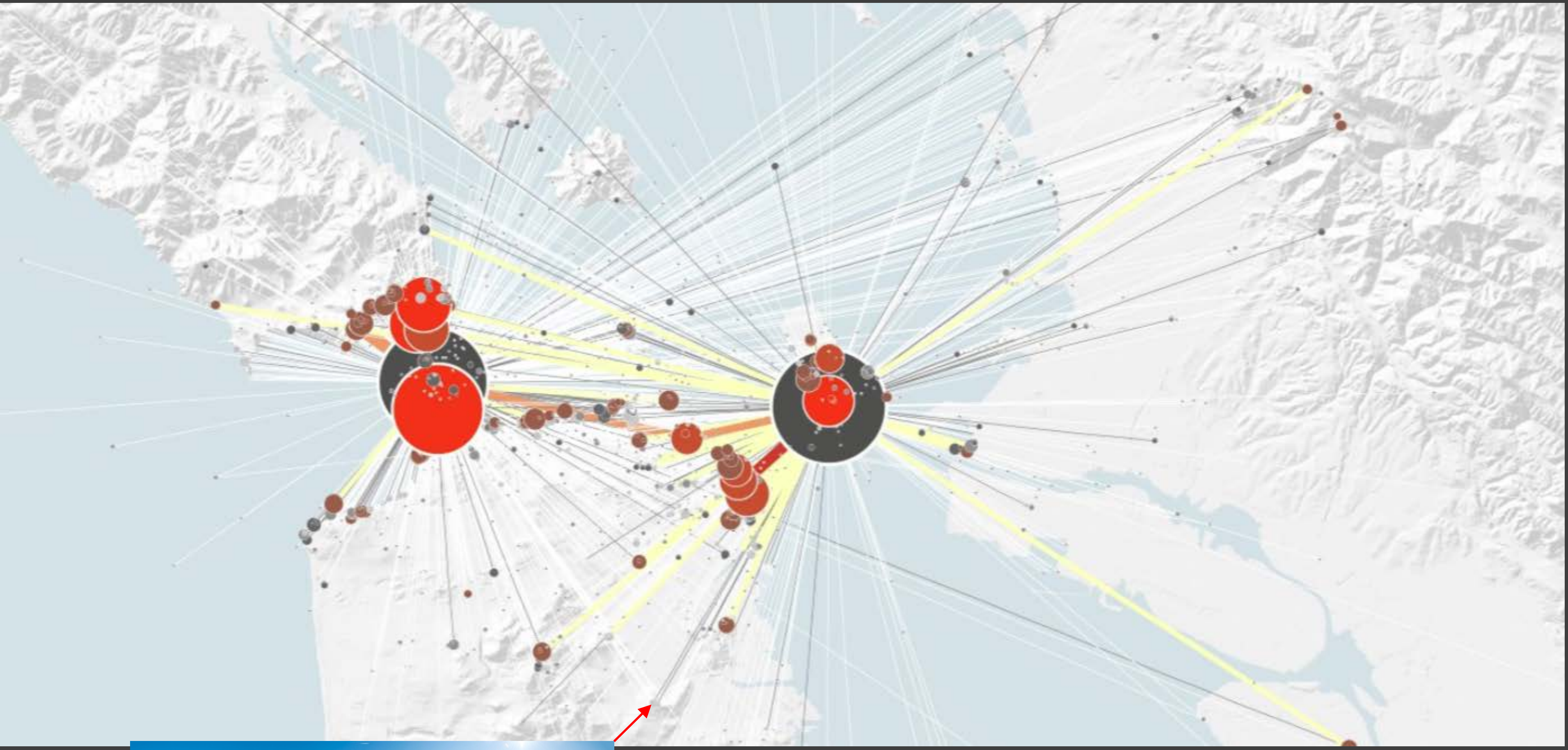

a.
ocean, california, blue, sunset, red, sea, sky, bird, colors,
sunglasses, silhouette, grey, bay, bravo, hills, albany,
sanfranciscobay, hdr, trilogy, gonewiththewind, goldengatefields,
albanyca, flopper, interestingness27, i500, explorefrontpage,
photomatrix, bonzag, p1f1, explore20
b.
red
sunset
bird
colors
silhouette
hills
blue
ocean
sea

Perception:
View from Bernal Hill, San Francisco

Dunkel (2012)

Tag Locations:

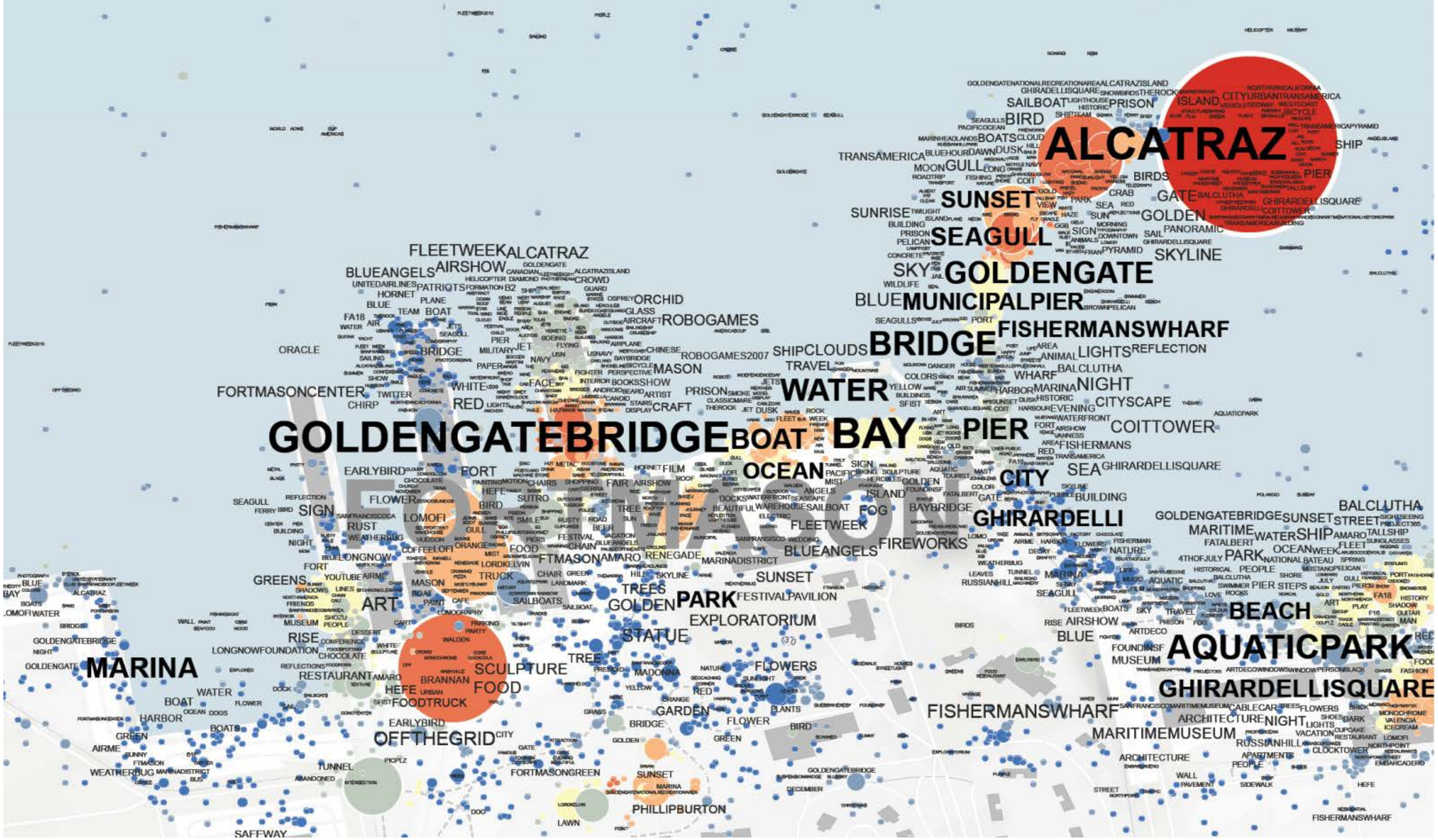
„GOLDENGATEBRIDGE“, „BAYBRIDGE“



→ **Location of Photo subjects (grey)**

→ **Location of photos/tags (red shades)**

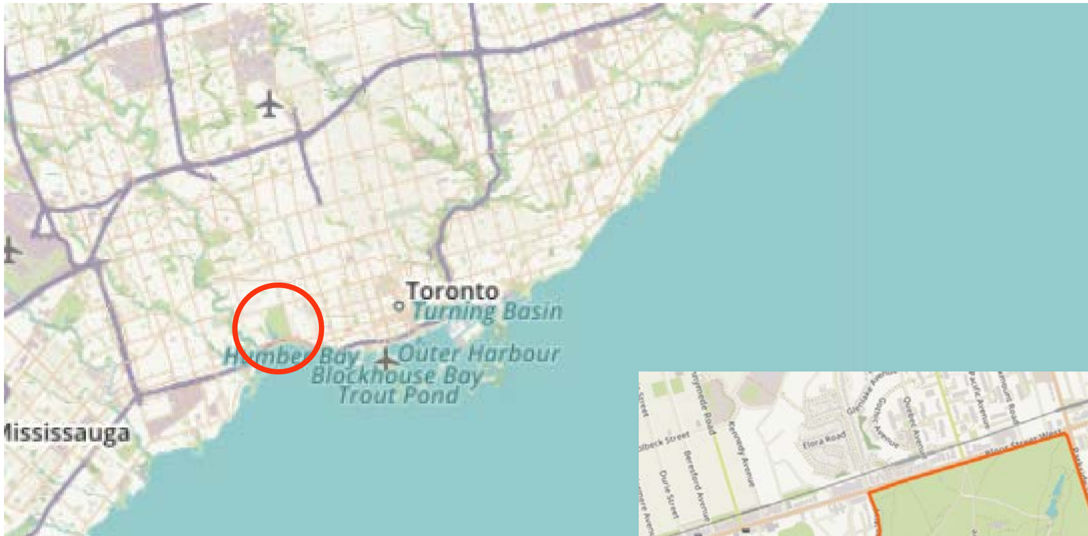
Example Tag Map: Fort Mason (San Francisco)

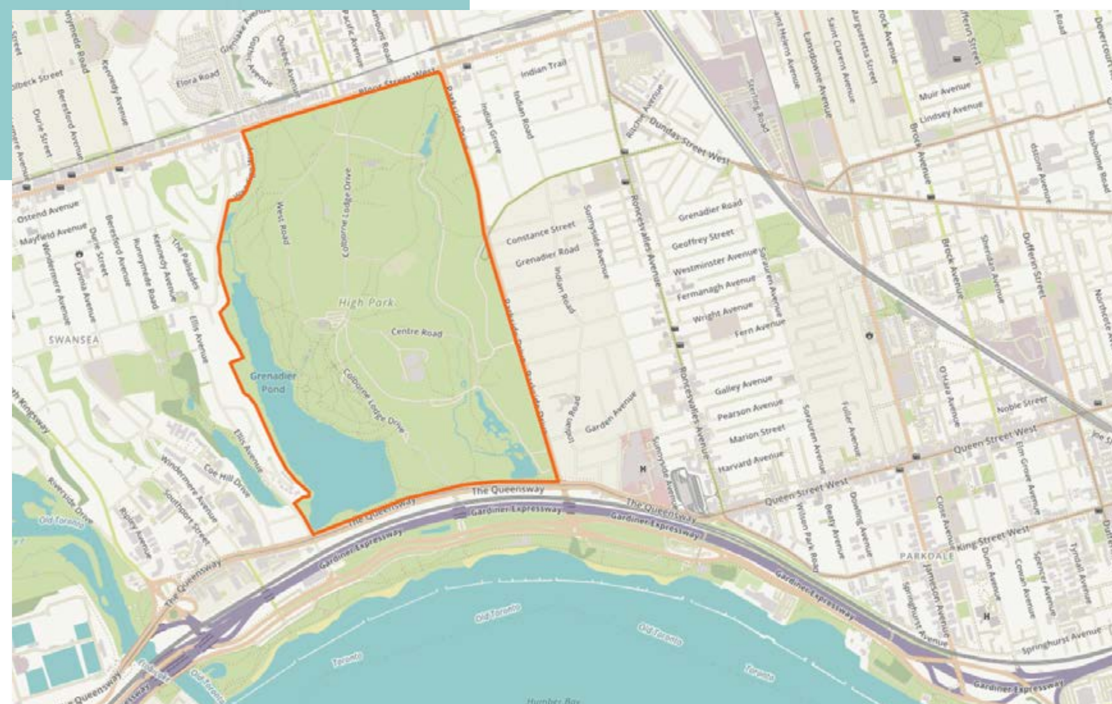


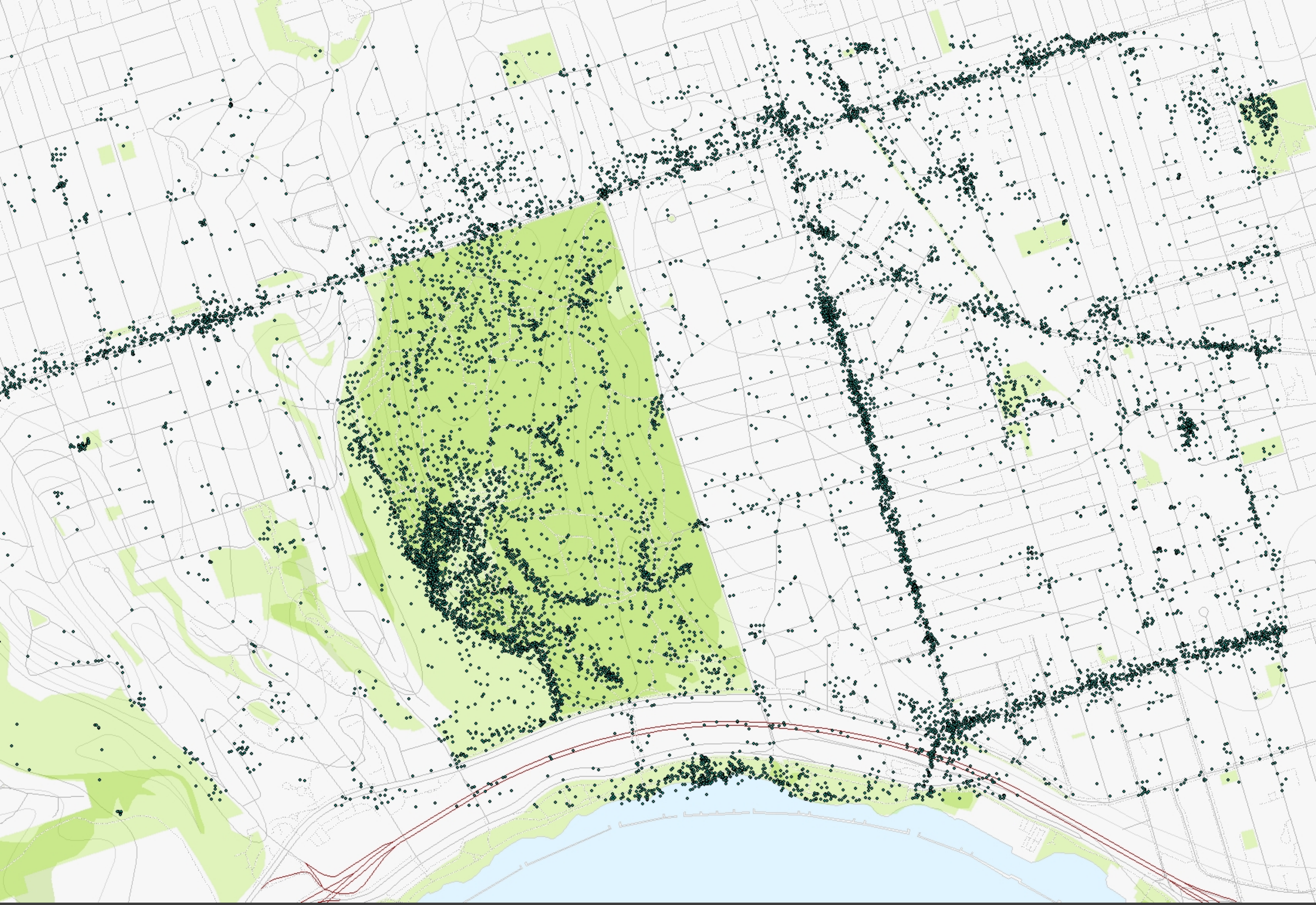
PART 2

Data processing

Example: High Park (Toronto)





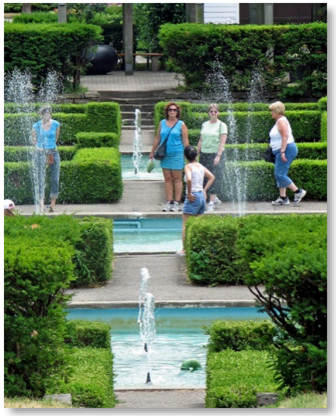


31,000 Photo Locations and 207,009 Tags

Example Photos: High Park

Flickr/ Benson Kua
(CC BY-SA 2.0)

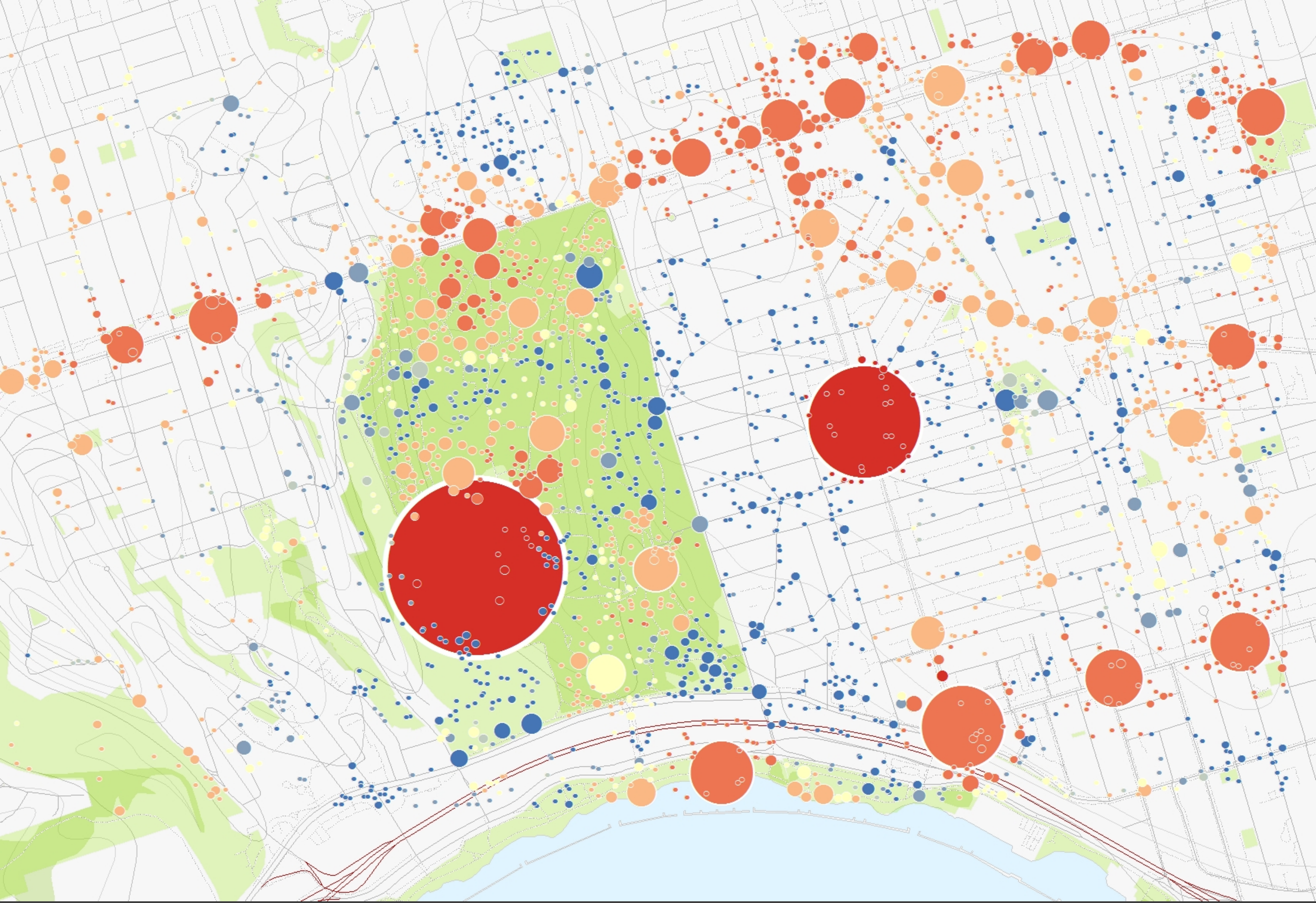
Flickr/ Kiril Strax
(CC BY-NC-SA 2.0)



Flickr/ Bobcatnorth
(CC BY-NC-SA 2.0)

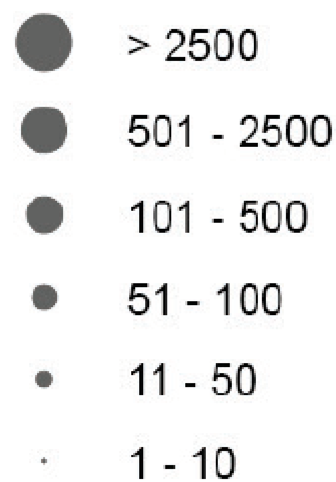
High Park Tag Map

First Layer: Photo Location Clustering

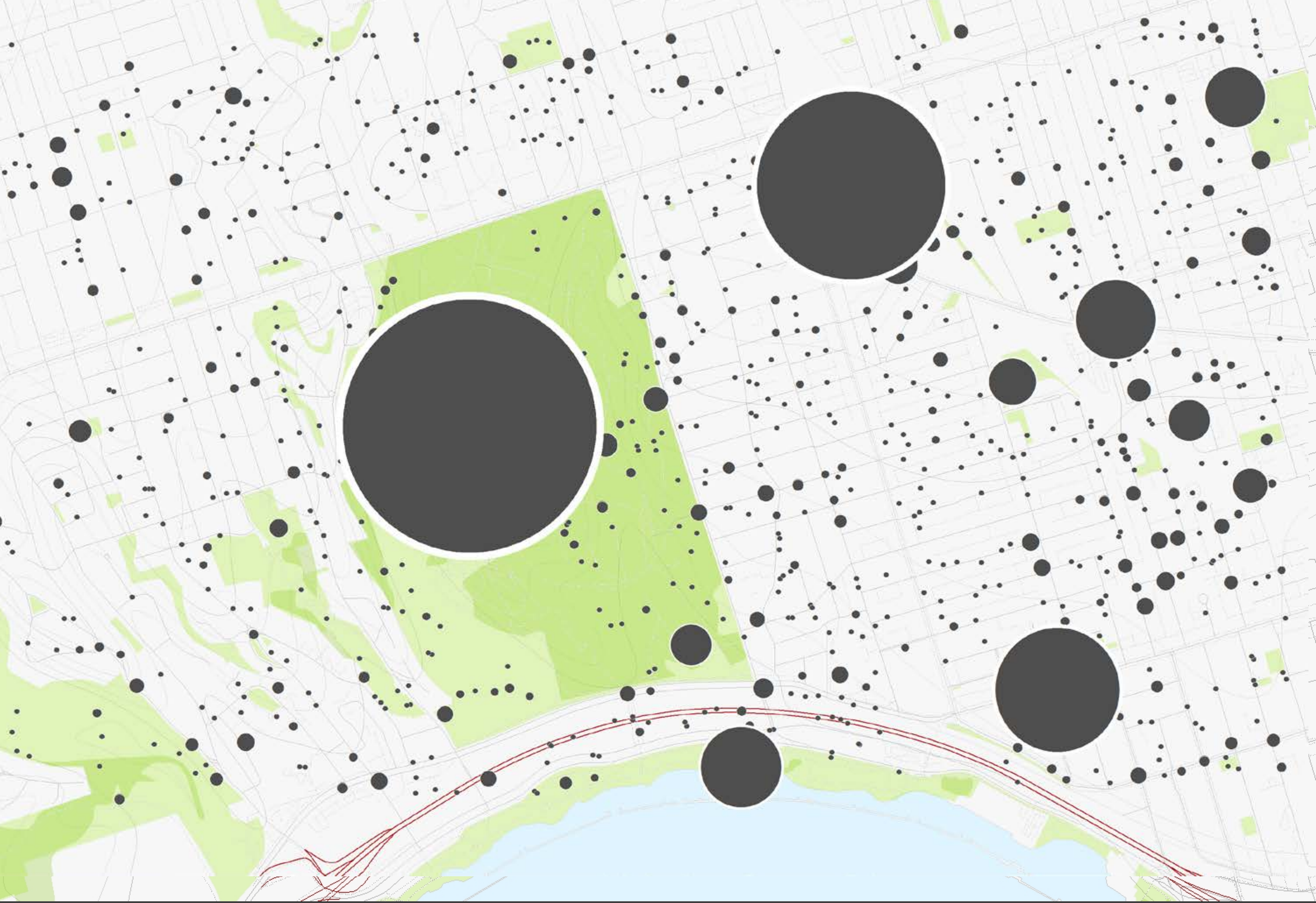


First Layer: Photo Location Clustering

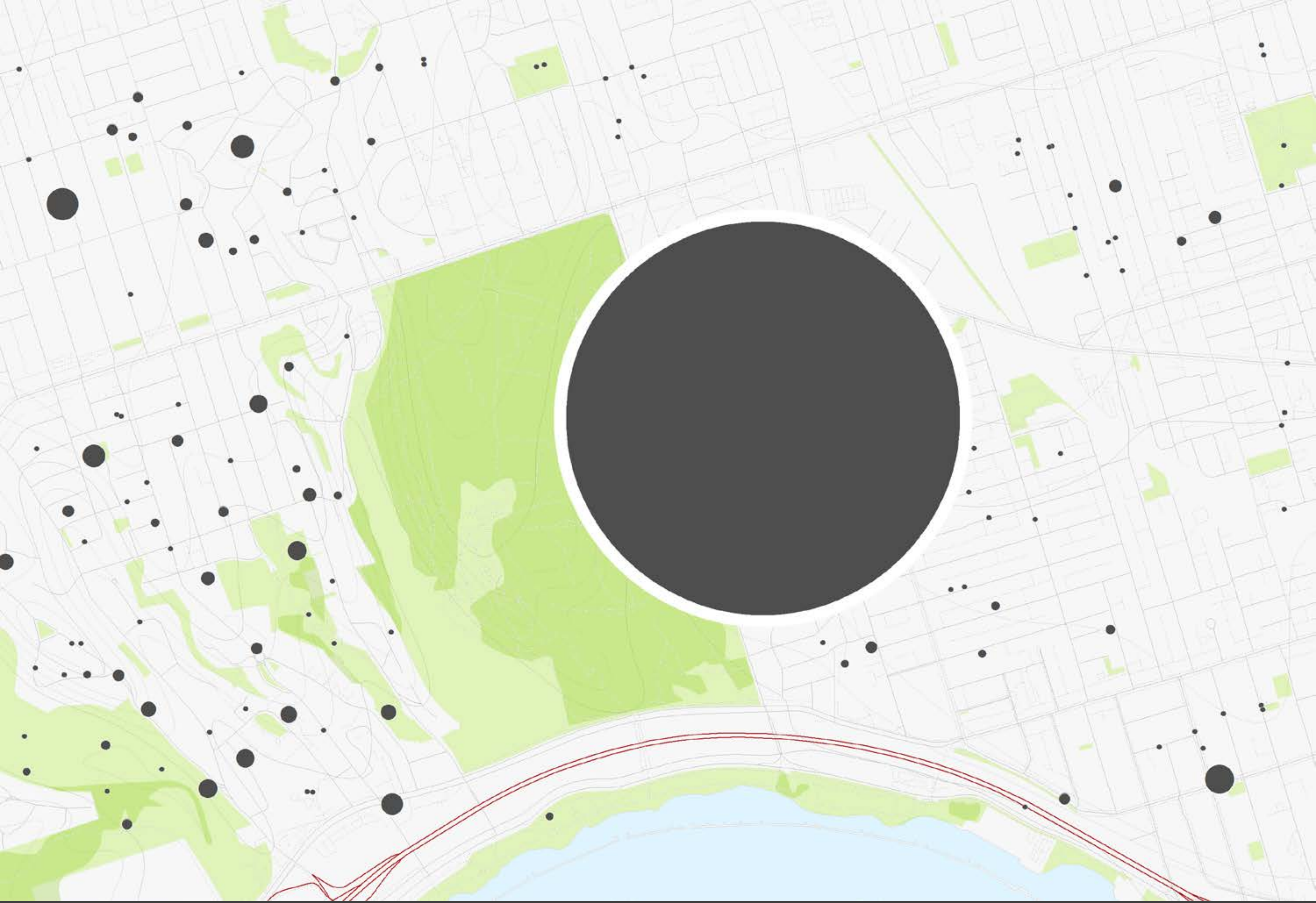
Size: Number of Photos



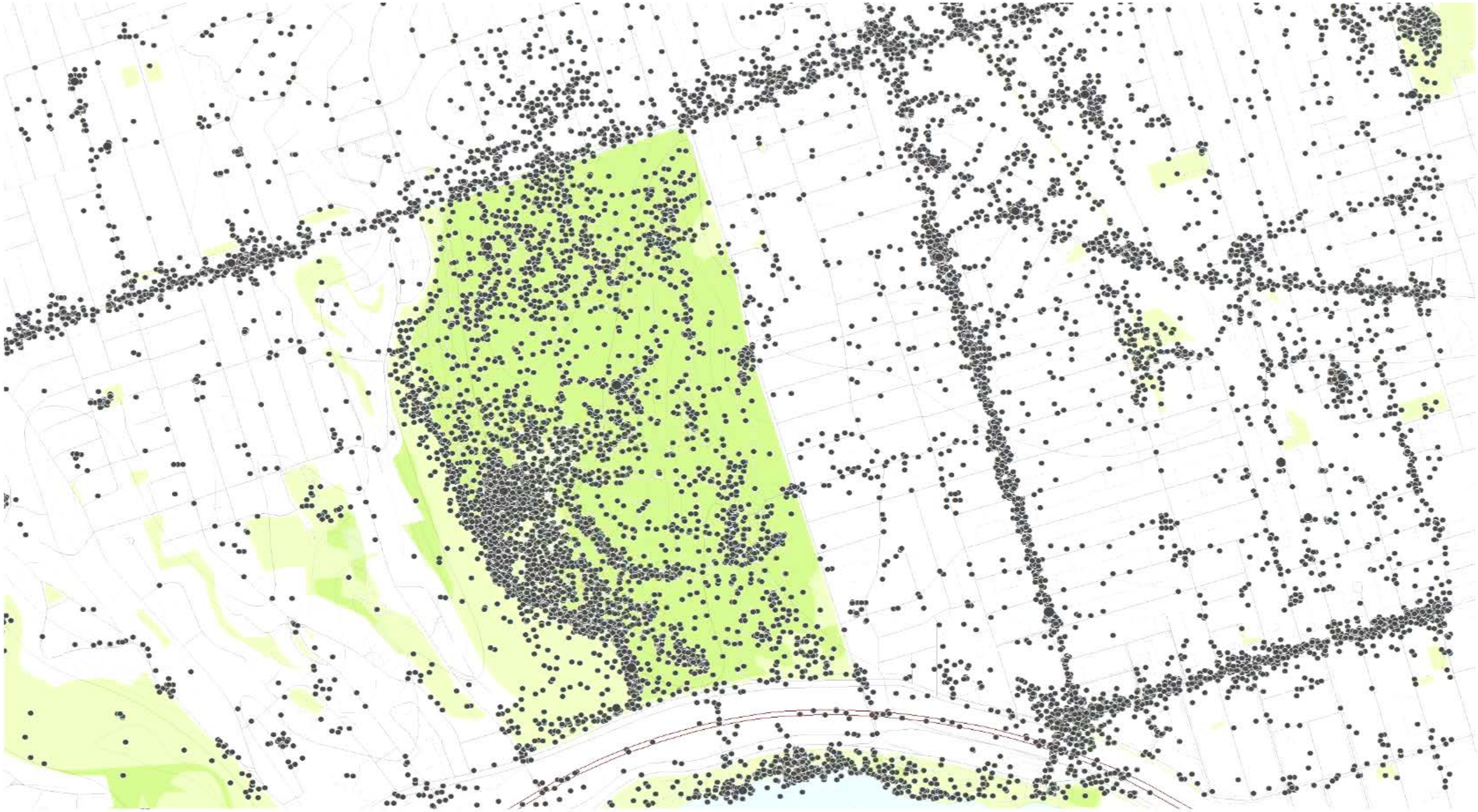
First Level Clustering: 2,800 Clusters (25m)



919 Clusters (50m)

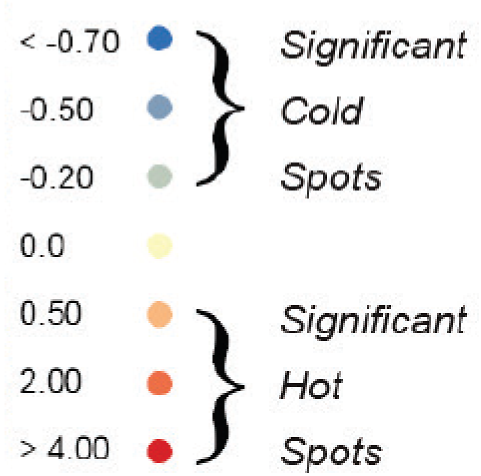


177 Clusters (100m)



CLUSTER DISTANCE: **1 m**

Color: Statistic distribution (Getis Ord GI*)



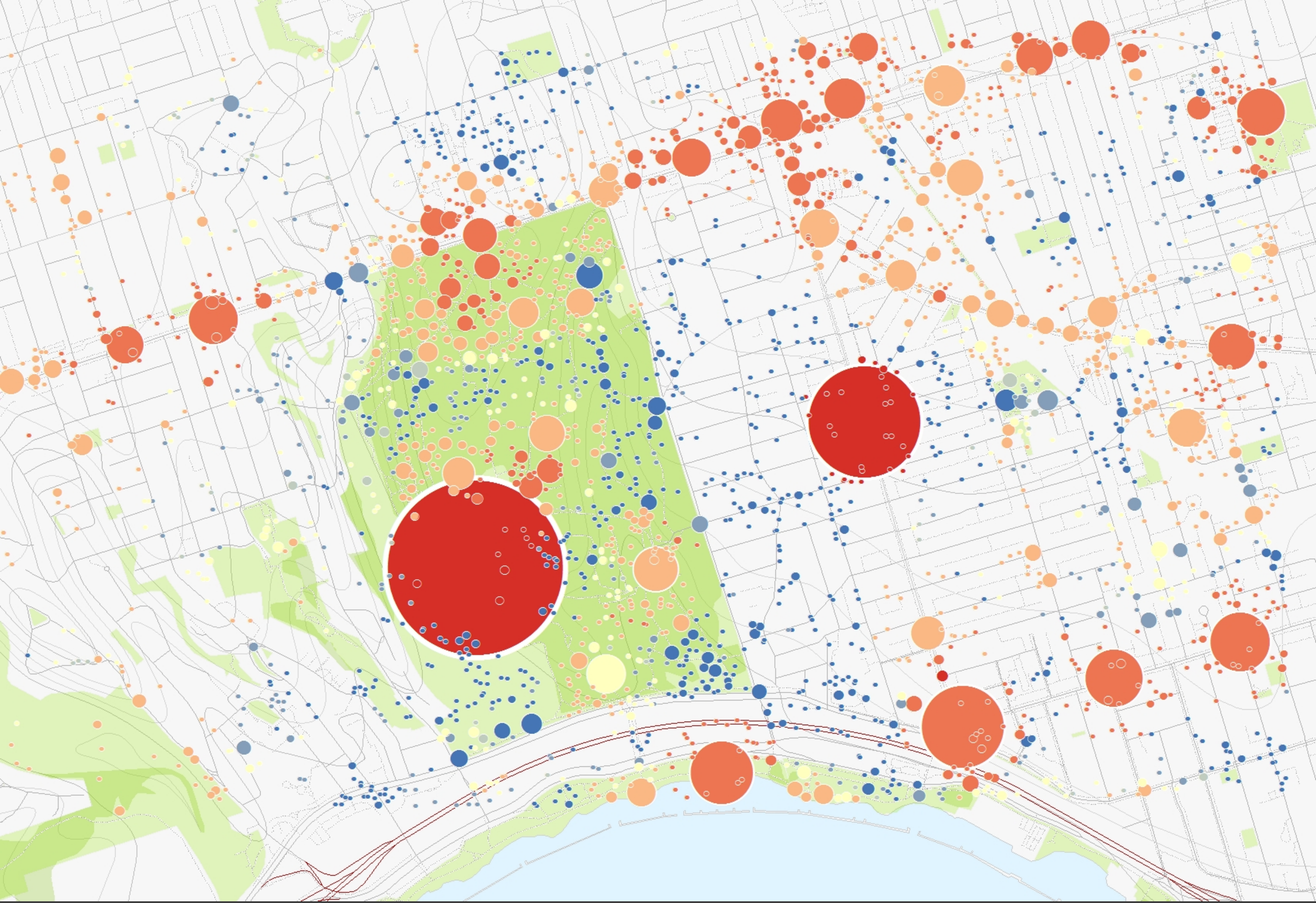
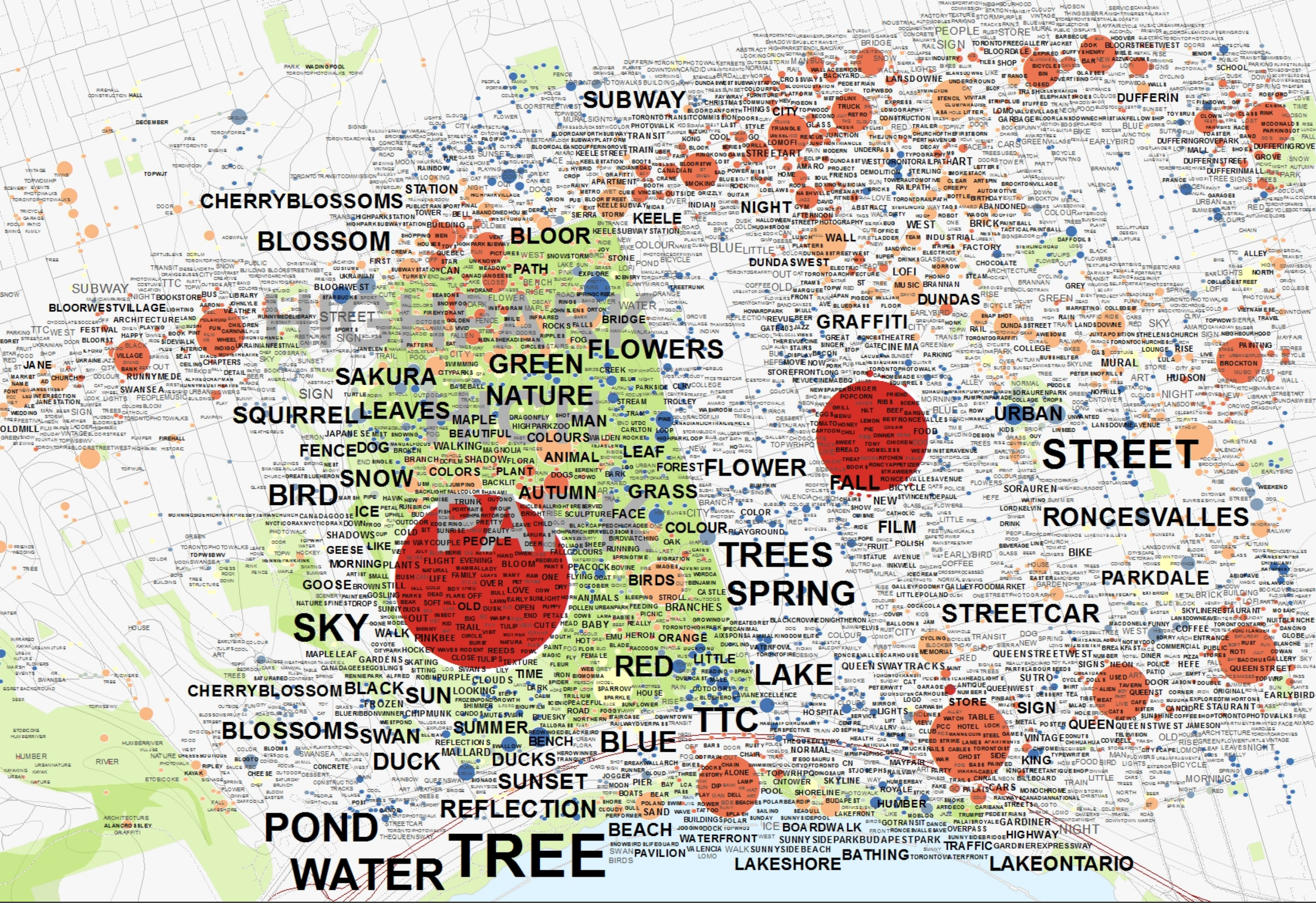


Photo Location Clustering: Cold and Hot Spots

Tag Maps

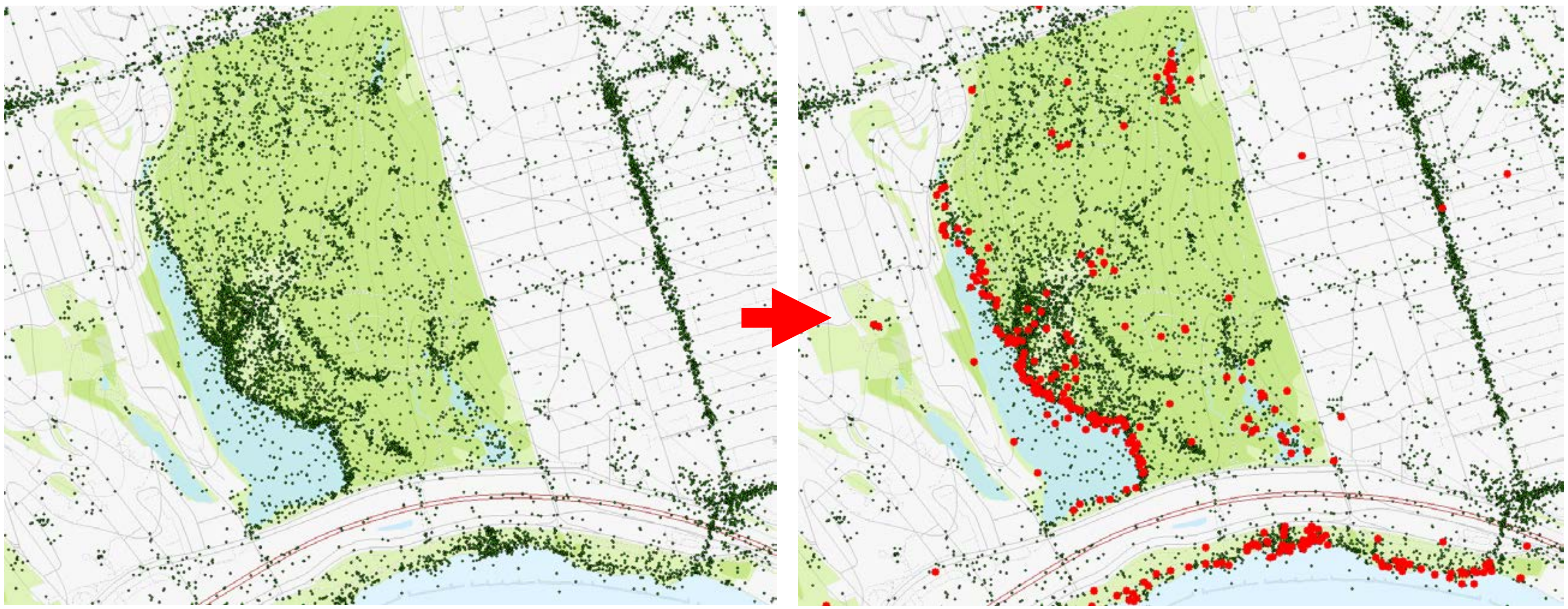
Second Layer: Tag Location Clustering



Second Layer: Tag Clustering

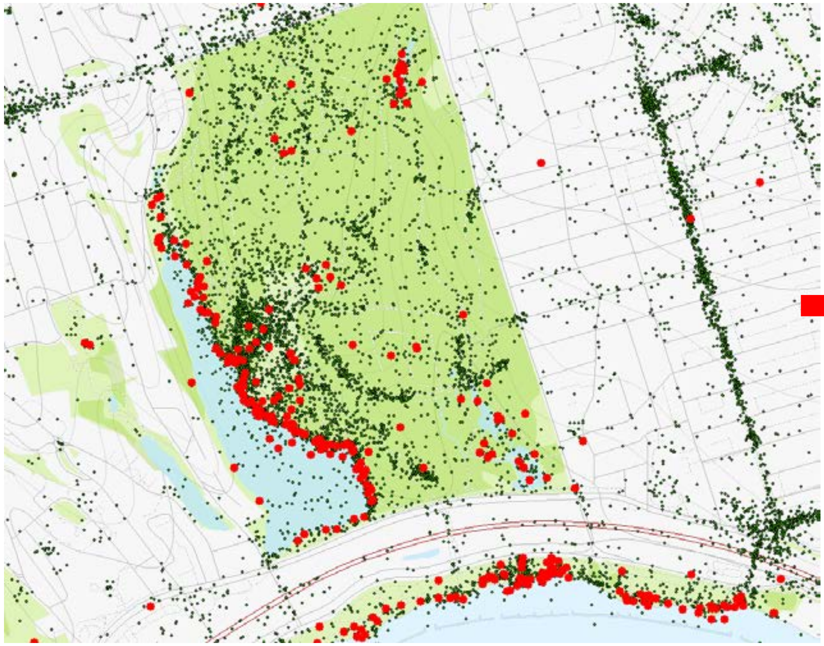
Individual Tag Selection & Clustering

Location of Photos with Tag ‘WATER’

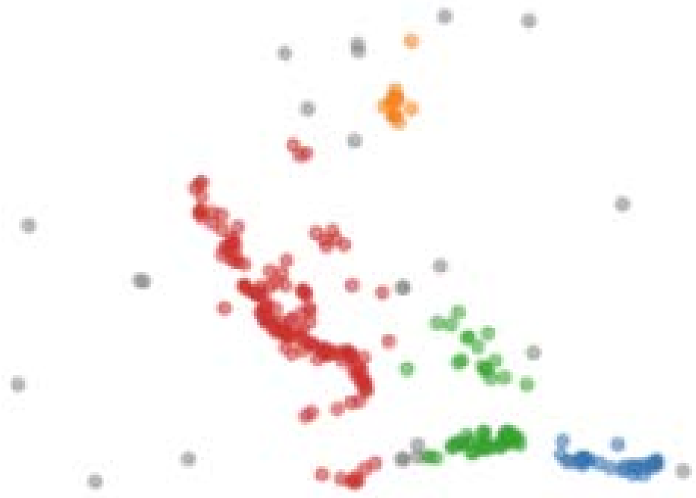


Tag Selection

Location of Photos with Tag ‘WATER’

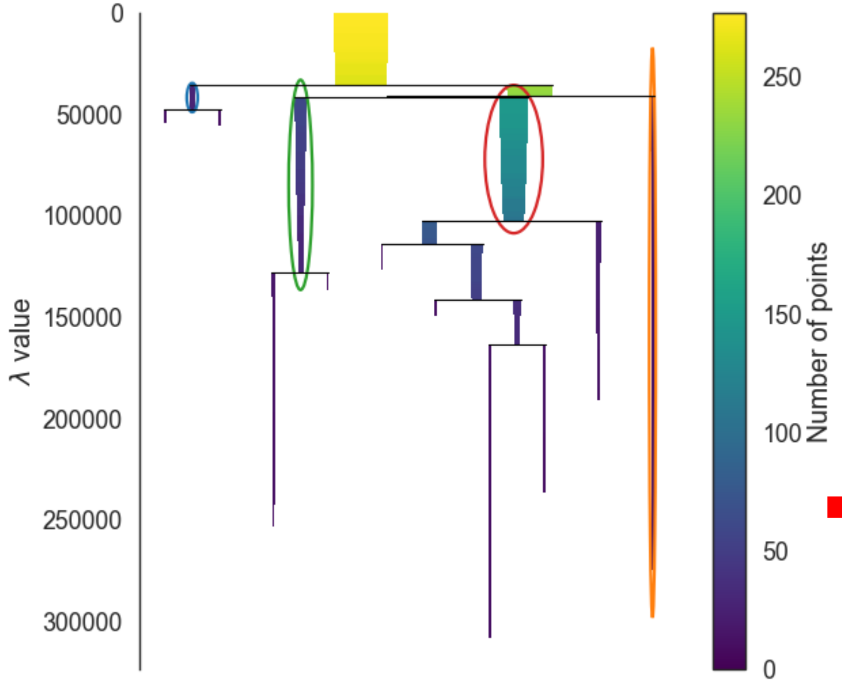


Tag Clustering

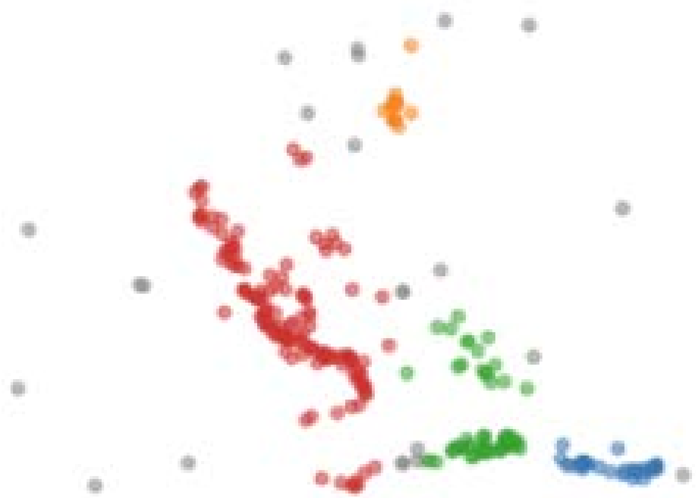


5 Clusters for Tag ‘Water’
(HDBSCAN Best Cluster Selection)

Best Cluster Selection: ‘WATER’

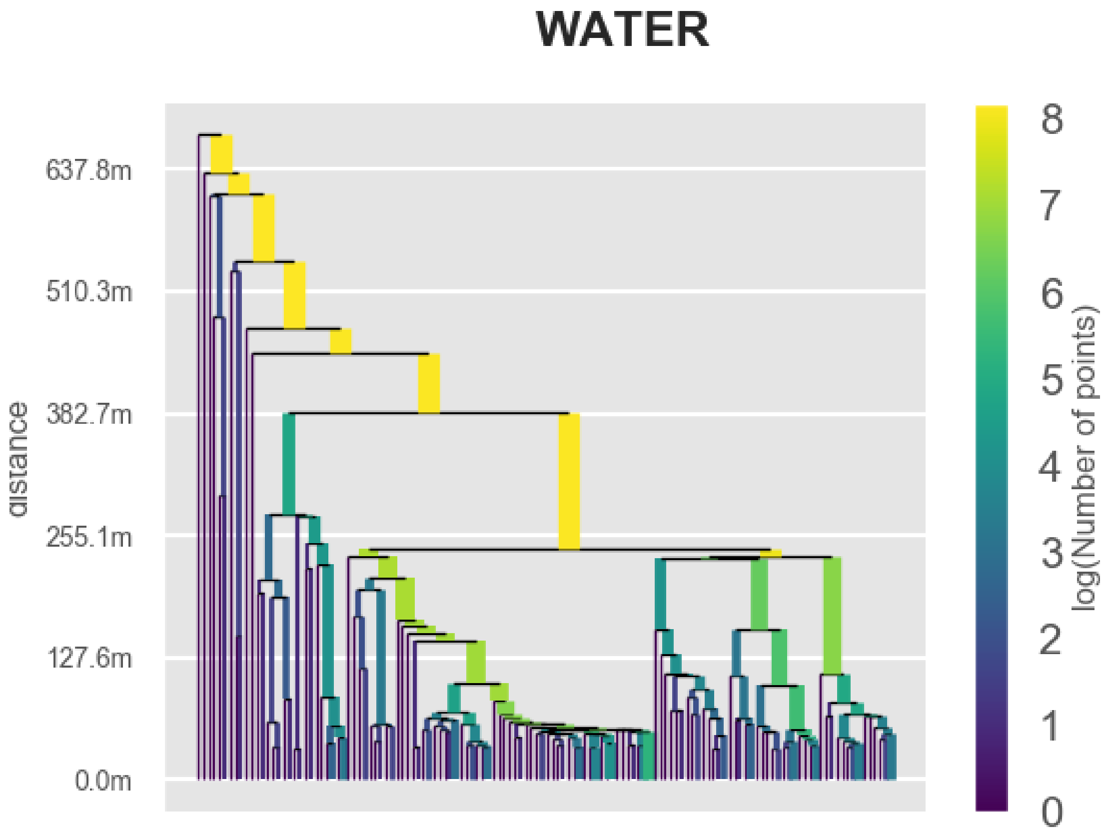


Best Cluster Selection (HDBSCAN) from Condensed Cluster Tree



5 Clusters for Tag ‘Water’

Cluster Hierarchy 'WATER'

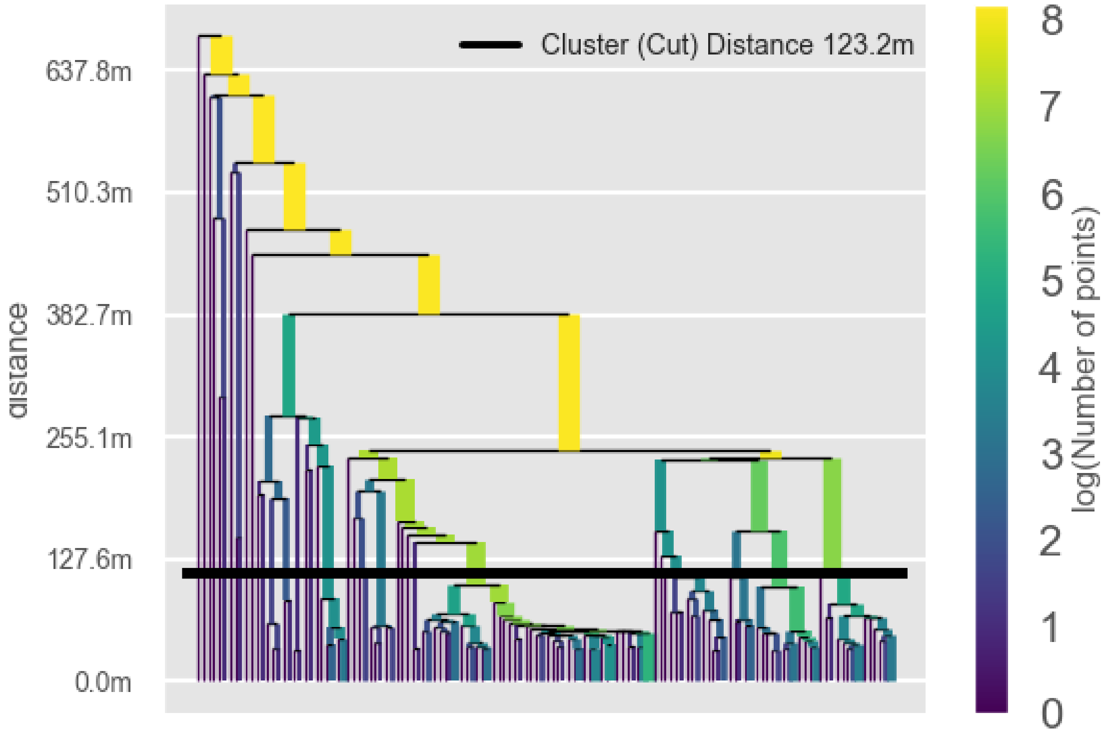


Single Linkage Tree

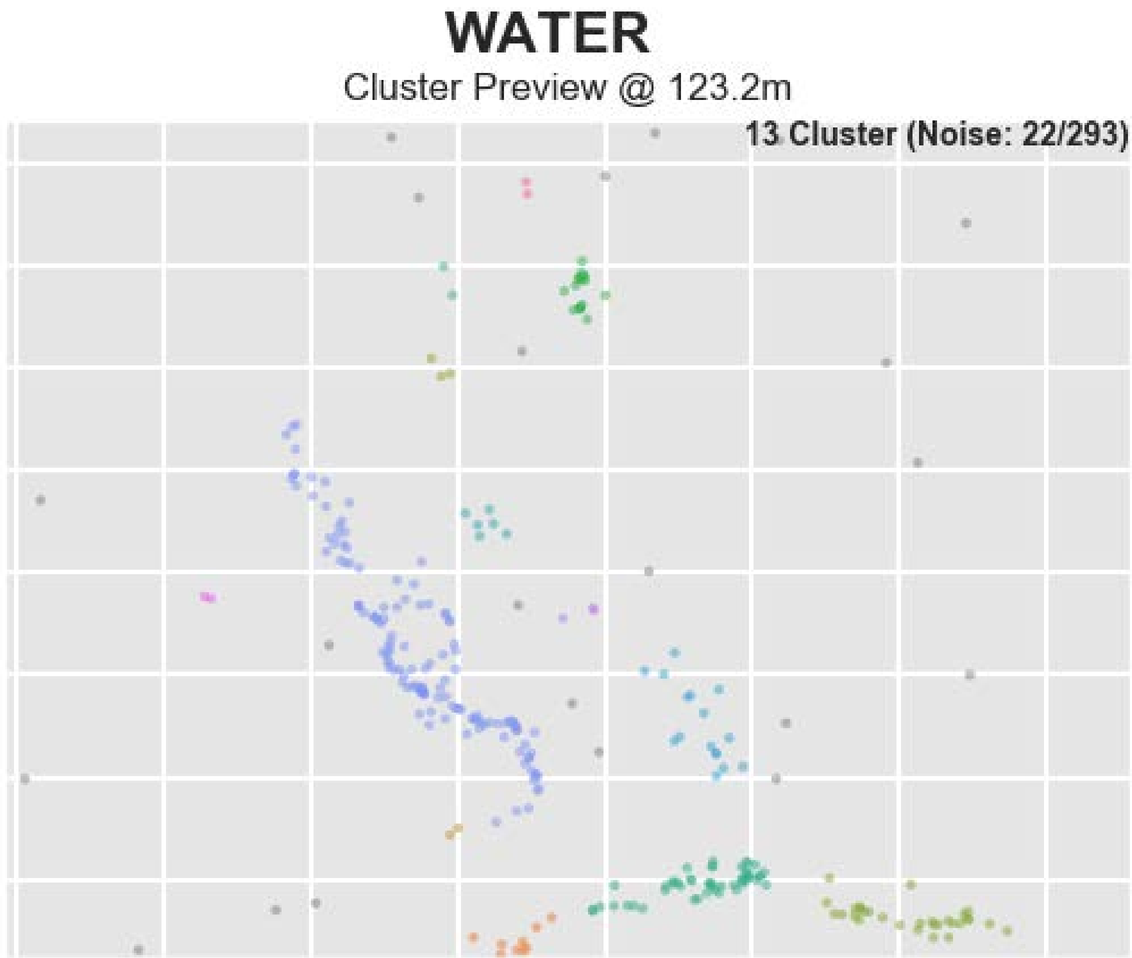
Cluster Stopping Criteria:

Cut Distance

WATER

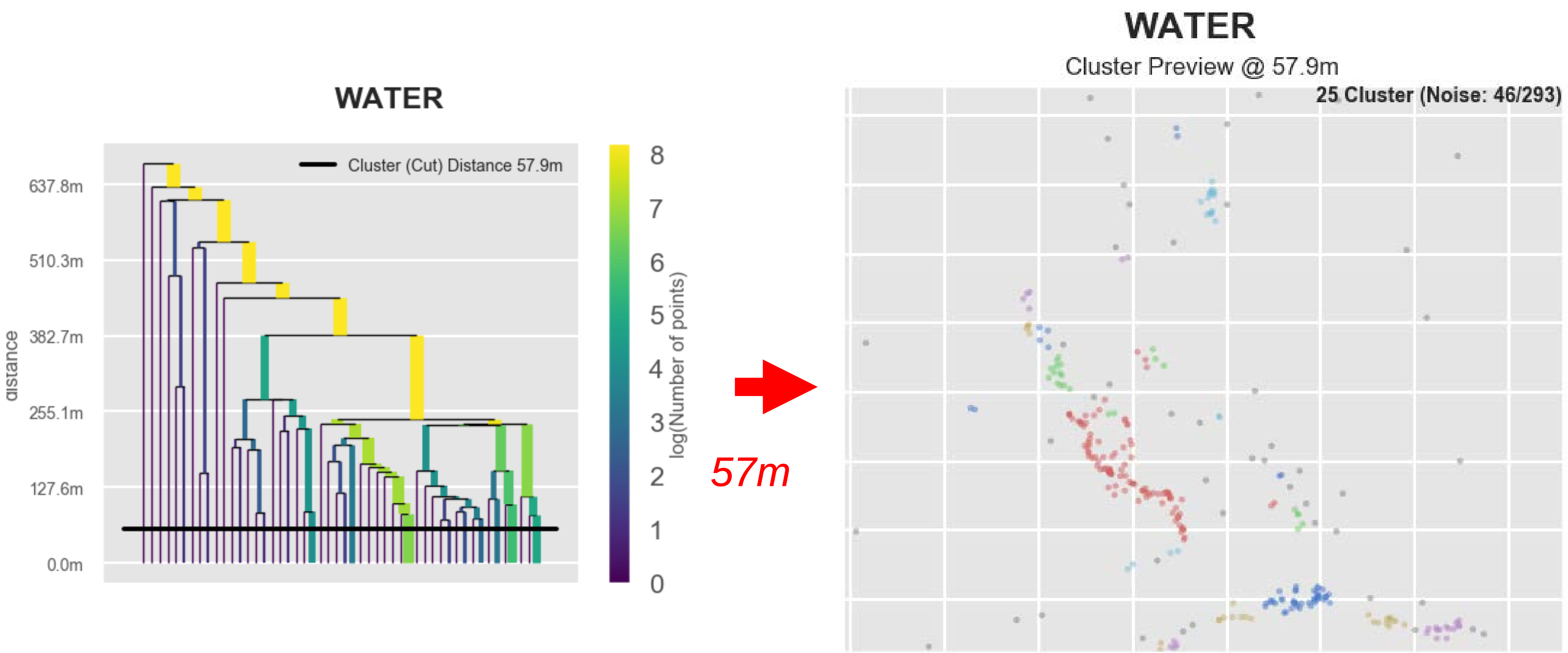


Single Linkage Tree



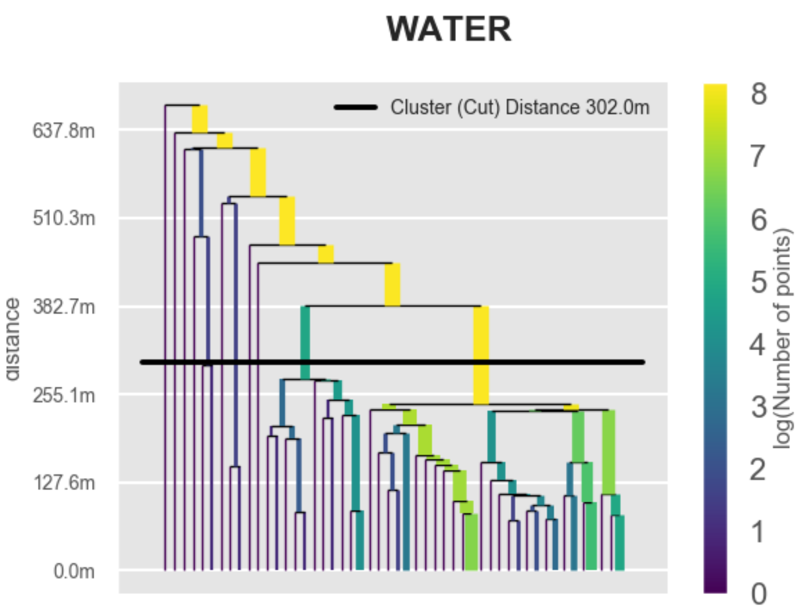
13 Clusters for Tag 'Water' (HDBSCAN Cut @ 123m)

Cluster Cut Distance

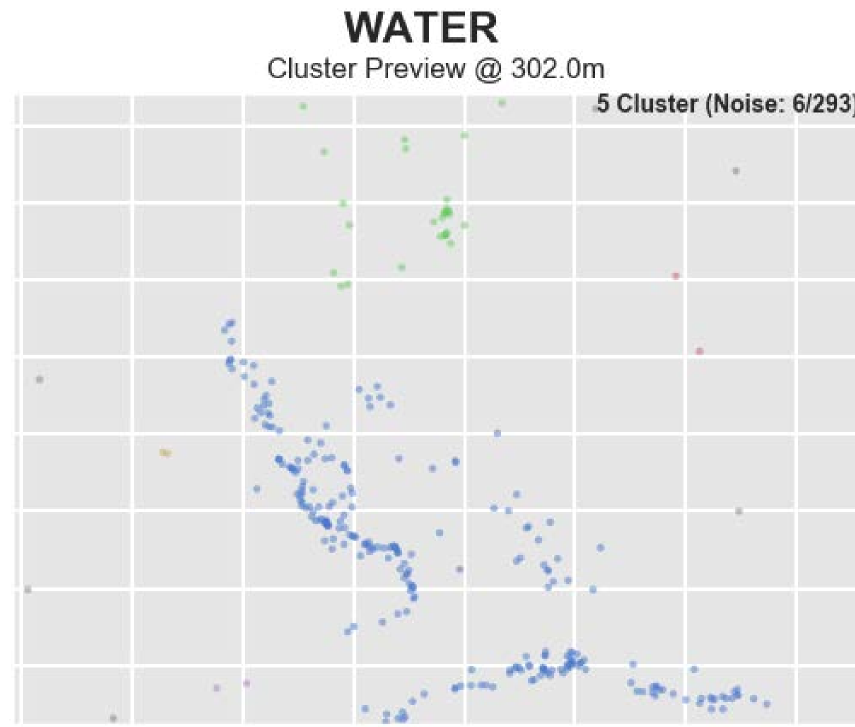


Cut Clustering at Specific Distance (123m)

Cluster Cut Distance



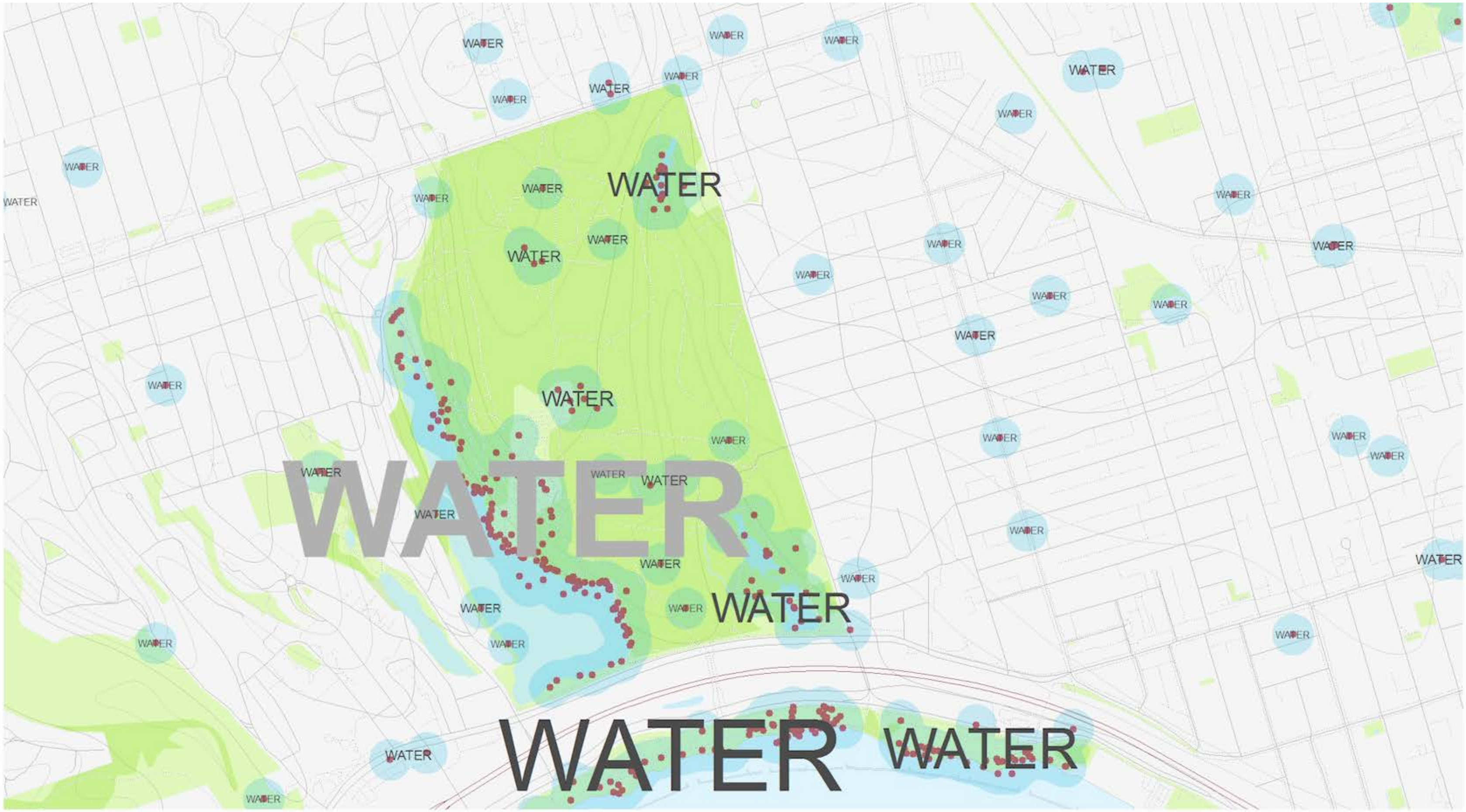
302m



Cut Clustering at Specific Distance (123m)

User Input:
Choosing the best Cluster Distance

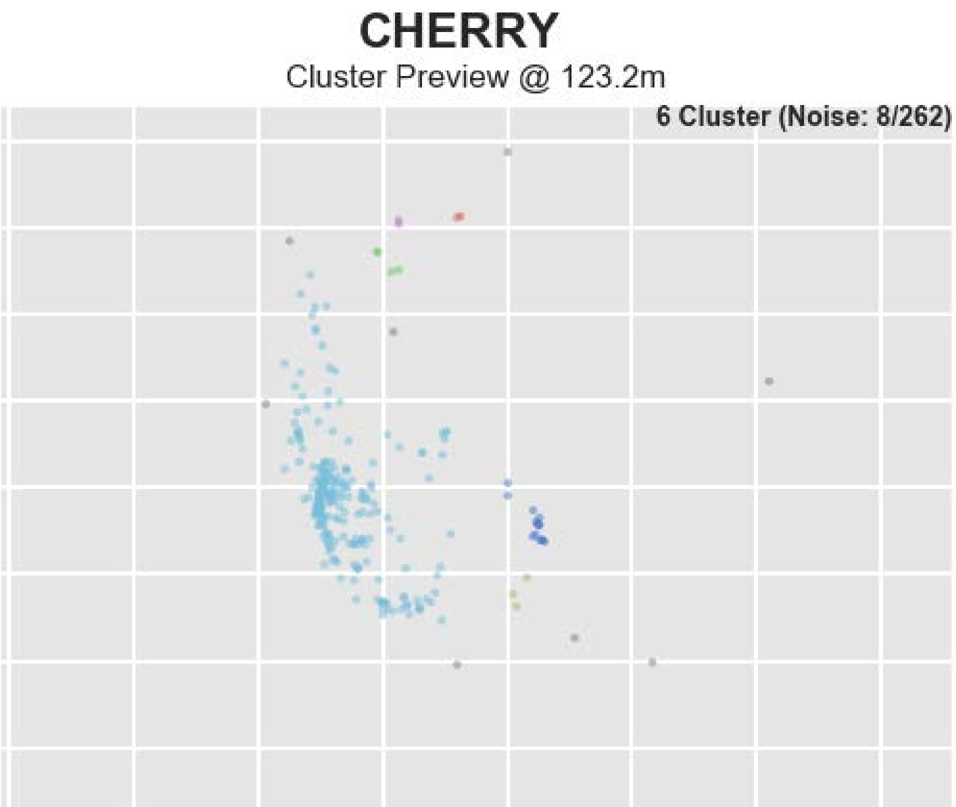
WATER

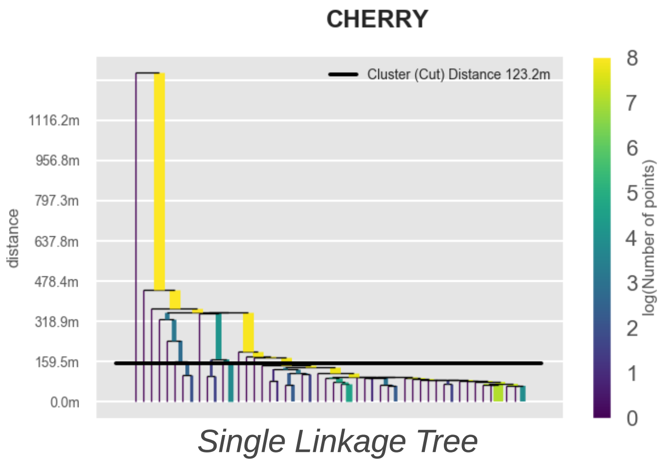


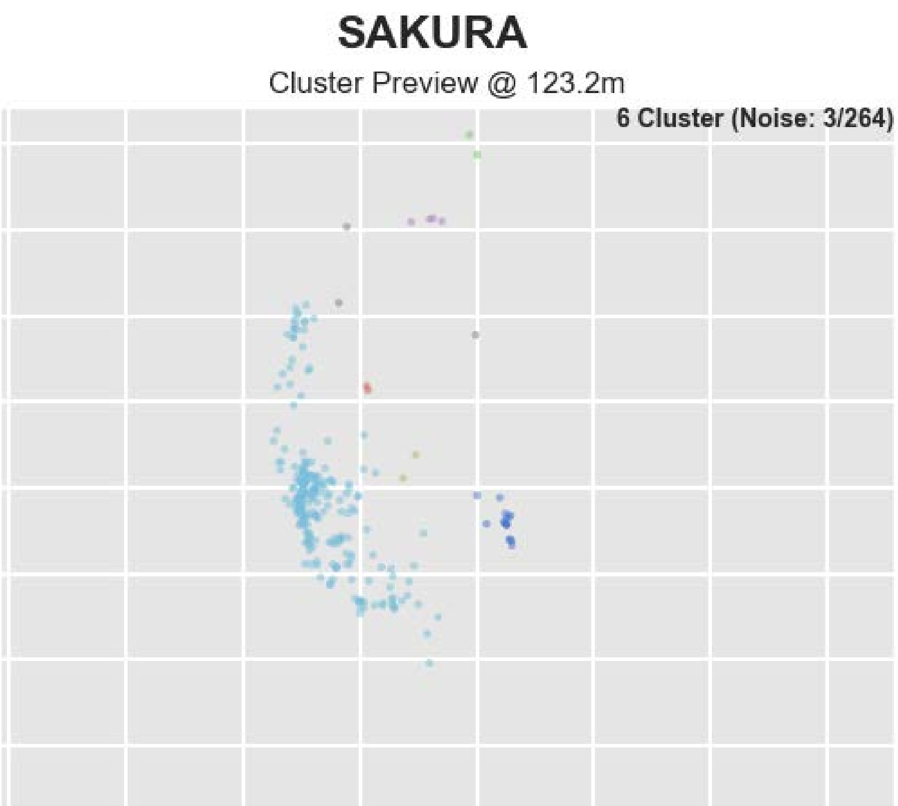
CLUSTER DISTANCE: **63 m**

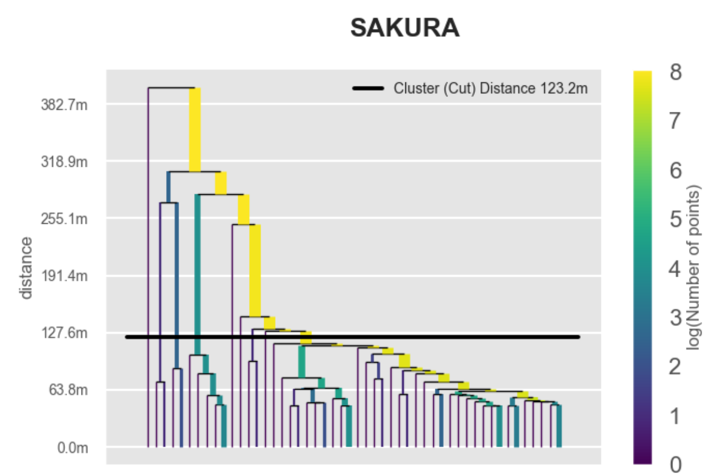
Radius x 2 = 120 m

More Tags

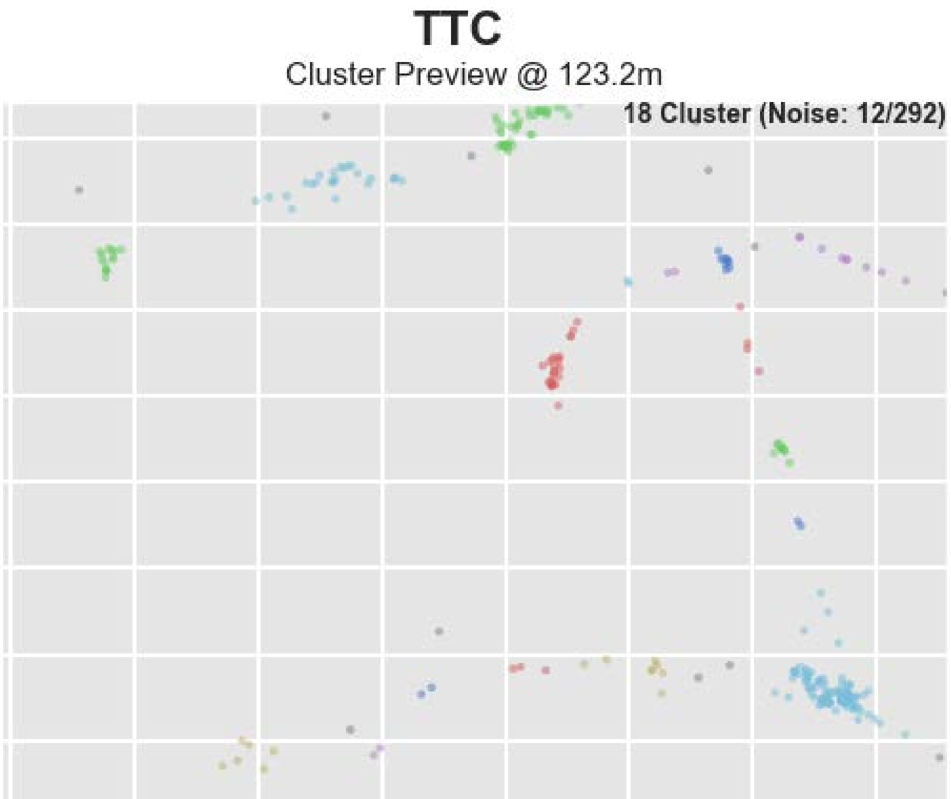

CHERRY
Cluster Preview @ 123.2m
6 Cluster (Noise: 8/262)

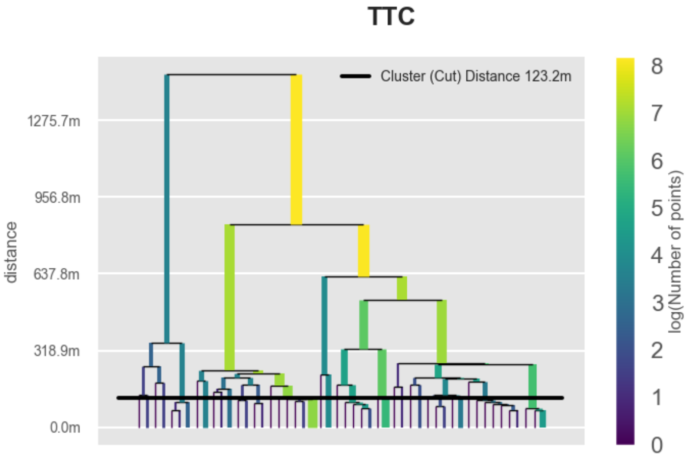

CHERRY
Cluster (Cut) Distance 123.2m
1116.2m
956.8m
797.3m
637.8m
478.4m
318.9m
159.5m
0.0m
distance
8
7
6
5
4
3
2
1
0
log(Number of points)
Single Linkage Tree





Single Linkage Tree

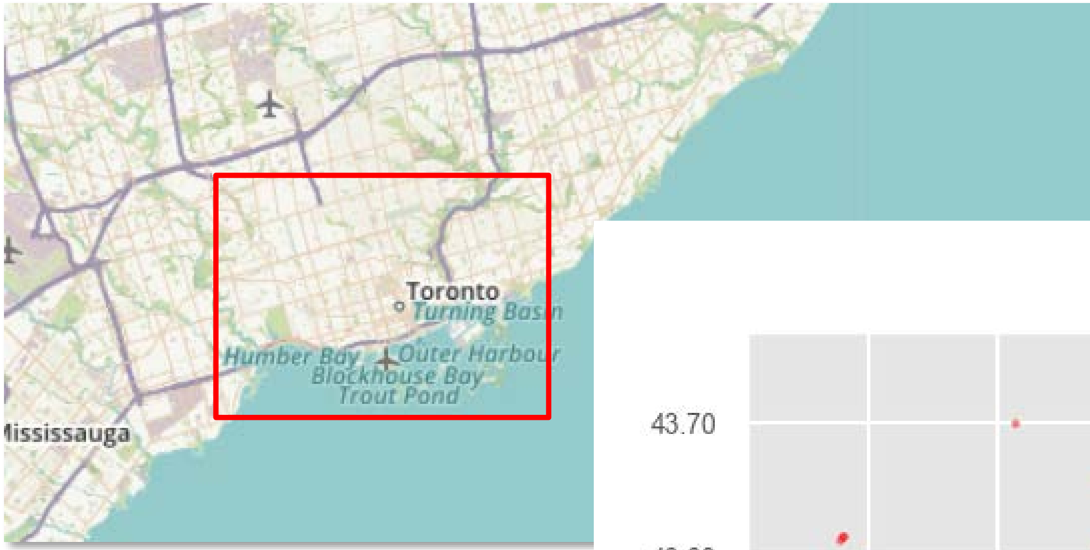


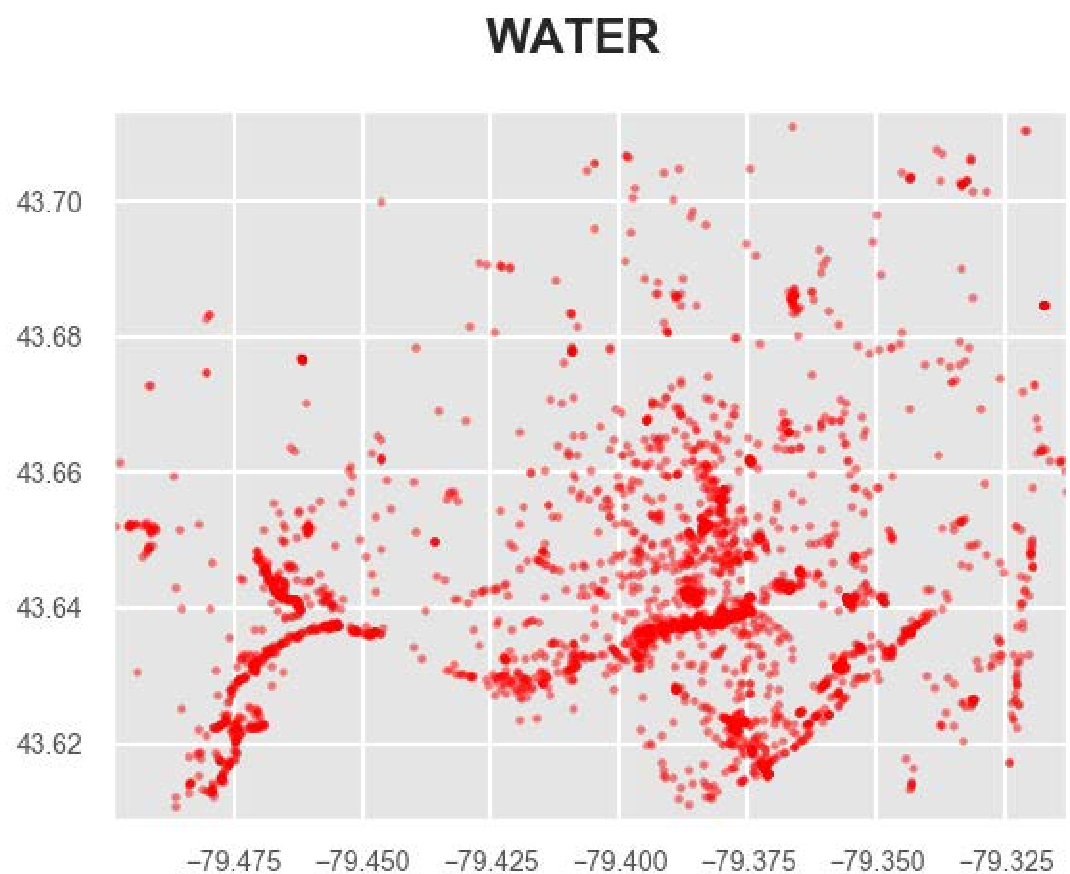


Single Linkage Tree

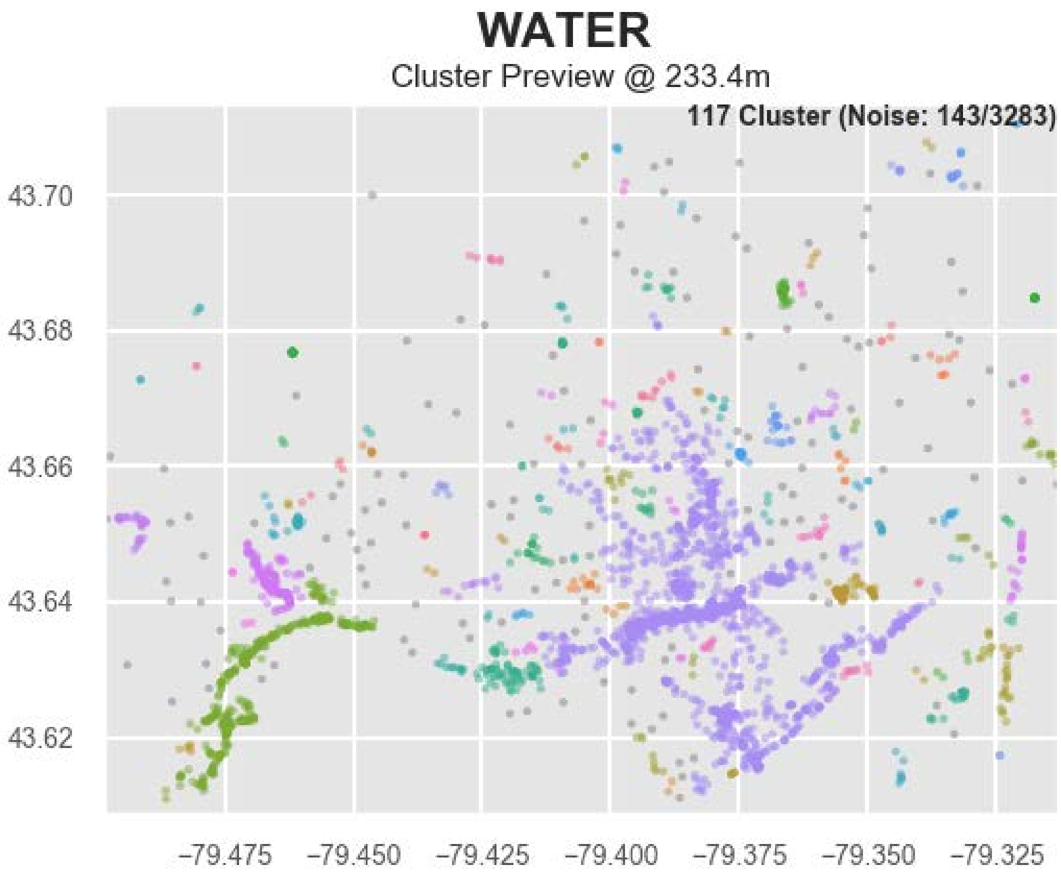
Tag Clustering at different Scales

Toronto


Toronto
Turning Basin
Humber Bay
Outer Harbour
Blockhouse Bay
Trout Pond

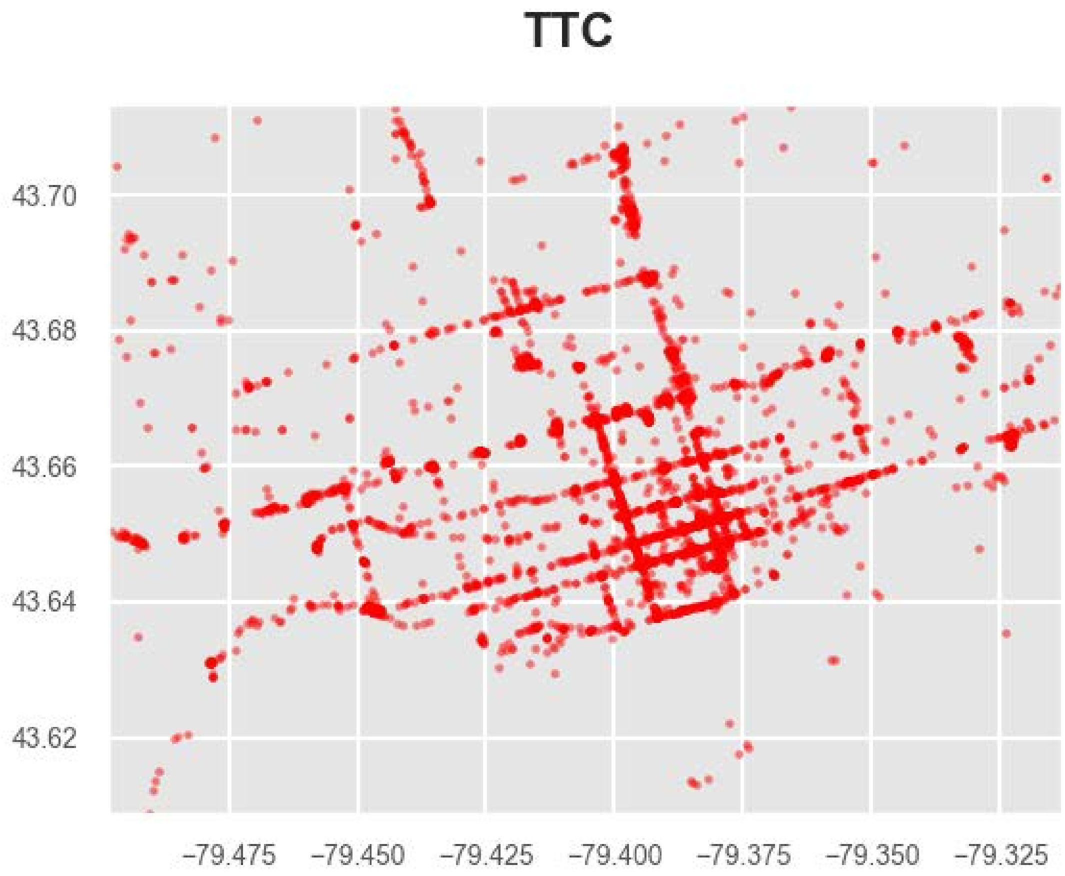

WATER
43.70
43.68
43.66
43.64
43.62
−79.475
−79.450
−79.425
−79.400
−79.375
−79.350
−79.325

Toronto



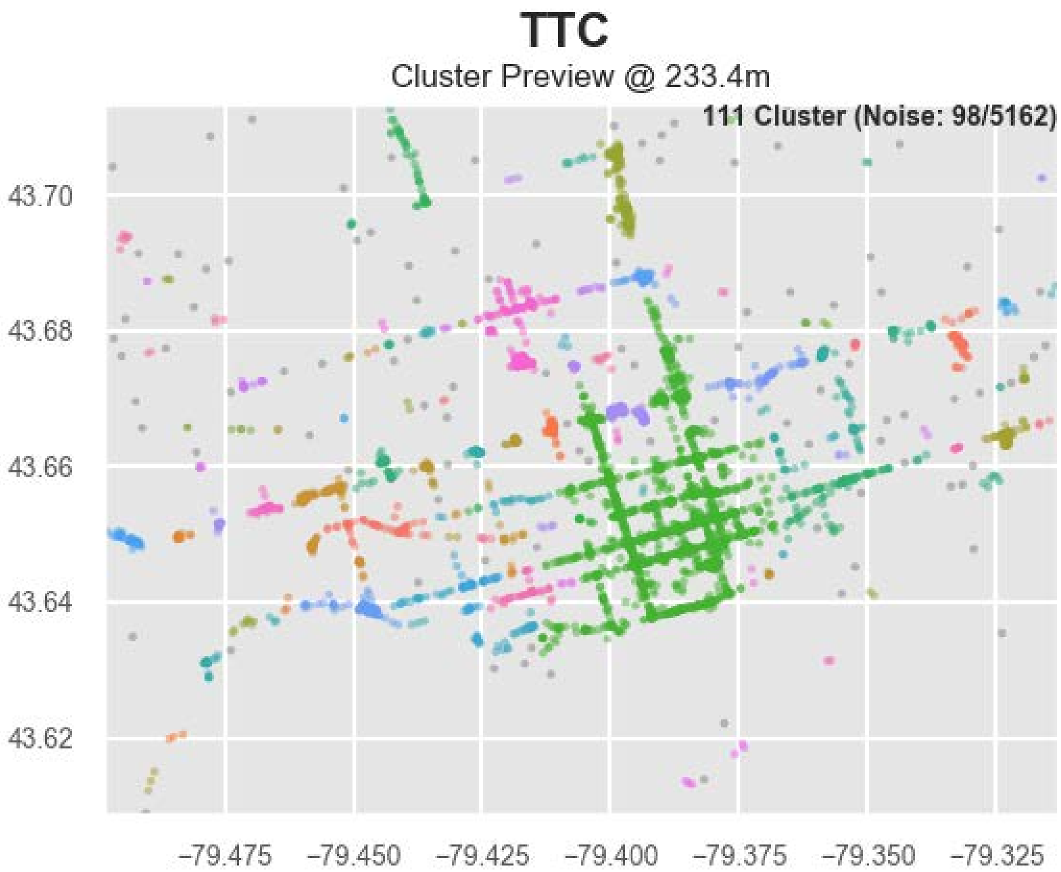
WATER
Cluster Preview @ 233.4m
117 Cluster (Noise: 143/3283)
43.70
43.68
43.66
43.64
43.62
−79.475
−79.450
−79.425
−79.400
−79.375
−79.350
−79.325

Toronto



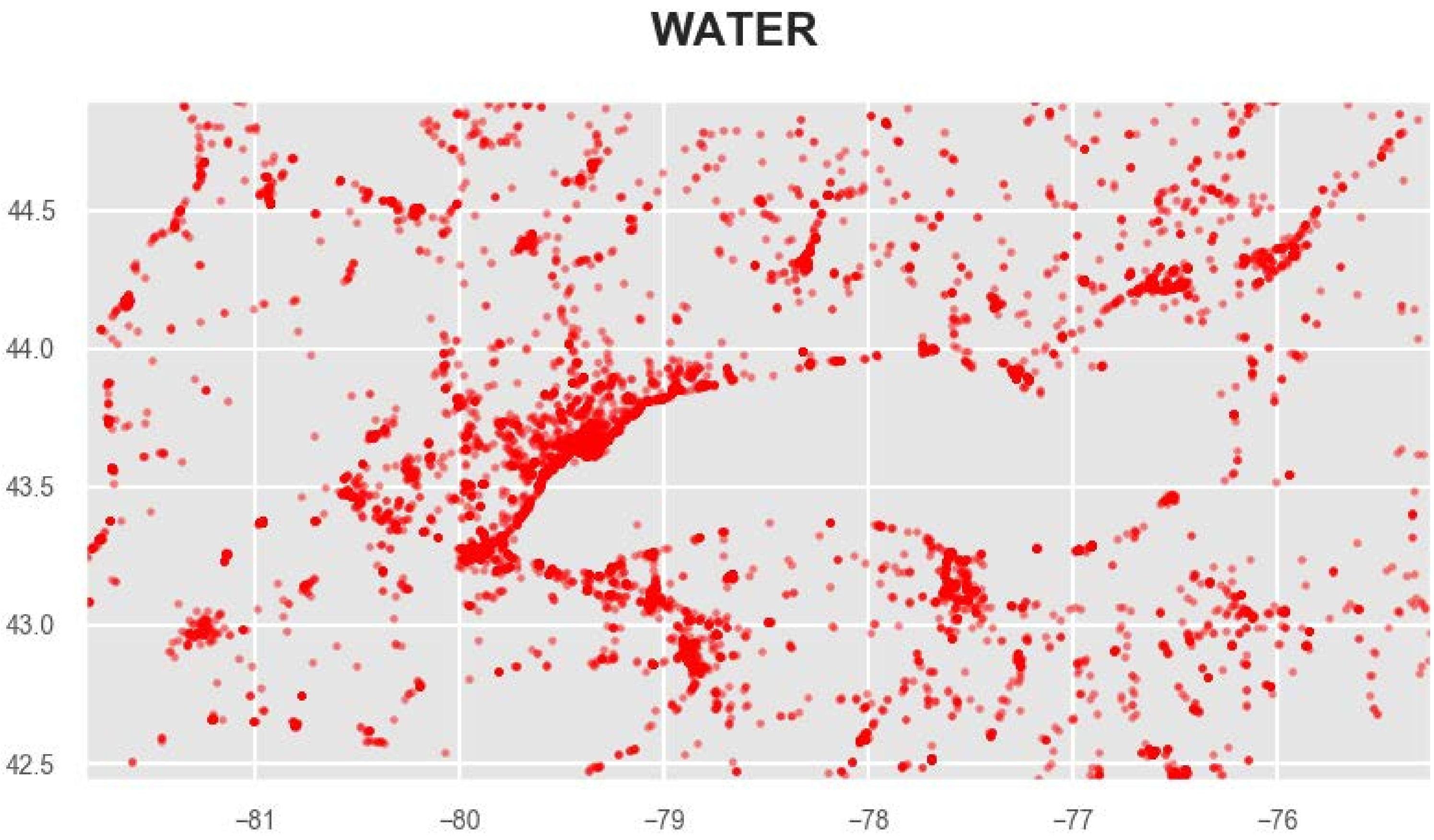
TTC
43.70
43.68
43.66
43.64
43.62
-79.475
-79.450
-79.425
-79.400
-79.375
-79.350
-79.325

Toronto

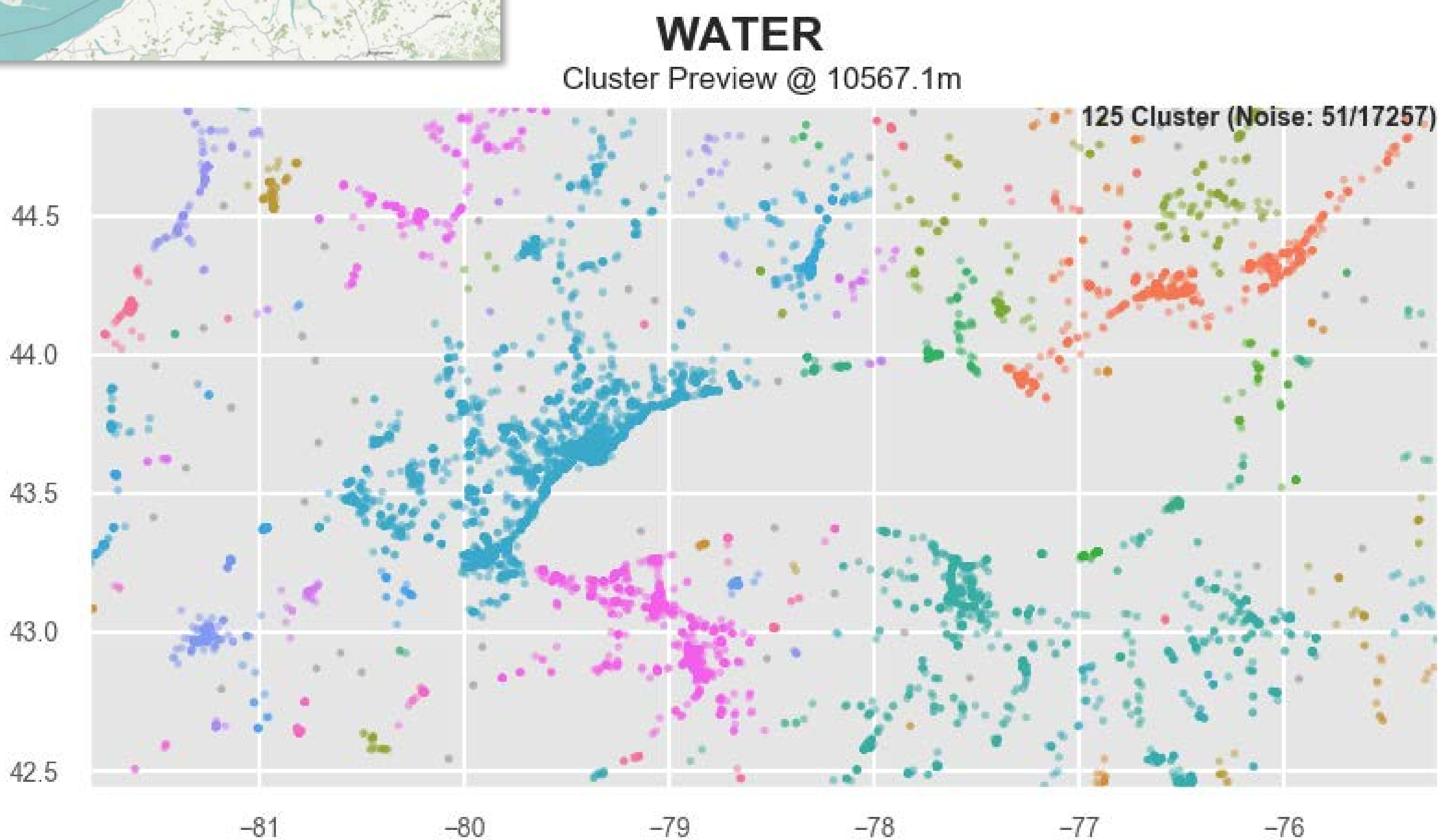


TTC
Cluster Preview @ 233.4m
111 Cluster (Noise: 98/5162)
43.70
43.68
43.66
43.64
43.62
−79.475
−79.450
−79.425
−79.400
−79.375
−79.350
−79.325

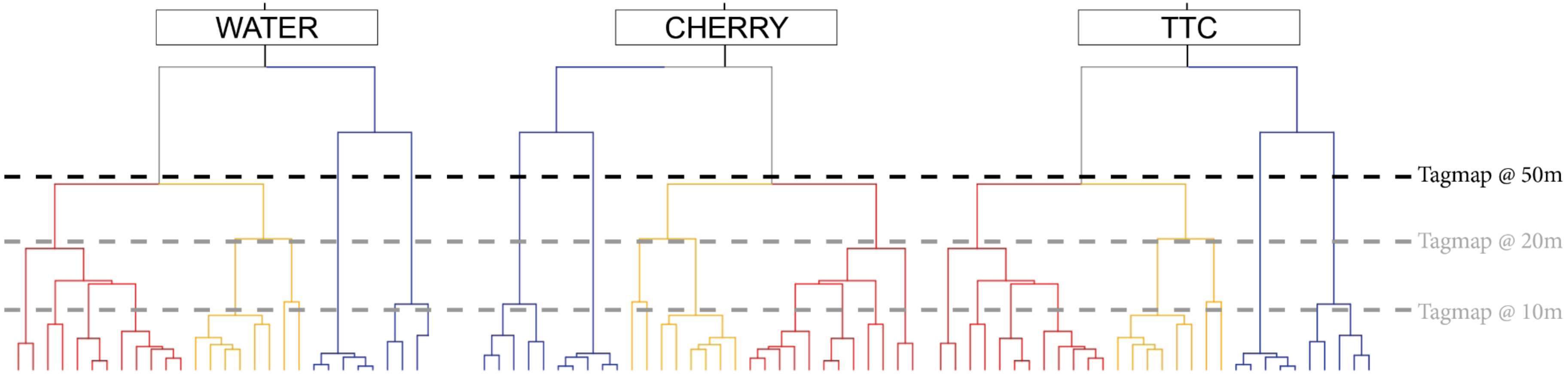
Lake Ontario & Greater Toronto Area



Lake Ontario & Greater Toronto Area



Scale Dependency of Tag Maps



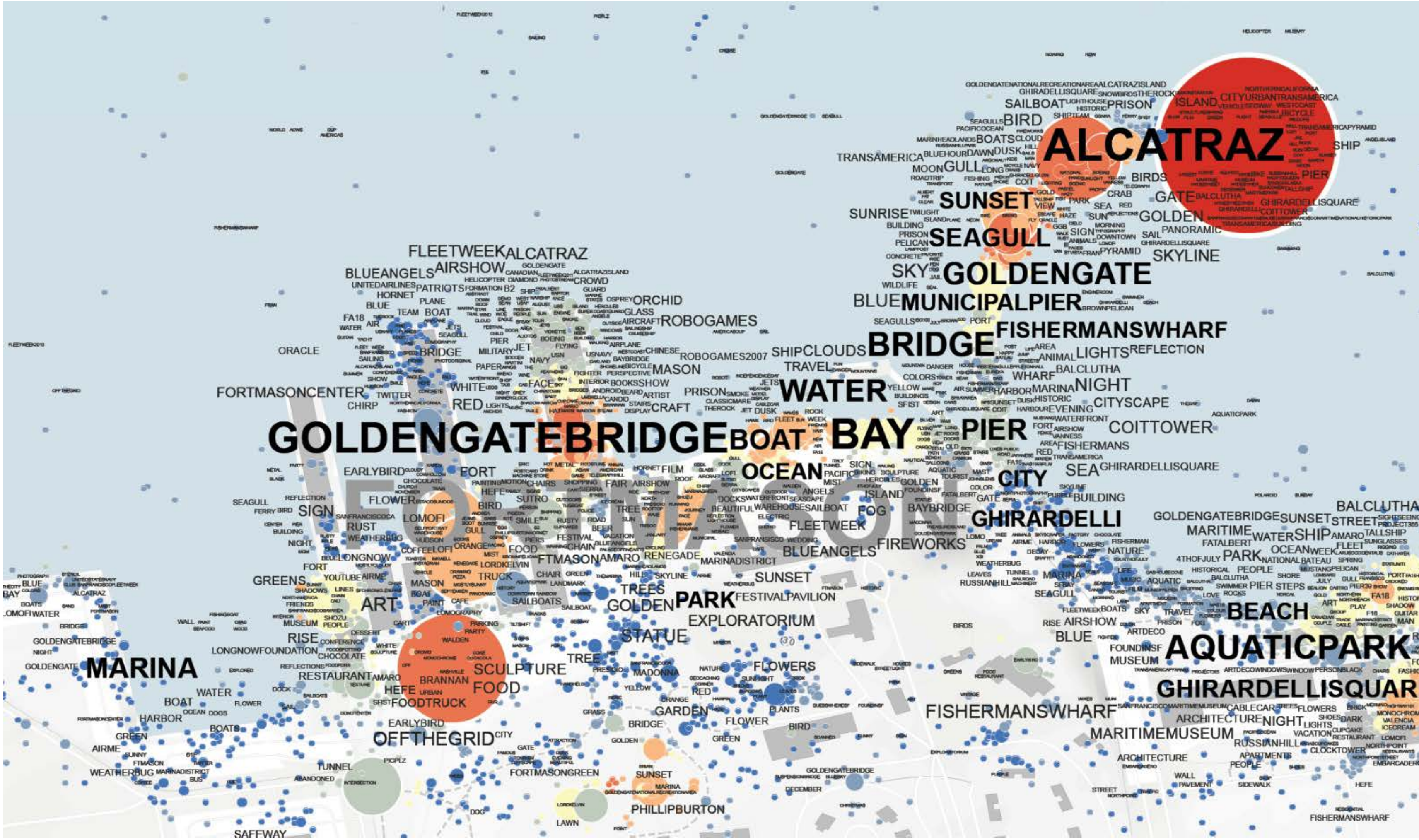
All Single Linkage Trees Cut at same Distance = Tag Map

Interactivity

maps.alexanderdunkel.com

PART 3

Data Visualization

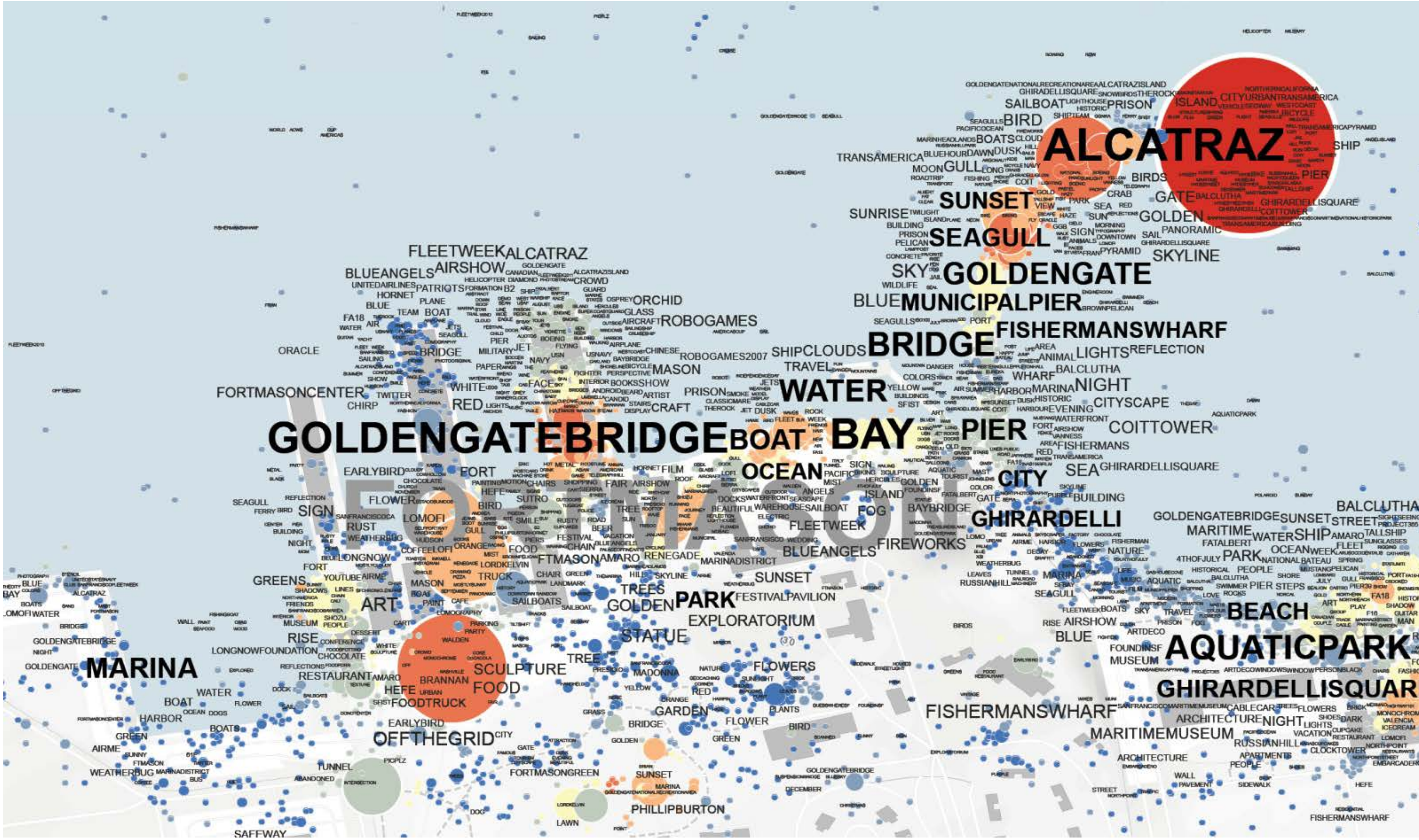


Final Visualization Instructions (ArcGIS):

- **Place Top10 Tags in background (grey)**

- **Use bold font weight for single most used cluster for each Tag**

- **Order of Tag Placement: Print important Tags first, then (if possible) print Tags of lower importance**

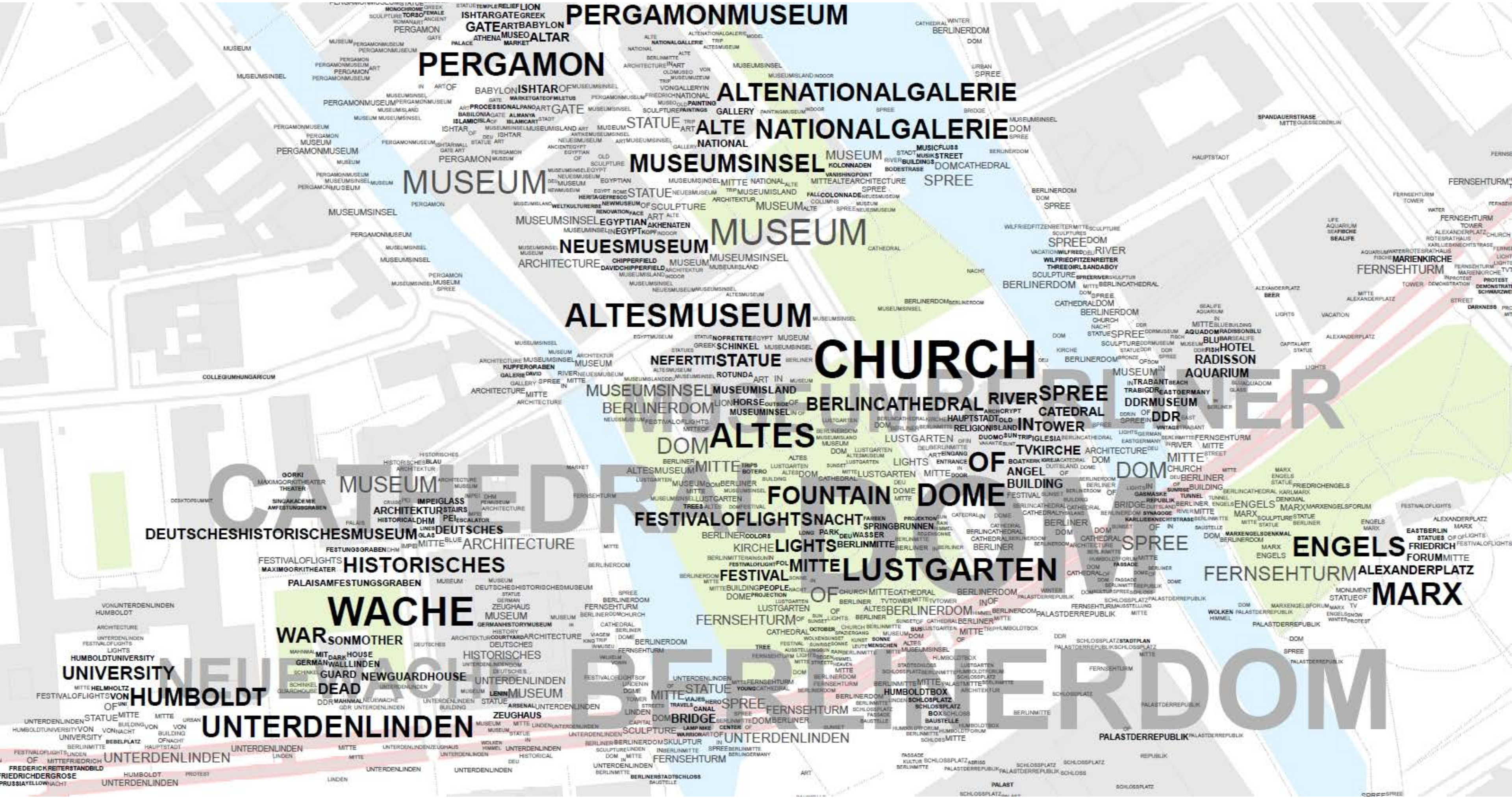


Additional aspects to consider:

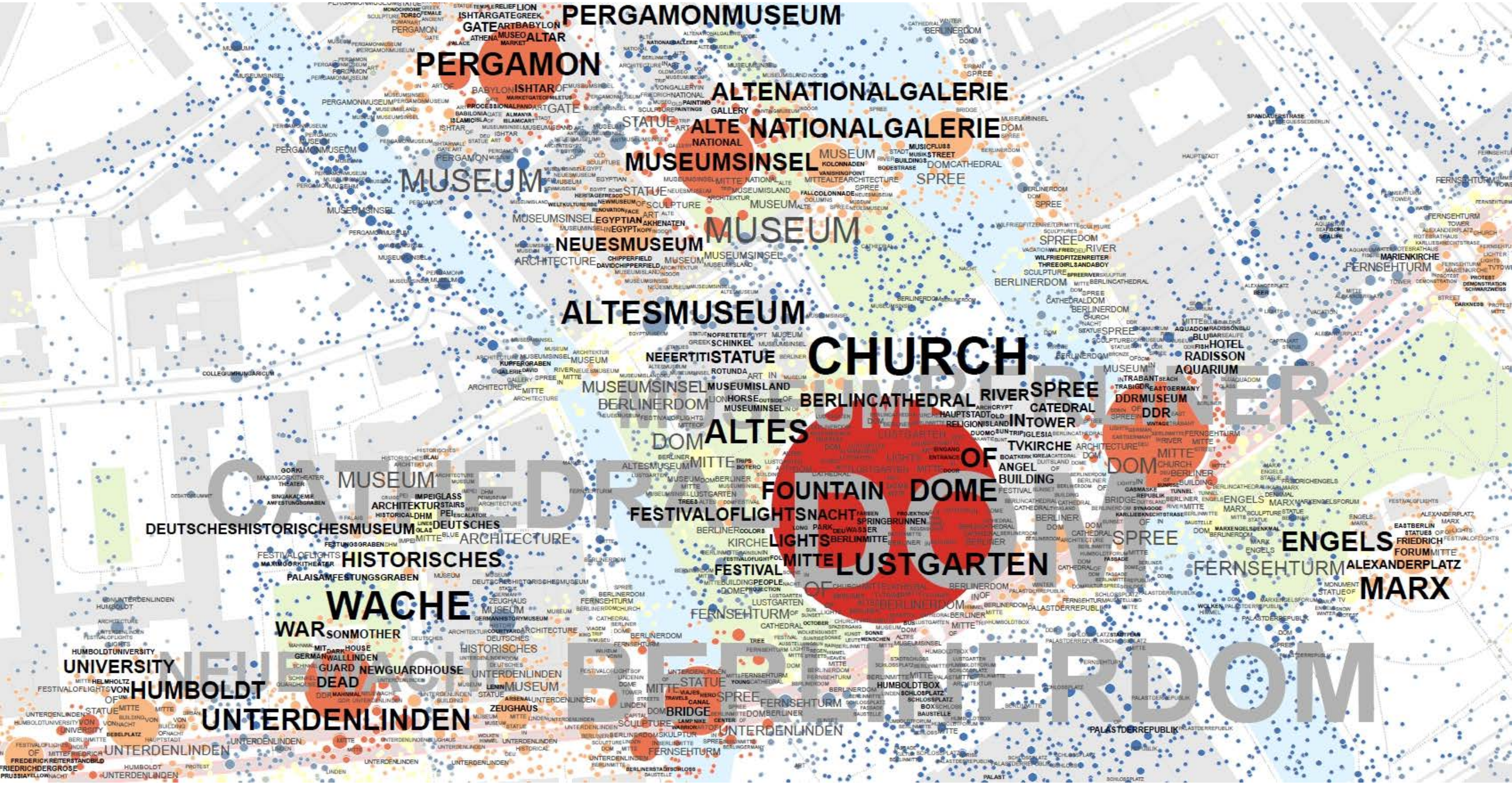
- **Add basic background information as reference**
- **Adjust Size of Largest & Smallest Points based on map size**
- **Adjust Size of Largest & Smallest Font based on map size**

Goal of Workshops:

Create your own Tag Map!



Berlin Spreeinsel
Wednesday, 17 January



Berlin Spreeinsel
Wednesday, 24 January

Workshop Assessment Criteria:

- **Participation optional**
- **Submission of own Tag Map: improve on your final grade (Chosen Area, Scale and Visual Quality)**

Thank You