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# LISBON

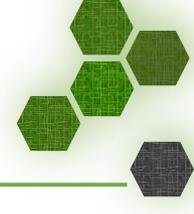
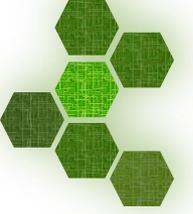
## Fragments of a complex City



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Catarina Rodrigo  
Daniel Campeão  
Luis Encalada  
Maurício Santos  
Pedro Dias





## LISBON: Fragments of a complex City

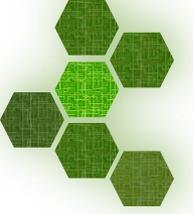
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From the technical point of view, the **Smart City** model considers the city as a **complex system** made up of citizens, resources and services. The status of each service is monitored through a layer of sensors, which send the captured data through the appropriate communication network to an analysis platform.

According to the late scientist John Henry Holland, **complex adaptive systems** are characterized by the presence of **components that learn through interaction**. This is a useful metaphor for the potential of **smart city systems**.

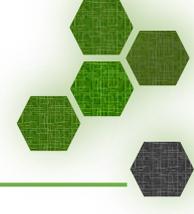
In **smart cities**, **order** is needed for planners to channel technological capabilities productively, while **chaos** provides a dynamic and flexible space for business and social innovation to breathe. The sterile and the organic exist in paradoxical equilibrium.





## LISBON: Fragments of a complex City

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We have intuitively invented the best way to create vast **social networks** embedded in **space** and **time**, and keep them growing and evolving without having to stop. When that is possible, a social species can sustain ways of being incredibly inventive and productive.

**Smart Cities** moved then into the mainstream as governments (including the European Union) commit sizeable funding and policy to smart city development, through deployments of smart city protocols and operating platforms and acceptance of smart technologies as the norm in **transport, energy, development, assisted living and security**.

The purpose of the smart cities passes through ensure **prosperity, competitiveness, efficiency** and **sustainability** in various socio-economic levels.

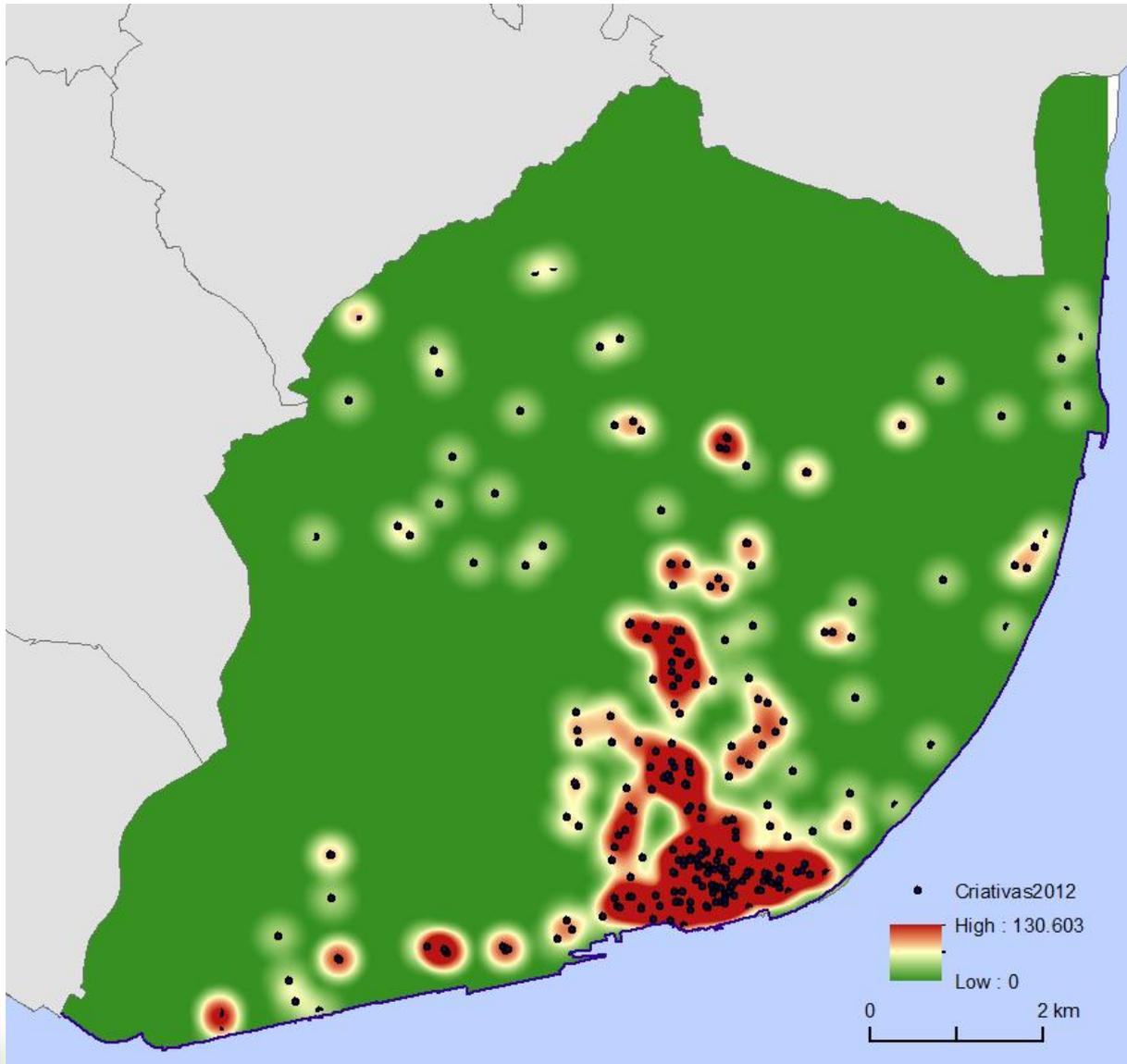
The city of Lisbon, the strategic sectors are defined by the City Council (LCC) and are the **creative economy, the sea economy, health, commerce, tourism** and **ICT**. In a close connection to strategic sectors, it is important to establish a **Map of Knowledge and Innovation (MKI)**, which identifies the institutional actors related to knowledge, research, innovation and creativity.



## LISBON: Fragments of a complex City

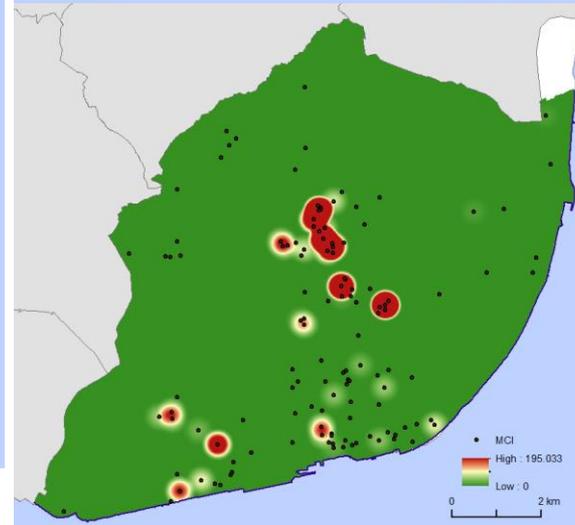
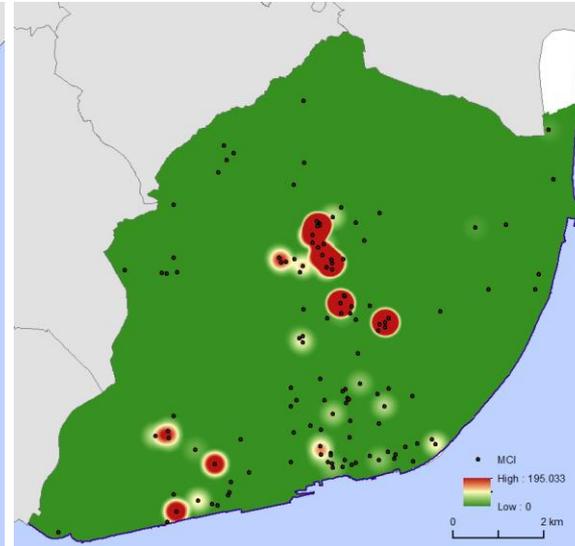
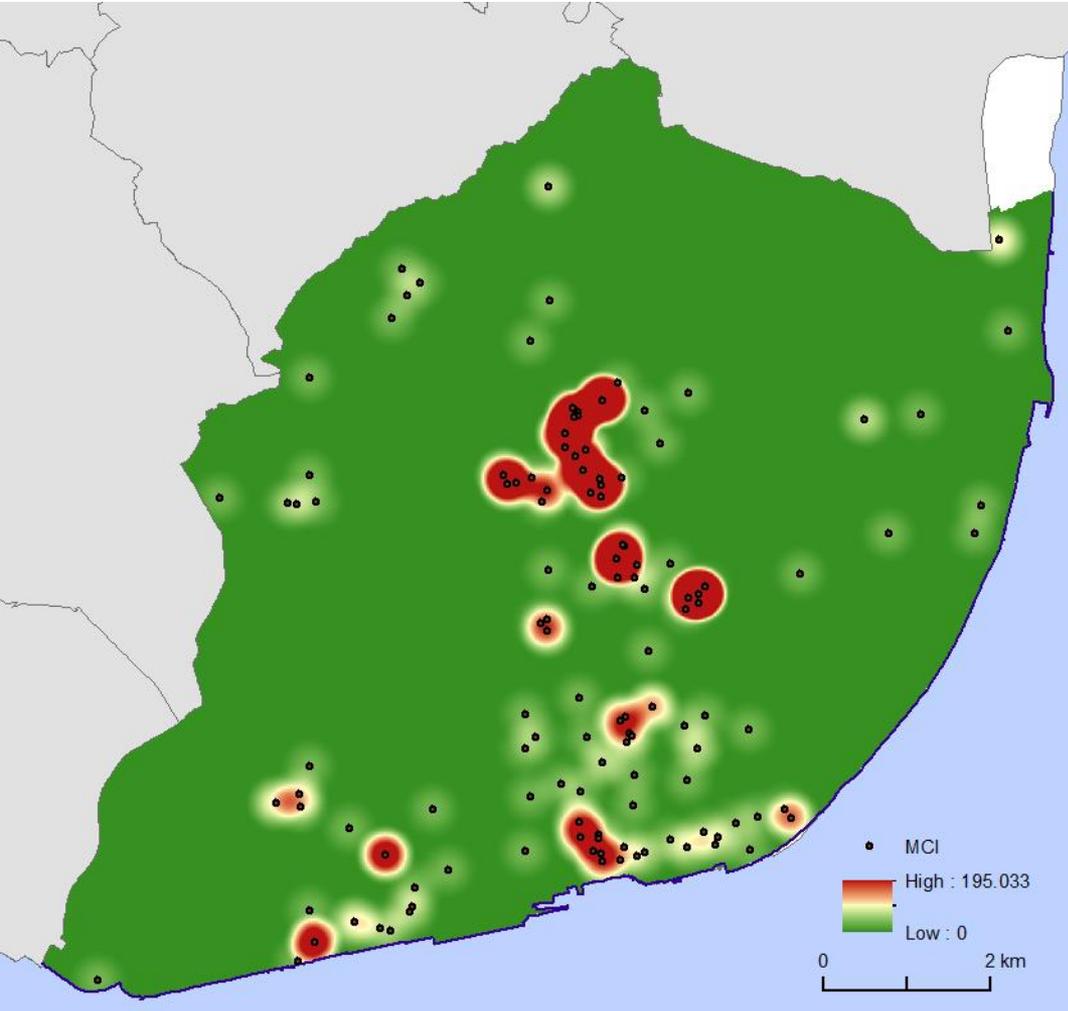


Pedro Dias  
MSc. GIS



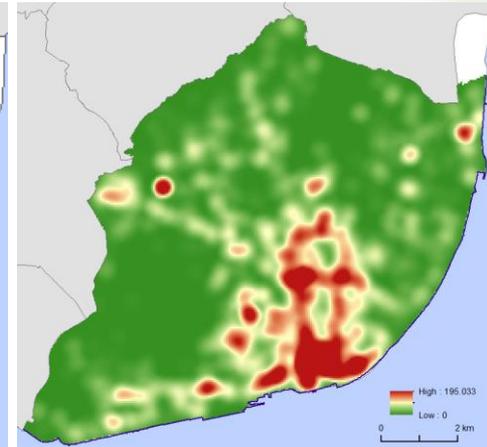
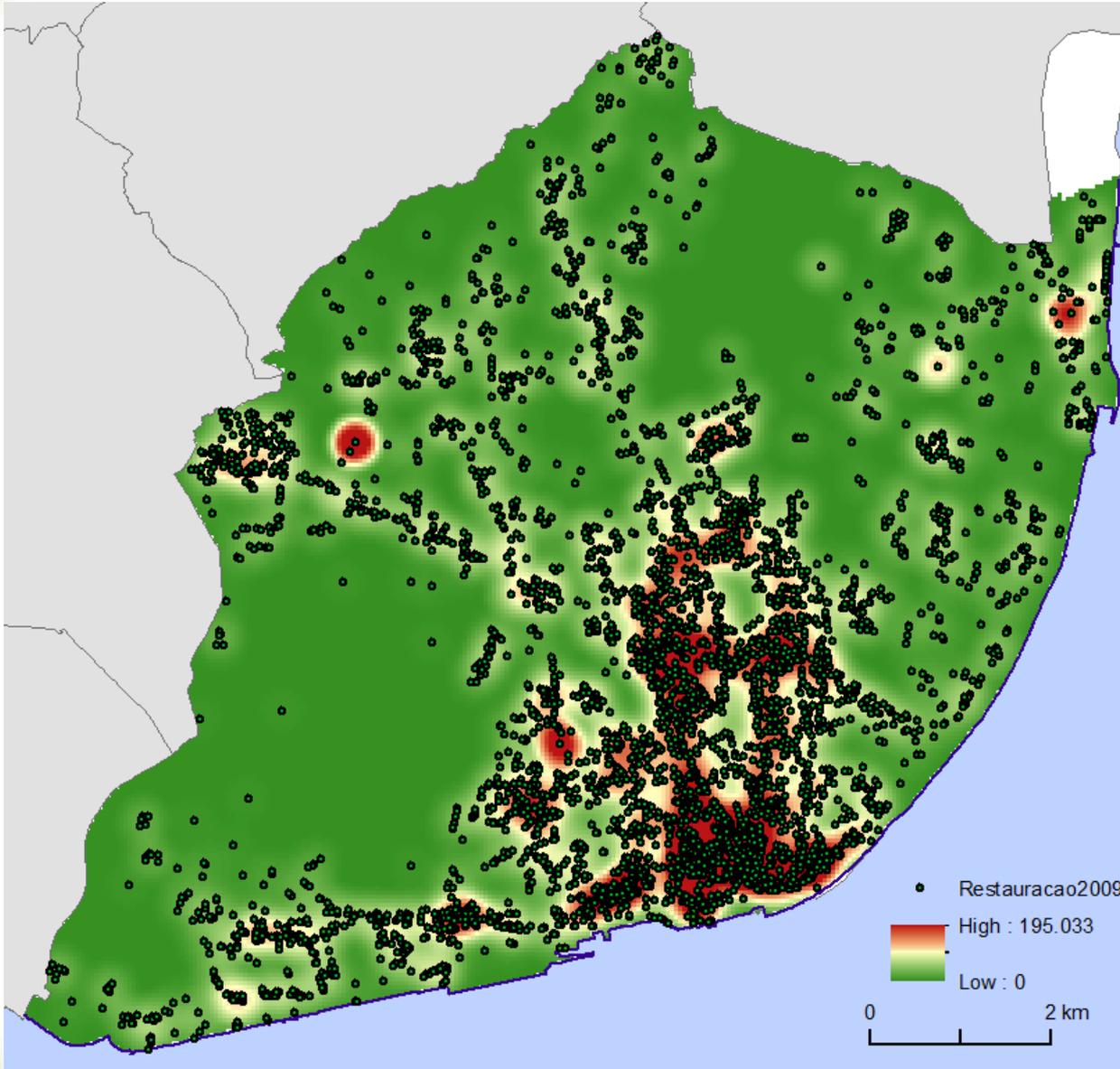
Smart Cities are designed as a function of a **immaterial vision** (Dameri and Rosenthal-Sabroux, 2014). It is important to note, that as larger the **cultural capital** present in a city, more efficient are the decisions taken.

# LISBON: Fragments of a complex City



The use of **collective human and intellectual capital** from a strategic point of view is another of the key elements that should not be overlooked.

# LISBON: Fragments of a complex City





### BIG DATA & SOCIAL MEDIA



Luis Encalada  
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### Photos from Panoramio®

Better positional accuracy of photos dataset (Zielstra and Hochmair, 2013). Panoramio requires geotagging information during the upload process, photos are reviewed in order to be accepted for being published in Google maps.

### Understanding popularity in Panoramio®

When you explore the world by using Panoramio's map or Google Earth, you want to see the best photos of a place first! That's why the most popular photos are visible at higher zoom levels. You'll see the other photos as you zoom into a location, with the least popular photos appearing only at the lowest zoom levels.

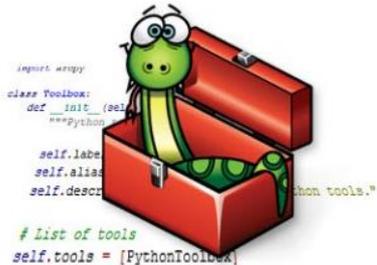
# LISBON: Fragments of a complex City

Retrieving data  
from Panoramio®

Summary of  
retrieved  
photos

Photos						
Grid Resolution(m)	Retrieved	Repeated	Unique	New	Accumulated	%
5,000	14,144	195	13,949	0	13,949	18.6
4,500	14,181	145	14,036	2,826	16,775	3.8
4,000	17,471	138	17,333	3,267	20,042	4.3
3,500	20,992	204	20,788	3,688	23,730	4.9
3,000	24,694	335	24,359	3,762	27,492	5.0
2,800	24,098	538	23,560	1,953	29,445	2.6
2,600	28,274	402	27,872	2,726	32,171	3.6
2,400	29,982	612	29,370	2,529	34,700	3.4
2,200	36,341	716	35,625	6,270	40,970	8.3
2,000	38,014	518	37,496	4,322	45,292	5.8
1,800	38,407	762	37,645	1,614	46,906	2.1
1,600	38,579	790	37,789	1,846	48,752	2.5
1,400	41,566	809	40,757	1,574	50,326	2.1
1,200	48,902	967	47,935	2,867	53,193	3.8
1,000	49,048	5,996	43,052	4,535	57,728	6.0
900	52,095	978	51,117	2,047	59,775	2.7
800	55,208	757	54,451	2,076	61,851	2.8
700	57,253	705	56,548	2,101	63,952	2.8
600	58,400	791	57,609	1,464	65,416	1.9
500	55,229	6,773	48,456	1,014	66,430	1.3
400	63,824	1,043	62,781	2,628	69,058	3.5
300	66,151	8,627	57,524	6,054	<b>75,112</b>	8.1

100

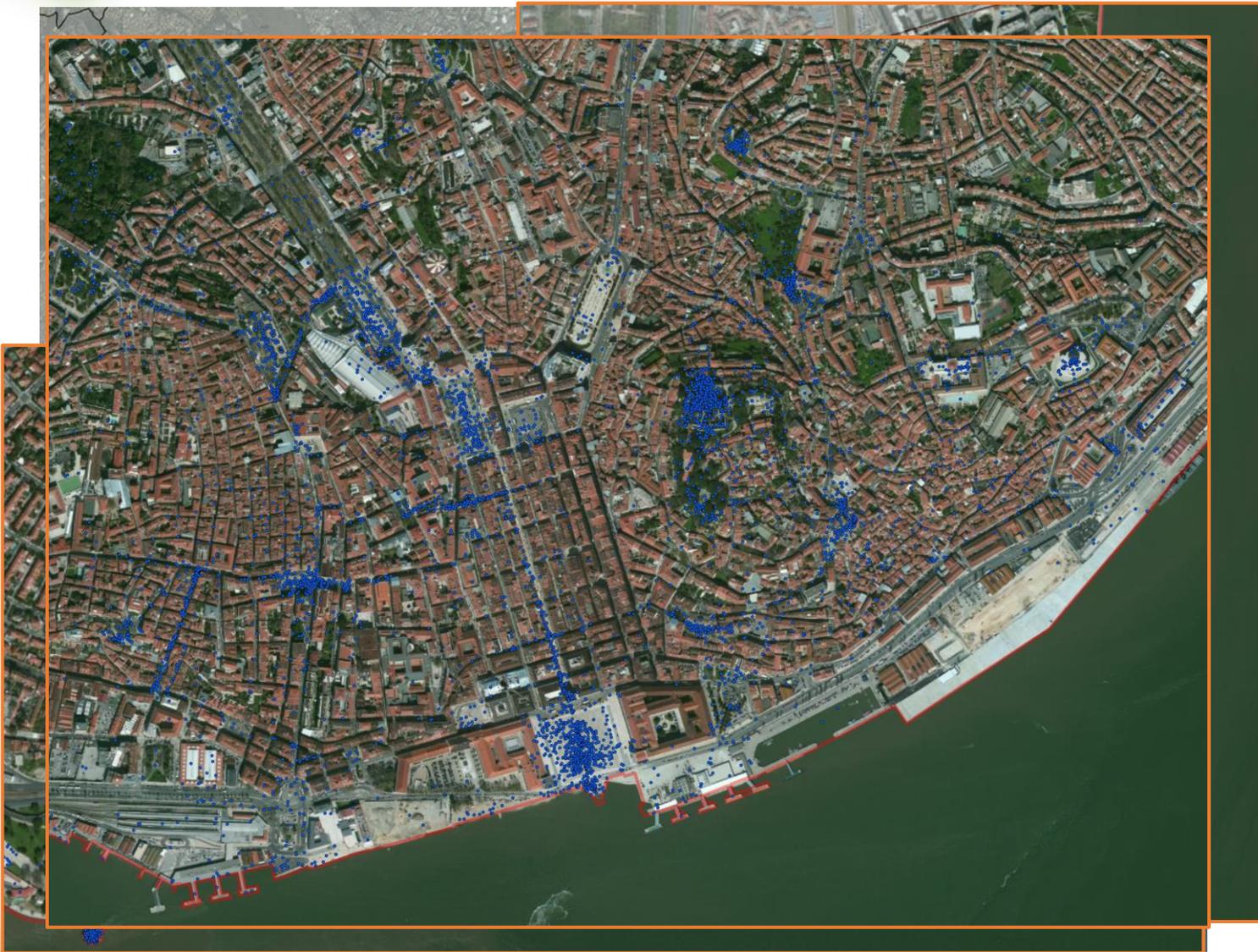


# LISBON: Fragments of a complex City



Geotagged  
photos  
dataset

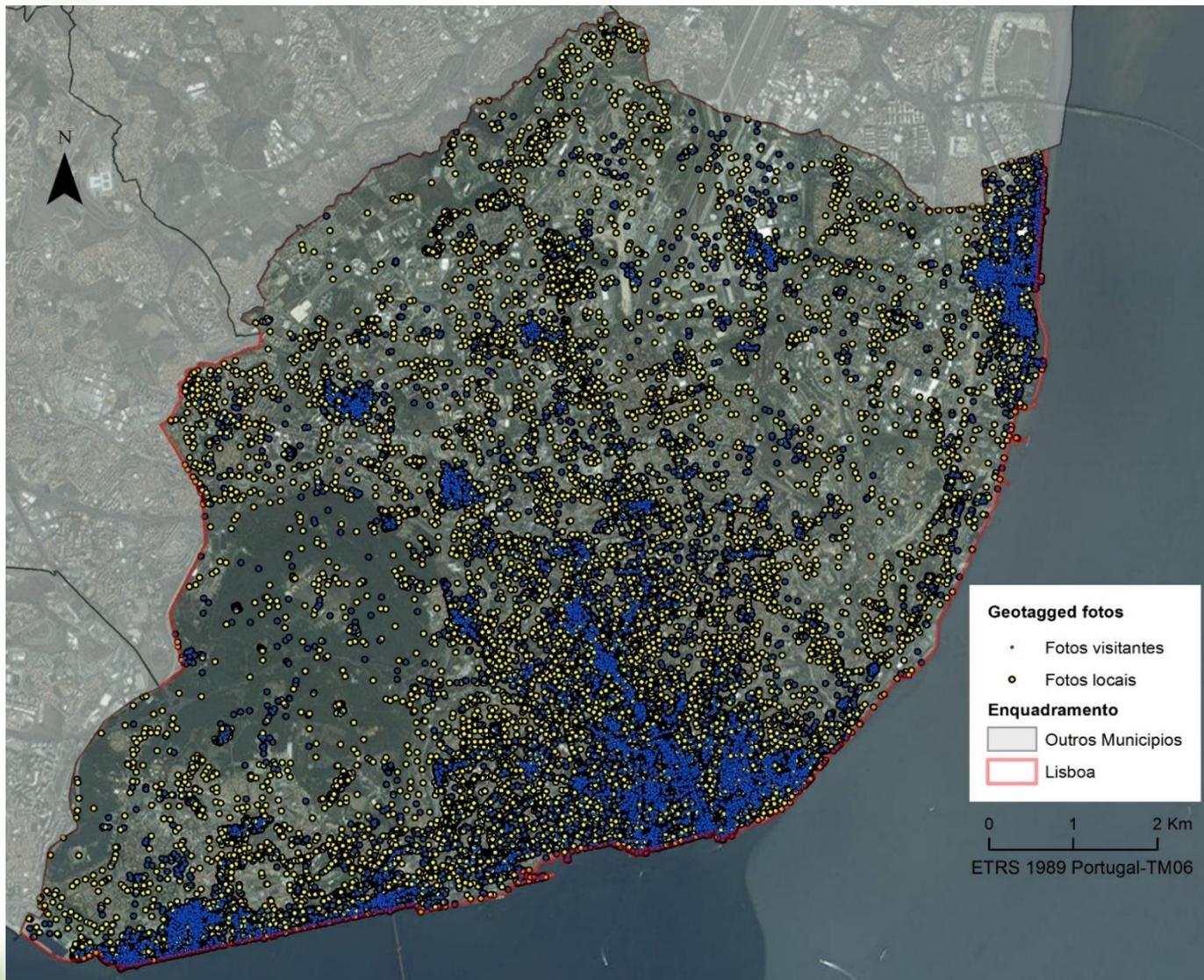
## LISBON: Fragments of a complex City



### Geotagged photos dataset from Visitors

Girardin *et al.* (2008), calculate the difference between the time-stamps of the users' first and last images taken in the area. García-Palomares *et al.* (2015); Kádár (2014) also used this approach to differentiate the photos.

# LISBON: Fragments of a complex City



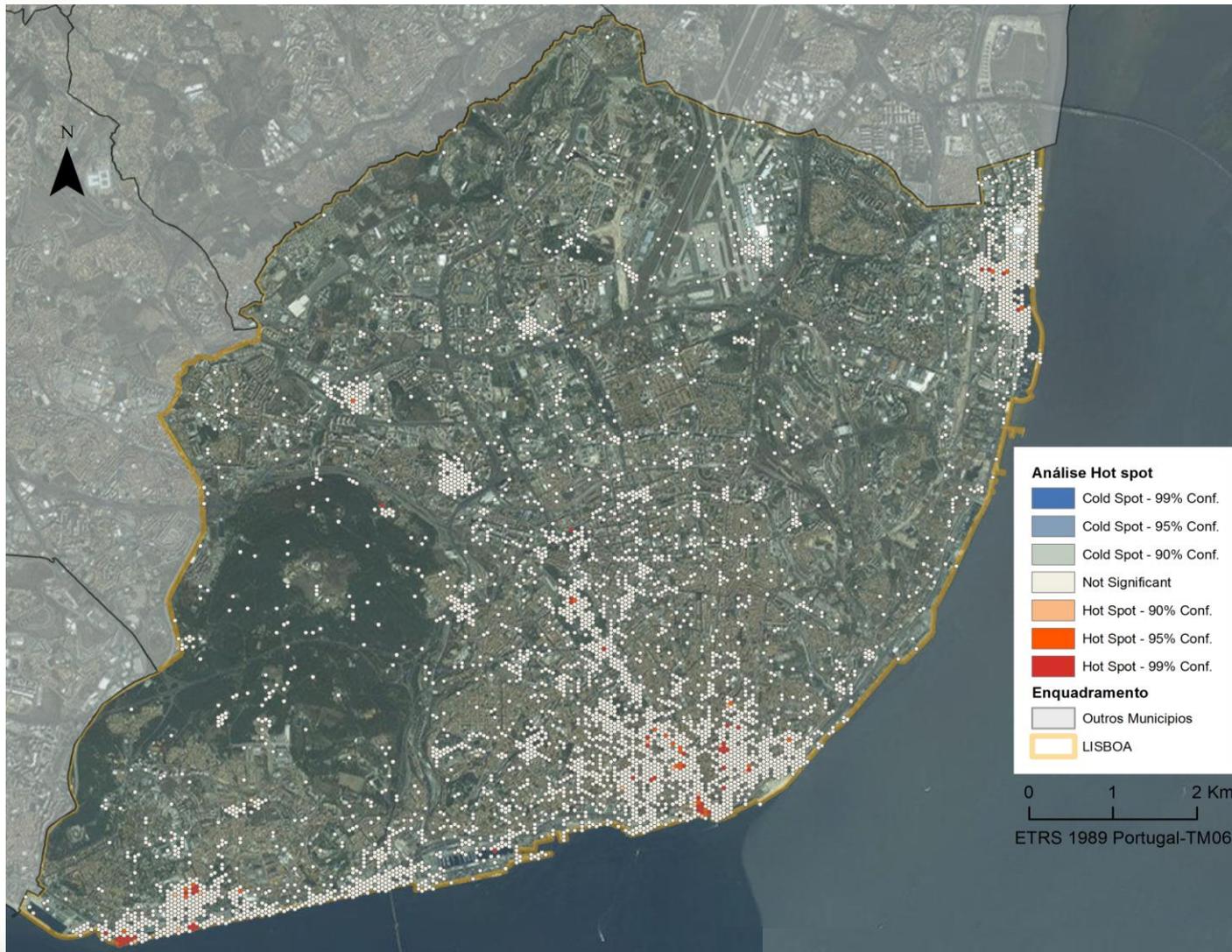
**Geotagged  
photos dataset  
(Locals vs. Visitors)**

# LISBON: Fragments of a complex City



Data  
aggregation  
by regular  
grid

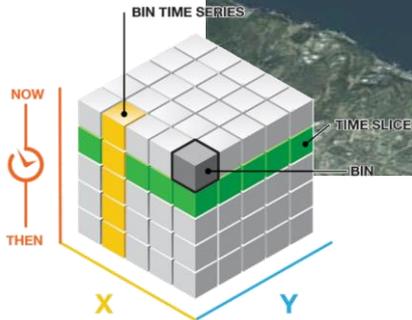
# LISBON: Fragments of a complex City



## Hot spot analysis (Spatial)

# LISBON: Fragments of a complex City

Photos by months

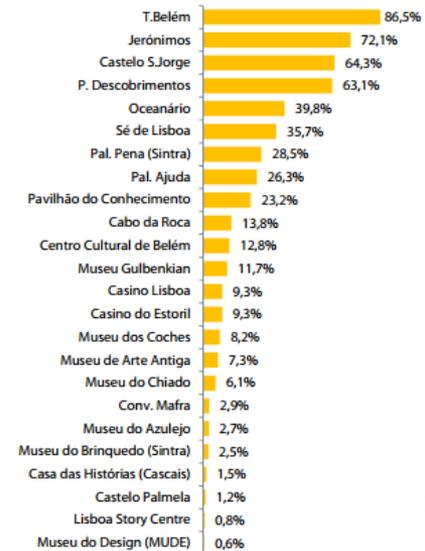


## Spatiotemporal data visualization

Survey apply to tourists about their activities in Lisbon  
(Source: *Inquérito às actividades dos turistas, 2014*)

Comparing the data retrieved from Panomario with data from surveys:

The six most visited places in Lisbon according to the survey, also present high number of photos (taken by visitors throughout the year).



# LISBON: Fragments of a complex City

**Intensifying Hot Spot:** The intensity of clustering of high counts in each time step is increasing overall.

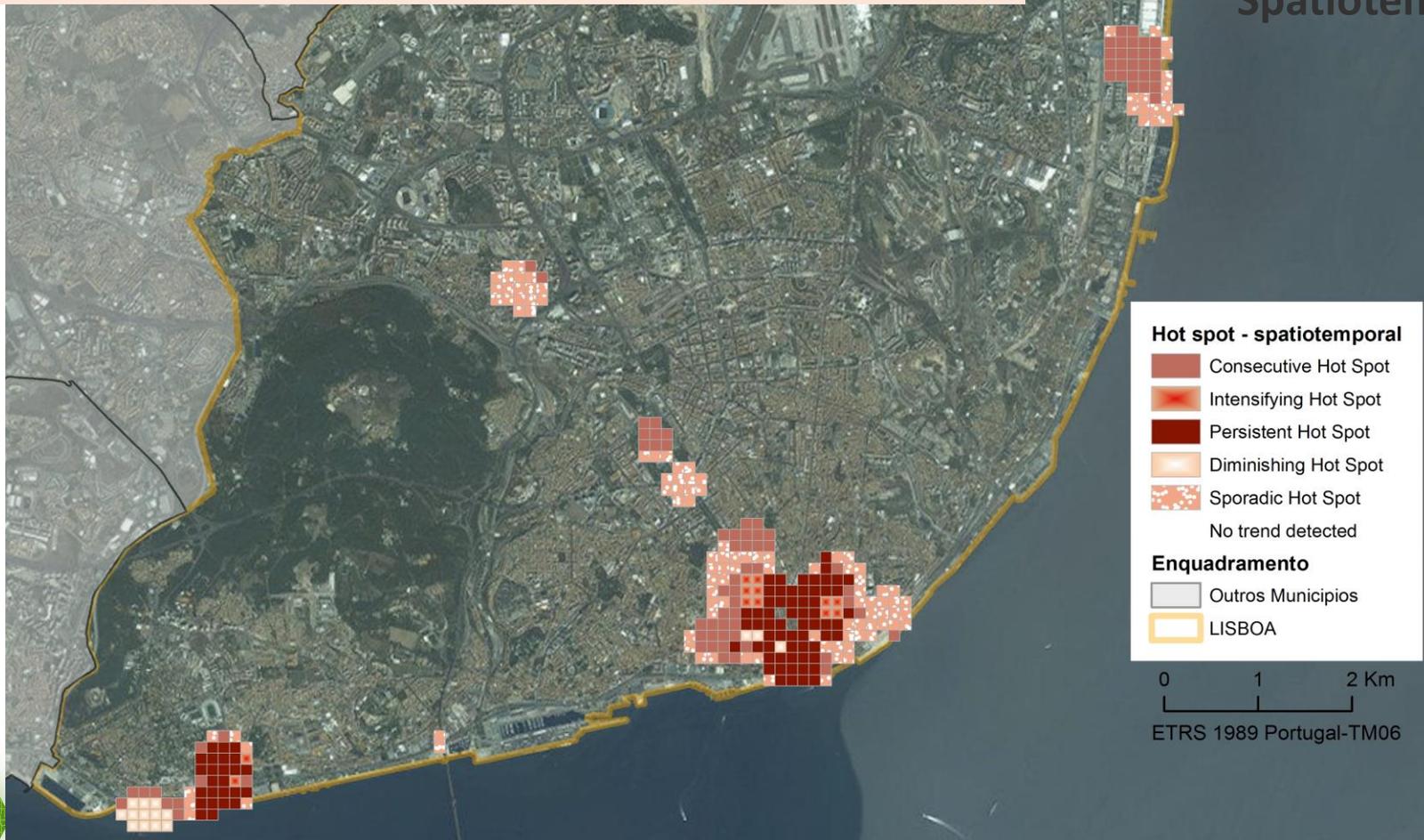
**Persistent Hot Spot:** A statistically significant hot spot with no discernible trend indicating an increase or decrease in the intensity of clustering over time.

**Diminishing Hot Spot:** The intensity of clustering in each time step is decreasing overall.

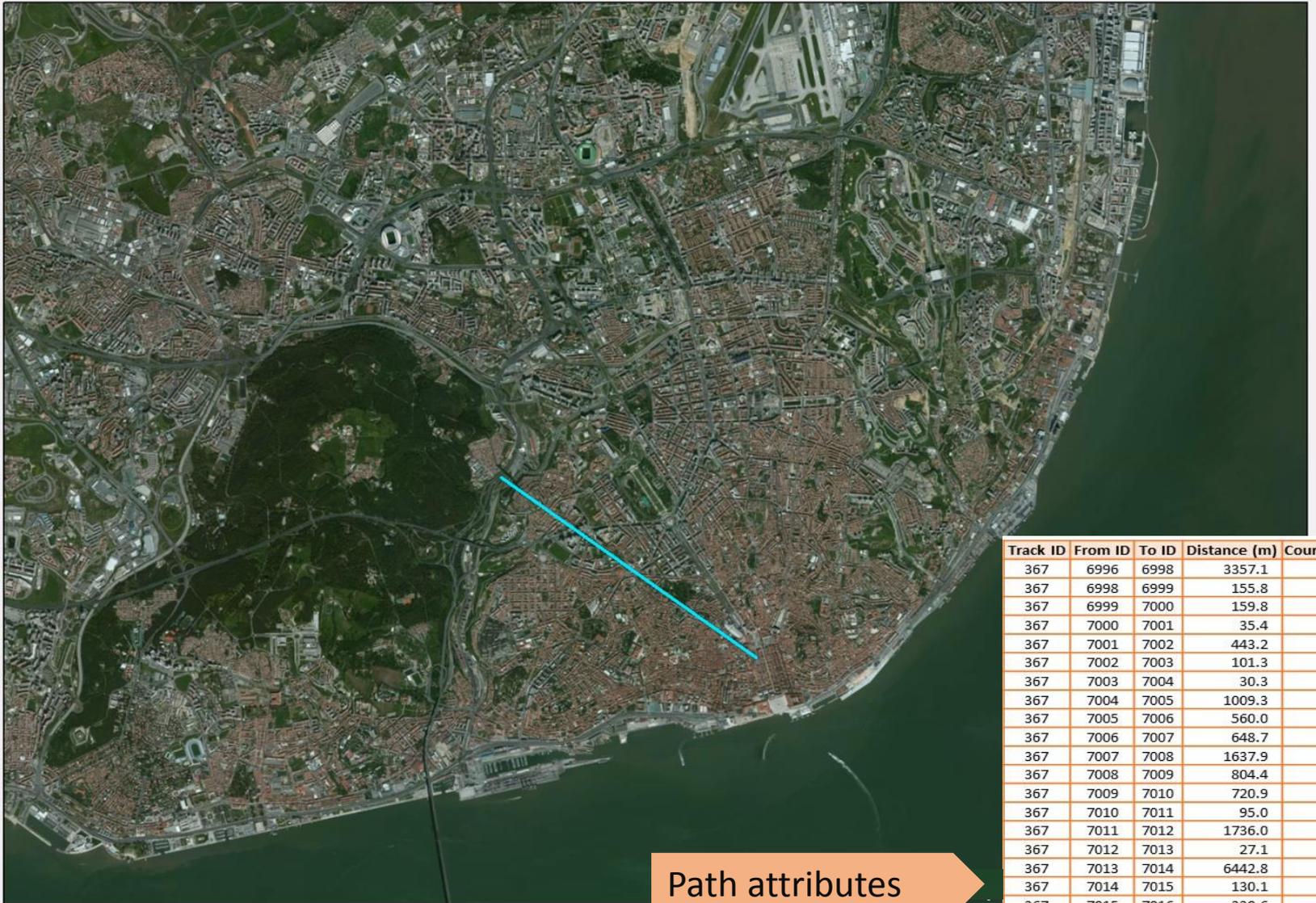
**Sporadic Hot Spot:** A location that is an on-again then off-again hot spot.

**Consecutive Hot Spot:** A statistically significant hot spot in the final time-step intervals.

Hot spot analysis  
Spatiotemporal



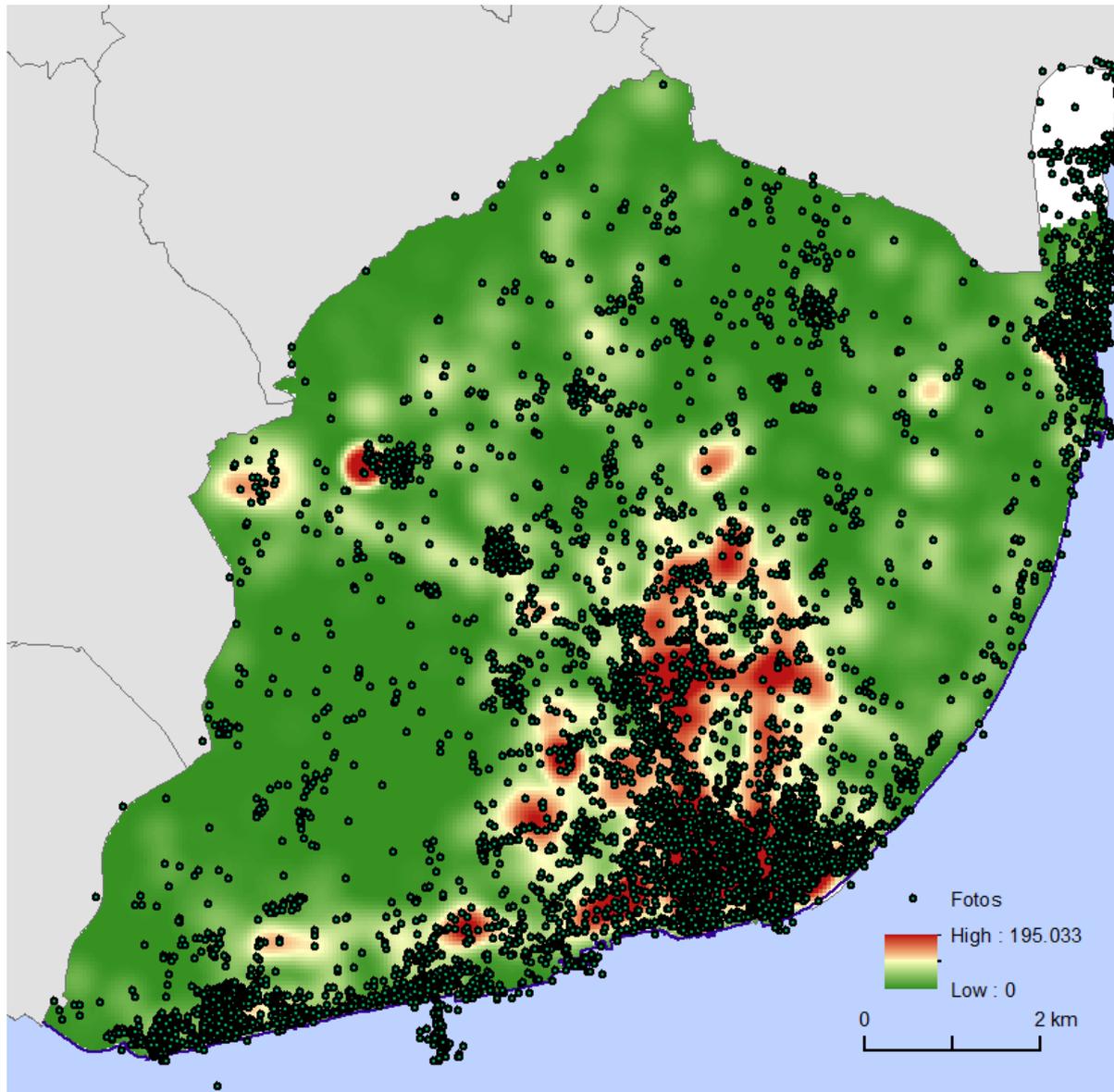
# LISBON: Fragments of a complex City



Path attributes

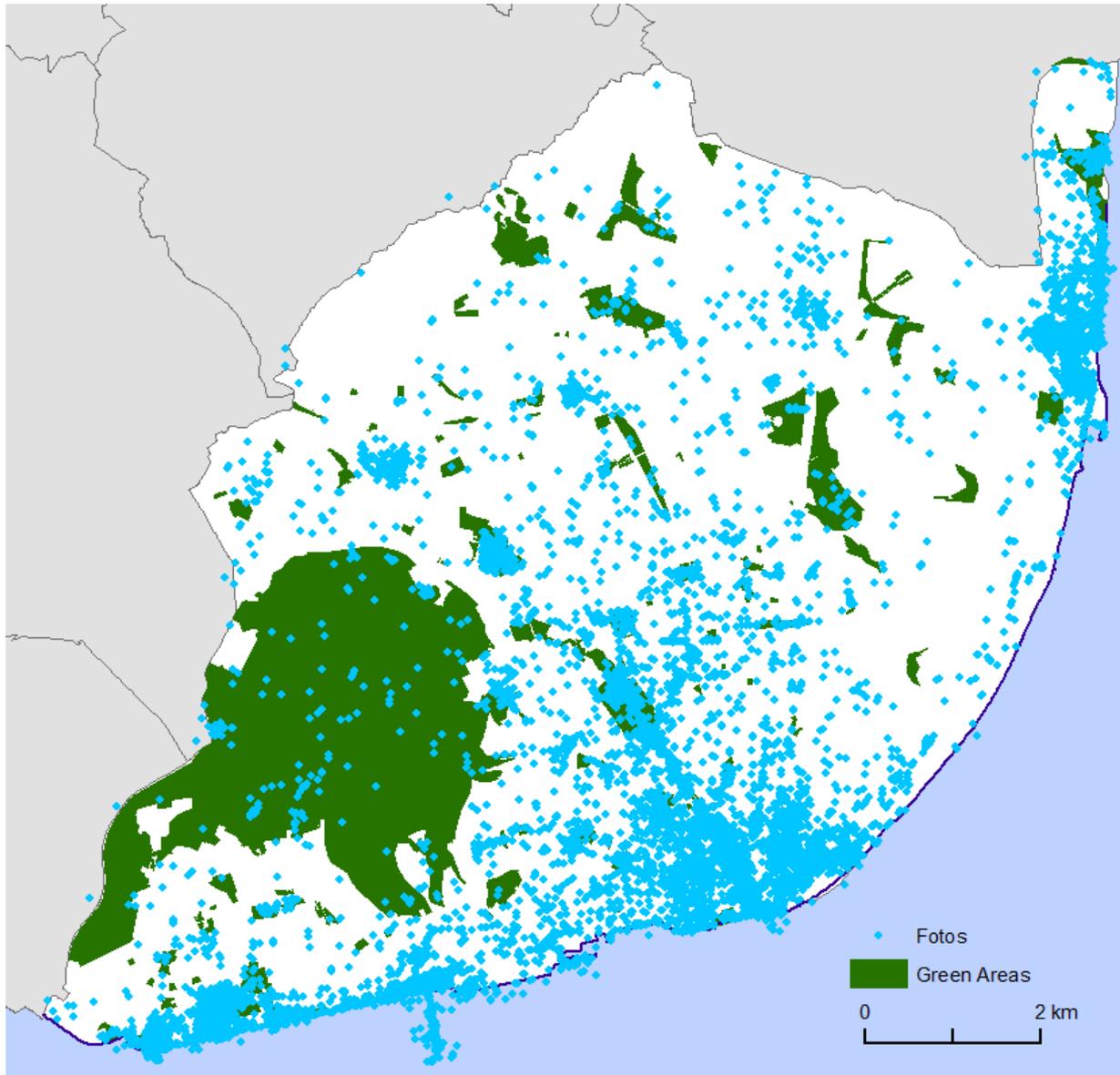
Track ID	From ID	To ID	Distance (m)	Course (Degrees)
367	6996	6998	3357.1	126
367	6998	6999	155.8	3
367	6999	7000	159.8	140
367	7000	7001	35.4	250
367	7001	7002	443.2	164
367	7002	7003	101.3	173
367	7003	7004	30.3	170
367	7004	7005	1009.3	334
367	7005	7006	560.0	198
367	7006	7007	648.7	271
367	7007	7008	1637.9	284
367	7008	7009	804.4	95
367	7009	7010	720.9	114
367	7010	7011	95.0	302
367	7011	7012	1736.0	97
367	7012	7013	27.1	88
367	7013	7014	6442.8	257
367	7014	7015	130.1	21
367	7015	7016	330.6	197
367	7016	7017	102.5	176
367	7017	7018	13.0	181

# LISBON: Fragments of a complex City



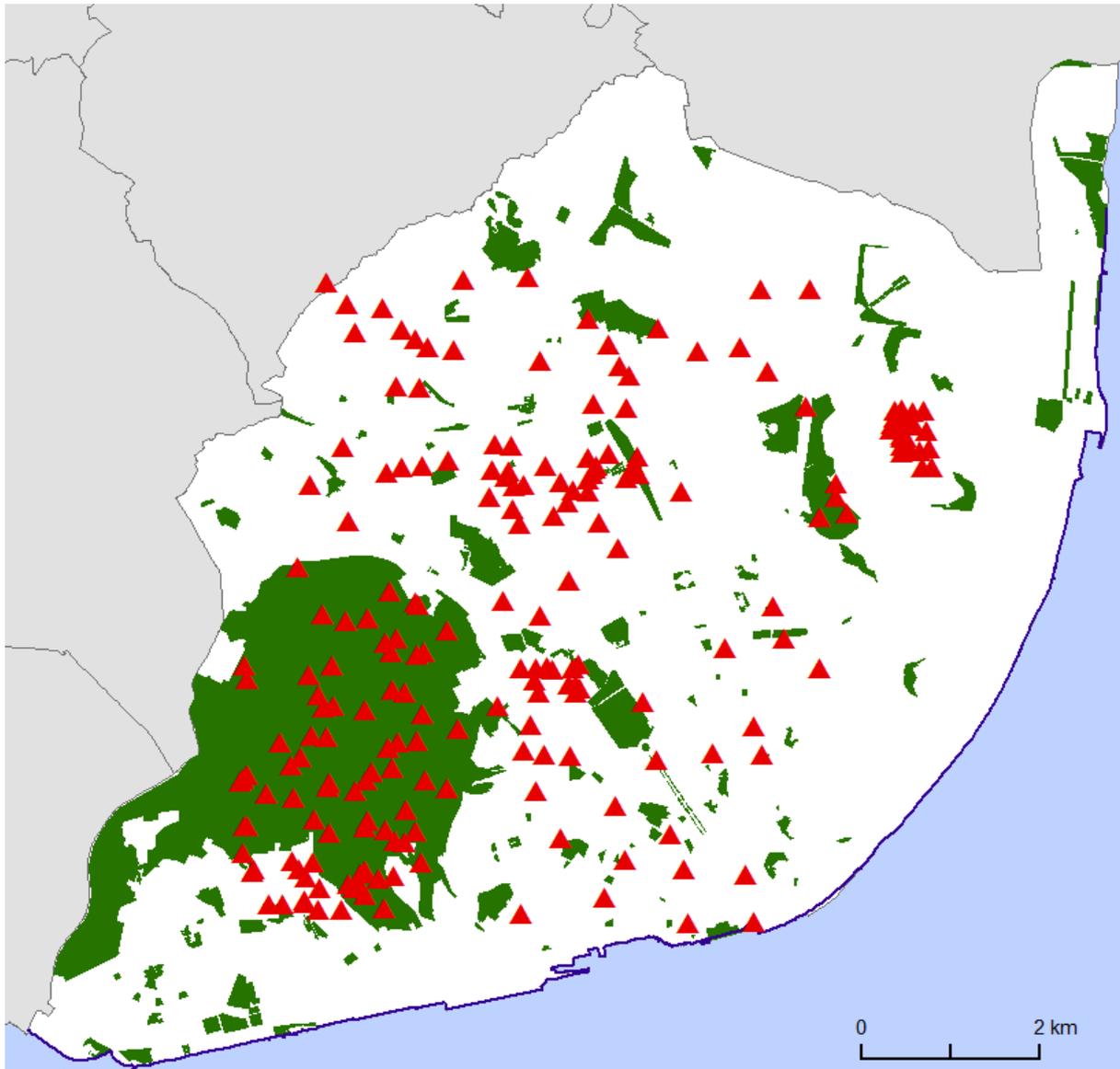
**Restauracion  
Vs.  
Tourists**

# LISBON: Fragments of a complex City



**Green Areas  
Vs.  
Tourists**

# LISBON: Fragments of a complex City

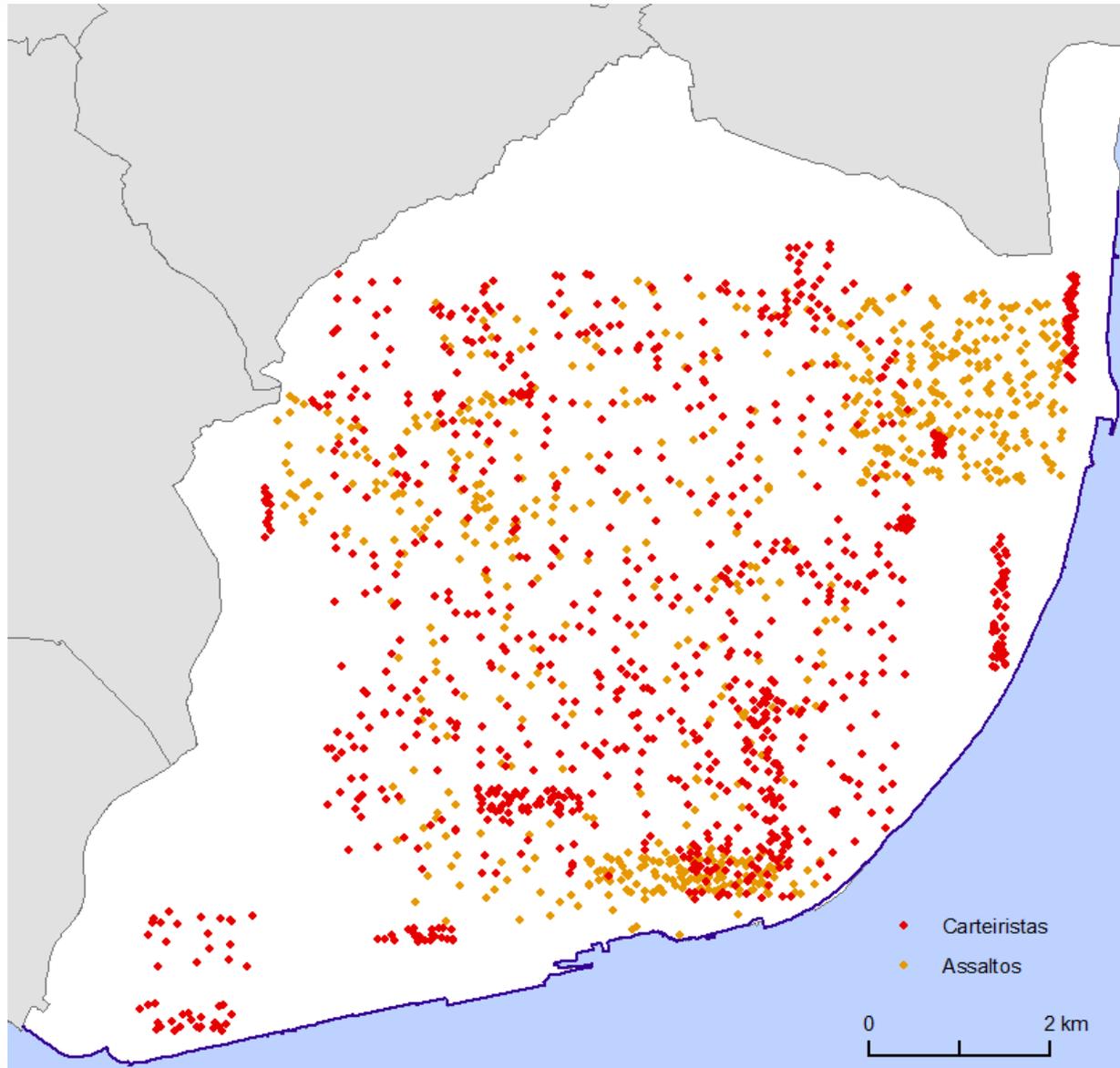


## SUSTAINABILITY?

- ▲ Rapes (2015)
- Green Areas

Shrubs were considered as a potential place to hide for perpetrators or obstructions of view (Lindgren and Nilsen, 2012).

## LISBON: Fragments of a complex City



Crime and fear of crime in urban green spaces were also recognized as potentially important influences on mental health and wellbeing (Lorenc et al., 2012; Foster et al., 2013).

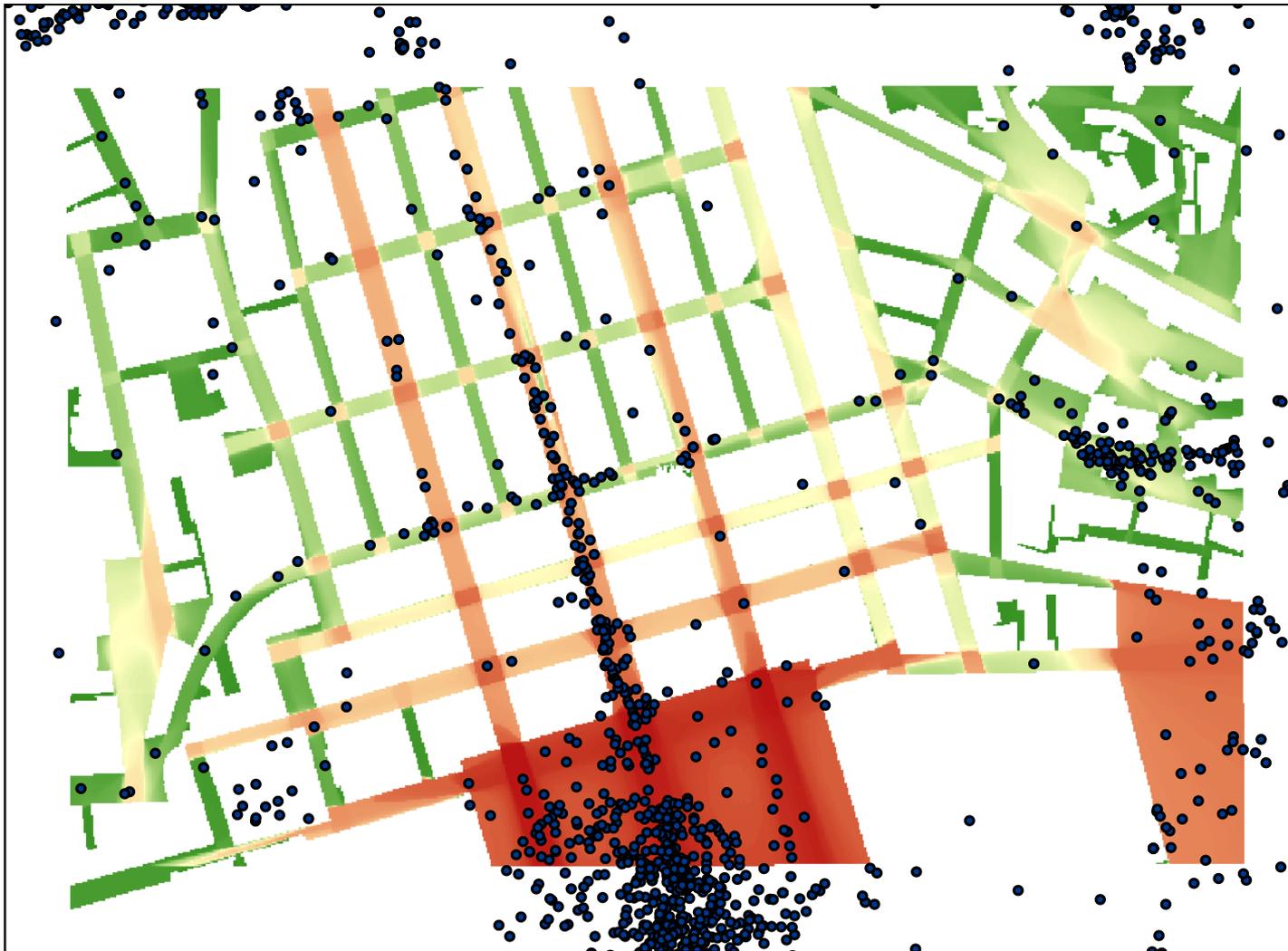
## URBAN WELLBEING



Daniel Campeão  
Maurício Santos  
MSc. GIS

Street **connectivity** means the level of connection in streets reflected to the human activities (Marshall and Garrick, 2010). In street connectivity, **visibility** is one of the factors that reveal the **connection between pedestrian and street environment.**

## LISBON: Fragments of a complex City



The highest connectivity is **27288**. This means that the point is viewed from **27288 locations** in the street network. Thus, the red area is most viewed area which connected from various locations and this reflects pedestrian movement in identifying the streets. The graph also shows privacy of the streets. The low connectivity area (5) means the less viewed area.

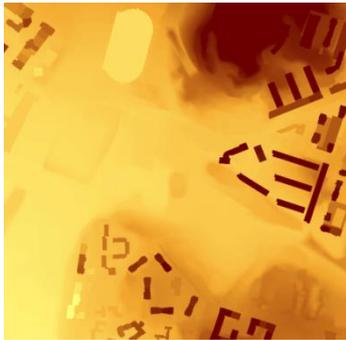
## LISBON: Fragments of a complex City

The use of **energy** from **renewable sources** is an importante objective of the European Union energy policy (Mabee, 2013). Among many available sources of renewable energy, **solar energy** is clearly a promising option and its market has seen outstanding growth in recent years (Devabhaktuni et al., 2013).



Catarina Rodrigo  
MSc. GIS

A - Alta de Lisboa



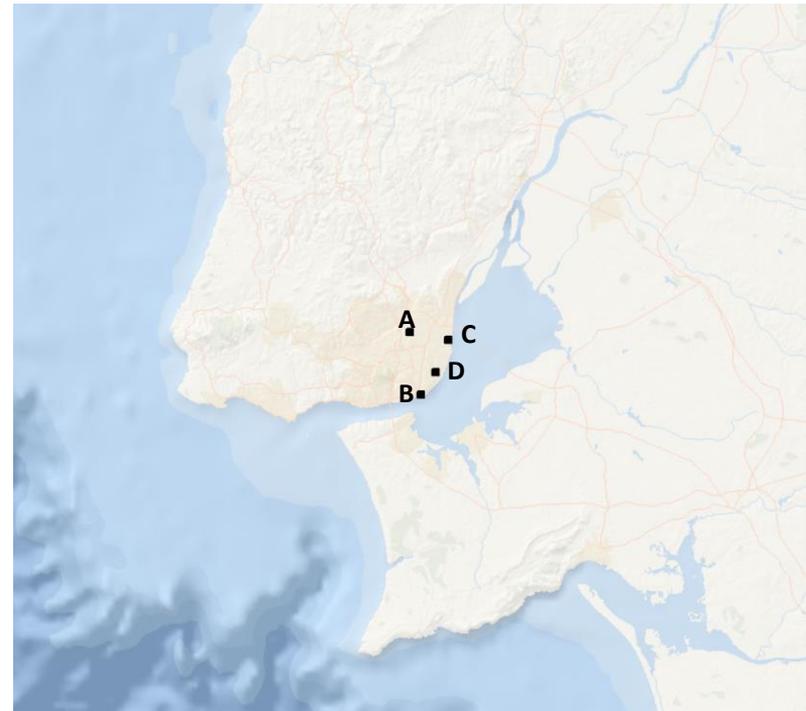
B - Baixa



C - Parque das Nações



D - Madre Deus



## LISBON: Fragments of a complex City



## General parameters

**Model Resolution-** Establishes the sky size for all possible model outputs.



Test area: **Alta de Lisboa** grid (1201 rows X 1201 columns);

Max. resolution: **8 hours (7h58m02seg)**

Min. resolution: **13 minutes**

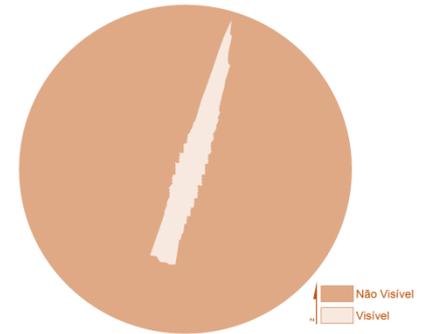
Average processing time: **0.02 seg. per pixel**



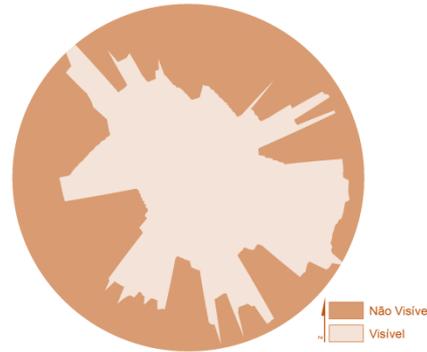
## General parameters Model Resolution



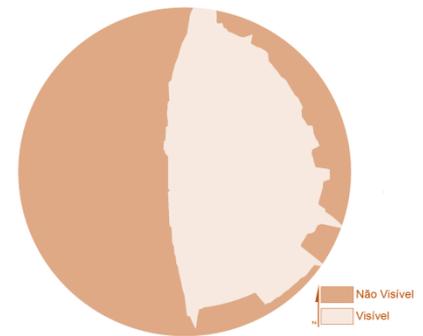
Alta de Lisboa



Baixa



Madre Deus



Parque das Nações

# General parameters

## Model Resolution

### CALCULATION DIRECTIONS

Sky Size resolution	CALC. DIRECTIONS(°)	Processing time
4000 X 4000	360	7h 58m 02 seg.
4000 X 4000	256	7h 38m 10 seg.
4000 X 4000	32	7h 25m 47 seg.
4000 X 4000	16	7h 21m 37 seg.



16 DIRECTIONS



32 DIRECTIONS

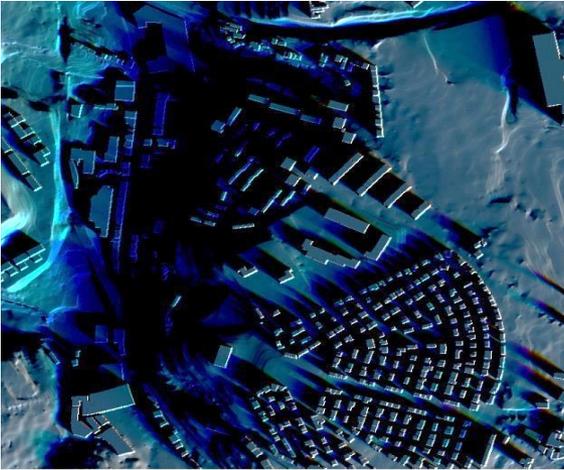


256 DIRECTIONS

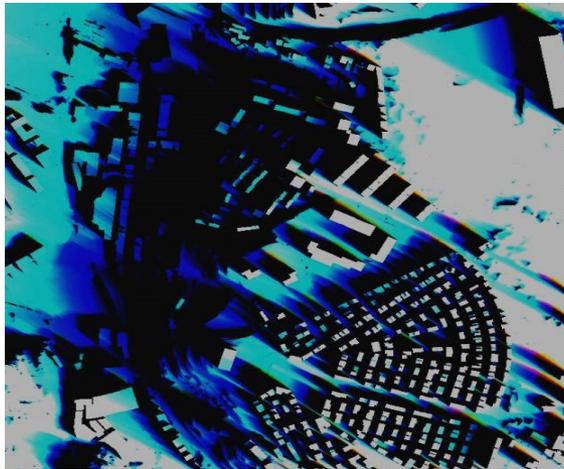


360 DIRECTIONS

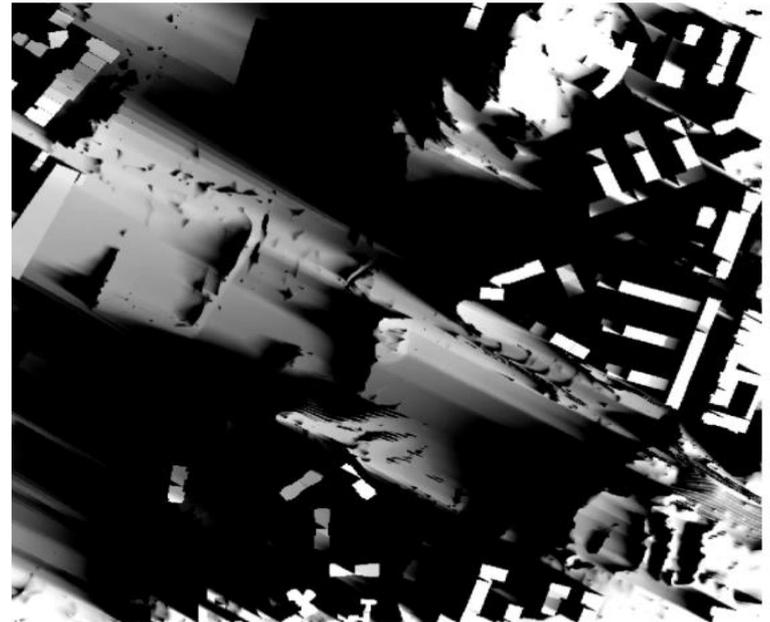
## Topographic configuration– Slopes and Aspect



FROM DEM

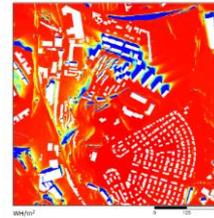
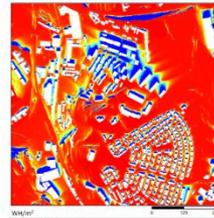
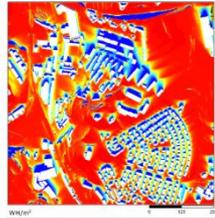
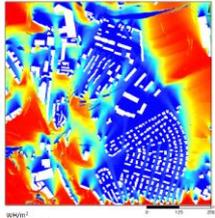


*FLAT SURFACE*

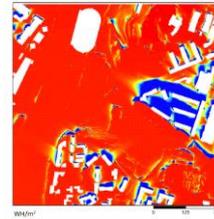
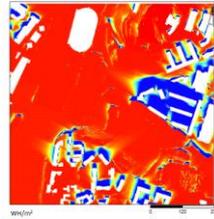
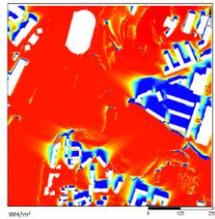
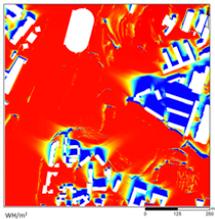


8:00

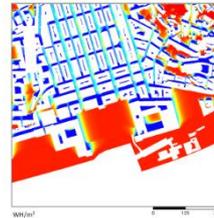
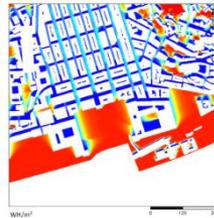
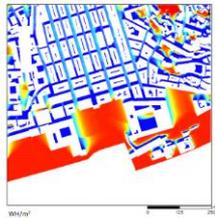
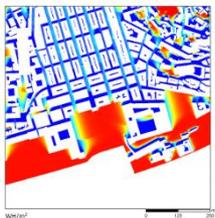
## Solar potential quantification for different ground levels



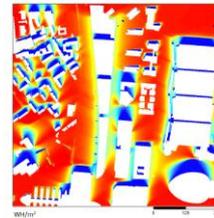
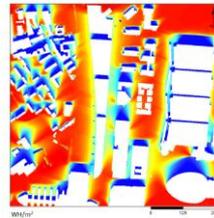
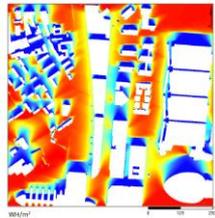
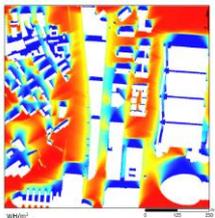
**Madre Deus**



**Alta de Lisboa**



**Baixa**



**Parque das Nações**

0m

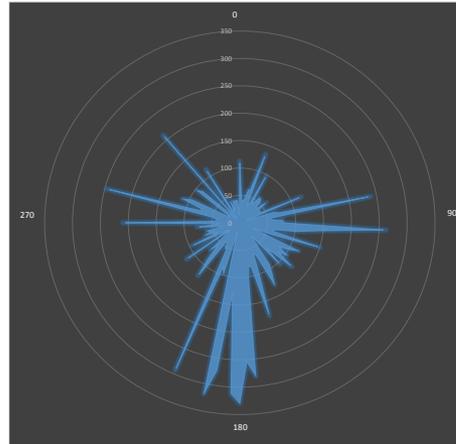
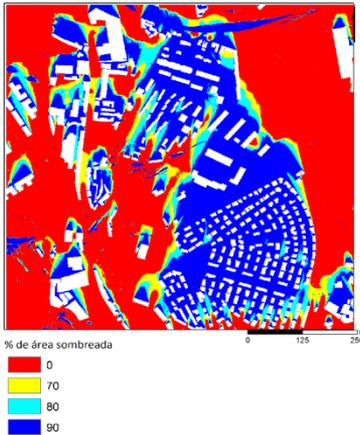
1m

5m

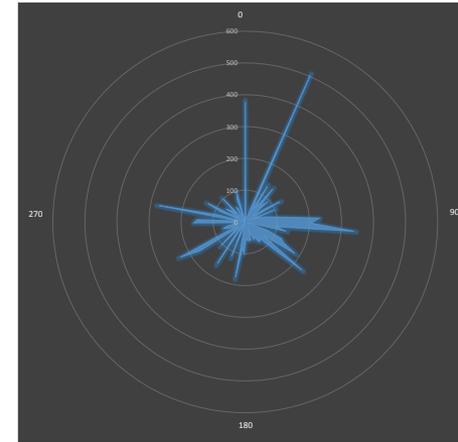
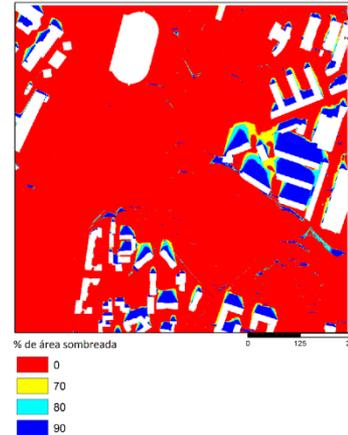
10m

# LISBON: Fragments of a complex City

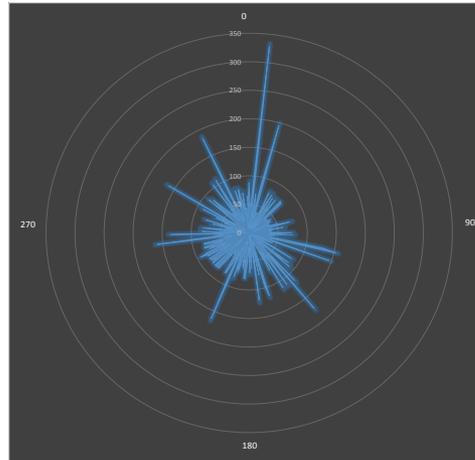
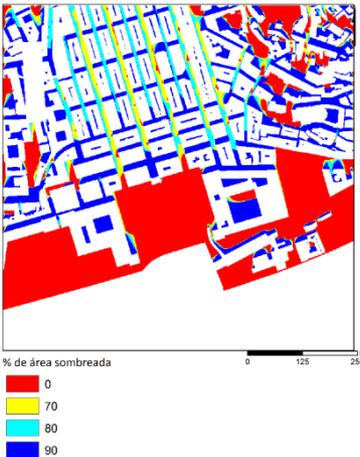
## Shadow variation



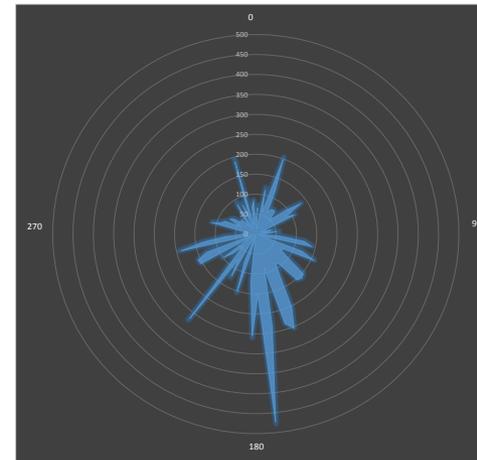
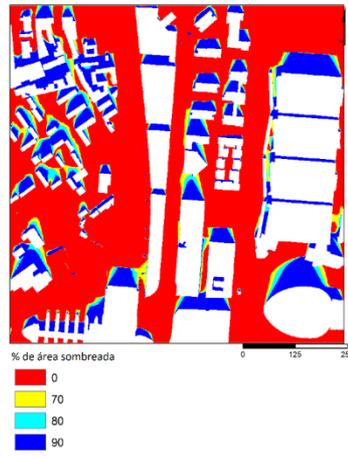
**Madre Deus**



**Alta de Lisboa**



**Baixa**



**Parque das Nações**

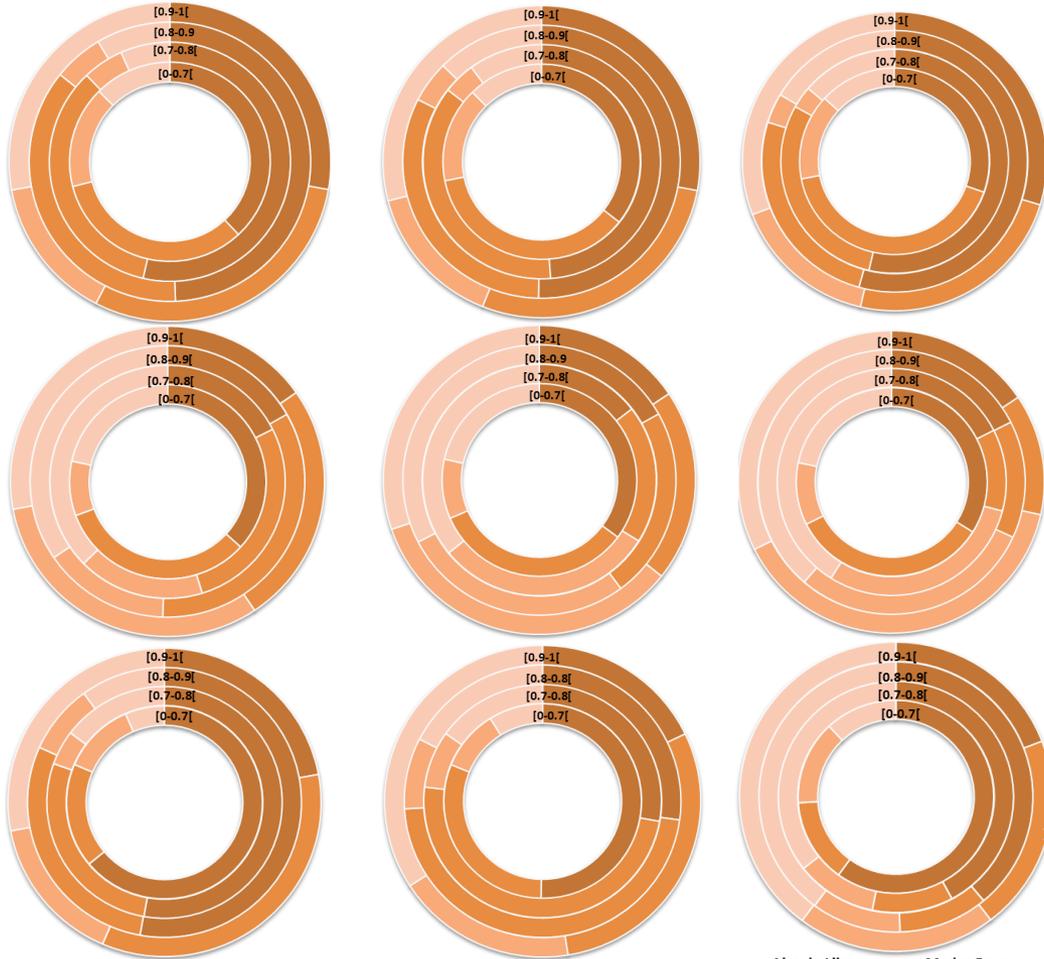
# LISBON: Fragments of a complex City

0 m

5 m

10 m

% shaded area at different times of the day and different ground levels



■ Alta de Lisboa    ■ Madre Deus  
■ Baixa            ■ Parque Nações

