WELL-BEING, URBAN PLANNING AND BIODIVERSITY IN BARCELONA

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Structure of the talk

- Problem and motivations of the problem
- Objectives and structural question
- Case study
- Methodology
- Concluding unanswered questions

Well-being and urban planning

- Cities: Past and present
- Agglomeration
- Shocks
- Urban services
- Natural ventilation
- Urban biodiversity

Determinants of the cities in the nineteenth to beginning twentieth centuries

Density, malnutrition, agglomeration, overworking, infected water, illiteracy → **Causes**

Mortality, ignorance, illness, unhappiness, uncultured, unsociability → **Consequences**

Shocks to the system:

Cities experienced a high incoming population during the industrial revolution

Population density increased in all of them

Mortality increased and life span decreased

Determinants of the cities in the beginning Of the twenty-one century

Density, agglomeration, pollution, climate change, global warming → **Causes**

Scale diseconomies, intensive use of energy, personal discomfort → **Consequences**

Shocks to the system:

Cities are the central node of the twenty-one cultural paradigm, attracting population and economic activity

Consequences of economic downturns and global warming and climate change would increase population pressure and would change personal comfort

Social well-being would decrease

Objective and Structural Questions

. How urban planning and, in particular, the location of urban services, the conditions of natural ventilation and biodiversity levels affect well-being

Why

-To which extend provision of services improve well-being

-To which extend urban grid facilitates natural ventilation (insolation and winds)

-To which extend urban grid and natural ventilation would increase efficiency in energy saving

-To which extend biodiversity improve well-being

-We want to answer the question of 'who gets welfare and where do they get it'

-(Spatial justice)

-We want to get further elements to incorporate in future planning practices

-(Policy making)

How

-Barcelona case is studied using location analysis and spatial analysis, and implemented in ArcGis

Working Hypothesis

- Urbanism can be used as a well-being redistribution tool

-Planning services to population is a necessary condition to improve
    -social well being

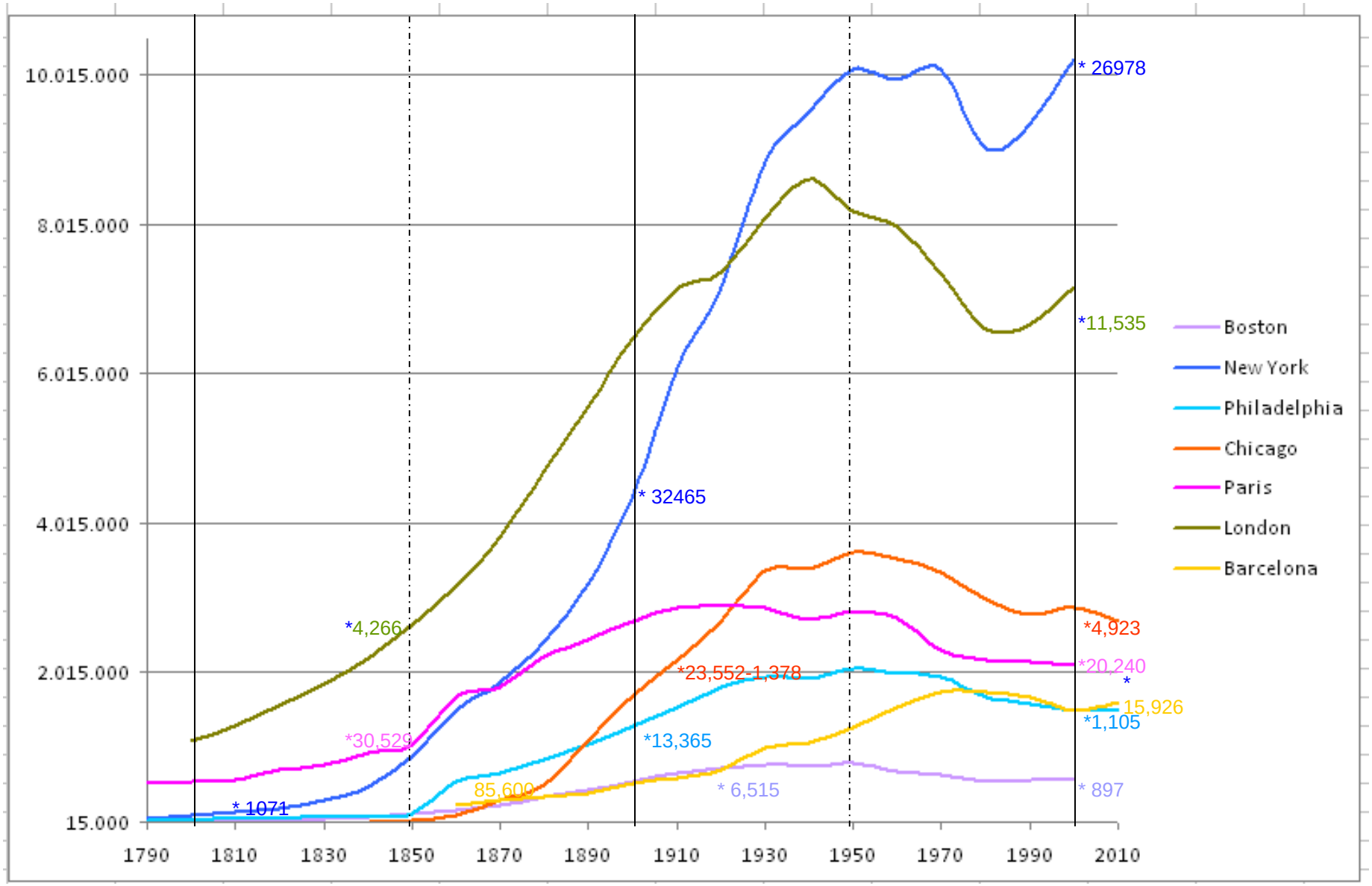
- The Cerdà Grid improves a more natural ventilation system which facilitates personal comfort, and energy efficiency saving than the North-South grid, such as New York, Chicago or Washington

-Increasing levels of biodiversity would rise personal comfort, and would
    -mitigate climate change effects in cities

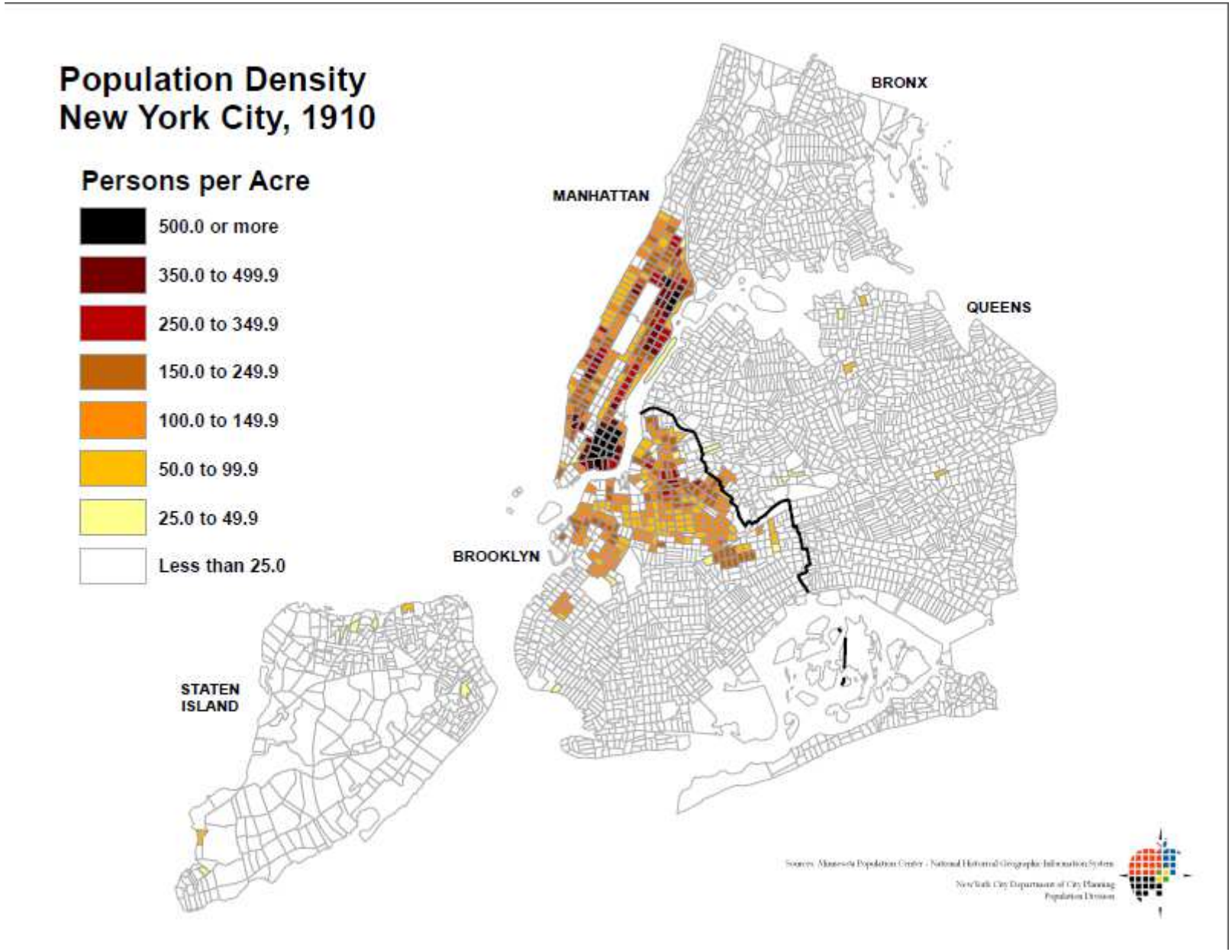
Quality of Life and Well-being

- Quality of life is identified as the satisfaction of desires associated with human needs and wants;
- Well-being as a general state of wellness.

Population and population density in cities, per Sq Km



Sources: Barcelona Institut d'Estadística de Catalunya (Idescat) and Centre d'Estudis Demogràfics;
Boston http://www.bpl.org/research/govdocs/boststats.htm;
Chicago http://tigger.uic.edu/depts/ahaa/imagebase/chimaps/mcclendon.html; London http://www.demographia.com/dm-lon31.htm;
New York http://www.demographia.com/dm-nyc.htm; Paris ;
Philadelphia http://physics.bu.edu/~redner/projects/population/cities/philadelphia.html.



http://www.nyc.gov/html/dcp/pdf/census/1910_pop_density.pdf

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Multicentered Chicago Ward System

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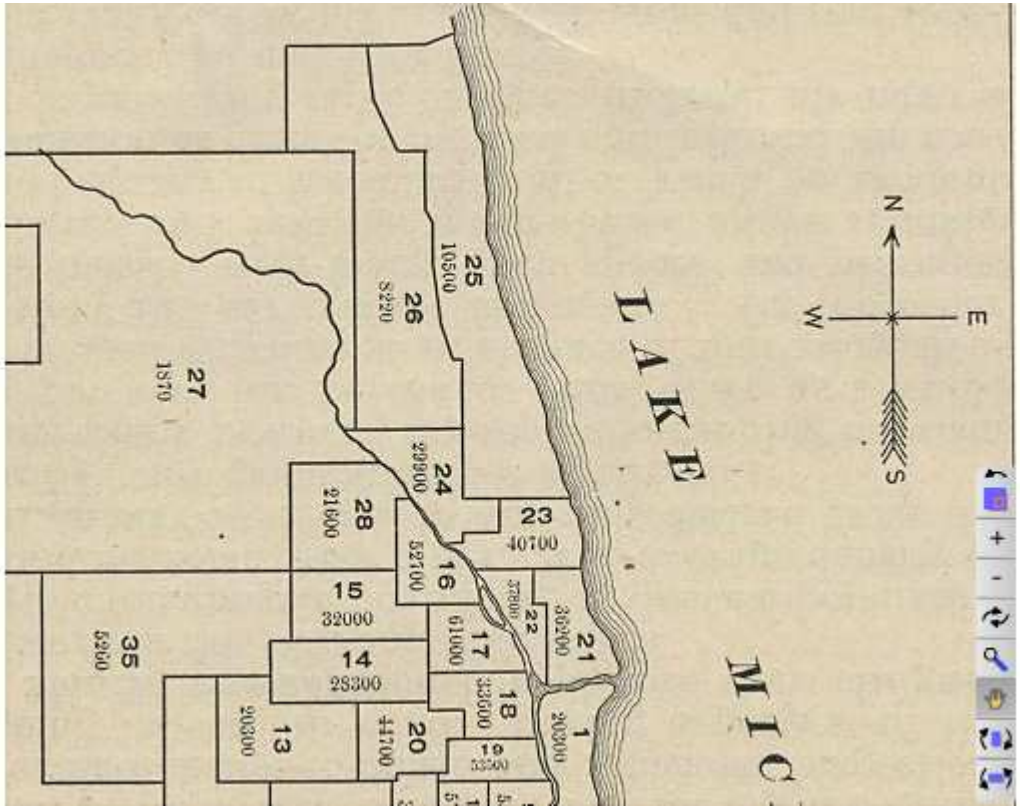
Population Density by Wards, 1904

Next

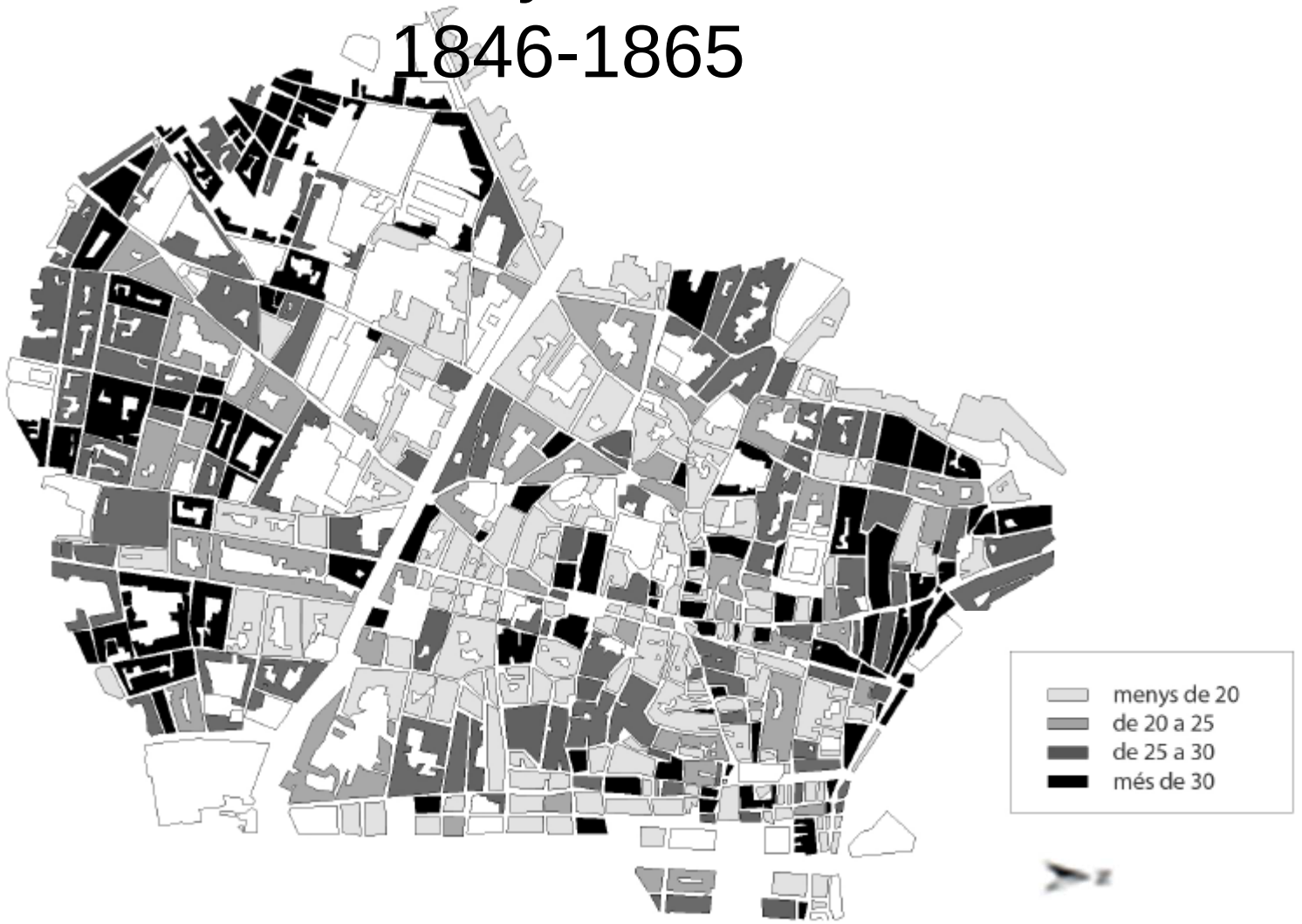
Population Density by Wards, 1904



Creator: Tenement Inspector
Source: Chicago Historical Society (ICHi-37341)

http://encyclopedia.chicagohistory.org/pages/10727.html

Barcelona. Mortality in the first floor level 1846-1865

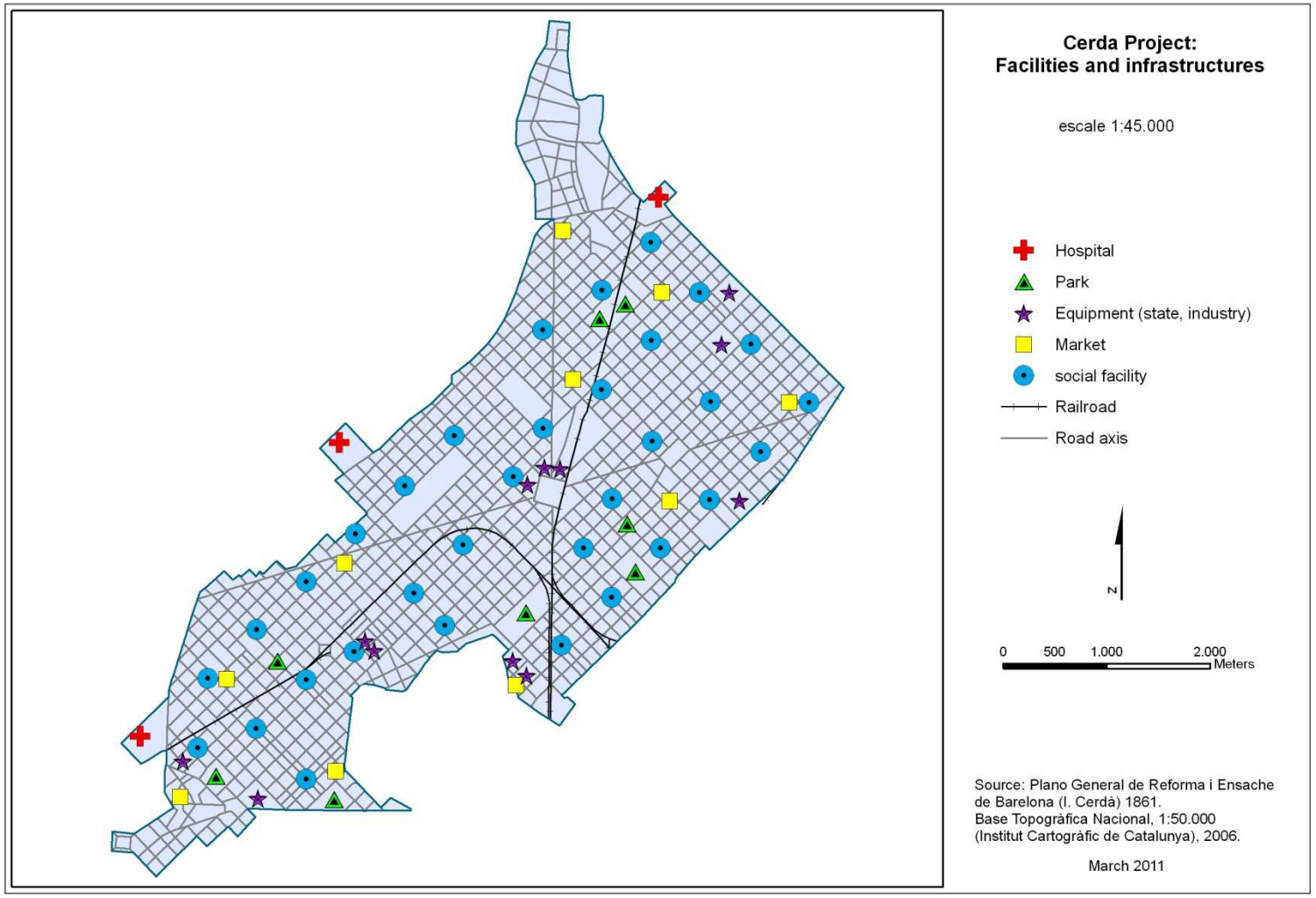


Average life expectancy between richer and poorer classes was 38.83 and 19.68 years of age, respectively (men, average between years 1837 and 1847; Cerdà, 1867)

Source. Canedo Arnedo, M. **Geohistòria ambiental de la Barcelona del segle XIX**. Master Research Project. Universitat Autònoma de Barcelona. Geography Department, 2010.

(1) García Fària, 1894, p. 26-27.

Service location made by Cerdà



Provision of Services to Population

Planning equipments

Type of services	Number	Number of blocks Occupancy
Parks	8	38
Markets	10	10
Hospitals	3	Outside the city
Schools	33	33
Government Institutions	12	25

Service provision in the Old Barcelona

- 10 midwifes and 69 surgeon doctors (Cerdà, 1867)

- 3 markets, 2 of them fisheries (Pescadería del Mercado del Borne, 425 m2, and Pescadería del Mercado de Isabel II, 900 m2), and 1 of them of general groceries (Mercado de la Plaza de Isabel II, 3,525 m2).

The optimization model (1)

- Location-Allocation

Minimize impedance. Minimize weighted impedance (P-Median). It chooses facilities such as the total sum of weighted impedances (demand allocated to a facility multiplied by the impedance to the facility) is minimized.

- ArcMap_10 Network Analyst

The optimization model (2)

General model:

Given $\{a_i\}_{i=1}^{n}$ $\{d_{ij}\}_{i,j=1}^{n}$

Choose $\{y_j\}_{j=1}^{n}$ $\{x_{ij}\}_{i,j=1}^{n}$

Where $y_j \in \{0,1\}$ $x_{ij} \in \{0,1\}$

In order to minimize Z equal to $\sum_{i=1}^{n}\sum_{j=1}^{n} a_i\, d_{ij} y_j x_{ij}$

Subject to $\sum_{j=1}^{n} y_j = p$ $\sum_{j}^{n} y_j\, x_{ij} = 1, \forall\, i$

- **Where,**
- **a_i = quantity of population in node i,**
- **i = origin of population,**
- **j = possible service location,**
- **p = number of services,**
- **d_{ij} = the shortest distance between node *i* and node *j*,**
- **x_{ij} = 1 if population of node i is assigned to j, 0 otherwise,**
- **x_{jj} = 1 if a service is located in node j, 0 otherwise.**

School service areas

•**Table 4. Population within each school time interval**

Interval time in minutes	Population	%	Cummulative
< 5	41,297	27	27
5 - 10	75,259	49	76
10,1 - 15	27,263	18	94
> 15	8,656	6	100
Total	152,475	100	

Park service areas, 5, 10 and 20 minutes

WorldMap BETA

Current Map: Barcelona_Cerda_1860

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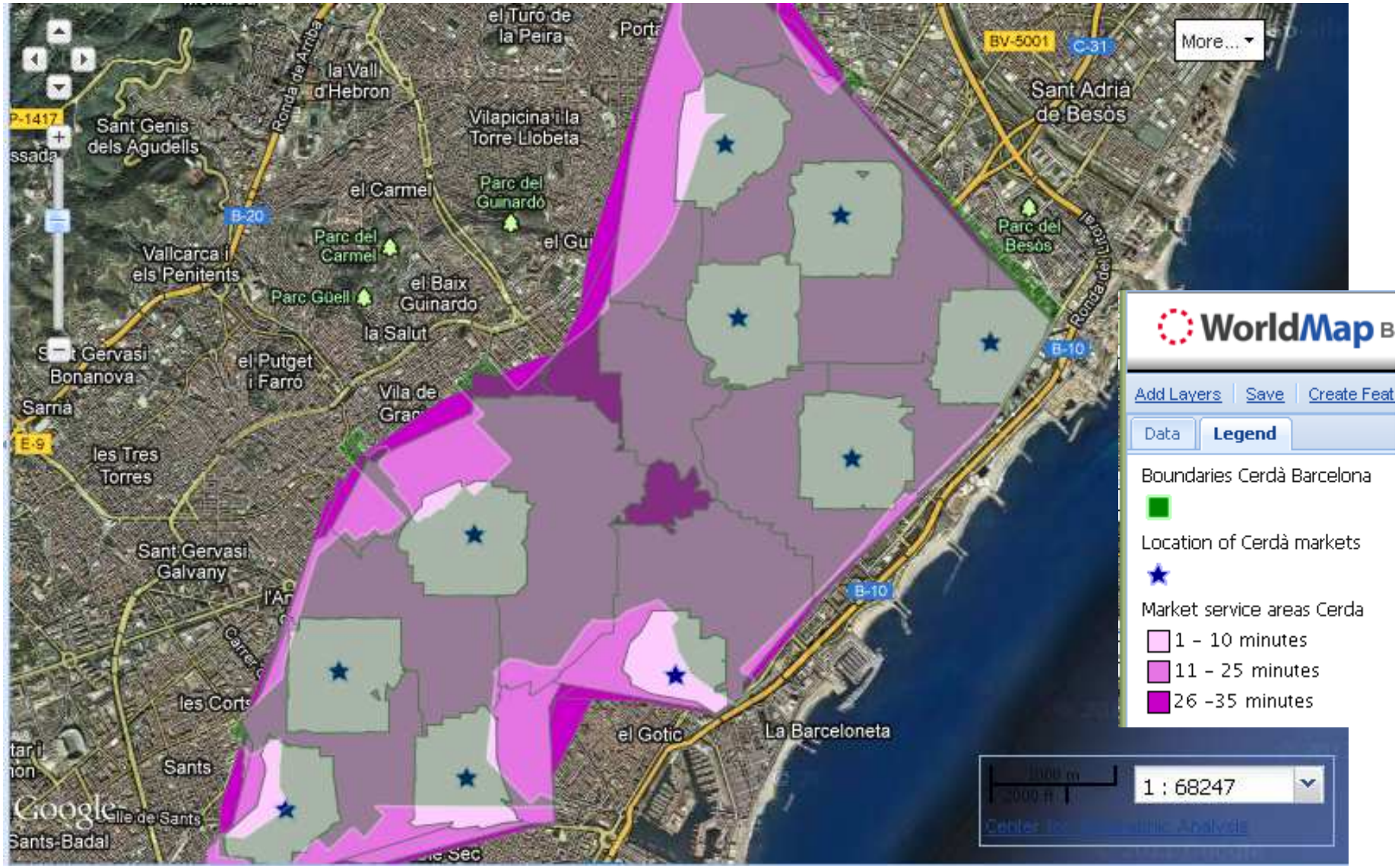
Market service areas



Cerdà hospitals allocation of demand within 30 minutes distance

WorldMap BETA

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La ciudad es un espacio abierto donde mecanismos dinámicos de conectores y nódulos de recarga permeabilizan el sistema urbano y favorecen niveles de biodiverssidad

Modelos de
naturación y **naturalización**

Naturación: estrategias de creación y adaptación de verde urbano con la finalidad de conseguir una fauna autóctona

Naturalització: proceso de entrada de biodiversidad faunística en sistema-ciudad en el paradigma sostenibilista.

Natural Ventilation and the Cerdà Grid

Streets of the New Barcelona

Area: 1,975 Ha

Street type/ wide	Longitude (km)
20 m	237,7
30 m	77,5
50 m	183
Streets with train	117,4
Streets Outside Enlargement	118,8
Perimeter	228,3

Streets of the Old Barcelona

Area: 193,97 Ha

Street type/ wide	Number of streets
<3 m	200
3-6 m	400

Bird's Eye View of Chicago, 1857

Creator: I. T. Palmatary and Christian Inger
Source: Chicago Historical Society (ICHi-05656)

http://encyclopedia.chicagohistory.org/pages/10603.html

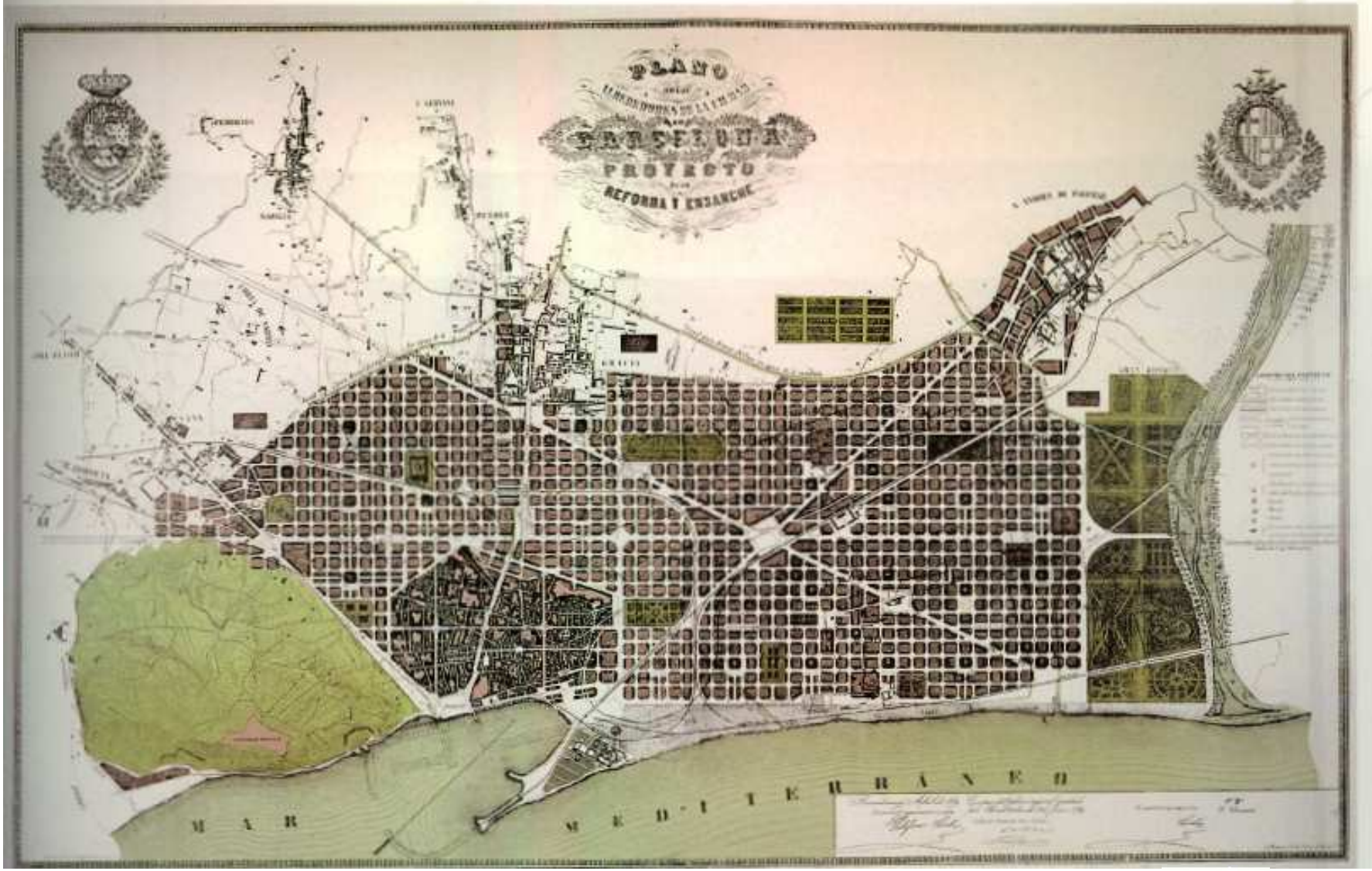
NYC-GRID-1811

Commissioner's Grid plan for Manhattan

http://en.wikipedia.org/wiki/File:NYC-GRID-1811.png

http://en.wikipedia.org/wiki/Commissioners%27_Plan_of_1811

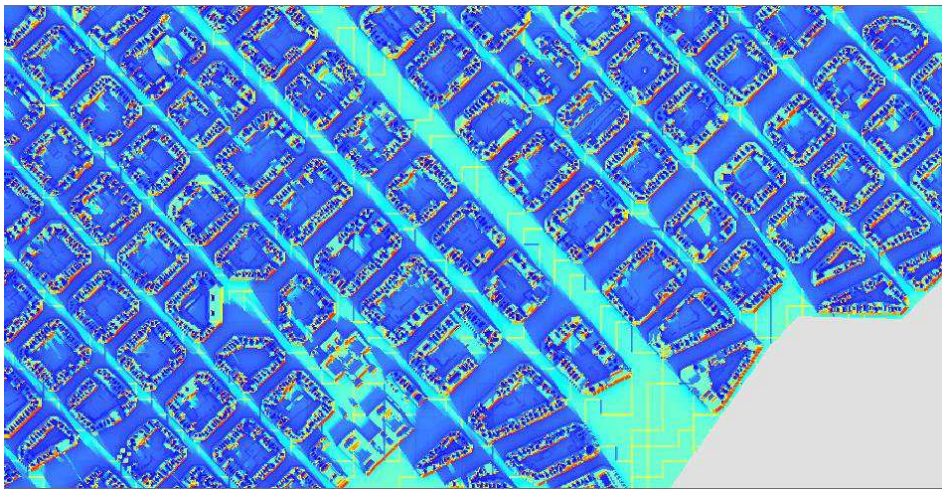
PLANOS DEL PROYECTO DE ENSANCHE Y REFORMA DE BARCELONA



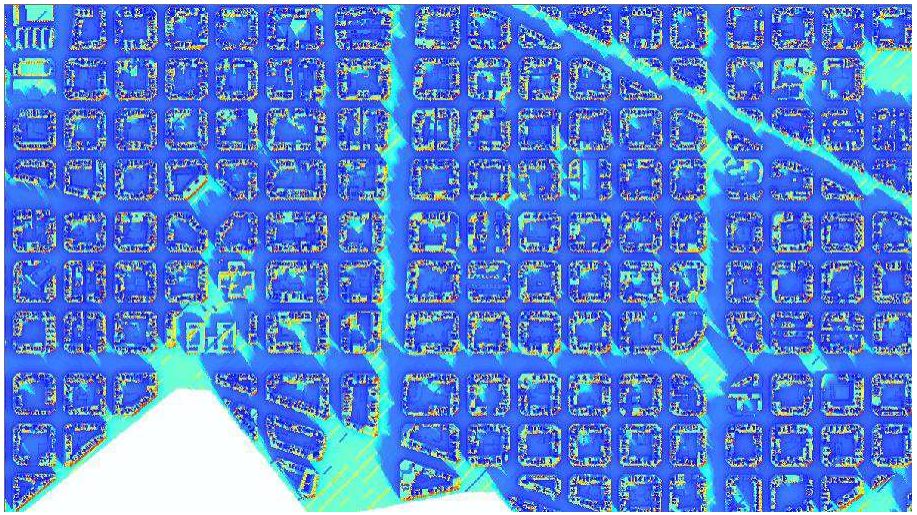
Case Study

Data capturing: Cerdà's Map spatial referentiation

Fig 1. Overlying the original Map and the current Barcelona's grid

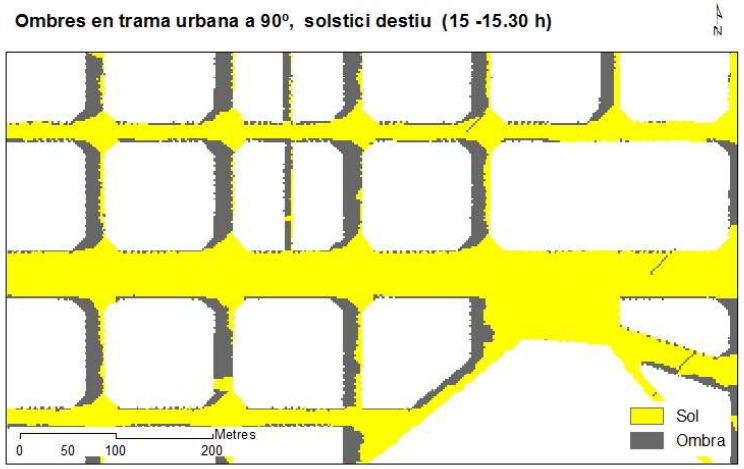


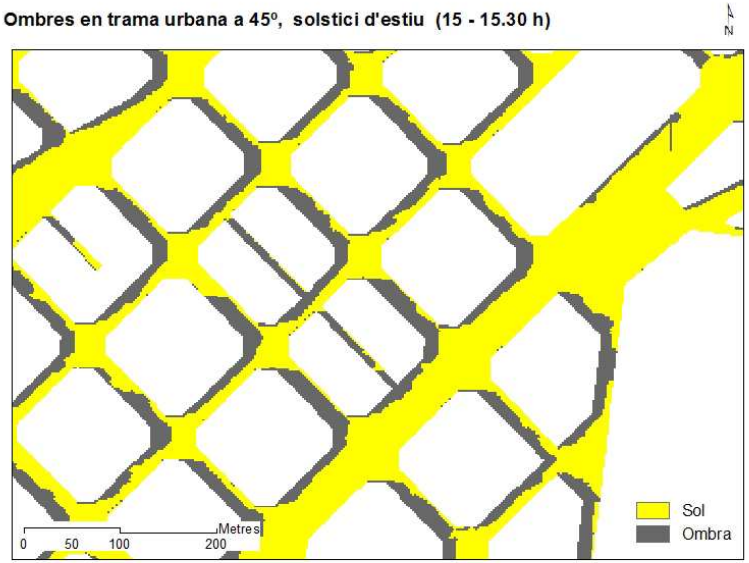
45_21Desembre_9h



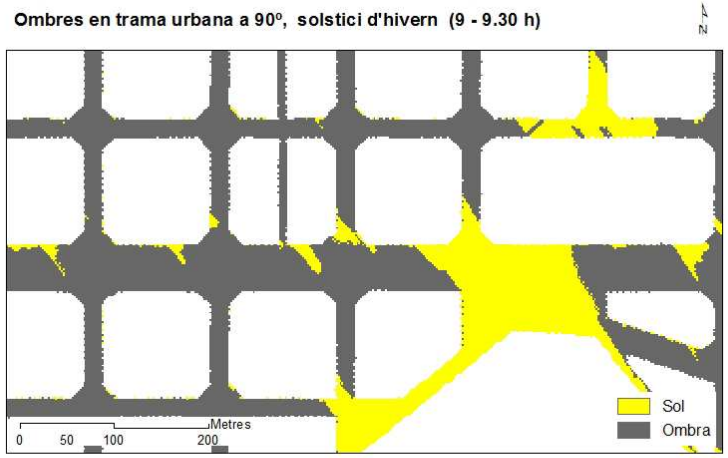
90_21Desembre_9h

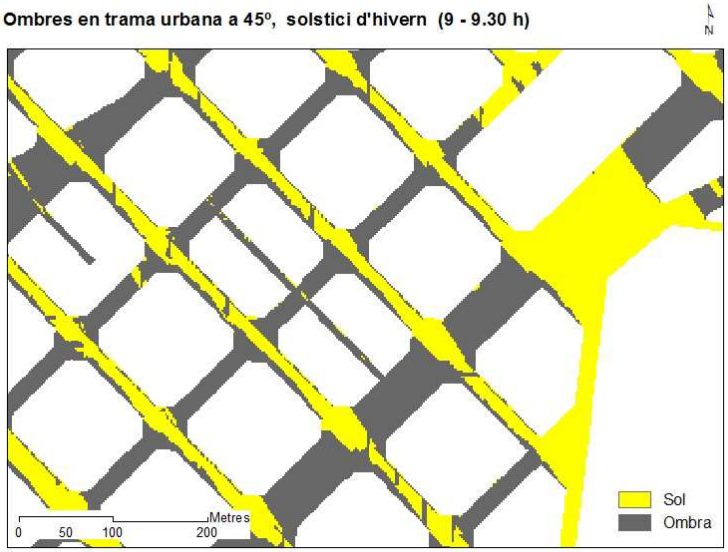
Insolation Summer Solstice (15-15,30h)



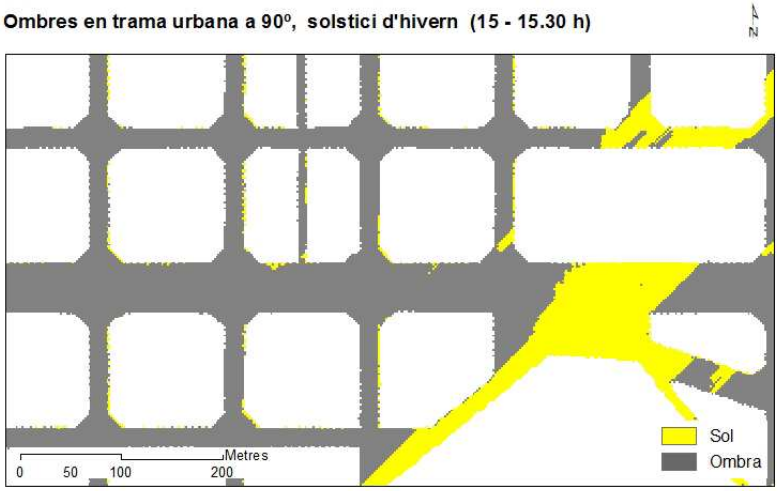


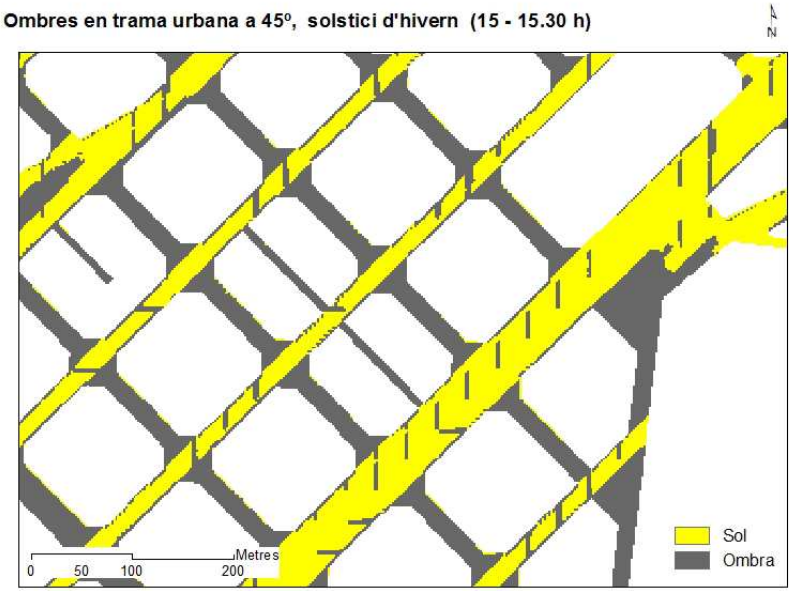
Insolation Winter Solstice (9,00-9,30h)



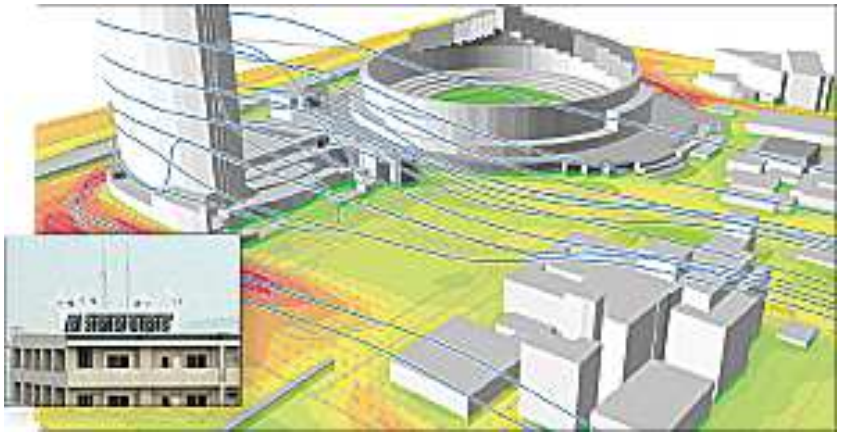


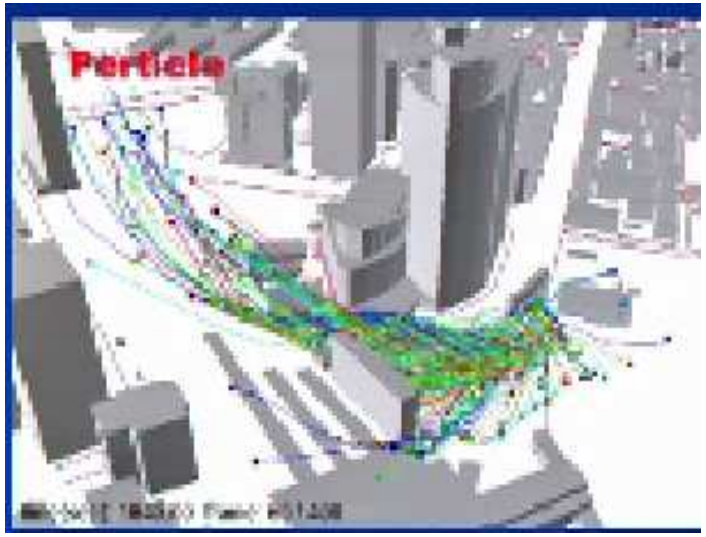
Insolation Winter Solstice (15,00-15,30h)





Airflow





Kyushu University: A model of a baseball stadium in Japan, showing the airflow around the stadium. This was created with ArcView, ArcGIS 3D Analyst, and Airflow Analyst.

http://video.esri.com/watch/187/airflow-modeling-in-urban-landscapes

THE END

THANK YOU VERY MUCH

MONTSERRAT PALLARES-BARBERA