WELL-BEING AND URBAN PLANNING. PUBLIC SERVICES, NATURAL VENTILATION AND BIODIVERSITY IN BARCELONA

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Association of American Geographers Meeting
Ecologies of Well-being III 3429 Session

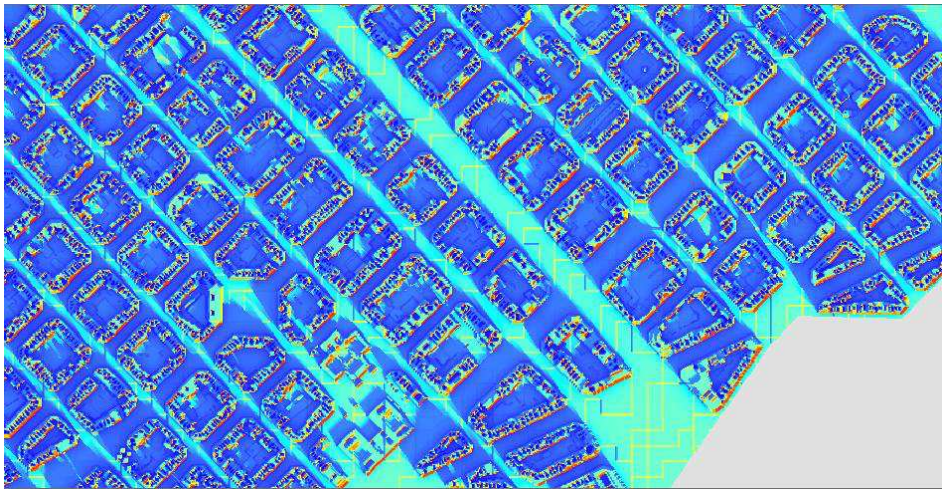
Thursday 11th April/2013, 1.40PM
Westin Hotel Venue Santa Monica C Level 3

Universitat Autònoma de Barcelona (UAB) and Institut de Ciència i Tecnologia Ambientals (ICTA)

Structure of the talk

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

Insolation



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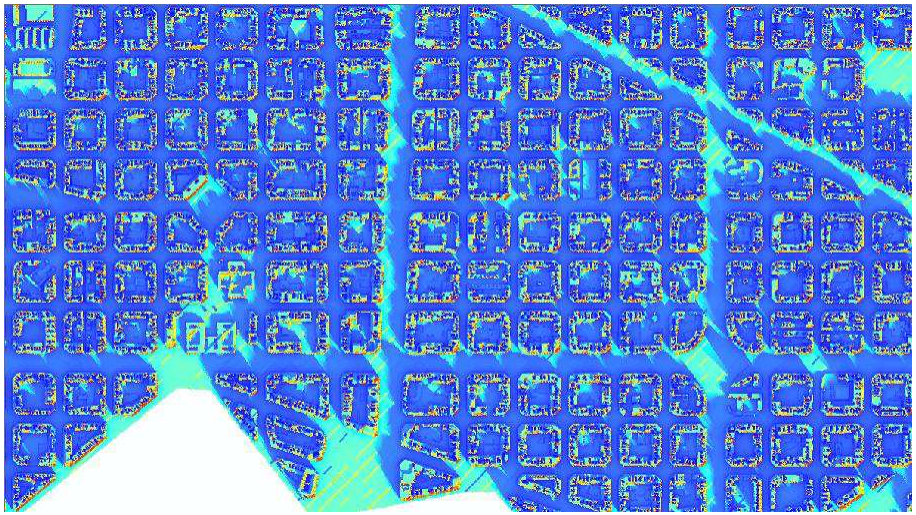

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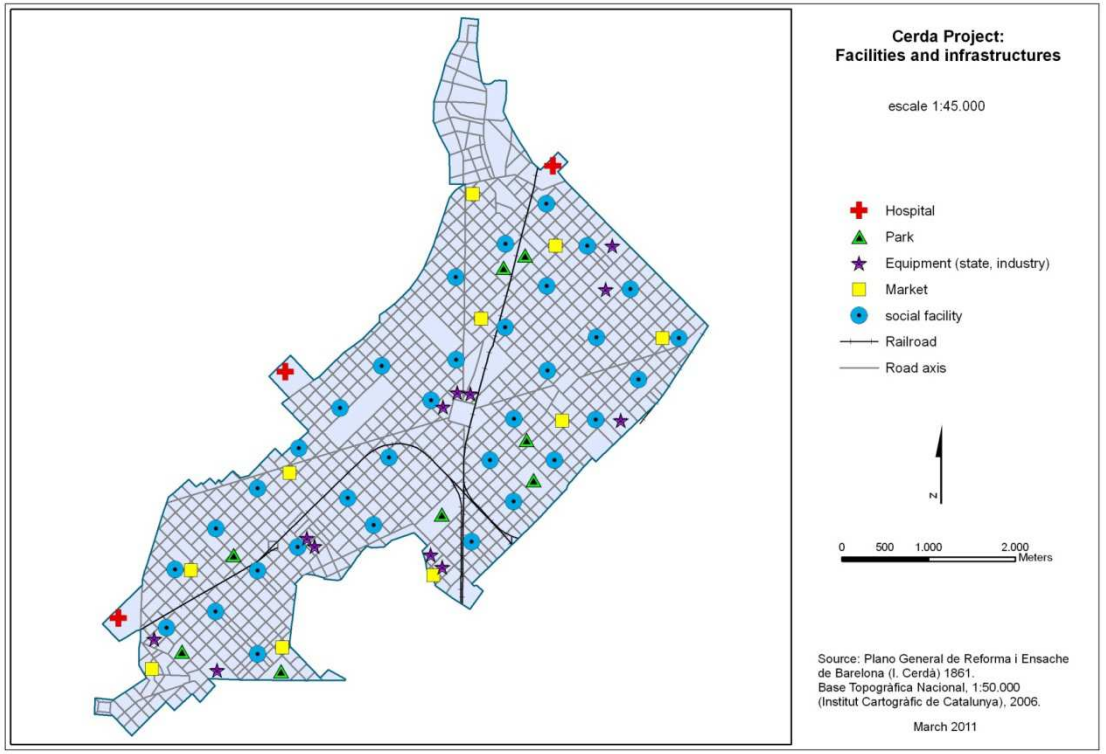
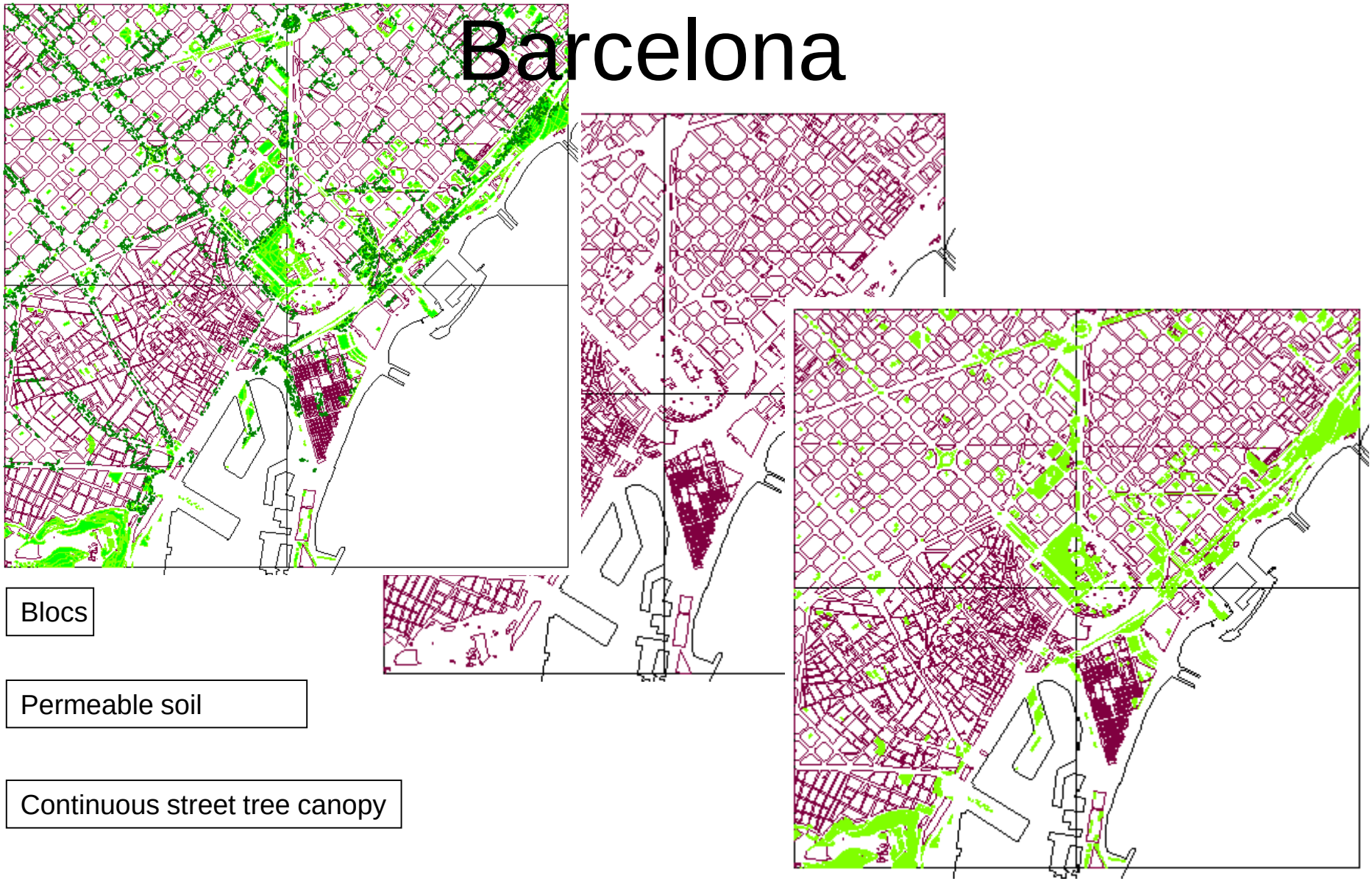
Services


Cerda Project:
Facilities and infrastructures
escale 1:45.000
Hospital
Park
Equipment (state, industry)
Market
social facility
Railroad
Road axis
N
0 500 1.000 2.000
Meters
Source: Plano General de Reforma i Ensache de Barelona (I. Cerdà) 1861.
Base Topogràfica Nacional, 1:50.000 (Institut Cartogràfic de Catalunya), 2006.
March 2011

Green Distribution in Barcelona



Blocs

Permeable soil

Continuous street tree canopy

Well-being and urban planning

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

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.

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

Mortality increased and life span decreased

Population density increased

Determinants of the cities at 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

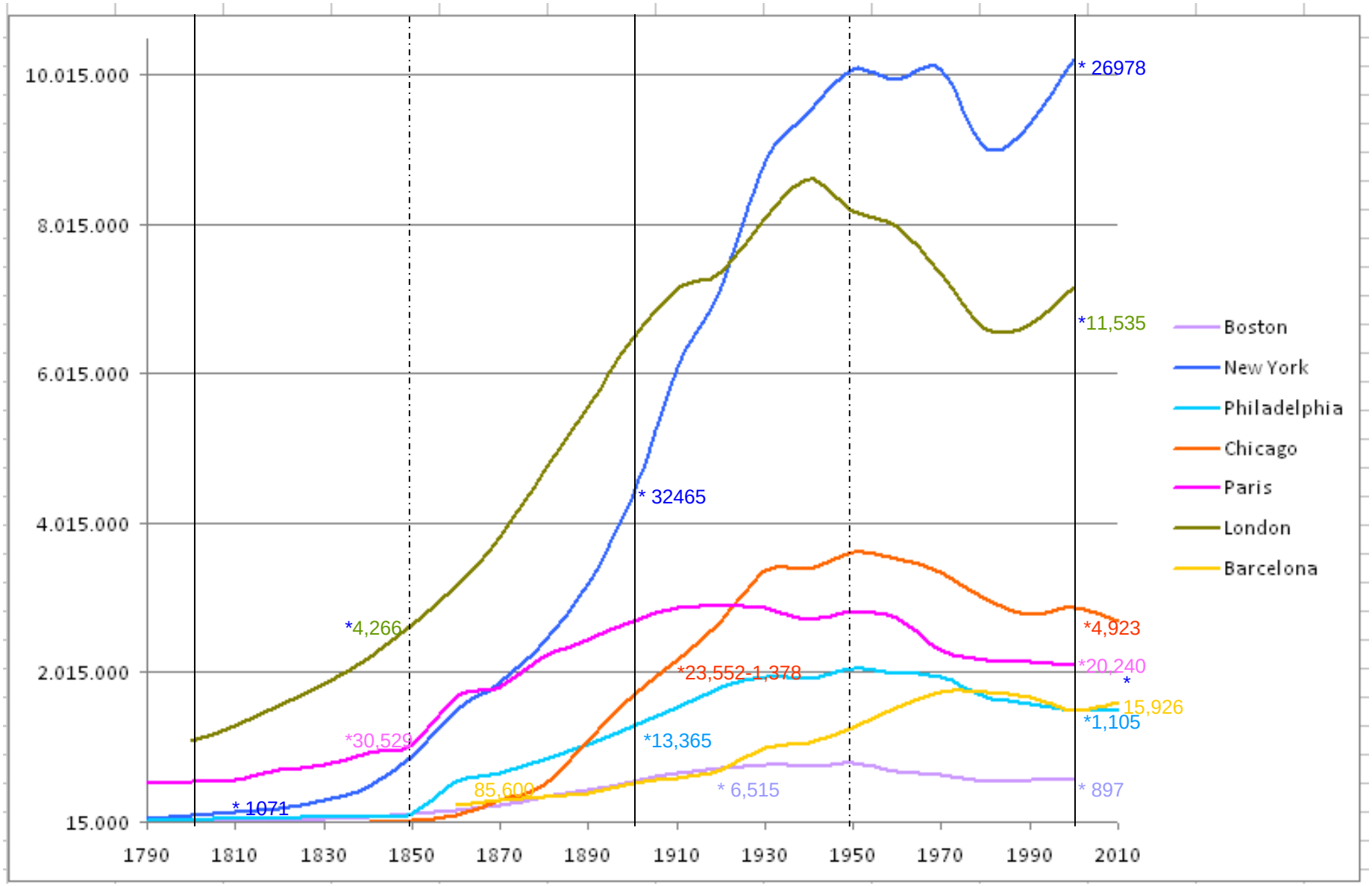
- Urbanism can be used as a well-being redistribution tool

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

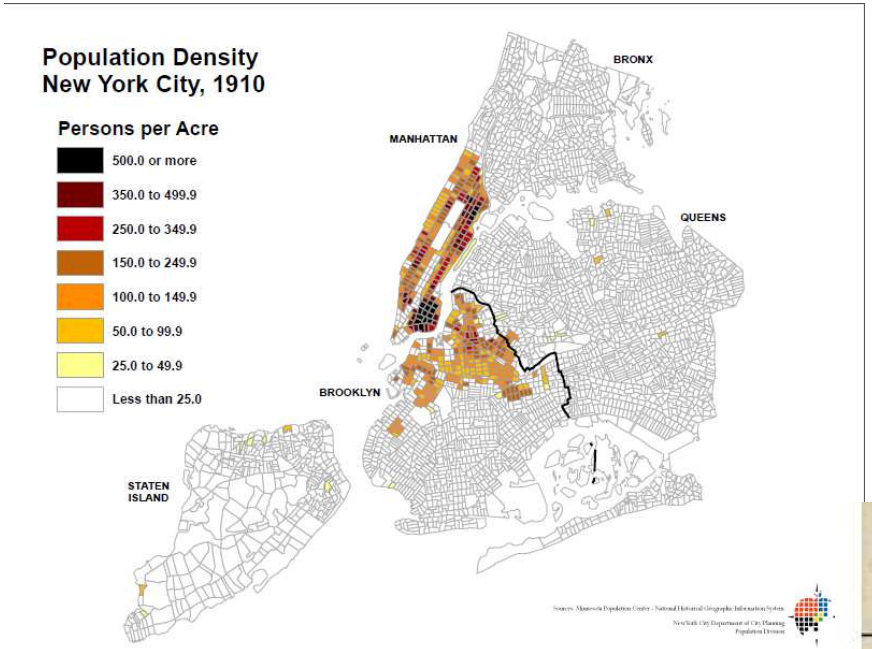
- The Cerdà Grid improves a more natural ventilation system which facilitates personal comfort, and energy efficiency saving than the North-South grid, such as New York, Chicago or Washington

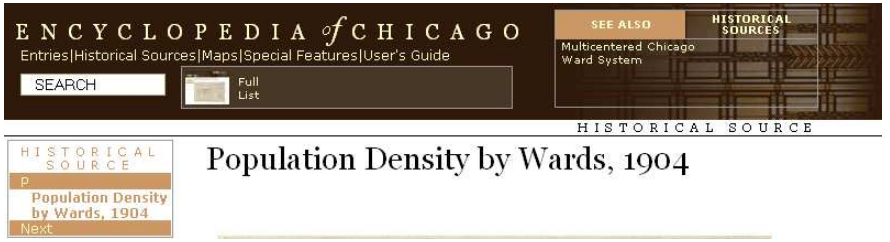
-Increasing levels of biodiversity would rise personal comfort, and would mitigate climate change effects in cities

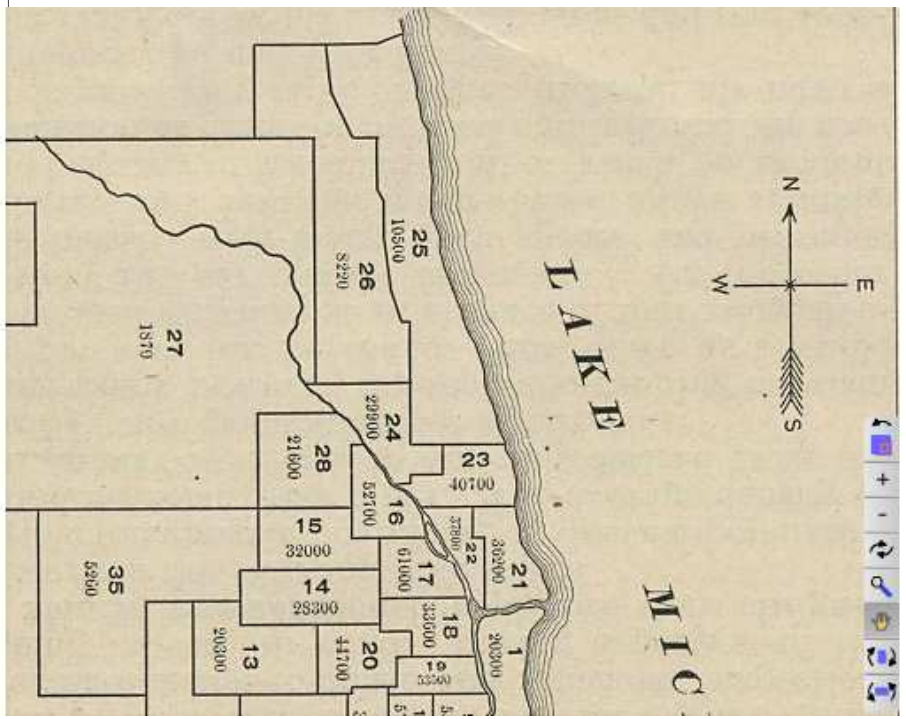
Population and population density in cities, per Sq Km



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.





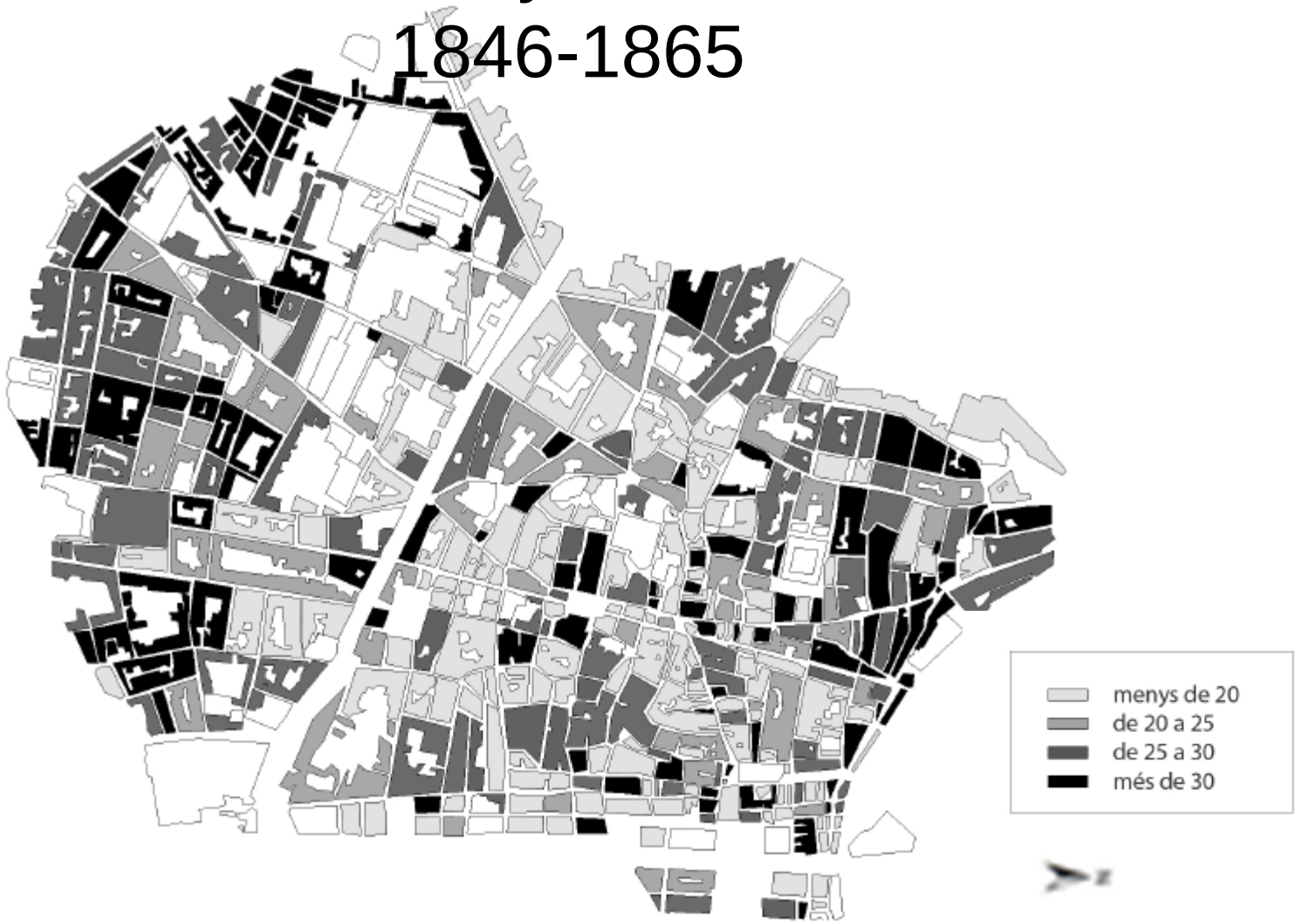


Creator: Tenement Inspector
Source: Chicago Historical Society (ICHi-37341)

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

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.

Provision of Services to Population

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).

Planning equipment for the new Barcelona

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 location made by Cerdà. The optimization model

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

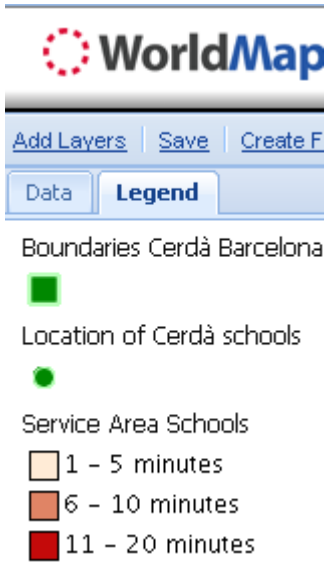


Table 4. Population within each school time interval

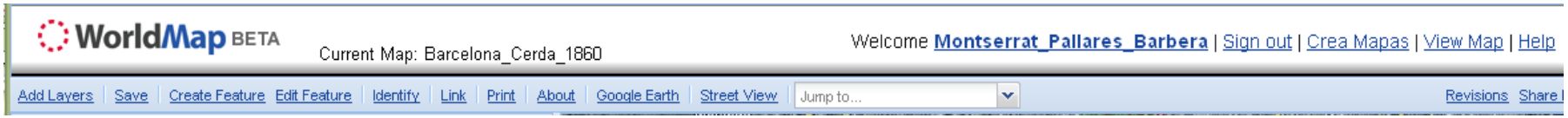
Interval time in minutes	Population	%	Cummulative
< 5	41,297	27	27
5 - 10	75,259	49	76
10,1 - 15	27,263	18	94
> 15	8,656	6	100
Total	152,475	100	

http://worldmap.harvard.edu/maps/Barcelona_Cerda_1860/CRD

Park service areas, 5, 10 and 20 minutes

Population and parks

Population served by parks			
Interval in time minutes	Population	%	Cumulative %
< 5	42,588	28	28
5 - 10	60,116	39	67
10,1 - 20	47,888	32	99
>20	1,883	1	100
total	152,475	100	



Market service areas

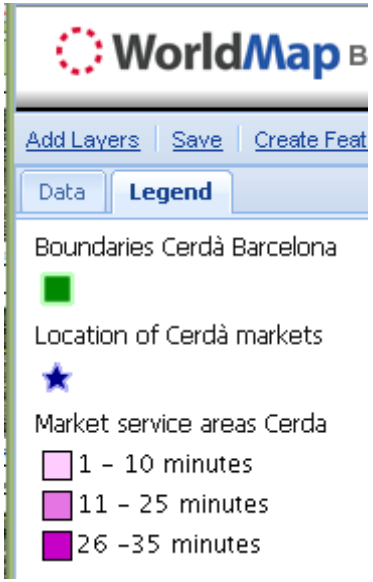


Table 2: Population within each market time-interval

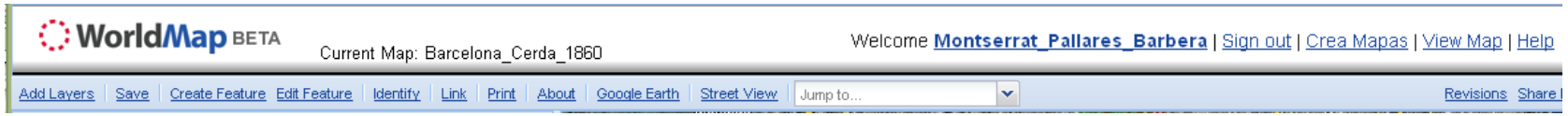
Interval time in minutes	Population	%	Cumulative %
1–5	19,444	13.0	13.0
6–11	54,268	36.0	49.0
12–24	70,691	46.0	95.0
>24	8,072	5.0	100.0
Total	152,475	100.0	

http://worldmap.harvard.edu/maps/Barcelona_Cerda_1860/CRD

Cerdà hospitals allocation of demand within 30 minutes distance

Table 1: Population within each hospital service area

Interval time in minutes	Population	%	Cumulative %
1–9	16,251	11.0	11.0
10–19	52,500	34.0	45.0
20–30	50,500	33.0	78.0
>30	33,224	22.0	100.0
Total	152,475	100.0	



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

- One of the Cerdà's objectives was to positioning the grid in order to get maximum sunshine and natural ventilation for housing

-More sustainable cities

-Old technique of house ventilation and natural air recycling and cooling inside the house

- He considered the streets as **"aerial channels", which had the function for the city what lungs do for humans**: "Por lo que toca a salubridad, siguiendo en esta parte a los highienistas, podemos considerar las calles como canales aereos (…) que vienen a ser para las ciudades como lo que para el cuerpo humano son los pulmones." Cerdà, 185, p. 376 (1991)

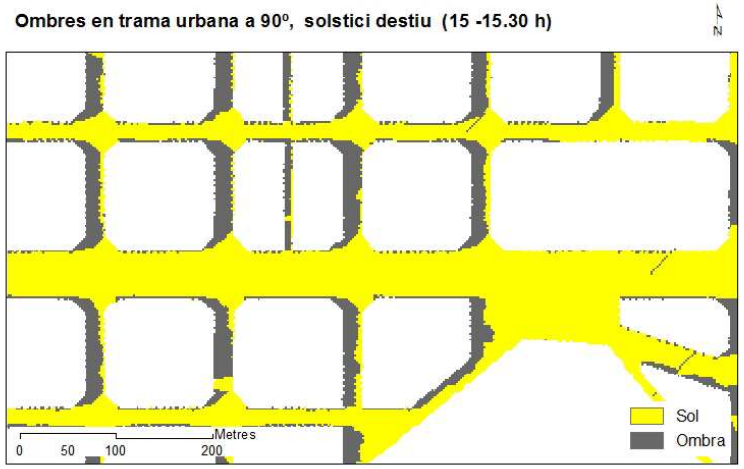
1200 **Orientacion de las calles.** La direccion u orientacion de las calles de una nueva ciudad debe considerarse bajo cuatro diferentes conceptos: 1º con respecto á la direccion de los vientos mas saludables que acostumbran reinar por mas tiempo en la localidad; 2º relativamente á la direccion del movimiento de importacion y de exportacion establecido ó que pueda establecerse en lo sucesivo; 3º por lo tocante á la suavidad ó aspereza de las pendientes que deben resultar y 4º por lo que se refiere al facil y conveniente desagüe de las alcantarillas.

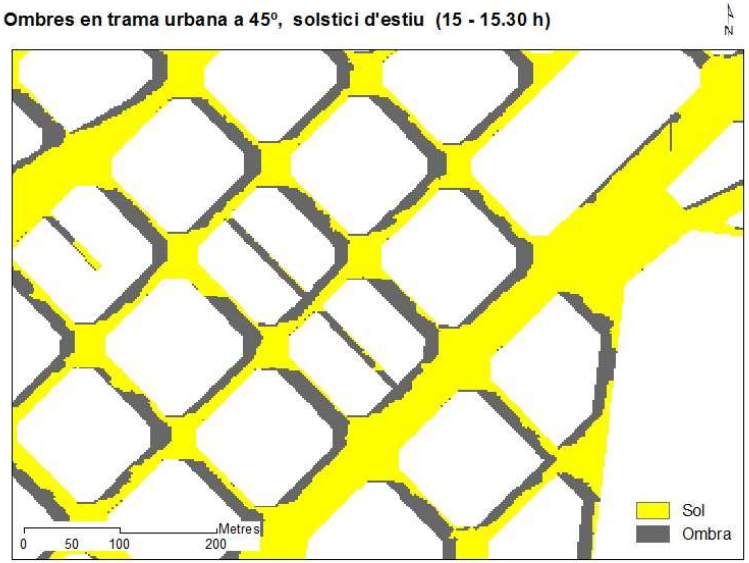
Source: Cerdà, 1855 p. 374 (1991).

PLANOS DEL PROYECTO DE ENSANCHE Y REFORMA DE BARCELONA

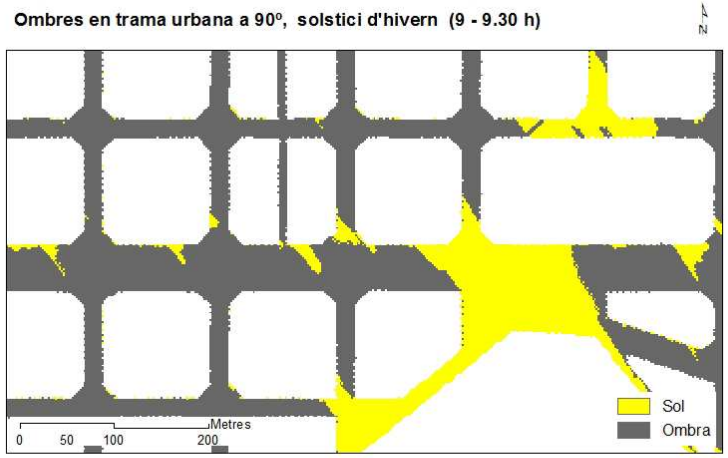
Case Study

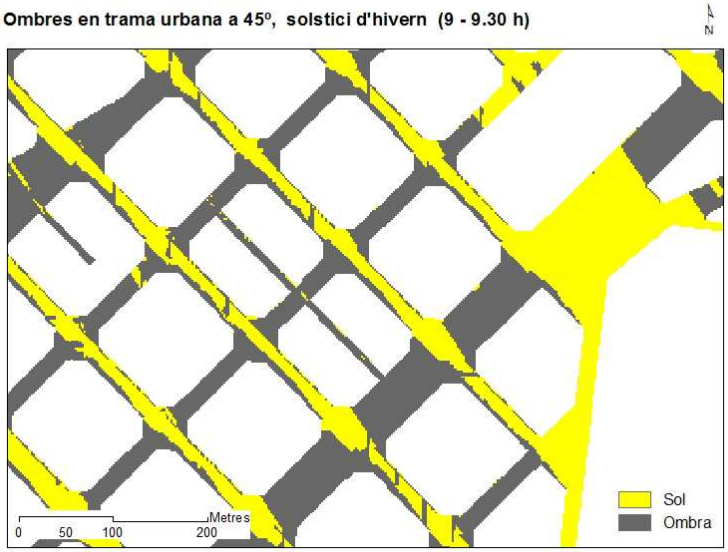
Insolation Summer Solstice (15-15,30h)



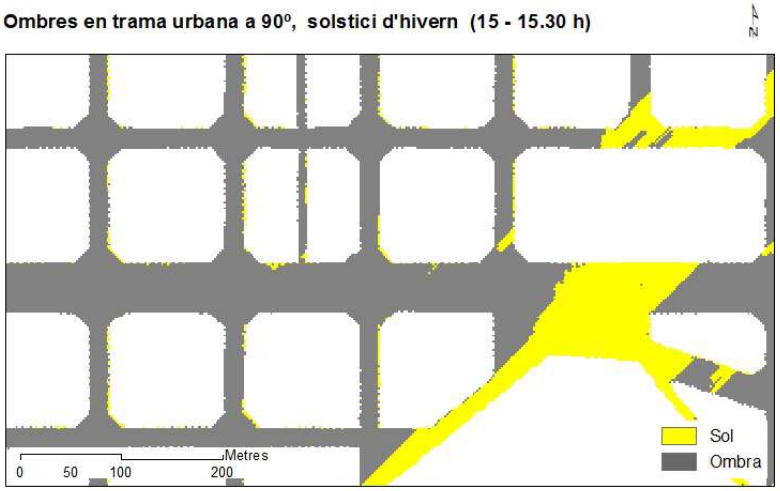


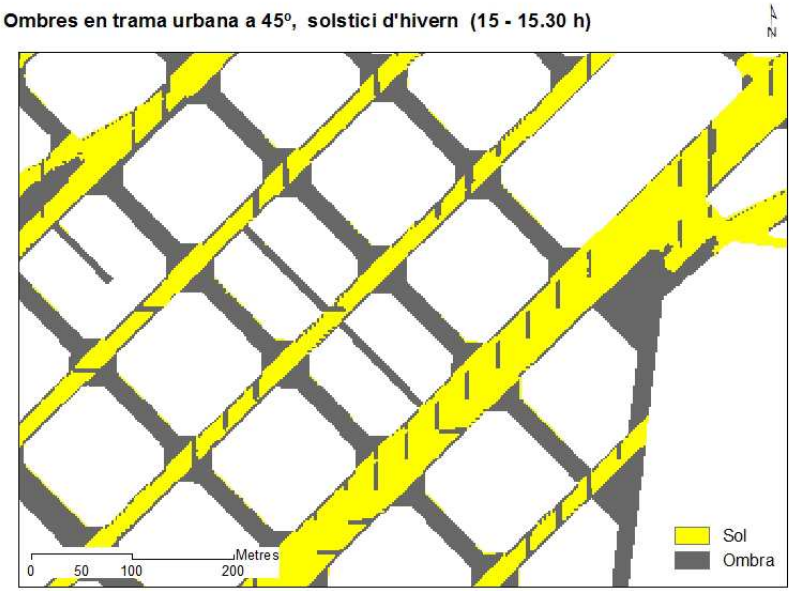
Insolation Winter Solstice (9,00-9,30h)



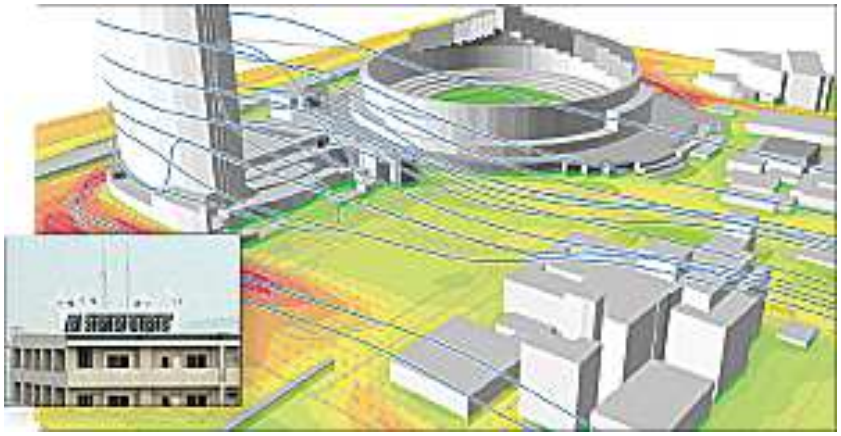


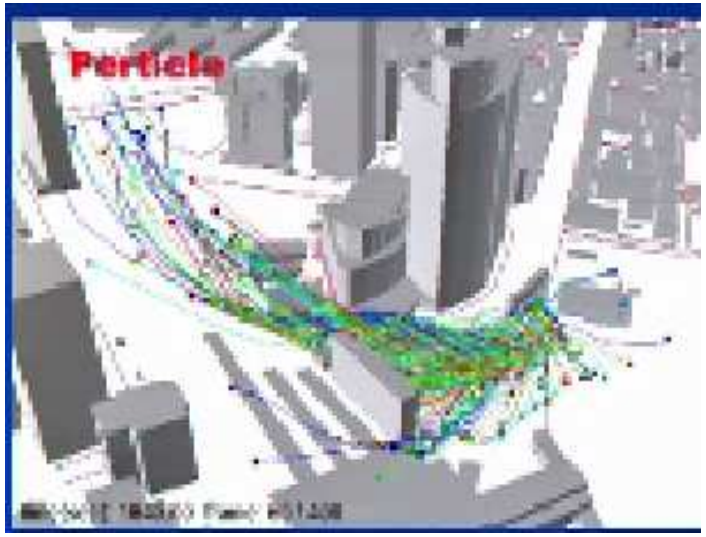
Insolation Winter Solstice (15,00-15,30h)





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

Annex 5

- 1_ PALLARES-BARBERA, M.; BADIA, A.; DUCH, J. (2011). **Cerdà and Barcelona: The need for a new city and service provision**. Urbani izziv, volume 22, no. 2, pp.: 122-136.
  http://urbani-izziv.uirs.si/en/Urbaniizziv/tabid/95/Default.aspx
  UDC: 911.375.1(460) DOI: 10.5379/urbani-izziv-en-2011-22-02-005

- 2_ Pallares-Barbera M, Duch J. Barcelona Urban Evolution from 1860. http://worldmap.harvard.edu/maps/Barcelona_urban_evolution/CRE [Internet]. 2012. Barcelona Urban Evolution since 1860

- 3_ Pallares-Barbera M, Duch J. Urban Planning and service provision in the Cerdà Barcelona Expansion. http://worldmap.harvard.edu/maps/Barcelona_Cerda_1860/CRD [Internet]. 2012. Barcelona_Cerda_1860Abstract