EUROGI Members Meeting
“Geospatial & Digital Transformation key for Industrial Revolution 4.0 and Society”
April 26th, Fisciano, Università di Salerno, Dipartimento di Informatica

Spatial Information in supporting environmental planning and disaster management

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Beniamino Murgante

Cities are the economic heart of America

http://www.washingtonpost.com/blogs/the-fix/wp/2014/02/19/you-might-not-like-big-cities-but-you-need-them/?tid=sm_fb
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The following table ranks the gross domestic products of nations across the world alongside the gross metro product of the 50 biggest U.S. cities.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country or Metro Area</th>
<th>2011 GDP or GMP (in billions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>United States</td>
<td>$15,094.0</td>
</tr>
<tr>
<td>2</td>
<td>China</td>
<td>$7,298.9</td>
</tr>
<tr>
<td>3</td>
<td>Japan</td>
<td>$5,669.1</td>
</tr>
<tr>
<td>4</td>
<td>Germany</td>
<td>$3,669.5</td>
</tr>
<tr>
<td>5</td>
<td>France</td>
<td>$2,774.4</td>
</tr>
<tr>
<td>6</td>
<td>Brazil</td>
<td>$2,476.7</td>
</tr>
<tr>
<td>7</td>
<td>United Kingdom</td>
<td>$2,416.4</td>
</tr>
<tr>
<td>8</td>
<td>Italy</td>
<td>$2,198.0</td>
</tr>
<tr>
<td>9</td>
<td>India</td>
<td>$1,897.9</td>
</tr>
<tr>
<td>10</td>
<td>Russia</td>
<td>$1,857.9</td>
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<tr>
<td>11</td>
<td>Canada</td>
<td>$1,739.4</td>
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<tr>
<td>12</td>
<td>Spain</td>
<td>$1,492.5</td>
</tr>
<tr>
<td>13</td>
<td>Australia</td>
<td>$1,483.8</td>
</tr>
<tr>
<td>14</td>
<td>New York-Northern New Jersey-Long Island, NY-NJ-PA</td>
<td>$1,287.7</td>
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<tr>
<td>15</td>
<td>Mexico</td>
<td>$1,154.1</td>
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<td>16</td>
<td>South Korea</td>
<td>$1,116.4</td>
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<tr>
<td>17</td>
<td>Indonesia</td>
<td>$846.8</td>
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<tr>
<td>18</td>
<td>Netherlands</td>
<td>$837.8</td>
</tr>
<tr>
<td>19</td>
<td>Turkey</td>
<td>$773.1</td>
</tr>
<tr>
<td>20</td>
<td>Los Angeles-Long Beach-Santa Ana, CA</td>
<td>$755.0</td>
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<tr>
<td>21</td>
<td>Switzerland</td>
<td>$637.7</td>
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<tr>
<td>22</td>
<td>Saudi Arabia</td>
<td>$576.8</td>
</tr>
<tr>
<td>23</td>
<td>Chicago-Joliet-Naperville, IL-IN-WI</td>
<td>$546.8</td>
</tr>
<tr>
<td>24</td>
<td>Sweden</td>
<td>$537.7</td>
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<tr>
<td>25</td>
<td>Poland</td>
<td>$514.3</td>
</tr>
<tr>
<td>26</td>
<td>Belgium</td>
<td>$512.6</td>
</tr>
<tr>
<td>27</td>
<td>Iran</td>
<td>$499.7</td>
</tr>
<tr>
<td>28</td>
<td>Norway</td>
<td>$486.2</td>
</tr>
</tbody>
</table>

Cities play a central role for humanity, offering the opportunity to learn from each other face to face.
Cities have the capability of providing something for everybody, only because, and only when, they are created by everybody. (Jane Jacobs)

All of us articulate our understanding of the city in different ways, thus implying that cities are kaleidoscopes of plurality, a multiplicity of ideas, perceptions, theories, models. (Batty, 2013)
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Increase in population

Will exceed 9 billion in 2050

Urbanization

The percentage of population residing in urban areas will reach 70% in 2050.

Increase in energy consumption due to the expansion of the middle class

The middle class will account for 65% of the total in 2020.

Beniamino Murgante

While India is still at an early stage of urbanization, China will continue to see rapid growth across cities of all sizes including rising megacities.

Contribution to country GDP growth, 2010–25%

In India, small cities and rural areas continue to matter—only 23 cities make it into Cityscope.

710 large cities in China will generate more than 90 percent of the nation’s GDP growth.

Top five cities

Rank 6 to 15

Rank 16 to 30

All other

large cities

Top three

Small cities and rural areas

Total growth

SOURCE: McKinsey Global Institute Cityscope 1.5

Cities segmented by contribution to total GDP, 2010, cumulative % of total

<table>
<thead>
<tr>
<th>Large cities, ranked by GDP</th>
<th>Small cities, rural</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td></td>
</tr>
<tr>
<td>Population</td>
<td>10</td>
</tr>
<tr>
<td>GDP</td>
<td>13</td>
</tr>
</tbody>
</table>

| Western Europe             |                      |
| Population                 | 8                    | 27                  | 24   | 43    | 0.4 billion | 16 trillion |
| GDP                        | 9                    | 31                  | 33   | 37    | $16 trillion |

| China                      |                      |
| Population                 | 5                    | 13                  | 33   | 52    | 1.3 billion | 36 trillion |
| GDP                        | 8                    | 29                  | 43   | 22    | $36 trillion |

| India                      |                      |
| Population                 | 0                    | 0                   | 0    | 81    | 1.2 billion | 1 trillion  |
| GDP                        | 7                    | 17                  | 15   | 61    | $1 trillion  |

*GDP measured at market exchange rate; some figures may not sum to 100% because of rounding.

Source: McKinsey Global Institute analysis

Percentage of EU population living in urban areas, 1950-2050 (forecast)
Source: UN (2009)
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An urban future: Kenya’s population growth

*Includes core- and peri-urban residents.
Note: Population growth projections are World Bank computations based on data from KNBS and UN, DESA (Source: World Bank)
Cities are Reaching Their Limits

Cities must become smarter about using existing capacity and resources

80%
Cities produce nearly 80 percent of the world’s carbon emissions.

1 billion
Today there are more than 1 billion cars on the road. That number will double by 2020.

1 second
Every second, the urban population grows by 2 people. Almost 180,000 people move into cities each day.

50%
Cities lose as much as 50 percent of their water supply to leaky infrastructure.

1/3
Commercial and residential buildings consume 1/3 of the world’s energy.
The Urban Effect

80%
Cities produce nearly 80 percent of the world's carbon emissions.

1/3
Commercial and residential buildings consume 1/3 of the world's energy.

75%
Cities consume an estimated 75 percent of the world's energy.

50%
Cities lose as much as 50 percent of their water supply to leaky infrastructure.

1 billion
Today there are more than 1 billion cars on the road. That number will double by 2020.

Exercising the Impact of the Growth of Cities
In 1950, New York City was the only megacity with a population of more than 10 million people. By 2015, the United Nations estimates there will be 22 megacities.

45
China will build another 45 airports during the next five years.

1 second
Every second, the urban population grows by 2 people. Almost 180,000 people move into cities each day.
Dharavi: 240-hectare slum in central Mumbai

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Informal settlements (South East Asia)
Informal settlements: Nairobi
"the paradox of the great civilization change consists in the fact that we have practically unlimited access to information and data and yet we are nearly unable to use it in any way". Manuel Castels 2009

Data is the new oil
Models are the new gold
Clive Humby
Supporting planning activities with the assessment and the prediction of urban sprawl using spatio-temporal analysis

Federico Amato, Piergiuseppe Pontrandolfi, Beniamino Murgante *
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ARTICLE INFO
Article history:
Received 10 January 2015
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ABSTRACT
The inestimable value of soil is exemplarily summarized in the definition provided by the European Union (2006), which considers it as “the upper layer of the earth’s crust, formed by mineral particles, organic matter, water, air and living organisms.”

The importance of soil protection is now universally recognized, but despite a lot of debates and principle’s enunciation, in the last decades soil was consumed at a rate of 8 m² per second. The aim of this study is to propose a model which, on one side, is able to measure variations occurred in land use and, and therefore, to determine soil consumption, and, on the other side, is capable to predict future changes. Specifically, a simulation model has been proposed based on two methods: Joint information uncertainty and Weights of Evidence in order to analyse and predict new built-up areas. The proposed model has been applied to Pisticci Municipality in Basilicata region (Southern Italy). This area is a significant example, because of its high landscape value and, at the same time, of a lot of developing pressure due to touristic activities along the coastal zone.
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<table>
<thead>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pisticci Municipality</td>
<td>28</td>
<td>58</td>
<td>98</td>
<td>111</td>
<td>125</td>
<td>97</td>
<td>28</td>
<td>153</td>
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<td>7.10</td>
<td>37.69</td>
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<td>F. Terruso</td>
<td>0.95</td>
<td>1.03</td>
<td>2.04</td>
<td>3.06</td>
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<td>2.32</td>
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<td>S. Leonardo</td>
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<td>1.39</td>
<td>3.48</td>
<td>4.38</td>
<td>4.82</td>
<td>3.50</td>
<td>1.24</td>
<td>6.06</td>
</tr>
<tr>
<td>Coastal area</td>
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<td>0.85</td>
<td>3.95</td>
<td>7.94</td>
<td>15.68</td>
<td>15.54</td>
<td>7.01</td>
<td>22.69</td>
</tr>
</tbody>
</table>

Quantity of built-up areas [ha] measured at different times.
Preserving cultural heritage by supporting landscape planning with quantitative predictions of soil consumption

Federico Amato, Federico Martellozzo, Gabriele Nolè, Beniamino Murgante

Abstract

Landscape preservation in Italy is a major issue in national cultural heritage conservation policies. Urban settlements growth is among the most threatening factors for the correct landscape preservation. Such phenomenon may result in corrupting the correct landscape-system functioning, particularly when the development occurs without precise planning prescriptions. Land-use/cover evolution dynamic is a subject widely and thoroughly investigated, especially concerning consumption of natural and other lands due to anthropogenic activities. This paper focuses on a region in southern Italy, where soil consumption is known to represent a urgent matter of concern. However, although the negative impacts of soil consumption are well known, to our knowledge there are no case studies presenting a precise quantitative assessment of the intensity of such phenomenon for the region of interest. Furthermore, this study aims at forecasting the development of urban settlements through the application of the cellular automata model SLEUTH; the case study concerns the Municipality of Altamura (Apulia region, Italy). Results highlight how current landscape preservation instruments alone cannot ensure a reduction in soil consumption phenomenon and how urban areas expansion is incompatible with a correct landscape conservation in the study area.
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Calibration Coefficients:
- Slope
- Land cover
- Excluded
- Urban
- Transport
- Hillshade

Growth simulation cycles

Results:
- $t_0$
- $t_1$
- $t_2$
- ... $t_n$
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The Effects of Urban Policies on the Development of Urban Areas

Federico Amato 1, Biagio Antonio Maimone 1, Federico Martellozzo 2, Gabriele Nolè 3 and Beniamino Murgante 1

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2 Department of Methods and Models for Economics, University of Rome "La Sapienza", Via Del Castro Laurenziano 9, 00161 Roma, Italy
3 Italian National Research Council, IMAA C.da Santa Loja, Tito Scalo, Potenza 85050, Italy

* Author to whom correspondence should be addressed.

Abstract

For more than a decade, the European Union recognizes soil as a common good and considers it as a finite...
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Origine dei dati
867 = 100%

Localizzati INDIRIZZO
79%

Localizzati COMUNE DI RIFERIMENTO
20%

Non Localizzabili
1%

Localizzati nell’indirizzo esatto dell’intervento

Indirizzo, strada o località non è riportato nel database di Google Earth

Interventi esclusi dall’analisi perché riportanti informazioni contrastanti o duplicazione dell’informazione
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Modelling the impact of urban growth on agriculture and natural land in Italy to 2030

F. Martellozzo\textsuperscript{a,b}, F. Amato\textsuperscript{b}, B. Murgante\textsuperscript{b}, K.C. Clarke\textsuperscript{c}

\textsuperscript{a} University of Modena, DISER Dep. of Economics and Management, Italy
\textsuperscript{b} University of Salerno, School of Engineering, Italy
\textsuperscript{c} University of California – Santa Barbara, USA

ARTICLE INFO

Keywords:
- Italy
- Land use projections
- Cellular automata
- SERUT
- Analytic Hierarchy Process
- Sustainable development

ABSTRACT

The uncontrolled spread of towns and cities into their surrounding rural and natural land, and the consequent increasing demand for new natural resources are among the most important drivers of global climate and environmental change. This study investigated the loss of natural and agricultural land in Italy in the last decade, during which urban areas have undergone significant expansion. The study underlines the negative consequences of past uncoordinated urban and regional planning in Italy which often featured adaptive or post strategies favouring real estate market returns, rather than avoiding ex-ante the unsustainable threats. The aim is to show that only through a recalibration of priorities in planning, by adding policies that favour ecological conservation, it is possible to better foster sustainable land use practices. To this end, the research features a comparison of forecasts of land-use/cover changes (LUCC) corresponding to different policy-oriented scenarios, using a combination of multi criteria analysis and cellular automata modelling. In the planning literature there are many applications of land-use change modelling at the regional/local scale, however, to the best of our knowledge, none does it at high resolution and at the full country scale. This sort of analysis is important for policy makers because it allows investigation of the combined relevance of local and global criteria in influencing urbanisation for the future. Thus it couples locally relevant findings with a comprehensive vision of the phenomenon at a national scale. We conclude by discussing some critical socio-economic implications of the modelled scenarios in order to provide policy makers with useful tools and information to develop resilient and sustainable planning strategies.
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- Areas within a 300m buffer from the coastal line ($\text{CBCP}_a$).
- Areas within a 300m buffer from the coastal line of lakes ($\text{CBCP}_b$).
- Water streams, river zones and areas within a buffer of 150m from these ($\text{CBCP}_c$).
- Glaciers and perennial snow areas ($\text{CBCP}_d$).
- National and regional reserves and parks ($\text{CBCP}_e$).
- Forests and woodlands ($\text{CBCP}_f$).
- Wetlands ($\text{CBCP}_g$).
- Sites of Community Importance (SCIs) and Special Areas of Conservation (SACs). SACs are usually included within SCIs.
- Special Protection Areas (SPAs). In Italy, these areas cover about 19% of inland and 4% of marine areas.
- Important Bird Areas (IBA)

The Number of Total Transactions (NTT).

The Housing Market Index (HMI), which consists in the ration of NTT with the stock of residential unit existing in a specific territorial unit.

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**Dataset LiDAR DSM e DTM**

**ACQUISIZIONE DATI**

**PRE**
- 2008
- Rilievo LiDAR MATTM

**POST**
- 29 Agosto 2016
- Rilievo Lidar PCFVG

**Importazione punti**
- .xyz

**Classificazione punti**
- .las/.laz

**Nuvola di punti**
- RASTER GRID

**DSM POST sisma**

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Beniamino Murgante

DSM<sub>pre</sub> – DSM<sub>post</sub>

Legenda

- Variazioni positive
  - 0,4 m
  - 5 m
  - 10 m
  - 15 m
  - 20 m
- Variazioni negative
  - -10 m
  - -6 m
  - -4 m
  - -2 m
  - -0,4 m
- Variazioni nulle
  - da -0,4 a 0,4 m


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DSM\textsubscript{PRE} – DSM\textsubscript{POST}

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Classificazione **non esaustiva**

Può indurre in **errori di valutazione**

Affiancata sempre da un **rilievo in loco**

\[ \Delta_h = 0 \quad \text{\rightarrow Classe inferiore alla 4?} \]
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<table>
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<th>MARKER EST</th>
<th>Δh (m)</th>
<th>MARKER INT</th>
<th>Δh (m)</th>
</tr>
</thead>
<tbody>
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<td>1</td>
<td>0.44</td>
</tr>
<tr>
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<td>9.15</td>
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<td>9</td>
<td>6.80</td>
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</tbody>
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CASO 2 – Crollo parziale nel solaio di copertura

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CASO 2 – Crollo parziale nel solaio di copertura

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Thank you for your attention

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https://unibas-it.academia.edu/BeniaminoMurgante
https://www.researchgate.net/profile/Beniamino_Murgante