

	needs official data concerning tourists (National institute of statistics, Regional tourism agency, etc.) and/or other proxy data (amount of solid urban waste produced; electricity consumption in private houses; number of houses available for vacation).
<b>Scale of measurement</b>	No./year
<b>Data source</b>	Public agencies (National institute of statistics, Regional tourism agency, Municipalities, etc.)
<b>Required data</b>	Number of visitors in the study area
<b>Data input type</b>	Quantitative
<b>Data collection frequency</b>	Annual
<b>Level of expertise required</b>	Medium
<b>Synergies with other indicators</b>	Number Of Visitors In New Recreational Areas
<b>Connection with SDGs</b>	8
<b>Opportunities for participatory data collection</b>	
<b>Additional information</b>	
<b>References</b>	

## 14.21 Building structure – Urban form

**Project Name:** MAVES (Mapping, Assessment and Valuation of Ecosystems and their Services) (JRC-D3- Institutional project)

**Author/s and affiliations:** Grazia Zulian<sup>1</sup>, Joachim Maes<sup>1</sup>, Guido Ceccherini<sup>2</sup>

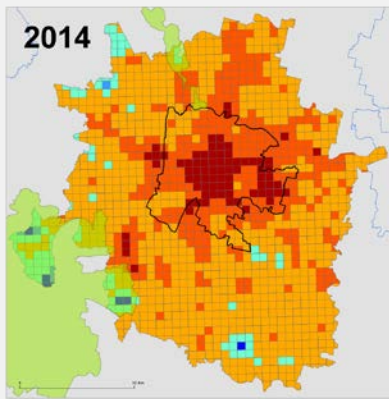
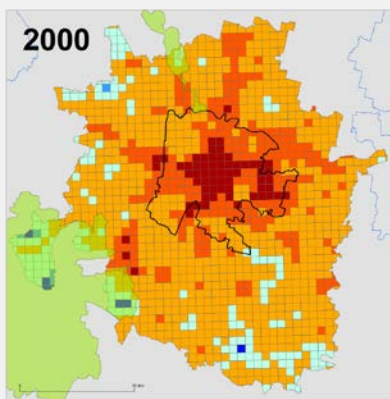
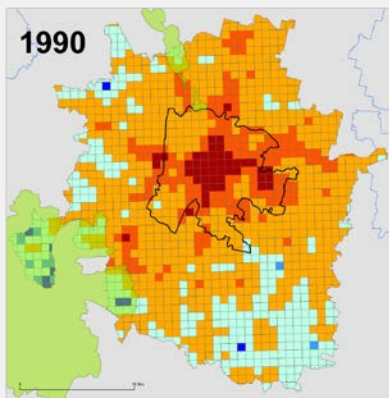
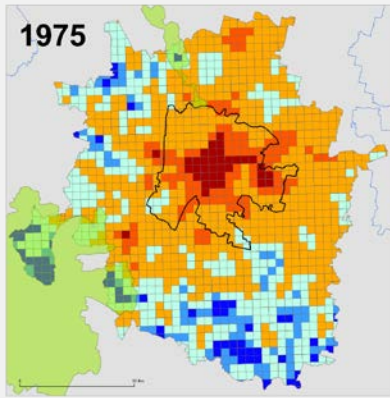
<sup>1</sup> European Commission Directorate-General Joint Research Centre Directorate D (D3 -Land Resources)

<sup>2</sup> European Commission Directorate-General Joint Research Centre Directorate D (D1 -Bio-Economy)

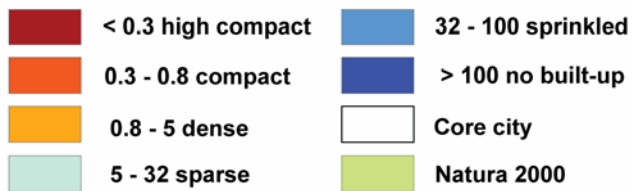
Building Structure	Place Regeneration
<b>Description and justification</b>	Urban Form provides a spatially explicit metric to describe the settlements pattern. The indicator has been derived, and adapted at European scale, from the sprinkling (SPX) index -mean Euclidean

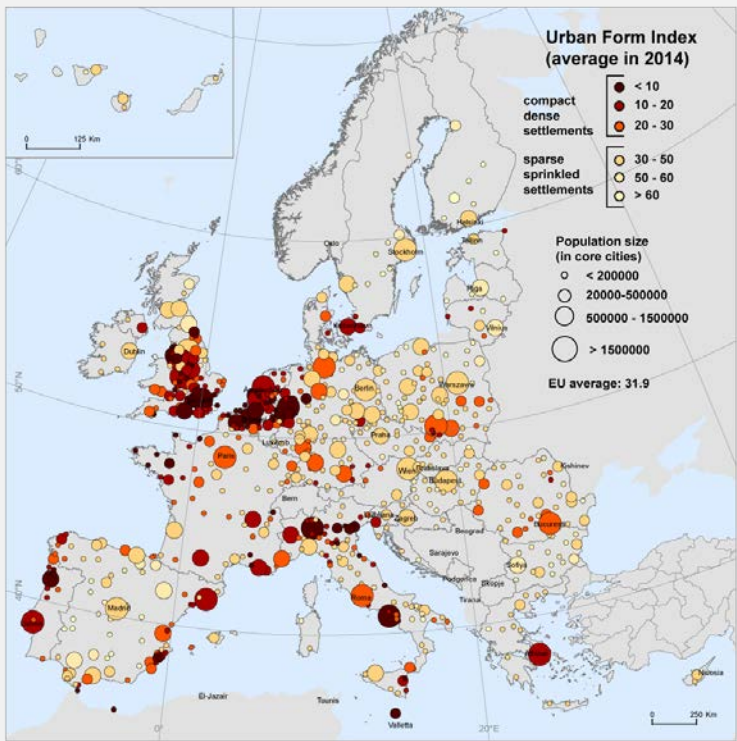
	nearest neighbor distance-, which analyses the fragmentation of urban settlements through a purely geometric point of view (Romano et al. 2017; Saganeiti et al. 2018).
<b>Definition</b>	<p>Assuming the circular form as compact as possible, the index is based on the calculation of distances between different built-up areas on a 2 km buffer around each 1 km grid cell, within Functional Urban Areas. The distance buffer of 2 km around each sub-reporting unit (1 km cell) was chosen following previous works on urban sprawl developed at European scale (Aurambout et al. 2018).</p> <p>The higher the index the higher the degree of fragmentation of the territory. For the analysis the indicator has been classified in six classes which represents categories of urban form which, according to the literature, have an impact on city performance in terms of mobility, urban resilience, ecosystem services and biodiversity (Cortinovis et al. 2019).</p>
<b>Strengths and weaknesses</b>	<p>-spatially explicit -&gt; provides the urban form structure</p> <p>-relatively complex</p>
<b>Measurement procedure and tool</b>	<p>Urban Form:</p> $Urban_{Form} = \frac{(Max_{-bld-dist})}{R}$ <p>where:</p> <p>Max(bld-dist) = the maximum distance between all built up areas extracted within a 2 km horizon (1 km buffer around each 1 km cell); the distance is measured within the target FUA and the adjacent FUAs in order to take the boundary effect into consideration.</p> <p>R= ray of an hypothetical built-up zone with an area equal to the sum of all the built up areas in the considered horizon</p>
<b>Scale of measurement</b>	Functional Urban Areas
<b>Data source</b>	
<b>Required data</b>	<p>-Built-up data (GHS built-up grid, derived from Landsat, multitemporal R2018A, 30-m (EPSG: 3857).</p> <p>- the model can be implemented using any built –up or imperviousness data sets</p>
<b>Data input type</b>	-raster (vector data will be rasterised)
<b>Precision</b>	30 m
<b>Data collection frequency</b>	<p>Year or time-series range (for available data at EU scale): 1975-1990-2000-2014</p> <p><a href="http://data.jrc.ec.europa.eu/collection/GHSL">http://data.jrc.ec.europa.eu/collection/GHSL</a></p>

<b>Level of expertise required</b>	-GIS programmer (advanced)
<b>Synergies with other indicators</b>	<ul style="list-style-type: none"> <li>- With soil sealing</li> <li>- With structure of Urban green and Urban Forest</li> <li>- With type of mobility or commuting behaviour</li> <li>- ...others....</li> </ul>
<b>Connection with SDGs</b>	//
<b>Opportunities for participatory data collection</b>	No
<b>Additional information</b>	
<b>References</b>	<p>Pesaresi M, Syrris V, Julea A (2016) A new method for earth observation data analytics based on symbolic machine learning. Remote Sens. doi: 10.3390/rs8050399</p> <p>Romano B, Zullo F, Fiorini L, Ciabò S, Marucci A (2017) Sprinkling: An approach to describe urbanization dynamics in Italy. Sustain. doi: 10.3390/su9010097</p> <p>Saganeiti L, Favale A, Pilogallo A, Scorza F, Murgante B (2018) Assessing urban fragmentation</p> <p><b>+ next MAES report will include the methodology applied to all EU cities</b></p>

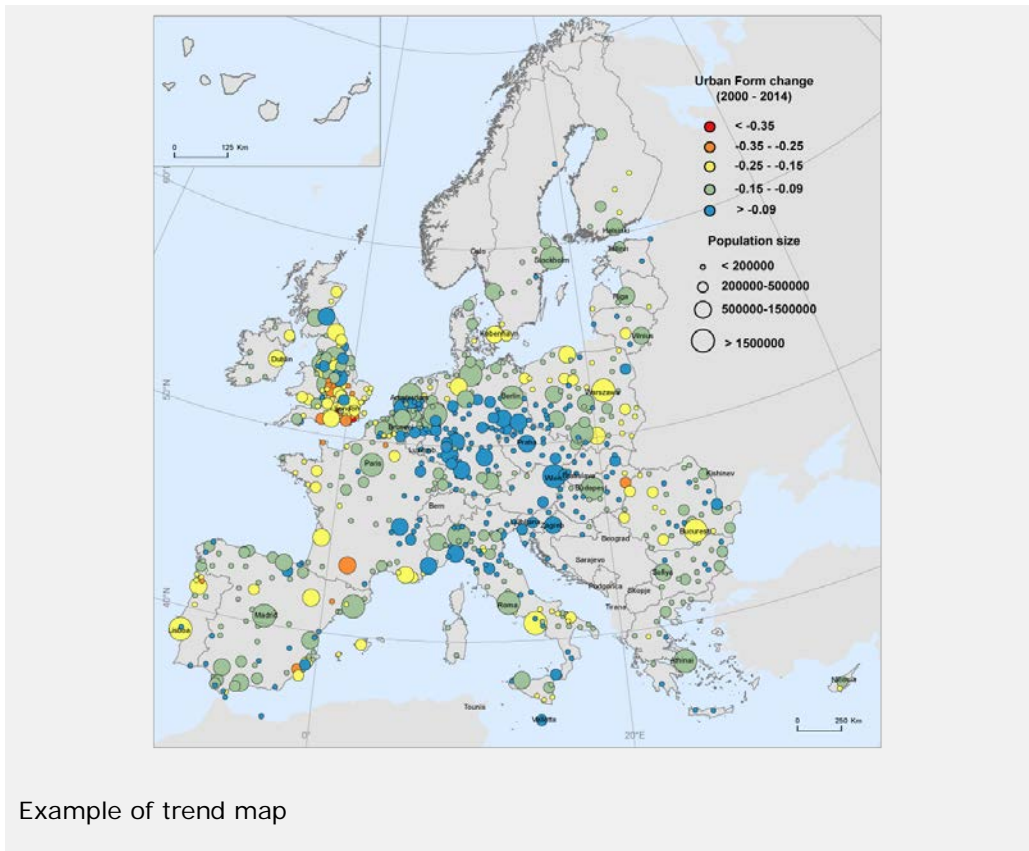


## Urban Form Index





Example of status map



Example of trend map

## 14.22 Material used coherence

**Project Name:** PHUSICOS (Grant Agreement no. 776681)

**Author/s and affiliations:** Gerardo Caroppi<sup>1,2</sup>, Carlo Gerundo<sup>2</sup>, Francesco Pugliese<sup>2</sup>, Maurizio Giugni<sup>2</sup>, Marialuce Stanganelli<sup>2</sup>, Farrokh Nadim<sup>3</sup>, Amy Oen<sup>3</sup>

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<sup>2</sup> University of Naples Federico II (UNINA), Department of Civil, Architectural and Environmental Engineering, Naples, Italy

<sup>3</sup> Norwegian Geotechnical Institute (NGI), Oslo, Norway

Material Used Coherence	Place Regeneration
<b>Description and justification</b>	Indicators of Application of Suitable Materials and Technologies sub-criterion will assess the coherence of used material and techniques with local materials and conditions.