



## Benchmarking European regions with GIS sustainability indicators: EPSILON project challenges

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# What is the EPSILON MODEL ?



**EPSILON : EU project 2002-2005**

**Environmental Policy via Sustainability Indicators On a European-wide NUTS III level.**

Assessing sustainability of EU regions to provide a quantitative tool for policy decision making.

***Epsilon tool***: a GIS integrated computerized model for monitoring & benchmarking regions through an aggregation of indicators represented on sustainability maps.

***Model Partners***: EPSILON-NTUA Greece (team leader) PbS Germany (GIS tool) EPFL (sustainability model)

***NUTS: Nomenclature of Territorial Units for Statistics = Geocode standard for referencing the administrative division of countries for statistical purposes***



# Sustainability along 4 pillars within EPSILON Model



- **Social pillar**

⇒ To assess social welfare for all – Objective/subjective  
[Quality of life - Social cohesion - Knowledge]

- **Economic pillar**

⇒ To assess the financial prosperity  
[Wealth creation – Innovation – structural conditions]

- **Environment pillar**

⇒ To assess the environmental state  
[Air, Water & soil quality – Land use]

- **Institutional pillar**

⇒ To assess the regional governance  
[Distribution of power between all actors – Regional Autonomy]

# The Environmental pillar

Theme index	Sub-theme index
<b>Air Index</b>	<b>Climate change</b> <b>Air quality Index 1</b> <b>Air quality Index 2</b> <b>Noise index</b>
<b>Soil Index</b>	<b>Soil degradation</b> <b>Soil toxicity</b> <b>Soil loss</b> <b>Soil sealing</b>
<b>Water index</b>	<b>Water quantity</b> <b>Surface Water quality</b> <b>Ground Water quality</b> <b>Ocean quality</b>
<b>Land index</b>	<b>Fragmentation</b> <b>Naturalness</b> <b>Wilderness</b> <b>Wetlands</b>



# How to navigate among 100 indicators?



**Social pillar**

**Economic pillar**

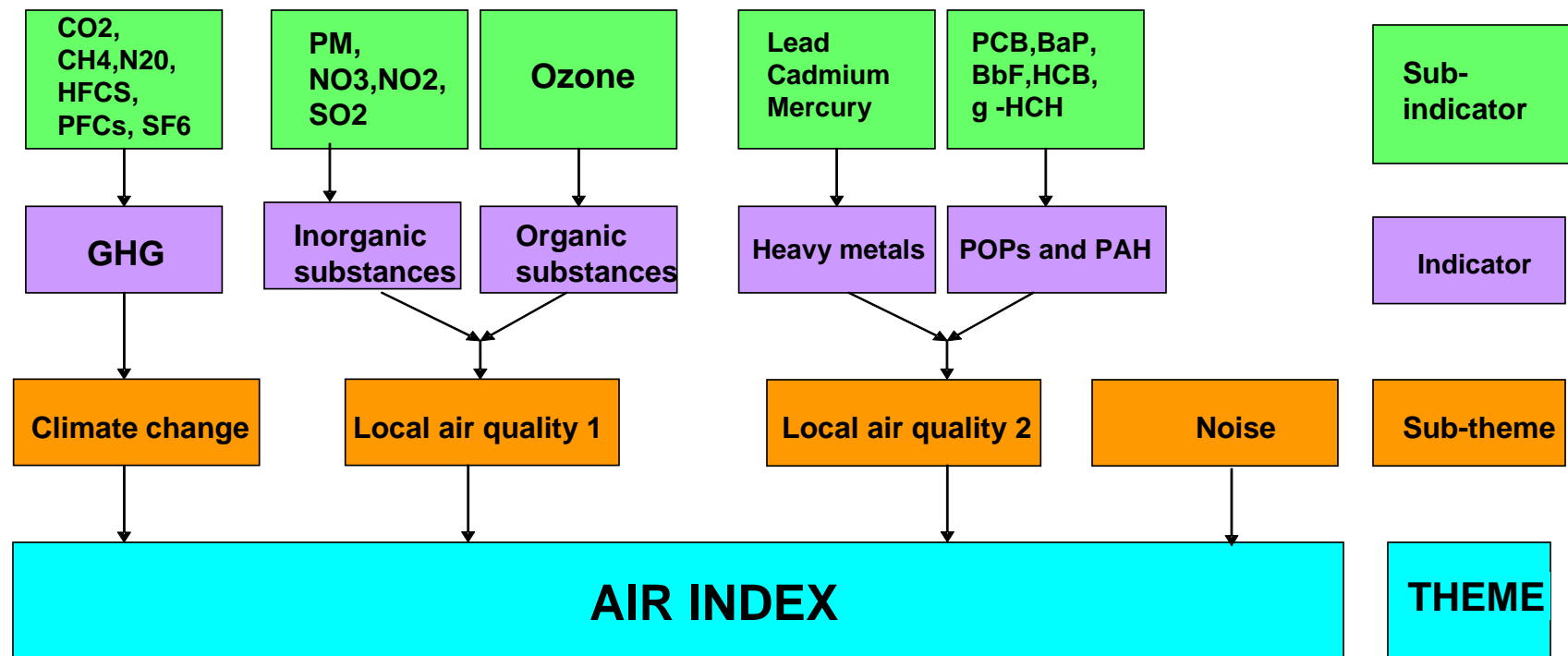
**Environment pillar**

**Institutional pillar**

**100 indicators**



**Conversion to a limited number  
of relevant indexes: 3 key issues**

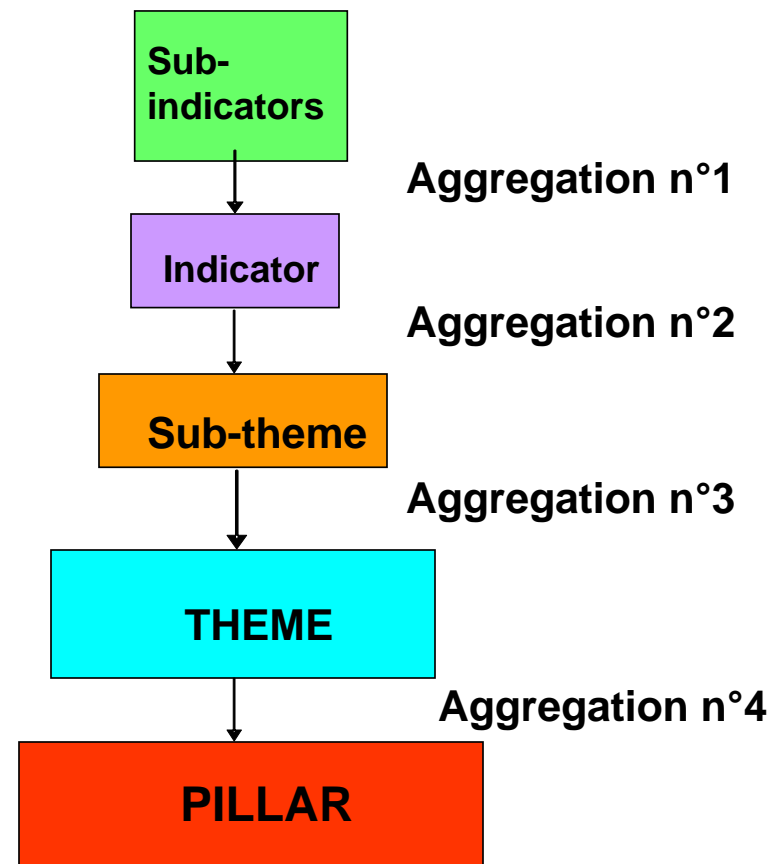


The data sample is weighted to construct a composite index at a higher level.

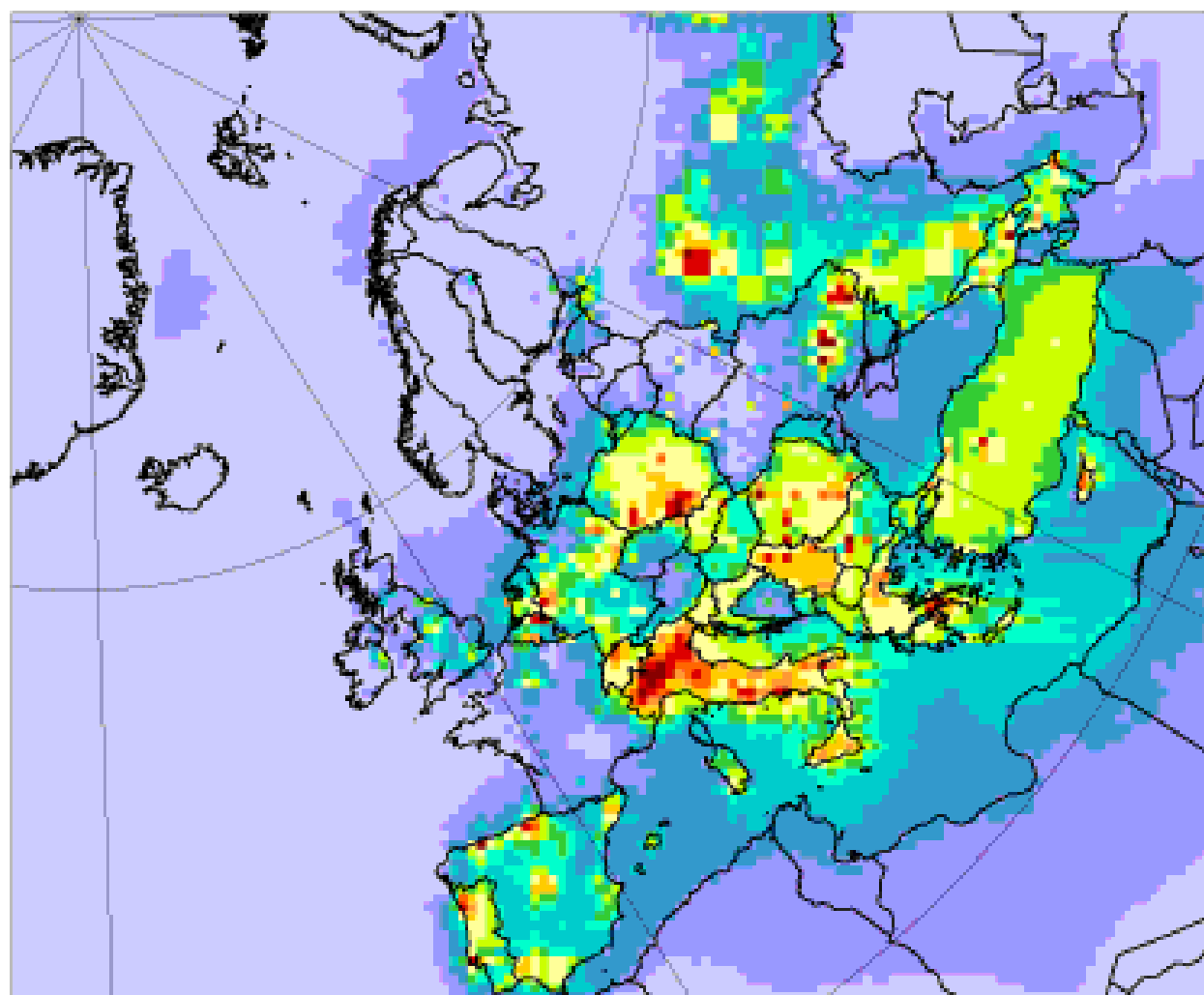
The aggregations are indicator, sub-theme, theme and pillar dependant.

Several types of aggregations:

- scientific weighting (GWP, DALY, ...): meaningful scores and no normalisation required
- Normalisation techniques



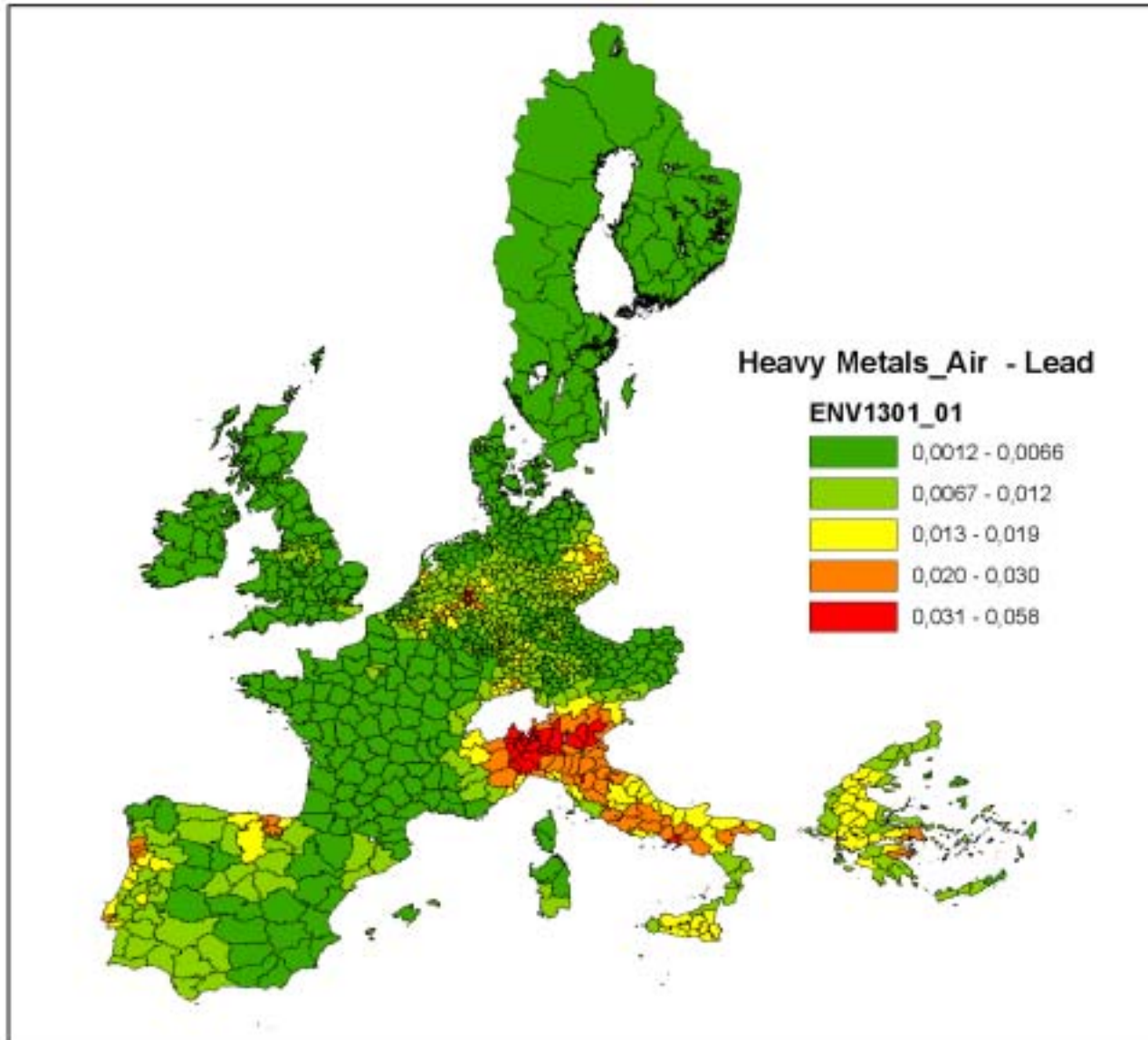
# Source data: EMEP concentrations



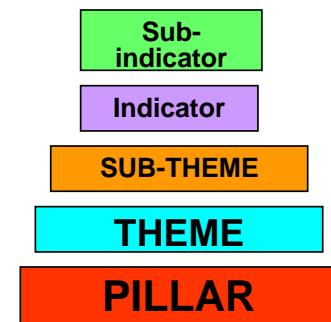
Annual mean  
air  
concentrations  
of lead in 2001,  
ng/m<sup>3</sup>



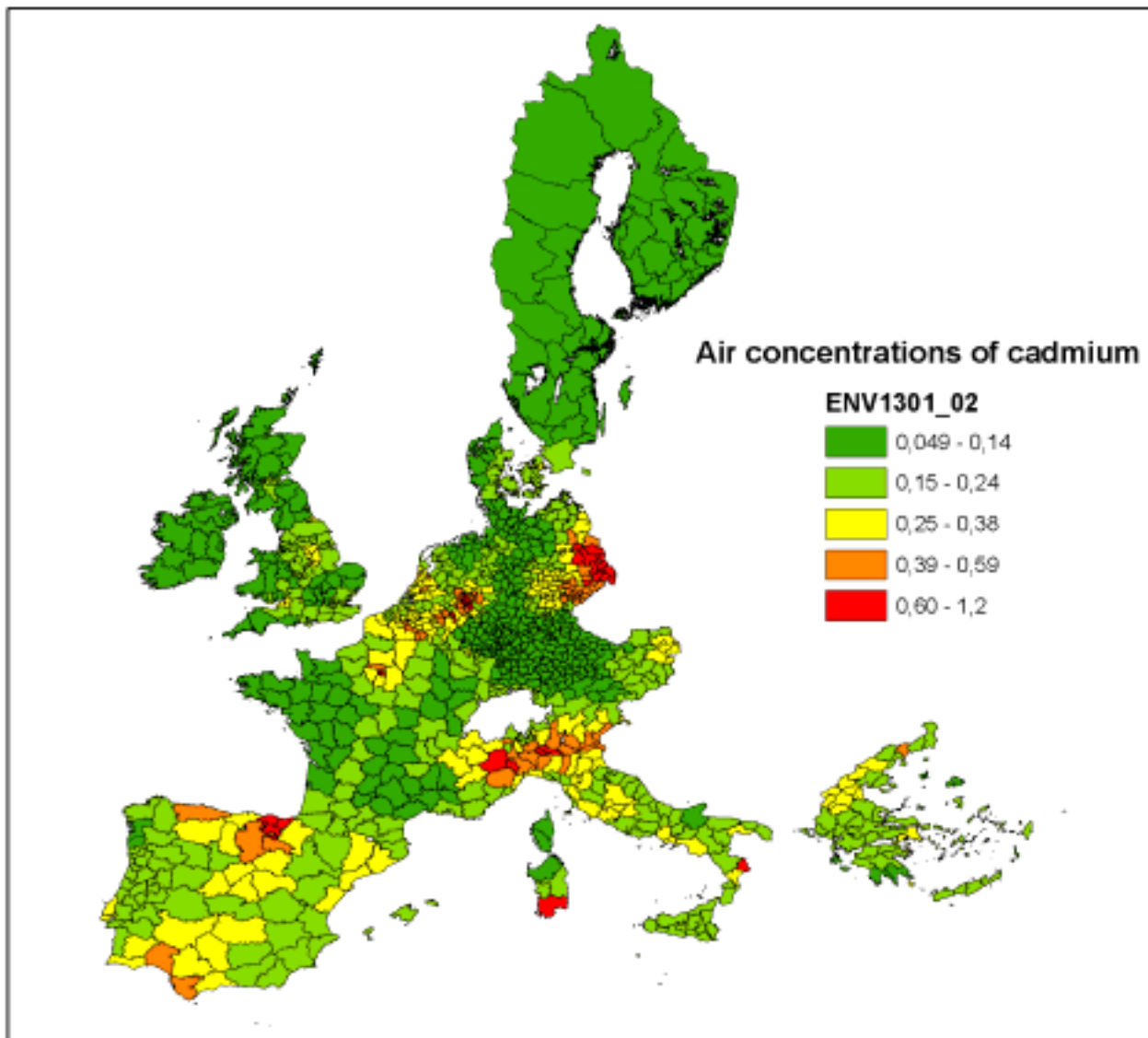
# Sub-Indicator Level at NUTS III



Annual mean air concentrations of lead (2001) in microg/m<sup>3</sup> from EMEP

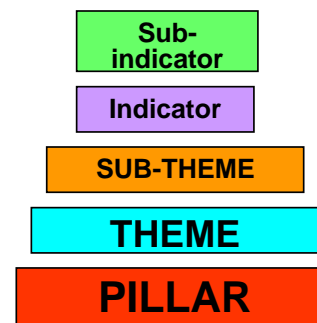


# Sub-Indicator Level at NUTS III

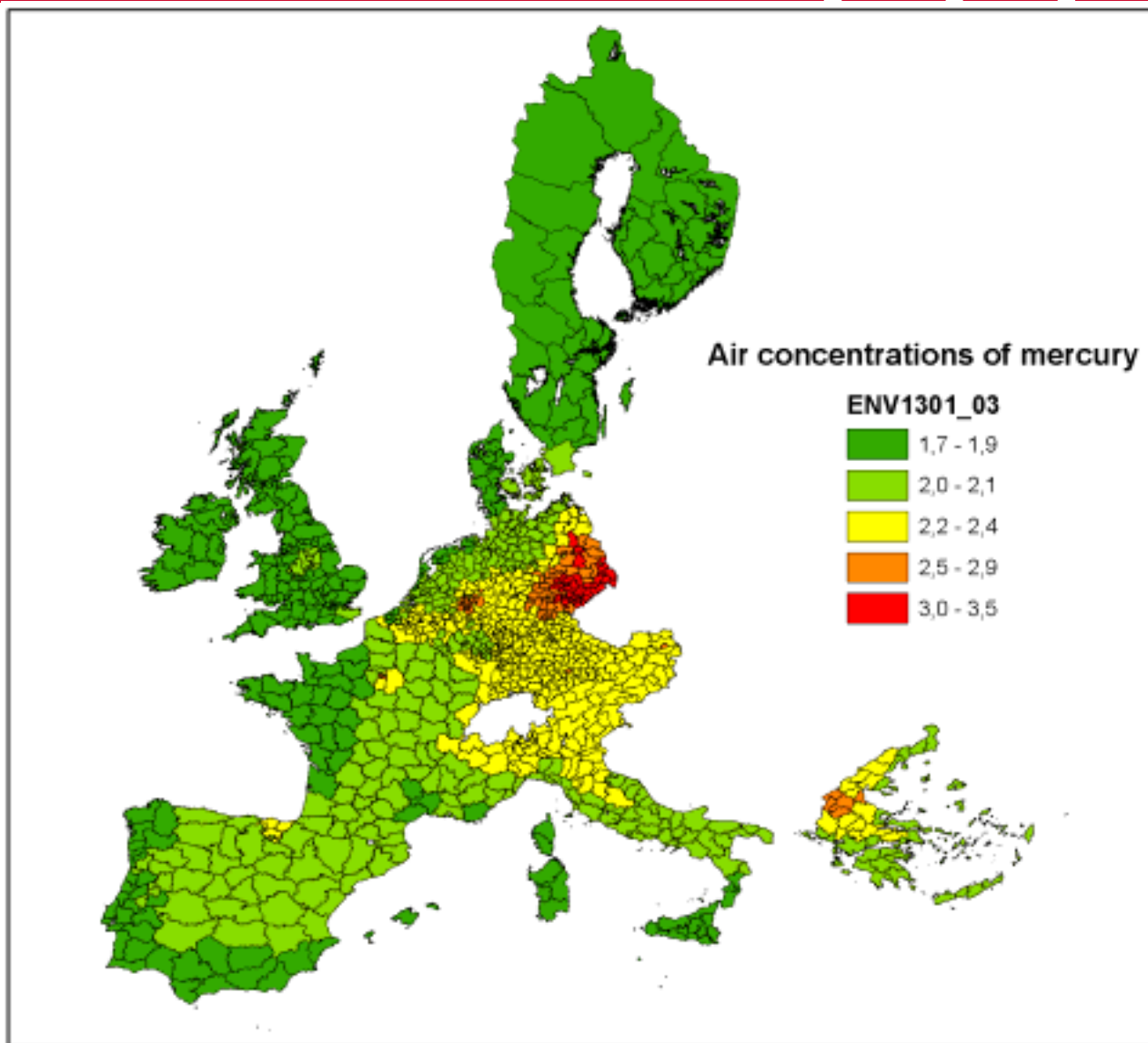


Annual mean air concentrations of cadmium (2001) in ng/m<sup>3</sup> from EMEP

100 times lower than lead

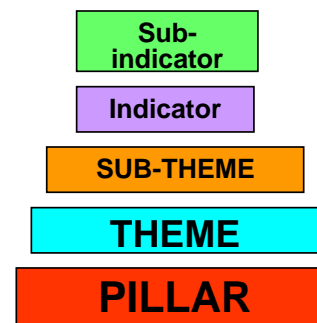


# Sub-Indicator Level at NUTS III



Annual mean air concentrations of mercury (2001) in ng/m<sup>3</sup> from EMEP

Same order as lead but 100 times more impact on human health



**EMEP**



Concentrations = Environmental State Indicators

Human exposure

+Dose response

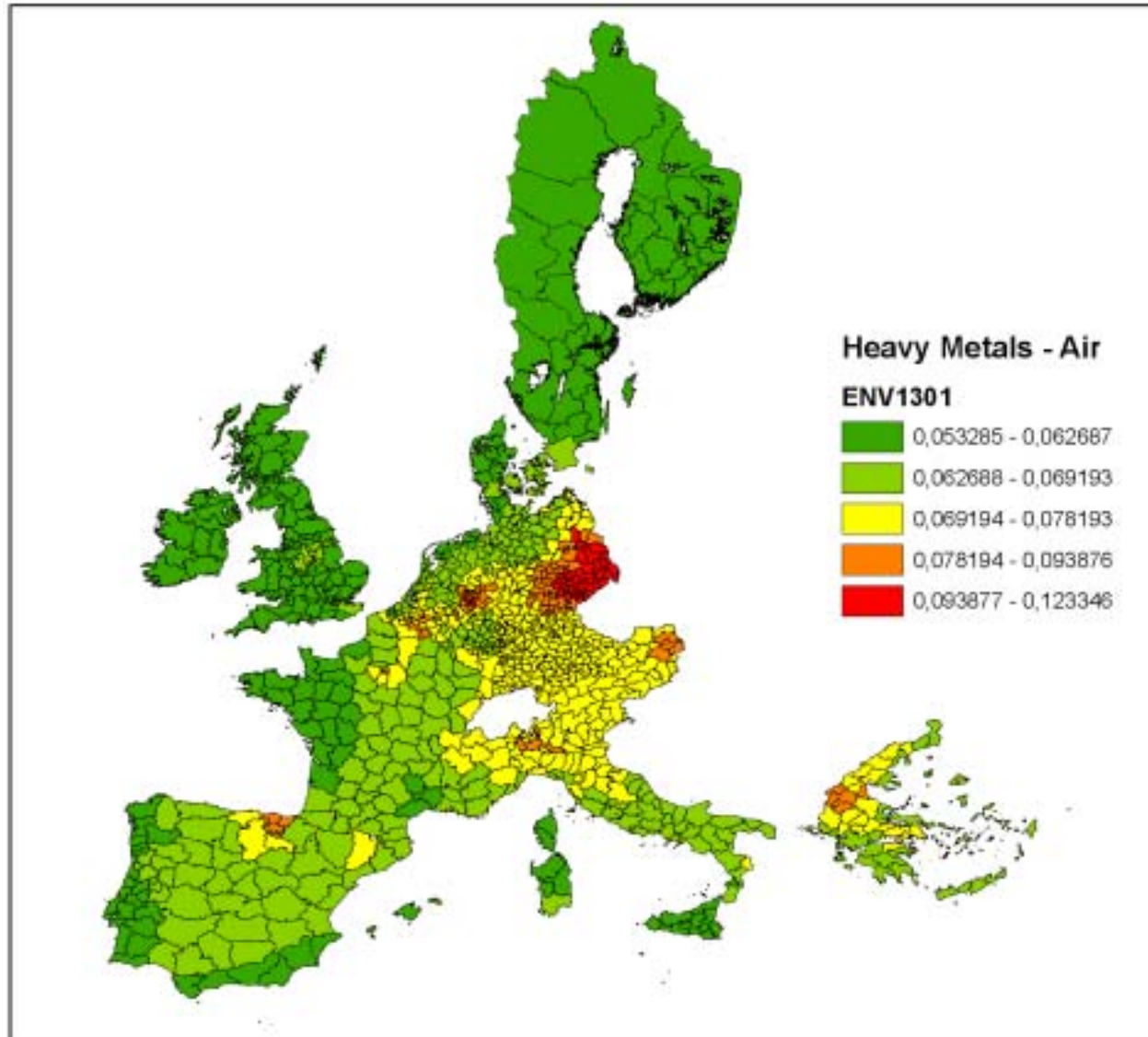
IMPACT 2002



Years of Life Lost (YLL)

=

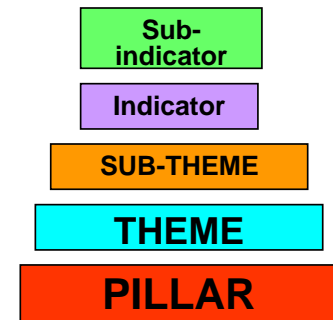
Concentration to Damage Factors  
in YLL/concentration =  
new scientific “DALY weighting”  
for EPSILON aggregation



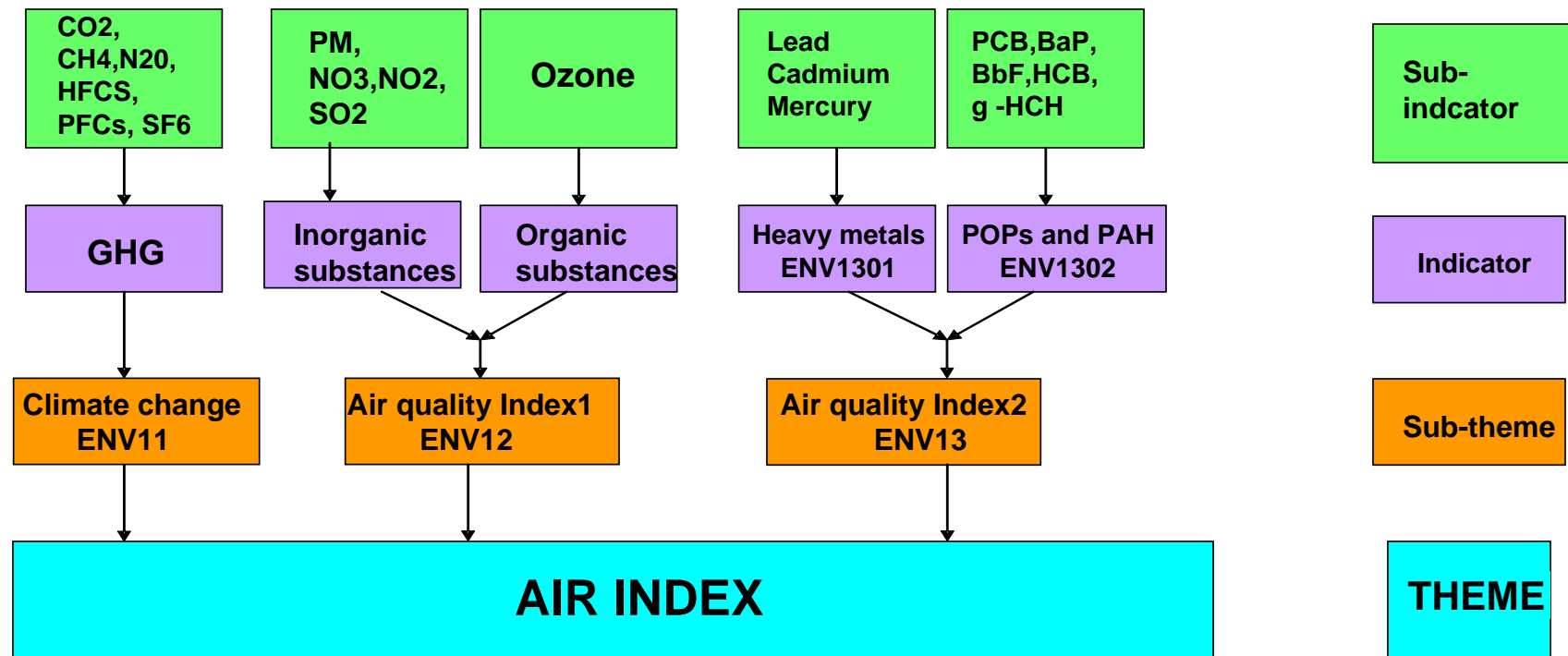
**DALY weighting  
applied on sub-  
indicators**

**Unit: DALY/pers**

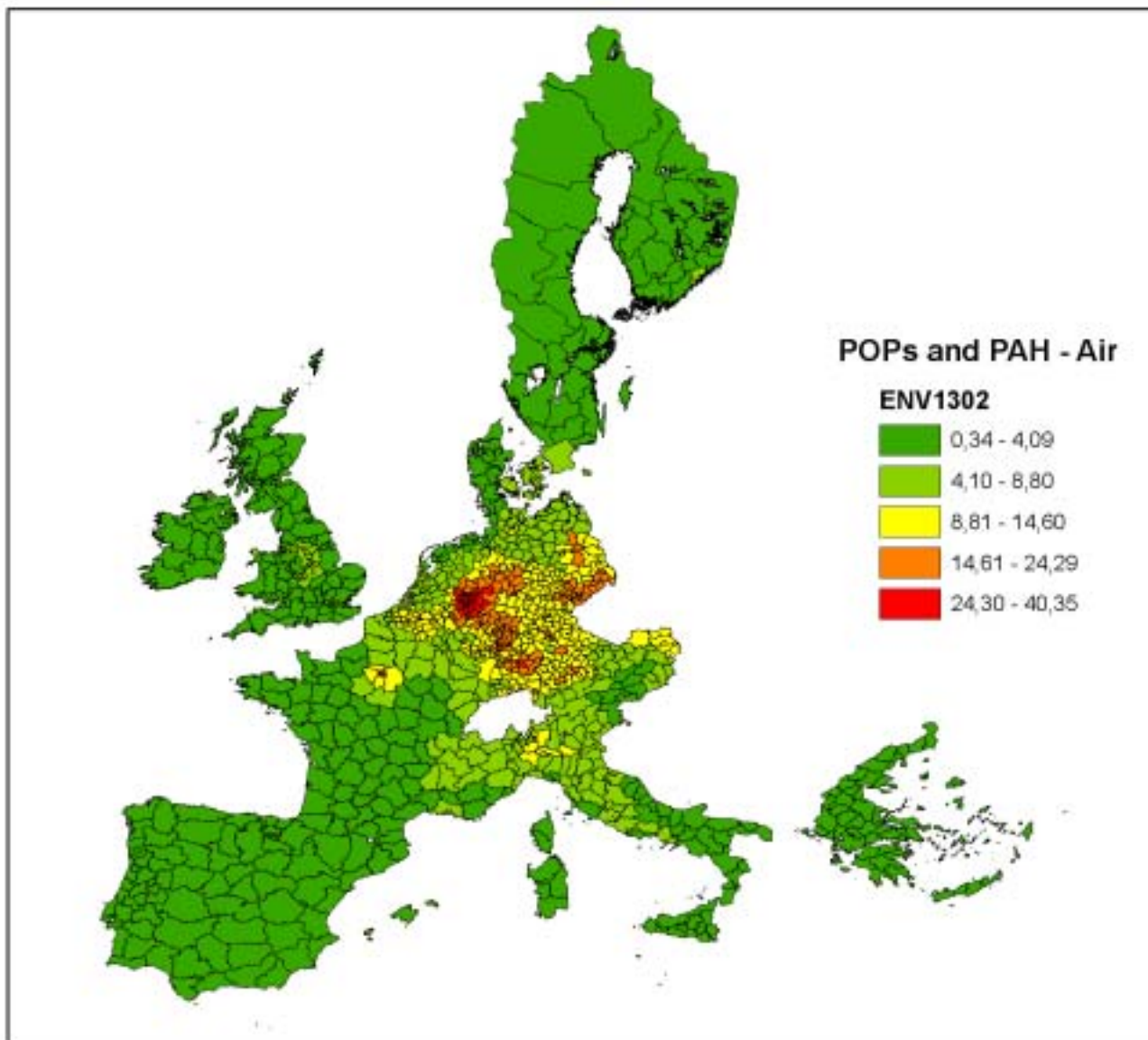
**DALY = Disability  
Adjusted Life  
Years**



# The Air index theme



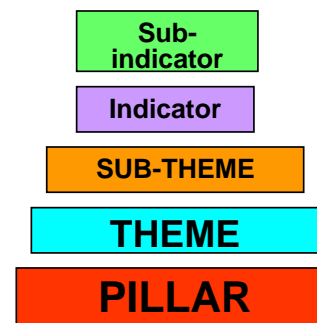
# Indicator Level at NUTS III

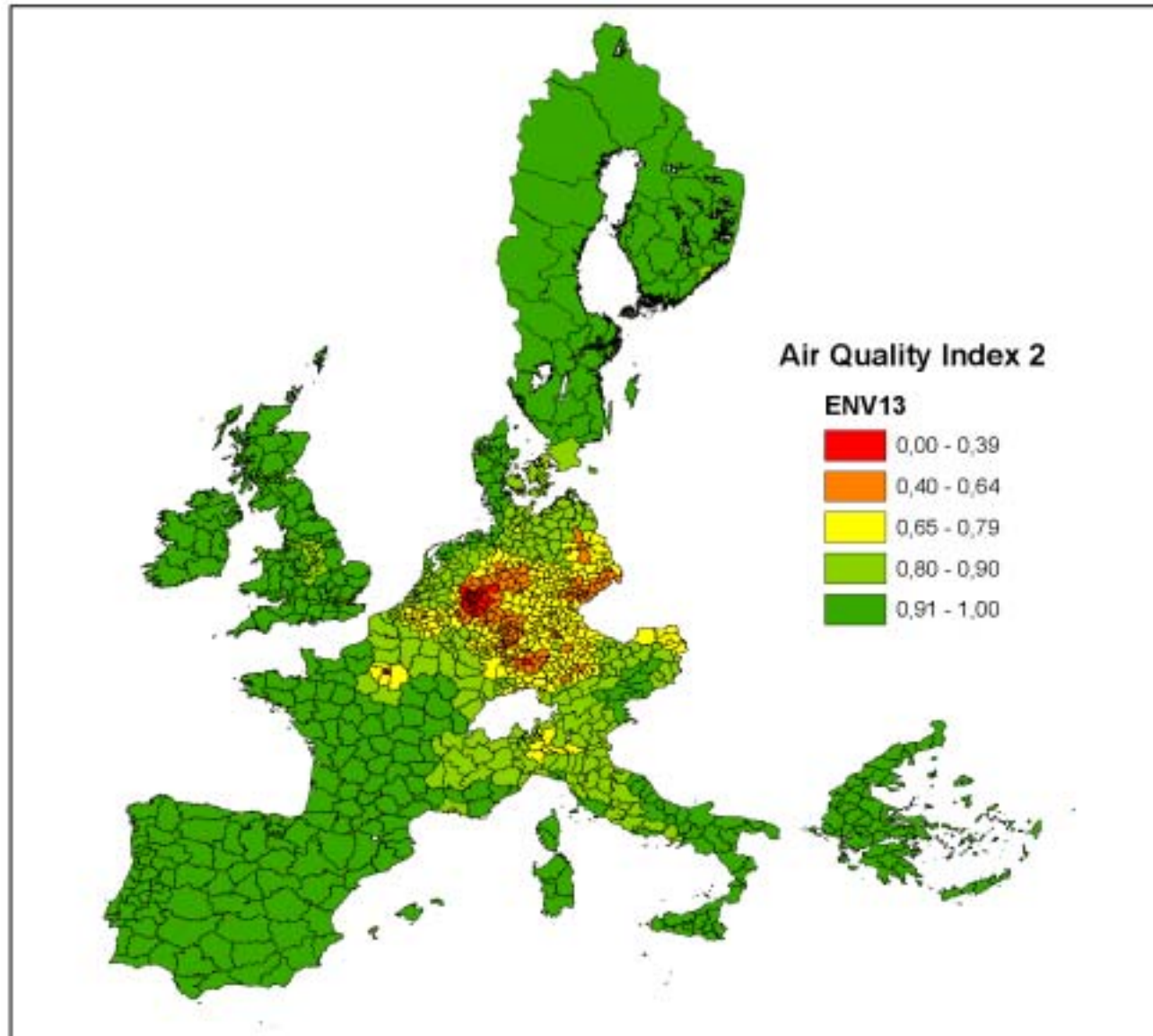


**DALY weighting  
applied on sub-  
indicators**

**Unit: DALY/pers**

**DALY = Disability  
Adjusted Life  
Years**

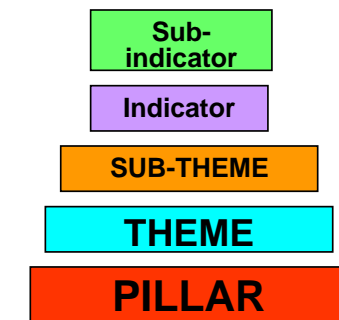


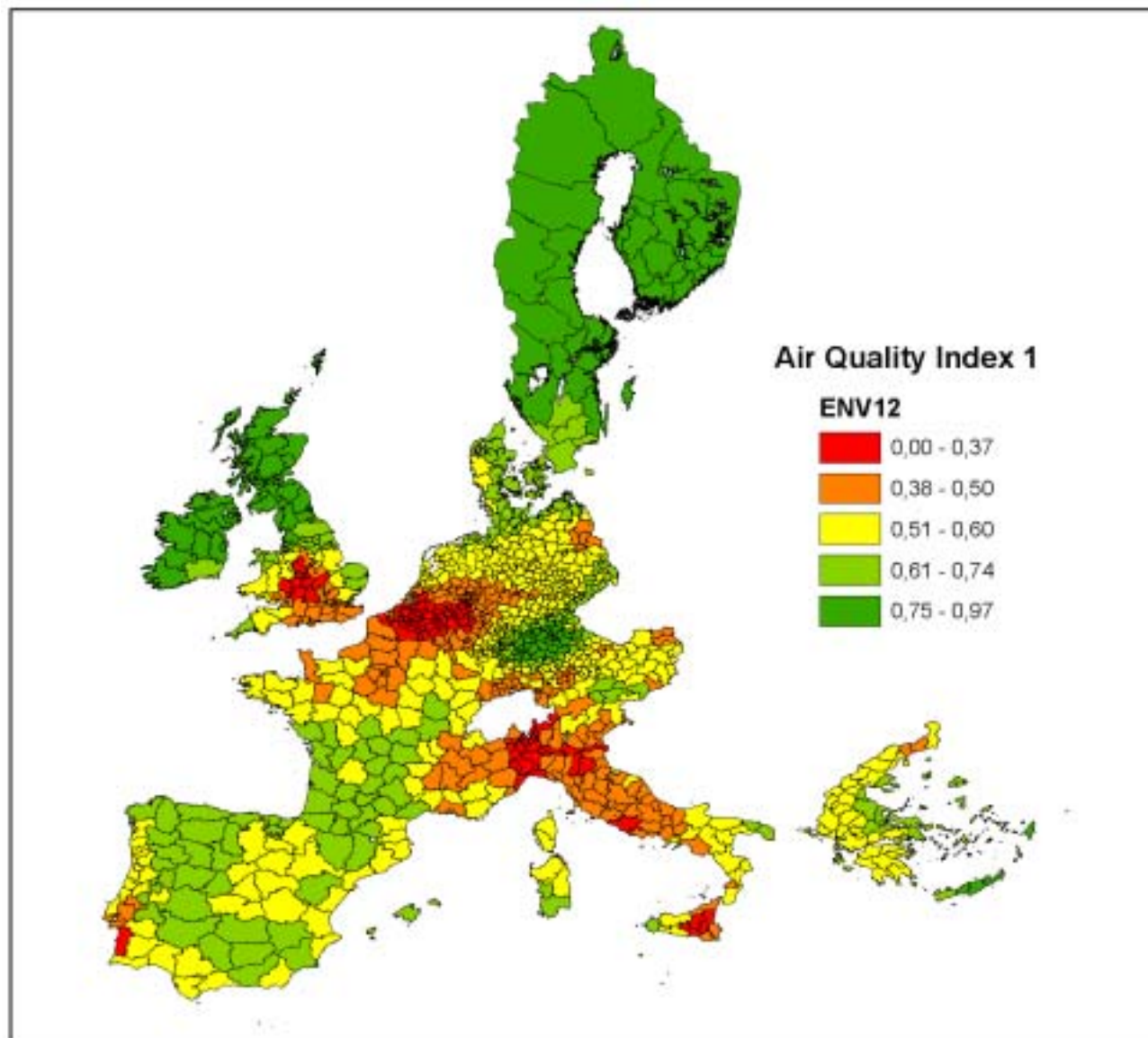


Normalised index

Min-Max  
technique:

0-1 data range

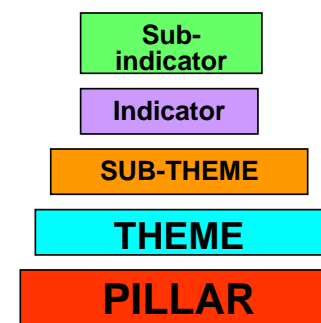




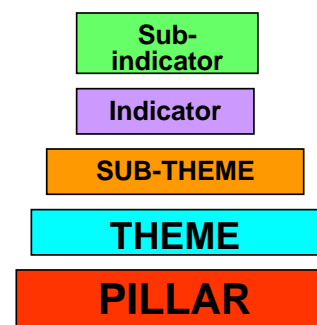
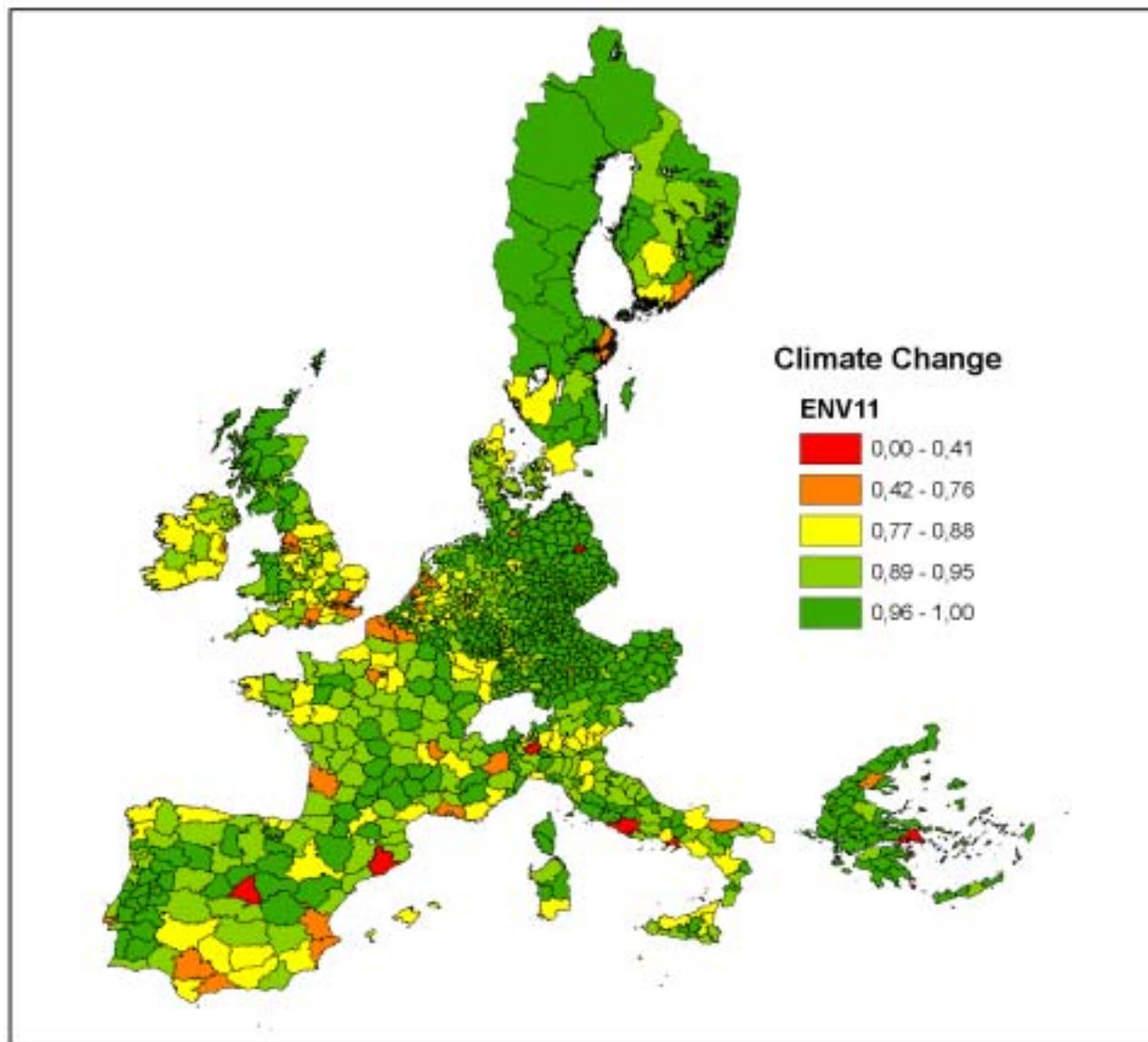
Normalised index

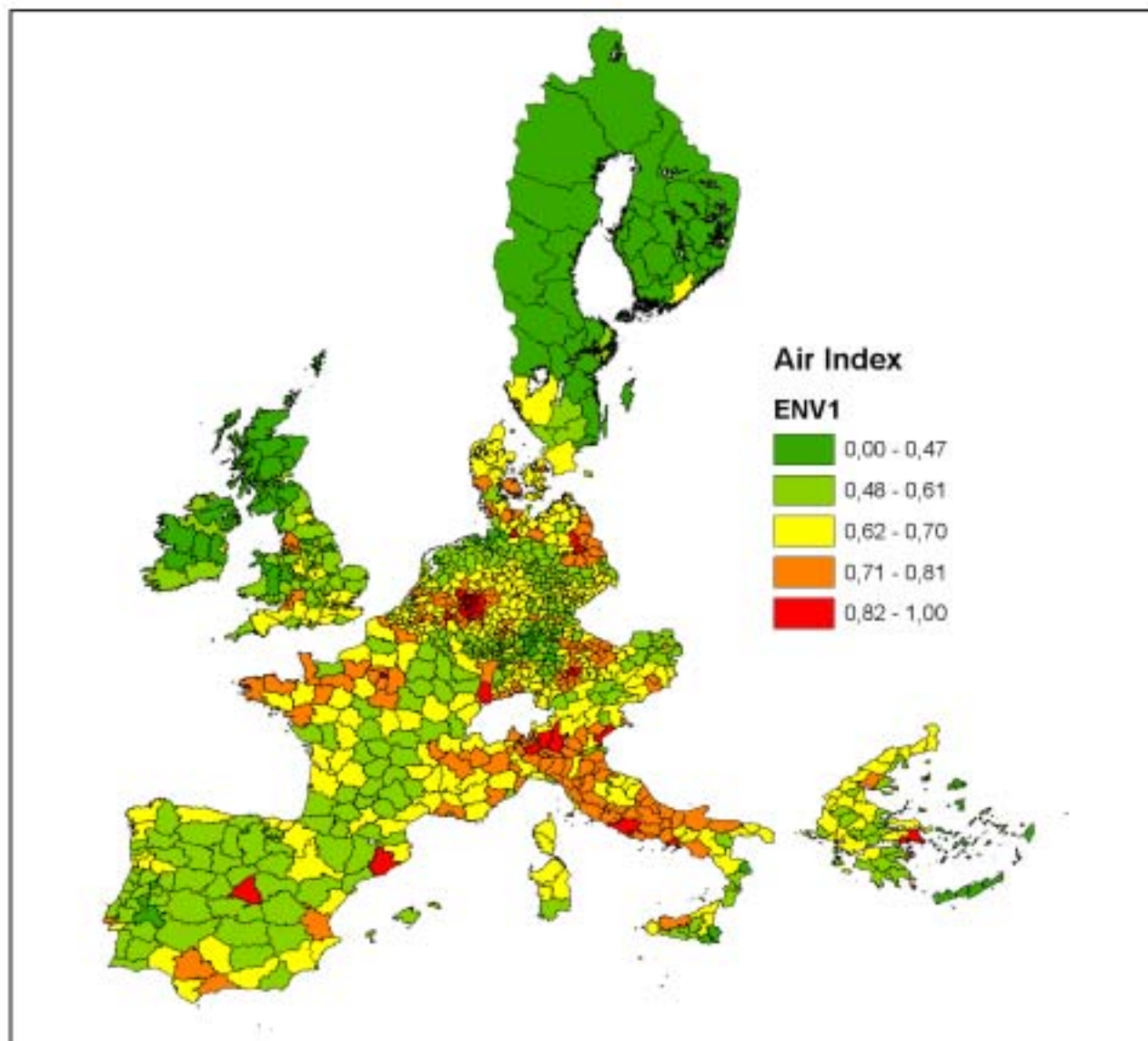
Min-Max  
technique:

0-1 data range



Normalised index  
Min-Max  
technique:  
0-1 data range

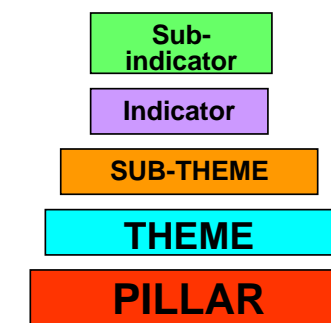




Normalised index

Min-Max  
technique:

0-1 data range



Map is correct but  
scale to be inverted:  
green = 0.82-1.00  
red = 0.00-0.47

- 1 **Relative** assessment of sustainability: EU Benchmarking
- 2 **EPSILON** Tool implemented for EU Sustainability assessment at **regional** level (15 EU countries NUTS0 ~ 200 NUTS II regions and ~ 1000 NUTS III regions)
- 3 **Bottom-up** (from 100 sub-indicators to 4 pillar index) and **top-down** navigation GIS tool
- 4 Aggregation techniques based on scientific weighting + normalisation techniques = **composite index strategy**
- 5 **Clustering techniques** to help visual focus on extreme common performances

**Soon available on line !**

- Aggregated information to be added underneath maps to avoid lengthy navigation
- Flags to be added to warn bad performance within a complex index
- Insert data quality performances (coherence, missing data, completeness, ...)

