Soil & Air

NO2 Removal by urban vegetation

Indicator definition

Urban green spaces and green infrastructures provide ecosystem services that sustain and promote human health: vegetation traps air pollution playing an important role for air quality regulation. Removal capacity is the product of dry deposition velocity and pollutant concentration.

Units: ton/ha/year

Spatial coverage: NUTS0, NUTS2 and NUTS3

Temporal coverage: 2010, 2020, 2030, 2040 and 2050

Methodology

Removal capacity (RC) is calculated as the product of deposition velocity (mainly dry) (DV) and pollutant concentration.

Results of both, concentration and deposition velocity levels, were developed as GIS maps, allowing the calculation of removal flux map with a simple map algebra multiplication of both factors. The final map of annual removal capacity was obtained multiplying the estimated removal flux map by a map of share of vegetation within pixel. Areas covered by vegetation were calculated by combination of detailed maps of urban vegetation and forest, aggregated to 100-meter resolution. For urban vegetation, the green layers of the Global Human Settlement Layer were used (Florczyk et al., 2014, Pesaresi et al, 2013).

For forests, the High Resolution Global Forest map developed by Hansen (2014) was used. In overlapping areas, the maximum value of both maps was applied. Final map of vegetation had values between zero (no vegetation) and one (totally covered by vegetation).

Final results of removal capacity were averaged within different EU-28 administrative regions.

Main references

- AirBase - The European air quality database [1].
- Beelen R, Hoek G, Vienneau D, Eeftens M, Dimakopoulou K, Pedeli X et al., 2013 Development
of NO2 and NOx land use regression models for estimating air pollution exposure in 36 study areas in Europe: The ESCAPE project. Atmos Env 72: 10-23.

- European Commission, 2013: Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: A Clean Air Programme for Europe. [2]
- European Commission Joint Research Centre (JRC). MARS daily data [3].
- Pesaresi et al. (2013). A global human settlement layer from optical hr/vhr rs data: Concept and first results. IEEE JSTAR 6(5):2102–2131.

More information


Responsibility and ownership: European Commission, Joint Research Centre

Urban population exposed to PM10 concentrations exceeding the daily limit value on more than 35 days in a year

Indicator definition

The EU urban population exposed to PM10 concentrations exceeding the daily limit value on more than 35 days in a year measures the percentage of population in urban areas exposed to PM10 concentrations exceeding the daily limit value (50 μg/m³) established by the Air Quality Directive (2008/50/EC) on more than 35 days in a calendar year.
Units:

**Spatial coverage:** NUTS0, NUTS2

**Temporal coverage:** 2010, 2020, 2030, 2040 and 2050

**Methodology**

Annual mean concentrations of PM$_{10}$ were calculated using Land Use Regression (LUR) Models. The LUR model was built using annual mean PM$_{10}$ concentration for 2010 from the monitoring sites included in the AirBase database (dependent variable) and several parameters (independent variables) defined within a Geographic Information System (GIS). Some of these variables reflect sources or sinks for air pollution such as the road network, different types of land use and population density. Furthermore, factors such as elevation, topographical exposure, distance to sea, annual mean temperature and annual mean wind speed also influence the spatial concentration of pollutants and were included for the modelling. Land Use Regression model was developed using Random Forest regression techniques (Breiman, 2001) and results of concentration were presented in GIS maps.

**Main references**

- AirBase - The European air quality database. [1]
- European Commission, 2013: Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: A Clean Air Programme for Europe. [2]

**More information**

- Lavalle, C.; Vizcaino, P. (2015): LF512 - Urban population exposed to PM10 concentrations exceeding the daily limit value on more than 35 days in a year (LUISA Platform REF2014). European Commission - Joint Research Centre

**Responsibility and ownership:** European Commission, Joint Research Centre

**Urban population exposure to air pollution by particulate matter**

**Indicator definition**

The EU urban population exposure to air pollution by particulate matter indicator shows the population weighted annual mean concentration of PM$_{10}$ in agglomerations expressed in ug/m$^3$. 
Units: Micrograms per cubic meter

Spatial coverage: NUTS0, NUTS2

Temporal coverage: 2010, 2020, 2030, 2040 and 2050

Methodology

Annual mean concentrations of PM$_{10}$ were calculated using Land Use Regression (LUR) Models. The LUR model was built using annual mean PM$_{10}$ concentration for 2010 from the monitoring sites included in the AirBase database (dependent variable) and several parameters (independent variables) defined within a Geographic Information System (GIS). Some of these variables reflect sources or sinks for air pollution such as the road network, different types of land use and population density. Furthermore, factors such as elevation, topographical exposure, distance to sea, annual mean temperature and annual mean wind speed also influence the spatial concentration of pollutants and were included for the modelling. Land Use Regression model was developed using Random Forest regression techniques (Breiman, 2001) and results of concentration were presented in GIS maps. Population weights were calculated with GIS techniques estimating the ratio of population per cell by the total population within the cities. Cities boundaries were taken from the Urban Audit 2012 data. Results if weighted mean concentrations were aggregated within different administrative units.

Main references

- AirBase - The European air quality database. [1]
- European Commission, 2013: Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: A Clean Air Programme for Europe. [2]

More information


Responsibility and ownership: European Commission, Joint Research Centre

Capacity of ES to avoid soil erosion

Indicator definition

Erosion control assessment is performed under the conceptual framework of the Revised Universal Soil Loss Equation (RUSLE) (Wischmeier, 1978), which is a simple empirical model that is widely used for assessing long-term annual soil losses.
The indicator measures the capacity of ecosystems to avoid soil erosion assigning values ranging from 0 to 1 at pixel level, covering the EU-28 territory for 2000 and 2010. This indicator is related to the capacity of a given land cover type to provide soil protection.

**Units:** Dimensionless

**Spatial coverage:** NUTS0 and NUTS2

**Temporal coverage:** 2010, 2020, 2030, 2040 and 2050

**Methodology**

Pan-European data sources, spatial analysis technics and LUISA (Land Use Integrated Sustainability Assessment) modelling platform have been used to model the soil retention and the capacity of ecosystems to avoid soil erosion at European from 2006 to 2050. The base map in LUISA for the simulation is the Corine Land Cover 2006 (refined version). Arable lands, permanent crops, pastures, natural vegetation and forest are the land uses/coveres that are considered to have a major influence when assessing erosion control service of ecosystems.

In order to assess erosion control service of ecosystems it is needed an adaptation of the empirical USLE equation to provide four outputs under a conceptual ecosystem services framework (Guerra et al., 2014). Specifically, these four concepts are: structural impact, capacity for ecosystem service provision, ecosystem service mitigated impact and actual ecosystem service provision.

**Main references**


**More information**


**Responsibility and ownership:** European Commission, Joint Research Centre
**Soil Retention**

**Indicator definition**

Erosion control assessment is performed under the conceptual framework of the Revised Universal Soil Loss Equation (RUSLE) (Wischmeier, 1978), which is a simple empirical model that is widely used for assessing long-term annual soil losses.

Soil retention is calculated as soil loss without vegetation cover minus soil loss including the current land use/cover pattern. Specifically, this indicator takes into account climate data (observed measurements for rainfall and modelled for snow), topographic aspects, soil properties and the presence or not of the vegetation cover.

**Units:** ton/ha

**Spatial coverage:** NUTS0 and NUTS2

**Temporal coverage:** 2010, 2020, 2030, 2040 and 2050

**Methodology**

Pan-European data sources, spatial analysis technics and LUISA (Land Use Integrated Sustainability Assessment) modelling platform have been used to model the soil retention and the capacity of ecosystems to avoid soil erosion at European scale from 2006 to 2050. The base map in LUISA for the simulation is the Corine Land Cover 2006 (refined version).

The indicator was implemented in LUISA according to the Revised Universal Soil Loss Equation (USLE/RUSLE) (Wischmeier, 1978; Renard, 1997). The parameters included in the USLE equation combine data on precipitation, soil properties, topography and land use/cover. USLE equation provides the conceptual framework for the estimation of soil losses and soil retention.

In order to assess erosion control service of ecosystems it is needed an adaptation of the empirical USLE equation to provide four outputs under a conceptual ecosystem services framework (Guerra et al., 2014). Specifically, these four concepts are: structural impact, capacity for ecosystem service provision, ecosystem service mitigated impact and actual ecosystem service provision.

**Main references**

prevention in a mediterranean silvo-pastoral system. Landscape Ecology, doi:10.1007/s10980-015-0241-1


More information


Responsibility and ownership: European Commission, Joint Research Centre

C- Stocks (soil organic carbon-stock changes in mineral soils 0-30cm)

Indicator definition

The C-stocks change indicator estimates the change in the stocks of carbon in organic compounds in mineral soils (Mt C year⁻¹) and CO₂ emissions or removals (Mt CO₂ equivalent year⁻¹) from land use and management changes for mineral soils.

Units: ton/ha

Spatial coverage: NUTS0 and NUTS2

Temporal coverage: 2010, 2020, 2030, 2040 and 2050

Methodology

The most generic method to estimate the CO₂ emissions and removals through C-Stocks changes in mineral soils is defined by the IPCC Tier 1 method. The Tier 1 method is based on the supposition that the flux of carbon between the atmosphere and the soil has a propensity towards a state of equilibrium. Following changes in land use and cover the state of equilibrium is reached after 20 years. Under Tier 1 general default values for SOC density are defined depending on soil type and climatic conditions. These default values are varied by a set factors for land use and management. For mineral soils changes in C-stocks, and as a consequences in CO2 emissions, are then calculated as the difference in SOC stocks between the two points in time.

Main references


More information


Responsibility and ownership: European Commission, Joint Research Centre

Source URL: https://ec.europa.eu/jrc/en/luisa/outputs-by-theme/soil-air

Links