WHAT IS IT?

Soil sealing can be defined as the destruction or covering of soils by buildings, constructions and layers of completely or partly impermeable artificial material (asphalt, concrete, etc.). It is the most intense form of land take and is essentially an irreversible process.\(^1\)\(^2\).

The picture on the left below shows a typical suburban pattern, with houses, gardens, drive ways and yards. This pattern corresponds to the term “settlement area” or “artificial surface”. On the right, the sealed soil of the same settlement area is shown in black. In this case about 60% of the settlement area is actually sealed by buildings and streets.

WHERE DOES IT OCCUR?

In 2012, the European Union’s territory was sealed by 2.43%. Compared to 2006 sealed surfaces increased by 6,360 km\(^2\), which corresponds to an area that is 4 times larger than London. The map shows the percentage of sealed area aggregated to NUTS 3 regions based on the European Environment Agency (EEA) soil sealing map. Metropolitan areas with more than 500,000 capita are hot spots of high sealing, with sealed areas of 30% or more.

\(^3\) Percentage of soil sealing according to EAA soil sealing layer, year 2012.
Driving forces of soil sealing relate to the need for new housing, business locations and road infrastructure for the socio-economic development of cities. Most social and economic activities of the population depend on the construction, maintenance and existence of sealed areas and developed land. However, the new housing or infrastructure developments usually take place at the edge of existing settlements creating pressures on previously agricultural lands and increasing areas of artificial surfaces and sealed soils.

**HOW CAN IT BE MEASURED OR ASSESSED?**

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<tr>
<th>Soil threat</th>
<th>Soil threat RECare</th>
<th>ENVASSO 6</th>
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<tbody>
<tr>
<td>Soil sealing</td>
<td>• sealed area (ha, %)</td>
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<td></td>
<td>• transition index (TI)</td>
<td>• land take (Corine Land Cover, CLC)</td>
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<td></td>
<td>• sealed to green areas ratio</td>
<td>• new settlement area established on previously developed land (%)</td>
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The table below lists indicators, purpose of the indicator, methods and corresponding references for soil sealing.

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<th>Indicators</th>
<th>Purpose</th>
<th>Methods</th>
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<td>Artificial surface (established at European level)</td>
<td>Land take changes, in particular increase of urbanization and urban sprawl, based on the CLC classes 1.1, 1.2 and 1.3</td>
<td>Corine Land Cover (CLC) inventory: high resolution satellite imagery which is visually interpreted, according to 44 land cover classes, available for EU and associated countries for 1990, 2000, 2006, 2012.</td>
</tr>
<tr>
<td>Transition index (TI) (experimental, EU project URBAN SMS)</td>
<td>Determine loss of top soils within a defined region over time</td>
<td>Transition index (TI) $^{7,8} = $ percent of soil class “n” in new built area / percent of soil class “n” in whole soil area. Data: local soil quality data</td>
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<tr>
<td>Sealed to green areas ratio (experimental, RECARE)</td>
<td>Determine availability of green areas in relation to sealed areas for a defined region</td>
<td>Sealed to green areas ratio = sealed area of defined region [hectare] / green area of defined region [hectare]. Data: Corine Land Cover, Urban Atlas 5.</td>
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</table>
The European Commission recommend a three tiered approach to limit (L), mitigate (M) and compensate (C) soil sealing.

A range of different measures are available to prevent or influence soil sealing, however only a limited number of measures are fixed in legal regulations. Some measures are largely focused on creating regional or city policies or strategies that take into consideration the valuable role or valorisation of soils and the need to protect them.

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<th>Local measures</th>
<th>Regional measures</th>
<th>National measures</th>
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<td>Green roofs M</td>
<td>Make small city centres more attractive L</td>
<td>Integrated spatial planning L</td>
</tr>
<tr>
<td>Permeable surfaces, e.g. driveways M</td>
<td>Improve the quality of life in large urban centres L</td>
<td>Land take targets at national and regional levels L</td>
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<tr>
<td>Reuse of topsoil M</td>
<td>Steer new developments to already developed land and provide financial incentives for the redevelopment of brownfield sites L</td>
<td>Imposing development restrictions on top agricultural soils and valuable landscapes L</td>
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<tr>
<td>De-sealing C</td>
<td>Integrate soil information into regional spatial development plans L</td>
<td>Fees for converting most productive soils into non-agricultural purposes L</td>
</tr>
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</table>

Soil biodiversity. Sealing of soil also causes a near complete loss of soil biodiversity.

Flooding and landslides. Soil sealing drastically increases the risk of flooding. A high proportion of impermeable surfaces leads to enhanced runoff during rainstorms, which significantly contributes to flooding. Risk of landslides might also be enhanced by human settlements due to loss of natural vegetation and disturbance of slope stability or increased runoff and related soil erosion.

Soil compaction. Construction work can cause soil compaction due to heavy machinery. This effect is increased when soil is excessively saturated with water.

Soil contamination. Urbanization also usually elevates the contents of pollutants in the soil (e.g. trace elements or polycyclic aromatic hydrocarbons).
HOW DOES IT AFFECT SOIL FUNCTIONS?

- Biomass production – land found in suburban areas is often agriculturally productive and therefore sealing these areas results in less availability of fertile soil for food and other biomass production.
- Storing/filtering/transforming – soil sealing reduces the soil’s function as a sink and diluter for pollutants and reduces its capacity to store water.
- Gene pool - Soil sealing results in habitat loss for soil organisms, plant species and animals and such pressures lead to local extinction processes. Decreases in soil biodiversity lead to the inhibition or slowdown of organic matter and nutrient cycles.
- Physical basis - Major functions provided by sealing and urbanisation as a whole are housing and workplace provision (industry, services, commerce) and transport infrastructure.
- Raw material - soil sealing is a driving force for extraction of raw materials for construction work (sand, clay, limestone)
- Cultural heritage - The cultural heritage function of soil, measured as an archaeological value, is generally negatively affected by urbanization and soil sealing, despite the fact that some construction work might help to discover buried records of natural or human history.

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<th>Biomass production</th>
<th>Storing/filtering/transforming</th>
<th>Gene pool (diversity)</th>
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REFERENCES


MORE INFORMATION

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