European Environment Agency

8th Environment Action Programme

Land take: net land take in cities and commuting zones in Europe

8TH EAP HEADLINE INDICATOR, 2025

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Net land take in cities and commuting zones in Europe

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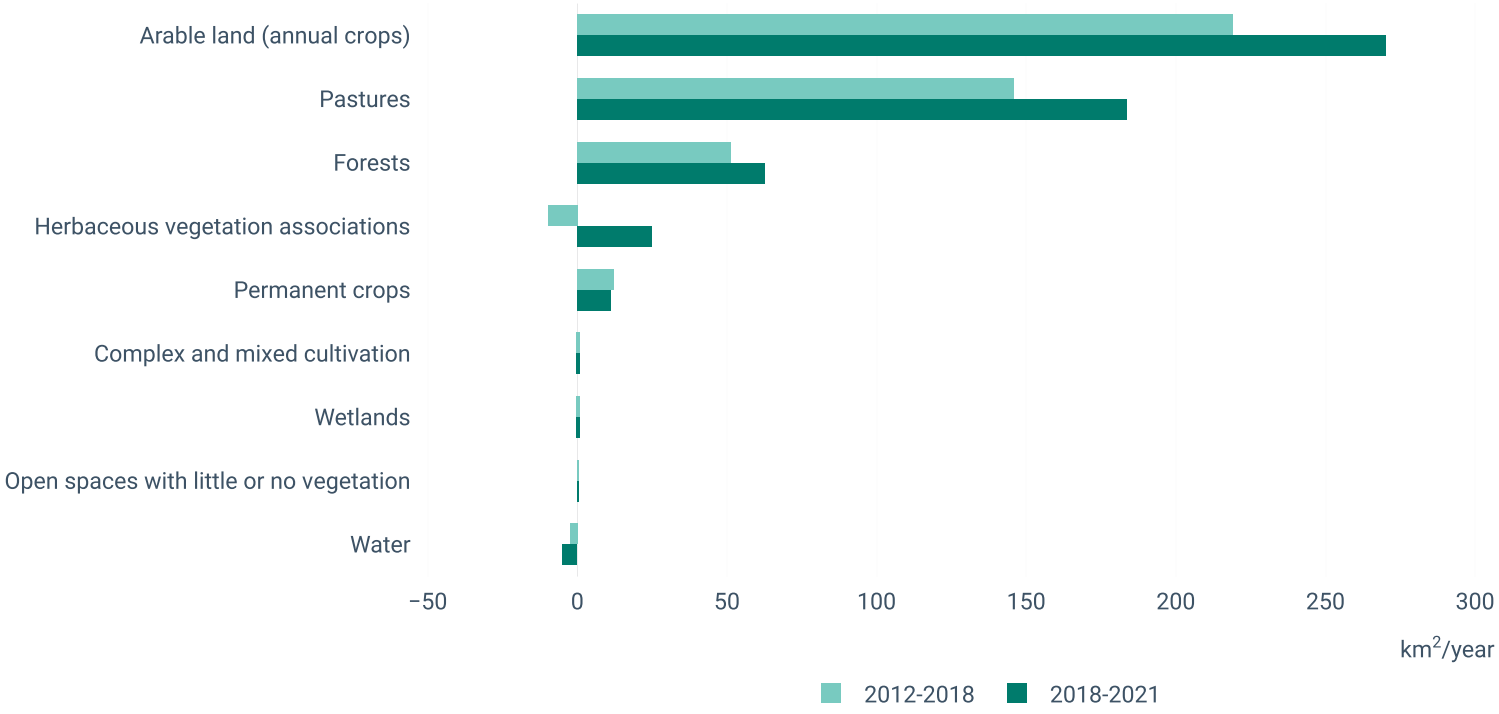
Conversion of natural land to artificial surfaces continues to undermine ecological functions and weaken ecosystem resilience. The EU Member State average net land take increased by about 32% in cities and their commuting zones, from 410km²/year during 2012-2018 to 540km²/year in 2018-2021. Most conversions affected cropland and pastures, followed by forests. Achieving the EU's goal of no net land take by 2050 will require major reductions amid ongoing urban expansion. However, given the upward trend observed between 2012 and 2021, Europe is currently likely off track to meet this target.

Figure 1. Yearly net land take in cities and commuting zones by land cover class, 2012-2018 and 2018-2021, EU-27 Member States (in km^2/year)



This indicator defines land take as the **conversion of natural and semi-natural land** to artificial surfaces. This process reduces ecosystem resilience by fragmenting landscapes, decreasing carbon storage and biodiversity capacity, increasing flood risk through higher surface run-off, and intensifying heatwave impacts in urban areas. Additionally, it might in some cases have a negative impact on quality of life through the loss of natural areas for relaxation, regeneration, and outdoor activities.

The **reduction and mitigation of land take** is a cross-cutting objective linked to several major policy frameworks. The EU Biodiversity Strategy for 2030 and the Nature Restoration Regulation aim to halt ecosystem degradation and loss through protection and restoration, such as reconnecting fragmented landscapes. Similarly, the adopted Soil Monitoring Law strives to reduce and mitigate the impacts of soil sealing and soil removal on soil health and resilience in terms of ecosystem services.

In the context of climate-related policies, countries aim to enhance their carbon sinks by **preventing and mitigating carbon losses** resulting from the sealing of land covers with high carbon sequestration and storage capacities, such as forests. Together these initiatives support the overarching EU goal to achieve 'No Net Land Take by 2050', which requires that climate, biodiversity, and soil protection objectives are considered in spatial and urban planning across all spatial scales.

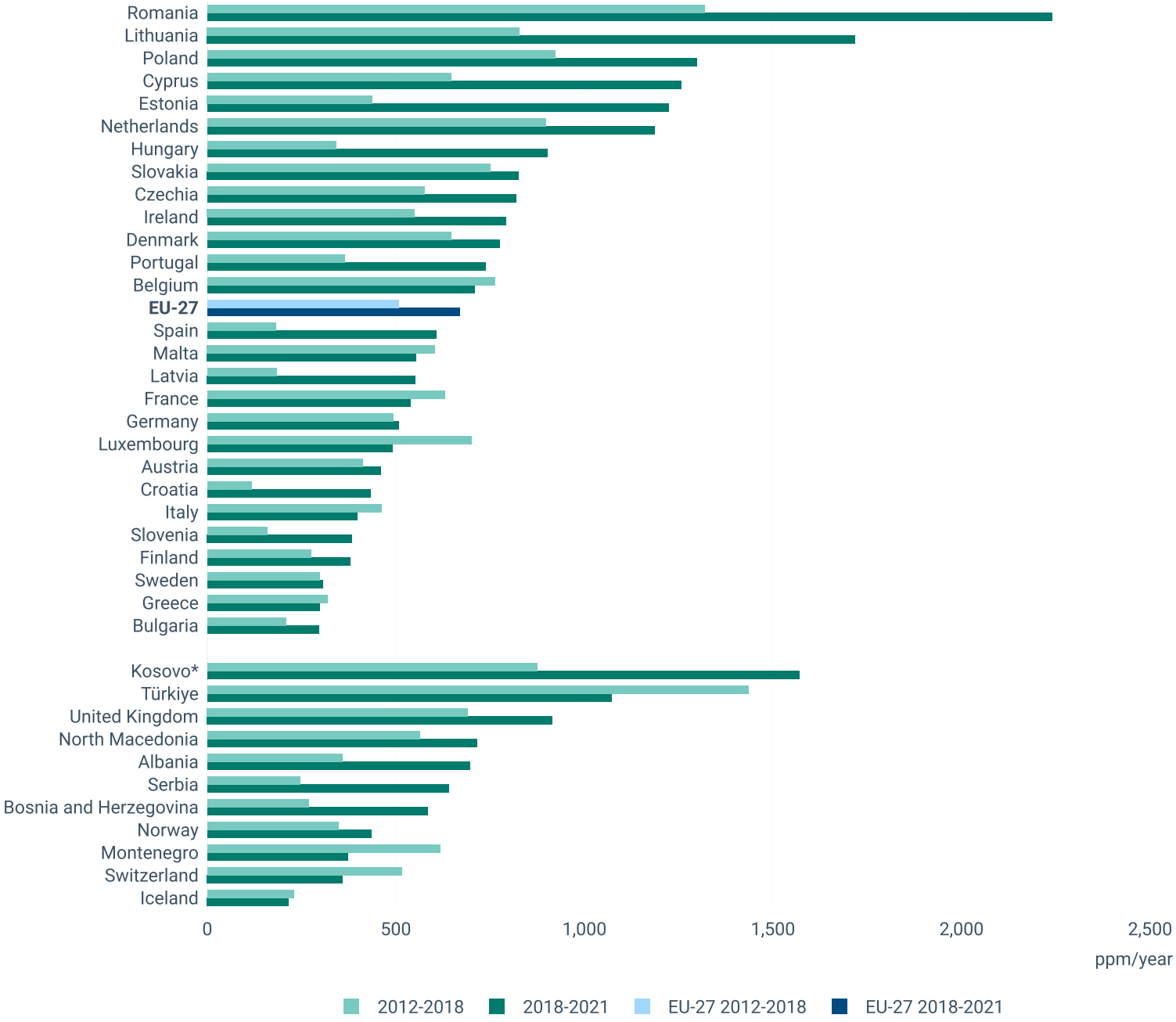
Monitoring land take within cities and their commuting zones serves a valuable insight into urban sprawl and the land conversion rate present in and around urban areas. The total net land take estimated within cities and commuting zones during 2012-2018 was 2,459km² (annual rate: 409km²/year) and 1,622km² in 2018-2021 (annual rate: 540km²/year). This represents an increase of about 32% in the average yearly rate between the two periods.

In cities and their commuting zones, most of the **new land take** occurred on arable land, being lost at a pace rising from 216 to 268km² per year, which heightens concerns for food security and biodiversity. Losses of pastures also grew, from 144 to 182km² per year. Forest losses rose from 49 to 59km² annually, affecting carbon stocks and biodiversity.

Although wetland conversion represents only a small fraction of the total, it increased slightly from 0.6 to 0.7km²/year and continues to pose a threat to these crucial ecosystems, which provides important carbon sink capacities and habitats for rare species. Overall, the data indicate an upwards trend in net land take within cities and commuting zones, adding pressure on Europe's ecosystems and complicating efforts to reach the 2050 **no net land take goal**.

Assuming a linear trend for simplicity, the EU would need to reduce its net land take in cities and commuting zones by approximately 27km² annually from 2022 onwards to achieve zero net land take by 2050. This implies that by 2030, the annual net land take would need to be lowered to around 324km²/year, from 540km²/year recorded in 2018-2021. However, given the upward trend observed between 2012-2018 and 2018-2021, Europe is currently likely **off track** to meet this target.

Figure 2. Yearly net land take by country, 2012-2018 and 2018-2021, EEA-38 member and cooperating countries (in ppm of total urban surface per country)



During 2012-2018 and 2018-2021, most EU-27 countries saw **notable increases** in yearly net land take in cities and commuting zones relative to their total area. Countries in Figure 2 are ordered according to the highest average yearly net land take in 2018-2021. The most dramatic increases of average yearly net land take were seen in Croatia, Spain and Latvia who more than tripled their rates (267%, 233%, 202% respectively), followed by Estonia (179%), Hungary (164%) and Slovenia (142%). Note that country size plays an important role when interpreting these percentages, as a tripling of the rate in Spain contributes more to the total EU area converted than a similar increase in Latvia.

However, several countries experienced **reductions**. Luxembourg stands out for achieving the most significant decrease in yearly net land take rate, dropping by 30% over the periods. France (15%), Italy (14%), Malta (8%), and Belgium (7%) also achieved modest decreases. Results for Germany and Austria remained nearly stable, with minimal changes. View the dashboards offering **tools for exploring the data** derived on net land take in cities and commuting zones.

Despite reductions in a few countries, most of Europe continues to drift away from the no net land take goal, with increasing land conversion making it unlikely for policy targets to be met. **Immediate action** and stronger implementation are needed for the EU to reverse this negative trend and protect its natural land for future generations.

Supporting information

Definition

This net land take indicator tracks changes in agricultural, forest, and semi-natural land converted to urban or uses considered as artificial, such as buildings, infrastructure, urban green areas, sport and leisure facilities. It covers both land taken for housing, industry, transport, or extractive activities and, on the inverse, land restored from artificial to natural states. Calculated as the difference between land taken and land re-naturalised, it measures the net loss of natural and semi-natural land more accurately. Definition of how EEA measures land take is further described the Land take and land degradation in functional urban areas report. The definition is dependent on the mapping methodology and nomenclature structure of the Urban Atlas dataset. Table 1 presents the division of urban and semi-/natural classes used for the land take calculations. Additional information on the land use included in these classes is available in the Urban Atlas mapping guidelines.

Table 1. CLMS Urban Atlas nomenclature separated into *Urban classes* and *Semi-natural and natural classes*. Land take considers conversion of classes from right to left, and inverse land take considers conversion from left to right.

Urban classes	Semi-natural and natural classes
11100: Continuous Urban Fabric (S.L. > 80%)	21000: Arable land (annual crops)
11210: Discontinuous Dense Urban Fabric (S.L. 50% - 80%)	22000: Permanent crops
11220: Discontinuous Medium Density Urban Fabric (S.L. 30% - 50%)	23000: Pastures
11230: Discontinuous Low Density Urban Fabric (S.L. 10% - 30%)	24000: Complex and mixed cultivation
11240: Discontinuous Very Low Density Urban Fabric (S.L. < 10%)	25000: Orchards
11300: Isolated structures	31000: Forests
12100: Industrial, commercial, public, military and private units	32000: Herbaceous vegetation associations
12210: Fast transit roads and associated land	33000: Open spaces with little or no vegetations
12220: Other roads and associated land	40000: Wetlands
12230: Railways and associated land	50000: Water

12300: Port areas	
12400: Airports	
13100: Mineral extraction and dump sites	
13300: Construction sites	
13400: Land without current use	
14100: Green urban areas	
14200: Sports and leisure facilities	

Methodology

Methodology for indicator calculation

The indicator tracks net land take in urban areas, specifically within cities and commuting zones across the EEA-38 member and cooperating countries using Functional Urban Areas (FUAs) as the reporting unit. The indicator covers two periods, 2012-2018 and 2018-2021, relying strictly on the overlap areas available in both Urban Atlas change datasets (more information below in the Caveats and Notes section). Net land take is calculated by also considering the 'reverse land take' process, i.e. when urban areas are converted to semi-natural land. For example, this may occur when a former mineral extraction site becomes forested. Thus, net land take is the result of subtracting the total land taken with the land restored, expressed in km².

Key Methodological Steps:

1. Preparation: Creation of reference geospatial boundaries for 2012-2018 and 2018-2021, incorporating FUA and city boundaries.

2. Creation of a data cube for analysis: Urban Atlas change data and reference boundaries (FUA and city) are rasterised at 10-metre spatial resolution and integrated into a data cube ready for analysis.

3. Aggregation: The aggregated cube data are exported to a SQL Server for indicator calculation.

4. Indicator Calculation: Indicator figures (e.g., km²/year of net land take by land cover class, country-level and yearly ppm over total FUA overlap area) are derived via SQL queries and stored in views.

5. Visualisation: Data views are linked to Tableau for production of charts and dashboards.

Classification and Charts: Net land take figures are reported at land cover level 2 of the Urban Atlas classification, ensuring comparability between the two change periods. Only the overlap area is considered for calculating the share of total FUA area, and all absolute figures are based on yearly averages.

Caveats and Notes:

- The delineation of Functional Urban Areas (FUAs) is a process led by Eurostat in collaboration with the national statistical authorities of the Member States, who regularly update these to accurately reflect the extents of cities and commuting zones. The Urban Atlas production adhere to these updates which results in slightly different mapping

extents each reference year due to either shrinkages or expansions of some FUAs. Hence, when producing change layers, i.e. comparing two reference years (e.g. 2021 vs. 2018), it is only possible for where the two FUA-extents overlap. Consequently, the net land take calculation is confined to these overlap areas, which leads to a slight underestimation.

- Underestimation may vary by country depending on the extent of areas not covered in both periods.
- The indicator is restricted to the classification depth of the Urban Atlas nomenclature (table 1). Therefore, separate handling of water between artificial and natural is not possible. For example, an artificial lake established in previously agricultural land use is thus not measured as land take.
- The methodology ensures robust time-series comparability and supports analysis across countries and land cover classes. However, users should note that some recent or marginal expansions may not be fully captured.

This structured methodological approach ensures comparability and clarity in indicator reporting while leveraging advanced data processing and integration of tools for robust, reproducible outputs.

Methodology for gap filling

Not applicable.

Policy/environmental relevance

The net land take indicator is a key measure of land conversion pressure and ecosystem degradation in Europe. Land take drives habitat loss, biodiversity decline, soil sealing, and reduced ecosystem resilience, undermining climate mitigation, food security, and, in some cases, human well-being.

It is central to several key EU policy frameworks: the Biodiversity Strategy 2030 identifies it as a core threat; the Soil Strategy 2030 recalls the existing “no net land take” goal by 2050 set in the 7th EAP; and the Nature Restoration Regulation mandates restoring 20% of EU land and sea by 2030 and halting green space loss in cities. These strategies further align with the UN global sustainable development goals on land degradation neutrality (SDG 15.3) and sustainable cities (SDG 11). The net land take indicator thus provides a critical metric for monitoring progress towards these international targets and for evaluating the effectiveness of EU-wide and national policies. By tracking conversion of natural to artificial surfaces, the indicator informs policy on unsustainable urban expansion and hence supports evidence-based decision-making, promoting urban densification, planning, zoning, and land recycling. However, despite these policy efforts, current trends show a rise in net land take, underscoring the need for stronger land-use action across Europe.

This indicator is a headline indicator for monitoring progress towards the 8th Environment Action Programme (8th EAP). It contributes mainly to monitoring aspects of the 8th EAP Article 2.1. that requires that ‘by 2050 at the latest, people live well, within the planetary boundaries in a well-being economy where nothing is wasted, growth is regenerative, climate neutrality in the Union has been achieved and inequalities have been significantly reduced. A healthy environment underpins the well-being of all people and is an environment in which biodiversity is conserved, ecosystems thrive, and nature is protected and restored, leading to increased resilience to climate change, weather- and climate-related disasters and other environmental risks. The Union sets the pace for ensuring the 'prosperity of present and future generations globally, guided by intergenerational responsibility'. The European Commission 8th EAP monitoring Communication specifies that this indicator should monitor whether the EU is on track to meet the ‘no land take by 2050’ target.

‘No net land take’ is also addressed in the land degradation neutrality (LDN) target of the United Nations Convention to Combat Desertification (UNCCD), which aims to maintain the amount and quality of land resources. LDN is promoted by target 15.3 of the UN Sustainable Development Goals (SDGs), which, by 2030, strives to combat desertification and to restore degraded land and soil. Land and soil are also linked to goals that address sustainable agriculture and food security (SDG 2), access to clean water and sanitation (SDG 6), the environmental impact of urban sprawl (SDG 11), climate change (SDG 13) and life on land (SDG 15). The EU biodiversity strategy to 2030 calls for the restoration of at least 15% of degraded ecosystems in the EU and the expansion of the use of green infrastructure, e.g. to help overcome land fragmentation.

Accuracy and uncertainties

While the Urban Atlas data benefit from rigorous photointerpretation and have a thematic accuracy generally above 80%, several sources of uncertainty remain:

- Minimum Mapping Unit and Spatial Resolution: The Minimum Mapping Unit (MMU) differs between urban and rural contexts. For urban areas, the MMU for detecting changes is 0.1 hectares, allowing identification of relatively small changes common in densely built environments. For rural and semi-natural areas, the MMU for detecting changes is 0.25 hectares, reflecting coarser granularity in less developed landscapes. Changes smaller than these thresholds are excluded or aggregated, potentially underestimating very fine-scale land take.
- Change Detection and Classification Errors: While the Urban Atlas accounts for conversions from artificial to agricultural or natural land, i.e. re-naturalisation, such changes may be underestimated due to classification limitations and interpretation challenges.
- Temporal Gaps and Data Processing: The datasets are generated for discrete years (for example, 2012 and 2018), so actual land cover changes occurring between these intervals can be temporally imprecise. Differences in methodologies or data availability across years can introduce inconsistencies.
- Underrepresentation of Rural Large-scale Processes: This indicator addresses the net land take in cities and communing zones. Some extensive land conversion activities outside these areas are therefore missed, leading to underestimation of total net land take.
- Regional Variability: Classification accuracy can vary by geographic context due to differences in landscape complexity and heterogeneity.

The Urban Atlas 2018 dataset demonstrates high thematic accuracy, with observed accuracy rates exceeding specification thresholds for both urban and rural land classes after plausibility checks. However, uncertainties remain due to unclear class definitions and the challenges of distinguishing certain land types. Particularly when only mono-temporal imagery is available. Additionally, positional accuracy could not be conclusively evaluated for the 2018 reference year due to a lack of assessment of the underlying very high resolution imagery. While logical, domain, and topological consistency criteria were met, continuous enhancements in class definitions, temporal data coverage, and validation completeness are being assessed to further strengthen the dataset's reliability and reduce remaining uncertainties. The validation of Urban Atlas 2018-2021 dataset is starting in Q4 2025 and will be published during 2026, and therefore the data might be a subject to revisions.

Despite these uncertainties, Urban Atlas remains the most detailed and harmonised pan-European land cover product available for urban areas, providing robust trend and spatial pattern information. The calculated net land take values should be regarded as conservative estimates of true land conversion.

Ongoing efforts to improve spatial and temporal resolution, classification algorithms, and to validate datasets will continually enhance indicator accuracy. The current data support reliable monitoring and policy assessment for sustainable land management.

Data sources and providers

- Urban Atlas Land Cover/Land Use Change 2012-2018 (vector), Europe, 6-yearly, Copernicus Land Monitoring Service (CLMS)
- Urban Atlas Land Cover/Land Use Change 2018-2021 (vector), Europe, 3-yearly (Dataset URL not available), Copernicus Land Monitoring Service (CLMS), Copernicus Land Monitoring Service (CLMS)

Metadata

DPSIR

Pressure

Topics

Land use

Tags

Communting zones # 8th EAP # LSI001 # Artifical surfaces # Fnctional urban areas # Urban sprawl # urban # cities # Land take

Temporal coverage

2012-2021

Geographic coverage

Albania
Austria
Belgium
Bosnia and Herzegovina
Bulgaria
Croatia
Cyprus
Czechia
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Iceland
Ireland
Italy
Kosovo (UNSCR 1244/99)
Latvia
Liechtenstein
Lithuania
Luxembourg
Malta
Montenegro
Netherlands
North Macedonia
Norway
Poland
Portugal
Romania
Serbia
Slovakia
Slovenia
Spain
Sweden
Switzerland
Türkiye
United Kingdom

Typology

Descriptive indicator (Type A - What is happening to the environment and to humans?)

UN SDGs

SDG15: Life on land, SDG11: Sustainable cities and communities

Unit of measure

km² and percentage

Frequency of dissemination

Every 3 years

References and footnotes