

Lifewatch-WB geodatabase (v6.20): attribute description

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This database is published under Creative Common 0 4.0. However, reference to this work and to the other data used to build it is much appreciated.

Note to users

This database is produced with the greatest care about quality, but we are aware that AI is not perfect. However, we believe in user experience and field knowledge, therefore you can make this map better using the tool provided on the web interface. Bi-annual release will include this information to make this map even better.

Warning

This pre-release version has not yet been validated. Thematic accuracy values will be provided in June 2024.

1. Major changes since last version

The variables of the ecotopes are compute with the best available dataset and adapted to model needs. The first version number (v6.*) is defined by the methodology used for the delineation of spatial units. The second number (v*.20) is defined by the methodology and the source datasets used to extract the variables.

The main changes in version 6 concern geometric corrections and improvements to soil attributes. Notably, certain cadastral boundaries have been integrated to ensure more accurate representation of land use variations. Various anomalies have been rectified, mainly the overestimation of forest areas resulting from automated delineation errors, such as slopes and cast shadows. Additionally, polygons now fill in the gaps left by roads, giving complete coverage of the territory, while roads can be easily excluded for specific analysis thanks to a specific code. Furthermore, soil properties have undergone enhancements and are now presented as continuous variables.

Previous updates: the geometry had been updated to fully comply with the OGC simple geometry standard. Temporal consistency rules have been applied to the land cover reference data to mitigate the commission of land cover change due to classification or geometric discrepancies. New fields had been added: the categorical field related to potential natural vegetation and the age of permanent grassland for agricultural areas. In addition, the information about soil properties is now stored in smaller number of fields using a numerical value assigned to each category along an expert-based gradient.

2. Climatic variables

2.1. Variables extracted from climate models

Bioclimatic variables were extracted from the high-resolution future climate data for species distribution models in Europe (De troch et al, 2020). They represent historical climate between 1971 and 2005. <https://zenodo.org/record/3694065>

Temperature

AnM_T: mean annual temperature in °C.

AnVar_T: annual variation of the temperature in °C (standard deviation).

AnRg_T: temperature annual range in °C.

MaxWarmM_T: maximum temperature of the warmest month in °C.

MinColdM_T: minimum temperature of the coldest month in °C.

Precipitation

WetM_P: precipitation of the wettest month in mm.

DryM_P: precipitation of the driest month in mm.

AnTot_P: sum of annual rainfall in mm.

AnVar_P: annual variation of the precipitation (coefficient of variation).

Other

GDD_5deg: mean annual cumulated growing degree days (above 5°C).

An_PotETP: annual mean potential evapotranspiration in mm day⁻¹.

AnM_SolR: annual mean solar radiation in W m⁻².

AnVar_SolR: annual variation of the solar radiation in W m⁻².

2.2. Metrics extracted from Lifewatch-WB land surface dynamics products

Those metrics are derived from the Lifewatch WB snow analysis, which consists in the filtering and analysis of MODIS snow product between 2000 and 2012. Those variables are good proxies of the other climatic variables and are available with a better resolution. (www.uclouvain.be/lifewatch)

Because of the spatial resolution of 500m, values are extracted at the location of the centroid (with a nearest neighbour interpolation).

Snow_len: the average snow duration, in weeks.

3. Topographic variables

The source of elevation information for computing the topographic variables is the 2013-2014 LIDAR dataset of the Walloon region (0.8 pts/m²). It was smoothed and resampled at 10 m resolution, then combined with the 2015 LIDAR dataset of the Flemish region in order to cover the full extent of Belgium. A linear

combination of the two DEM was used in the overlap region in order to avoid sharp transitions.

Elev_mean: average of the elevation in the ecotope in meter.

Elev_min: minimum of the elevation in the ecotope in meter.

Elev_max: maximum of the elevation in the ecotope in meter.

SunSpring: potential incident light energy in Wm^{-2} for the first day of spring, measure at the center of the polygon. This variable integrates the clear sky sun energy reaching the ground during 24h (measure every hour) on march 21. Slope is measured in the center of 4 pixels. Topographic shadows are taken into account.

Slp_mean : mean percentage of slope of the ecotope. Slope is derived from 1-m or 5-m LIDAR data resampled at 10 m with Lancsoz method.

Slp_max: maximum percentage of slope of the ecotope. Slope is derived from 1-m or 5-m LIDAR data resampled at 10 m with Lancsoz method.

TPI_1km: topographic position index, that is the mean relative position of the ecotope in a 1000 m radius. This value ranges is negative when the ecotope is in a valley and positive when it is on a crest.

TPI_250m: topographic position index, that is the mean relative position of the ecotope in a 250 m radius. This value ranges is negative when the ecotope is in a valley and positive when it is on a crest.

4. Land cover proportion

4.1. Raw raster layers

The ecotope database comes with a raster layer (Lifewatch land cover) produced at 2 m resolution based on the analysis of ortho-images, LIDAR data and Sentinel-2 time series. This raw raster layers is used to compute the different raster variables of the database and can be downloaded independently. It was produced for the years 2006, 2010, 2015, 2018, 2019, 2020, 2021 and 2022. See [Radoux et al, 2023](#) for more details.

The class codes are the following:

10: Open water, including rivers, ponds and lakes

15: Permanent bare soil or vegetation cover < 10%, including dunes, bare rocks and quarries

20: Artificialized impervious surface, including roads, railroads and car parks

21: Buildings taller than 1 m, including houses, commercial and industrial buildings, and bridges

30: Arable land (plowed at least once during the year), including cropland and temporary grassland

35: Grassland (managed), including intensive agricultural grassland, gardens and leisure grasslands

40: Open vegetation with biological interest (dry), including extensively managed grassland with biological interest, natural grassland and heathland vegetation (also peatlands if they are dry on top).

45: Open vegetation with biological interest (wet), including reed beds and marshes

48: Recently disturbed (less than 5 years before) ligneous vegetation, including young plantations and clear cuts

50: Needleleaved trees (>3m), isolated, in hedges or inside forests, including Christmas trees

51: Needleleaved shrub (<=3m), isolated, in hedges or inside forests

55: Broadleaved trees (>3m), isolated, in hedges or inside forests

56: Broadleaved shrub (<=3m), isolated, in hedges or inside forests, including intensive orchards

100 : No data (lack of information to classify the pixel)

4.2. Proportions inside ecotopes

The ecotopes are automatically delineated based on the orthophotos and the LIDAR data. More info on the method is available in [Delangre et al \(2017\)](#) and [Radoux et al \(2019\)](#). In addition to the ecotopes, different 1km grids are also available on request.

Thirteen land cover classes are used to characterise the ecotopes. The proportion of each class is computed based on the raw layer described in 4.1 . The two-meter layer has been validated by photointerpretation consolidated on the field when necessary. The Lifewatch project team thanks Jeroen Vanden Borre (INBO) for the validation of Flanders. The overall accuracy based on 1200 randomly distributed points is ~93%. The geodatabase file uses some aliases that are visible with some software. The proportions are stored in “per thousand”, ranging from 0 (absence of land cover type) to 1000 (pure ecotope for this land cover type).

BroadLV (Alias Broadleaved trees): broadleaved trees (angiosperms), located in forests or other land use (parks, orchards...) with a height above 3m.

NeedILV (Alias needleleaved trees): coniferous trees (gymnosperms) located in forests or other land use (hedges, gardens...) with a height above 3m.

Broad_SM (Alias needleleaved shrubs): broadleaved trees or shrubs (angiosperms), located in forests or other land use (vineyards, orchards...) with a height below 3m

NeedI_SM (Alias needleleaved shrubs): Coniferous trees or shrubs (gymnosperms) located in forests or other land use (gardens, Christmas tree plantations...) with a height below 3m

Plowed (Alias ploughed herbaceous cover) : arable lands (annual crops and temporary herbaceous cover).

MGramin (Alias permanent monospecific graminoid cover): permanent monospecific graminoid cover resulting from intensive land uses such as intensive farming, gardens, leisure ...

NOpen (Alias open area with relatively dry soils): permanent herbaceous cover mixed with other non lignous vegetation. This class covers a large number of potential biodiversity hotspots such as heathlands or extensive grasslands.

WOpen (Alias open area with humid soils): flooded herbaceous cover mixed with other non-ligneous vegetation. This class covers a large number of potential biodiversity hotspots such wetlands and peatlands.

COpen (Alias disturbed open area): permanent herbaceous and shrub cover from forest adventice plants and young trees. This class includes recent clear cuts, small forest gaps where tree crown cover is absent as well as ruderal vegetation from recently disturbed areas or Christmas tree plantations.

Water (Alias permanent water bodies): permanent water bodies.

Bare (Alias bare soils): bare soils or soils sparsely covered by vegetation (<15%), mainly quarries in Wallonia.

Art_Imper (Alias artificialised surface and building): surface of the soil covered with man-made impervious surfaces (e.g. concrete or bitumen) and buildings. This class includes roads, car parks, bridges, houses and other buildings.

Sealed (Alias sealed surface): subset of the “Art_Imper class composed of artificial sealed surfaces at ground level.

Building (Alias sealed surface): subset of the “Art_Imper” class composed of above ground buildings and other man-made constructions.

Trees (alias ligneous vegetation): sum of all the shrubs and trees.

4.3. Contextual land cover proportions

Contextual information is based on the 2-m land cover information resampled at 10-m with a majority rule. Three circular neighbourhoods are used: the first has a radius of 25 pixels, the second has a radius of 50 pixels and the third a radius of 100 pixels. The size of the radius is mentioned in the field name (250 for 250m, 500 for 500m and 1km for 1000m). The average of the proportion of each land cover is computed for each ecotope and rescaled between 0 and 1000.

BroadLV_250 or 500 or 1km: broadleaved trees (angiosperms).

NeedILV250 or 500 or 1km: coniferous (gymnosperms).

BroadLVSm_250 or 500 or 1km: broadleaved trees or shrubs (angiosperms), located in forests or other land use (vineyards, orchards...) with a height below 3m.

NeedILVSm_250 or 500 or 1km: Coniferous trees or shrubs (gymnosperms) located in forests or other land use (gardens, Christmas tree plantations...) with a height below 3m.

Plowed_250 or or 500 or 1km: land being ploughed during the year.

MGramin_250 or 500 or 1km: permanent monospecific herbaceous cover.

NOpen_250 or or 500 or 1km: permanent mix of herbaceous cover and other non-ligneous vegetation or small shrub.

WOpen_250 or or 500 or 1km: permanent inundated mixture of herbaceous cover and other non-ligneous vegetation or small shrub.

COPen_250 or 500 or 1km: disturbed vegetation (e.g. after clear cut).

Water250 or 500 or 1km: open water bodies.

Bare250 or 500 or 1km: permanent bare soil.

Sealed_250 or 500 or 1km: subset of the “Art_Imper” class composed of artificial sealed surfaces at ground level.

Building_250 or 500 or 1km: subset of the “Ar_Imper” class composed of above ground buildings and other man-made constructions.

5. Soils attributes

Soil attributes are derived from the digital soil map of Wallonia (Source : Copyright - SPW-licence n° 160114-0837 - Legrain et Briec, 2012). Data is not complete: values are missing in and around urban and some military areas.

5.1. Marginal soils

Each ecotope is characterized by numerous soil properties, each variable being continuous. The value assigned to each variable signifies the average of the variable's classes within the ecotope, with weights determined by the surface area (in ‰) occupied by each class within the ecotope. The classification of each variable is described below.

Variable	Class	Definition
Calc (Alias calcareous soils)	0	Other soils
	1	Clayey-schistose-sandstone- calcareous load
	2	Macigno-gritty-chalky load
	3	Clay- calcareous load
	4	Calcareous load
Clay (Alias clay content)	0	Soils with little clay
	1	Light clay
	2	Heavy clay
Org (Aliax organic soils)	0	Other soils
	1	Paratourbous soils
	2	Peat soils (more than or equal to 40 cm)
	3	Soils with thick peat (more than or equal to 150 cm)
Sandy (Alias sandy soils)	0	Other soils
	1	Light sandy loam
	2	Silty sands
	3	Sandy soils
Alluvial (Alias alluvial soils)	0	Other soils
	1	Alluvial soils
Podzol	0	Other soils

	1	Podzol off sand
	2	Podzol on sand
Stoniness	0	Little stony soils
	1	Stony soils
	2	Very stony soils

5.2. Hydric and trophic levels

HydrLev (Alias hydric level): The water level provides information on the availability water resources. The water level of an ecotope is determined by the weighted average of the water level classes included in this ecotope. The classification is consistent with that established in the ecological file determination key.

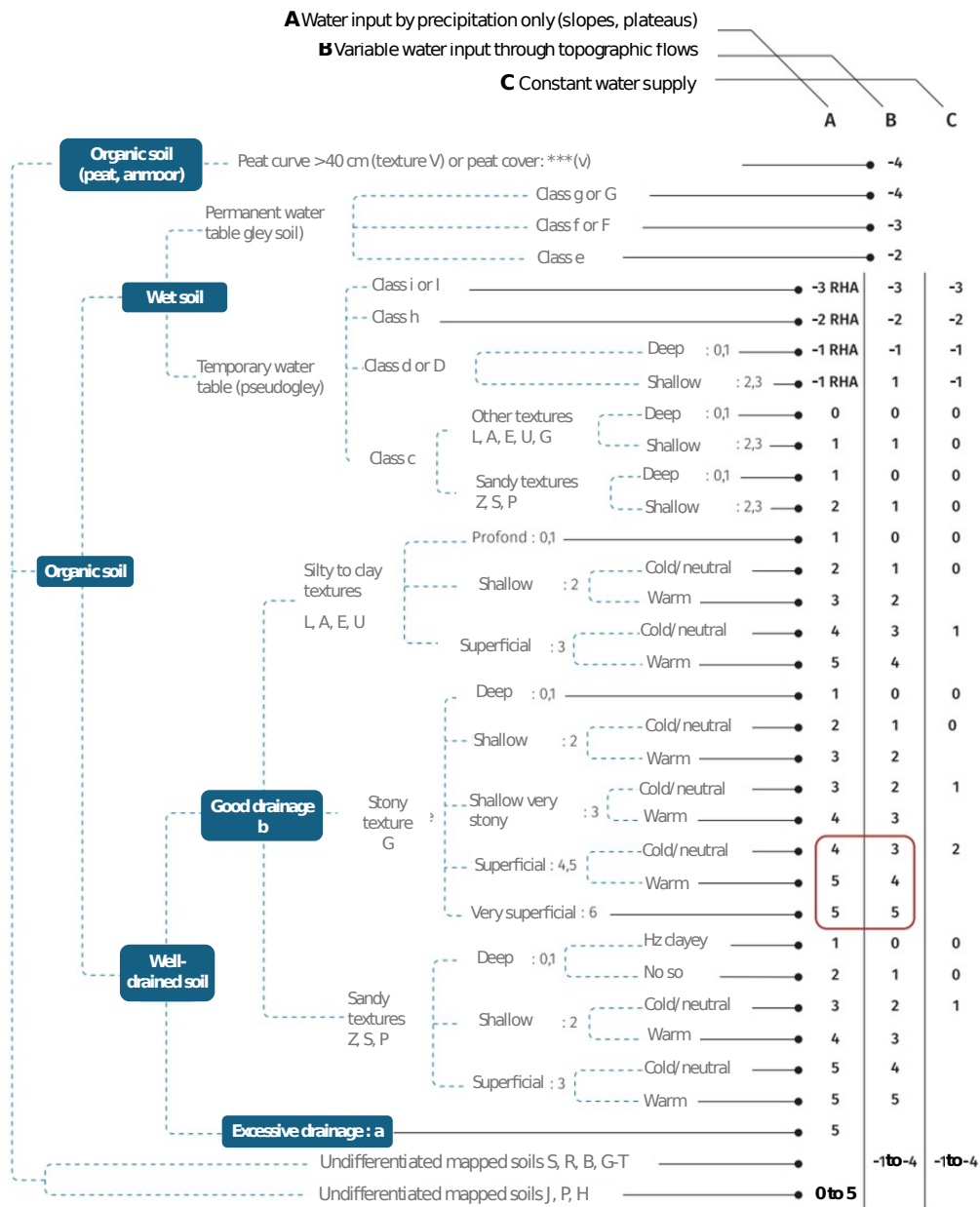


Figure 1 Hydric level determination key (source : [Fichier écologique des essences](#))

TrophLev (Alias trophic level): The trophic level provides information on the availability of mineral element resources. The trophic level of an ecotope is determined by the weighted average of the trophic level classes included in this ecotope. The classification is consistent with that established in the ecological file determination key.

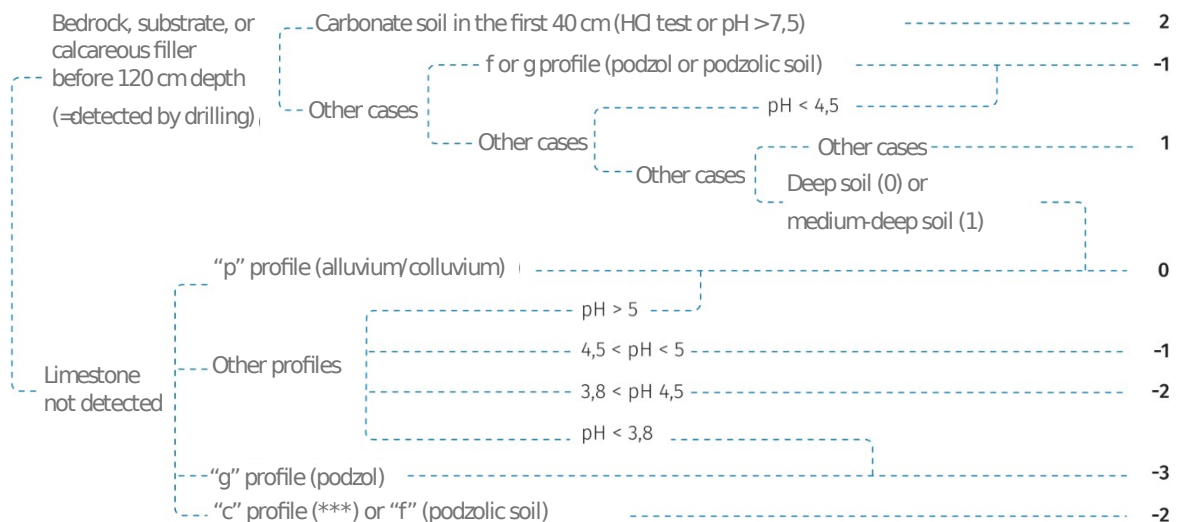


Figure 2 Trophic level determination key (source : [Fichier écologique des essences](#))

5.3. Soil depth

This variable summarizes superficial soils. The superficial soils value of an ecotope is determined by the weighted average of the superficial soils classes included in this ecotope.

Variable	Class	Definition
sup_soil (Alias superficial soils)	0	Very deep soils
	1	Deep soils
	2	Shallow soils
	3	Superficial soils
	4	Very superficial soils
	5	Rock outcrops

5.4. Drainage

This variable reflects the natural drainage of the soil. The drainage value of an ecotope is determined by the weighted average of the drainage classes included in this ecotope.

Variable	Class	Definition
Drain (Alias drainage)	1	Dry and very dry soils
	2	Moderately dry and wet soils
	3	Wet soils with oscillating water table
	4	Very wet soils with oscillating water table
	5	Hydromorphic soils with a quasi-permanent water table

5.5. Completeness

SoilQual (Alias Soil data quality): proportion (between 0 and 1000) of the ecotope that is actually described in terms of soil. Urban and military areas are indeed missing.

6. Thematic categories

For the sake of representation of the land cover, different classification systems have been applied on top of the land cover proportions. Currently, four classification systems are available: LCCS CCI-like (LCCSb), majority based (Majority), machine-driven land cover/land use clusters (kmeans), pure land use (land use) and potential natural vegetation (pnmj).

6.1. Land cover classification system

LCCS categories based on the ESA land cover CCI legend are available in field « LCCSb ». Those classes are based on fixed thresholds selected based on global landscapes. The grassland class from the LCCS was split into two classes: monospecific and diversified grasslands. Furthermore, one additional urban class has been added because a majority of settlements of Wallonia have a built-up proportion below the 50 % threshold. Details about the validation of the product are available in Radoux et al, 2017.

10	Periodically herbaceous
60	Broadleaved deciduous forest
61	Young broadleaved forest (<3m), also includes low-stem orchards and vineyards
70	Needleleaved sempervirens or deciduous forest
71	Young needleleaved sempervirens or deciduous forest (<3m), also includes Xmas tree
130	Permanent monospecific productive grassland
135	Diversified grassland and shrubland
180	Shrub and herbaceous flooded
190	Densely artificialized (>50% artificial surface)
195	Sparsely artificialized (>25% artificial surface)
199	Transport network (roads and rails)
200	Bare soil
210	Water
90	Mixed forest
100	Mixed herbaceous and tree cover (with majority of trees)
110	Mixed herbaceous and tree cover (with majority of herbaceous)
150	Mixture of vegetation and bare soils
120	Recently (< 5 years) disturbed forest areas (clear cuts with vegetation < 1m), also includes forest gaps
30	Mixed crop cover (with majority of crops)
40	Mixed crop cover (with minority of crops)

6.2. Land cover majority

The majority of the land cover proportions is provided as an additional label for a more simple representation of the land cover. The labels are not based on fixed thresholds in this case but correspond with the modal class of the high resolution raster land cover map described in 4.1.

6.3. Land cover Kmean

The land cover types are grouped according to a hierarchical kmean based on the non artificialized land cover classes.

1	Water bodies
2	Bare soils
3	Artificialized sealed surface
4	Dense residential area
5	Residential area with gardens
6	Wooded residential area
7	Annual crops
8	Mixed agricultural area
9	Intensive grassland
10	Natural open area (herbaceous and or small shrub) of potentially high biodiversity
11	Woody farmland
12	Young forest and tree plantations
13	Broadleaved forest
14	Needleleaved forest
20	Others
999	No data

6.4. Land use

The land use describes the human activities performed in a given area (how human use the area). Different activities can take place in the same area, but we describe here the main one only. The data is extracted from existing land use map (WAL_UTS2018) using a spatial majority rule. New built up areas and agricultural lands are updated annually and private gardens have been consolidated.

111 : Annual cropland and fodder
115 : Managed grassland
118 : Perennial crop
119 : Christmas trees
120 : Forest
130 : Extraction (undefined)
131 : Extraction (clay)
132 : Extraction (siliceous clay rock)
133: Extraction (siliceous rock)
134: Extraction (siliceous sand)
135: Extraction (carbonated siliceous)
136 : Extraction (carbonated rock)
140 : Aquaculture
200 : Undefined industry, services and/or commercial
210 : Light industry
230 : Heavy industry
310 : Commercial
320 : Public services
330 : Transport logistics and storage, including haven
340 : Sport and leasure
400 : Transport
410 : Waste management
500 : Residential
600 : Undetermined
700 : Natural (undetermined)
701: Natural (CSIS) cavity of biological interest

702: Natural (RF) forest reserve
703: Natural (RNA) Accredited natural reserve
704: Natural (RND) Domanial natural reserve
705: Natural (ZHIB) Humid zone of biological interest

999 : No data

6.5. Potential natural vegetation

The potential natural vegetations ([Bourdouxhe et al, 2023](#)) using open stages of vegetation successions allows to better consider the original ecological niche than biotopes in managed landscapes. 13 classes have been identified in Wallonia and are sorted according to soil moisture gradient. The majority PNV class is stored in **pnvMaj** field.

0: No data

1 : *Sphagnum Betula* woods

2 : *Alnus* swamp woods

3: *Quercus* and *Betula* forests with *Molinia spp.*

4: Riparian and gallery woodland

5: Neutrophilous *Quercus* and *Fraxinus* forests

6: Famennian *Quercus* and *Carpinus* forests

7: Acidic *Quercus* and *Fraxinus* forests

8 : Neutrophilous *Fagus* forests

9: Wet and shady ravine forests

10: Acidic *Fagus* forest

11 : Calcicolous *Fagus* and *Quercus pubescens* forests

12 : Thermophilous-acidophilous *Quercus* forests

13 : Xerophilous Famennian *Quercus* and *Carpinus* forests

pnvDv (Alias: potential natural vegetation diversity): Diversity index of the potential natural vegetation classes inside the ecotope.

6.6. Grassland age

grs_ageMJ (Alias grassland age majority): Age since the last land use change on grassland. This value is maximum 25 year (no information before)

grs_ageDv (Alias grassland age diversity): Diversity of grassland ages inside the polygon

7. Other variables

7.1. Height

Height classes are derived from different data filtered in the frame of Lifewatch-WB project. The height dataset is a combination of different sensors (LIDAR + photogrammetry) with post - processing, therefore the quality differs. The proportions of tree/shrub in each height class is computed and rescale between 0 and 1000.

WARNING: due to the lack of a complete height dataset each year, this information is not linked with a single year but covered by data from 2012 to 2018.

H_ground: less than one meter, but larger than the threshold of 25cm used to exclude sensor noise.

H_1To3m: 1 to 3m (shrubs)

H_3To7m: from 3 to 7 m (small trees)

H_7To15m: from 7 to 15 m (trees)

H_15m_plus: from 7 to 15 m (trees)

b_hgt : average height of the artificial buildings

vg_hgt : average height of the vegetation

7.2. Artificial light

NightLi: night light intensity measured by DMSP (Defense Meteorological Satellite Program) and interpolated at the location of the centroid

7.3. Distance

Distances are measured in meter from linear features. Unless otherwise noted, they were computed on the year 2015.

Dst_Road: weighted geometric mean of euclidian distance to roads, based on road categories (from Open street Map)

Dst_Rail: mean euclidian distance to rails (from Open street Map)

Dst_Forest_%year%: mean euclidian distance to forest blocks. Forest blocks are delineated using mathematical morphology by filling « small » gaps (< 100m) and opening with a radius of 50m to remove parts where edge effect would be too important. Distances inside forest blocks is negative. This variable is updated every year.

Dst_Stlmt: mean euclidian distance to settlement. Settlements are defined as patches grouping buildings at no less than 100 m from each others. This variable is updated every year.

Dst_Sea: mean Euclidian distance to the sea, in meters

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Annex. Confusion matrix for the land cover classification of the year 2022.

Ref CI	10	15	20	21	30	35	40	45	48	50	51	55	56	UA
10	12,9					1,5	1,5					1,5		73,9
15		1,7					0,5							79,3
20		1,5	59,9	0,2		6,6	1,1		1,9			5,7		77,8
21				26,2										100
30					248,5	2,0						1,5		98,6
35		1,5	0,2		7,3	252,9	3,2					2,4	1	94,1
40					0,5	0,7	8,8					1,7	0,2	74,5
45								1,7						100
48			1,1			3,3			30,9			1,1		85
50						1,1	1,7		2,1	161,4		8,5	0,2	92,2
51					0,2	2,1	0,5				4,8	3,8		42,4
55						1,1				5,3		294,1		97,9
56		1,7	0,7			1,7	0,5				3,8		10,2	55,1
PA	100	26,9	96,9	99,2	96,9	92,7	49,8	100	88,5	96,8	56,1	91,8	87,3	

With the support of the Fédération Wallonie-Bruxelles