

Lifewatch-WB geodatabase (v2.9): attribute description.

Julien Radoux, Thomas Coppée, Axel Bourdouxhe, Marc Dufrêne and Pierre Defourny

1 Climatic variables

1.1 Variables extracted from the Worldclim dataset

Bioclimatic variables were extracted from Worldclim (<http://www.worldclim.org/methods>), a regular grid at 30 arc-seconds (~1km) resolution, based on meteorological observations between ~1950 and 2000.

Due to the scale difference between the ecotopes and Worldclim, values are extracted from the centroid of each ecotope using a bilinear interpolation. Temperature values (*_T) are recorded in tenths of degrees and rainfall (*_P) is measured in mm.

AnM_T comes from BIO1, mean annual temperature

MDRg_T comes from BIO2, mean diurnal difference (mean difference between diurnal minimum and maximum temperature each month)

Isotherm_T comes from BIO3, isothermality, the ratio between mean diurnal difference (BIO02) and annual temperature difference (BIO07) multiplied by 100.

STD_T comes from BIO4, temperature seasonality, the standard deviation of temperature multiplied by 100.

MaxWarmM_T comes from BIO5, maximum temperature of the warmest month

MinColdM_T comes from BIO6, minimum temperature of the coldest month

BIO7, annual temperature difference, is not stored because it can easily be derived (BIO5-BIO6)

MWetQ_T comes from BIO8, mean temperature of the wettest quarter

MDryQ_T comes from BIO9, mean temperature of the driest quarter

MWarmQ_T comes from BIO10, mean temperature of the warmest quarter

MColdQ_T comes from BIO11, mean temperature of the coldest quarter

AnTot_P comes from BIO12, sum of annual rainfall

WetM_P comes from BIO13, rainfall of the wettest month

DryM_P comes from BIO14, rainfall of the driest month

CV_P comes from BIO15, rainfall seasonality (Coefficient of Variation of monthly rainfall)

WetQ_P comes from BIO16, total rainfall of the wettest quarter

DryQ_P comes from BIO17, total rainfall of the driest quarter

WarmQ_P comes from BIO18, total rainfall of the warmest quarter

ColdQ_P comes from BIO19, total rainfall of the coldest quarter

1.2 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 since 2000. Those variable are good proxies of the other climatic variables from Worldclim 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)

SnowStart is the earliest date of snow with more than 50 % probabilities (in weeks since the European least snow cover week, i.e. week #32). The probabilities are estimated based on filtered snow cover frequencies between 2000 and 2012. A value of 999 is assigned if the probability never exceeds 0.5.

SnowEnd is the latest date of snow without more than 50 % probabilities (in weeks since the European least snow cover week, i.e. week # 32). The probabilities are estimated based on filtered snow cover frequencies between 2000 and 2012. A value of -1 is assigned if the probability never exceeds 0.5.

SnowLength is the average snow duration, in weeks.

2 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 at 10 m resolution.

SlopeDeg is the slope, in degree, measure at the centroid of the ecotope.

Elev is the elevation, in m, measured at the centroid of the ecotope.

Azimuth is the orientation of the normal of the slope measure in the centroid of the polygon. The values is measure clockwise in centiDegrees, with 0 at the cartographic North.

SunSpring potential incident light energy in W/m² 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. Slop is measured in the center of 4 pixels. Topographic shadows are taken into account.

Roughness mean roughness of the ecotope. Difference between the min and max slope inside o 3*3 moving window on a 10 m resolution DEM.

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

Position is the mean relative position of the ecotope in a 200 m radius. This value ranges from 0 (lowest elevation of the neighbourhood) to 100 (highest elevation of the neighbourhood).

3 Land cover

3.1 Proportions inside ecotopes

The ecotopes are automatically delineated based on the orthophotos and the LIDAR. More info on the method is available in Delngre et al (2017). Ten land cover classes are used to characterise the ecotopes, out of which 9 are present in Wallonia. The proportion of each class is computed based on a 2m resolution layer from the Lifewatch-WB project based on the analysis of ortho-images, LIDAR data and Sentinel-2 time series. The two-meter layer has been validated by photointerpretation consolidated on the field when necessary. 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 (hedges, orchards...)

NeedLV (Alias needleleaved trees) : Coniferous trees (gymnosperms) located in forests or other land use (hedges, gardens...).

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 lignous vegetation. This class covers a large number of potential biodiversity hotspots such as wetlands and peatlands.

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

Ice (Alias permanent snow and ice) : permanent snow and ice (absent in Wallonia)

Artif (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.

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.

3.2 Contextual land cover proportions

Contextual information is based on the 2-m land cover information resampled at 10-m with a majority rule. Two circular neighborhoods are used : the first has a radius of 25 pixels and the second has a radius of 50 pixels. The size of the radius, in meter, is mentioned in the field name. The average of the proportion of each land cover is computed for each ecotope and rescale between 0 and 100%.

Warning : currently, land cover information is only available inside the boundaries of Wallonia. Pixels outside of this boundary are therefore ignored by the neighbourhood, which means that polygon along the boundaries are not characterized identically to the boundary polygons. A quality flag allows you to know how much data is missing. The proportions are stored in “per thousand”, ranging from 0 to 1000.

Q_boundary : proportion of valid pixels used to compute the neighbourhood. This index can be used to discard polygon along the boundaries of the Walloon region, where contextual information is incomplete. The values range in 0 (worse) to 100 (all valid).

BroadLV250 or 500 : broadleaved trees (angiosperms),

NeedlLV250 or 500 : coniferous (gymnosperms)

Plowed250 ou 500 : land being ploughed during the year

MGramin250 or 500 : permanent monospecific herbaceous cover

NOpen250 or 500 : permanent mix of herbaceous cover and other non lignous vegetation or small shrub

WOpen250 or 500 : permanent inundated mixture of herbaceous cover and other non lignous vegetation or small shrub

COPen250 or 500 :

Water250 or 500 : open water bodies

Bare250 or 500 : permanent bare soil

Artif250 or 500 : built up and impervious surfaces

3.3 Quality

Quality : A percentage of the consistent pixels inside the ecotopes. Pixels are considered consistent if the classification of ortho-photos, Sentinel-2 images match together, as well as the ancillary datas (when available).

3.4 Land cover categories

For the sake of representation, LCCS categories based on the ESA land cover CCI legend are available in field « LCCS ». The grassland class from the LCCS was split into two classes : monospecific and diversified grasslands. Furthermore, one additionnal 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
70	Needleleaved sempervirens forest
80	Needleleaved deciduous forest
130	Permanent monospecific productive grassland
135	Diversified grassland and shrubland (see annex)
180	Shrub and herbaceous flooded
190	Densely artificialized (>50% artificial surface)
195	Sparsely artificialized (>25% artificial surface)
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 cleared areas with forest regrowth, also includes forest gaps and Christmas trees
30	Mixed crop cover (with majority of crops)
40	Mixed crop cover (with minority of crops)

4 Soil attributes

Soil attributes are derived from the digital soil map of Wallonia (Source : Copyright – SPW-licence n° 160114-0837 – Legrain et Briec, 2012). Proportions are integer values between 0 and 1000. Data is not complete : values are missing in and around urban and military areas.

4.1 Marginal soils

Type	Texture	Definition
Organic	V-E	Peat and clay
	V	Peatland
	W	Inactive peatland
	(v)	Organic soil (more than 40 cm)
	(v3)	Organic soil (between 20 and 40 cm)
	(v4)	Organic soil (less than 20 cm)
Sandy	Z	Sandy soil
	S-Z	Sand and silty sand complex
	S	Silty sand
	E-Z	Light clay and sand complex
	G-Z	Silt, pebble and sand complex
	S-G	Silty-sand and silty-pebble complex
	A-S	Silt and silty-sand complex
	A-S-U	Silt, silty-sand and clay complex
	S-U	Silty-sand and clay complex
	E-L-S	Clay, silty-sand and asndy-silt complex
	U-L-S	Clay, silty-sand and asndy-silt complex
P	Silty-sand complex	
Type	Charge	Definition
Calcareous	n	Chalk
	nx	Chalk and silex
	N	Chalky complex
	k	Calcareous
	K	Clay-calcareous complex
	Km	Macigno-calcareous
	j	Calcareous sandstone
	J	Dicontinuous calcareous sandstone
	kf	Schisto-calcareous
	kr	Sell/sandstone/calcareous
	Kf	Sell/clay/calcareous
Type	Symbol	Definition
Source	B, B(1) ; B/o	Sources
AlluPebble	R ; R(1)*	Pebble alluvial soil
AlluSilt	S ; S(1)*	Silty alluvial soil
Alluvial	Soil profile p and drainage efg	Undefined soil profile with low drainage
	Soil profile p and drainage hi	Undefined soil profile with low drainage

4.2 Soil depth

Proportion of the soil depth classes inside each ecotope.

Dpt_Zero : no soil (flushing rock).

Dpt_Superf : superficial soil, less than 30 cm. Also includes the « no soil » class.

Dpt_Mid : depth between 30 and 80 cm

Dpt_Deep : deep soils, more than 80 cm

4.3 Drainage

Proportion of the soil drainage classes inside each ecotope.

Classe	drainage	Definition
Dr_Dry	a ; A (a+b+c+d) & texture=Sandy ; b & texture=Sandy	Very dry « sandy » (cfr 4.1) soils.
Dr_Mid	b & texture≠Sandy ; B & texture≠Sandy ; A & texture≠Sandy ; c	Favourable (clay or silt) or moderate drainage
Dr_Humid	F (e+f); h ; f ; e ; l(h+i) ; D(c+d) ; d	Imperfect or poor drainage
Dr_VeryHu	g ; G (e+f+g) ; texture=1/2	Very humid soil (or peatland soil)

5 Other variables

5.1 Height

Height classes are derived from LIDAR data filtered in the frame of Lifewatch-WB project. Those height include both vegetation and built up areaq. Wallonia was covered in **2013-2014** with different sensors, therefore the quality differs.

H_L1m : Less than one meter, but larger than the threshold of 25cm used to exclude sensor noise.

H_1To4m : 1 to 4m (shrubs)

H_4To7m : de 4 à 7 m (small trees)

H_7To50m : de 7 à 50 m (trees)

5.2 Artificial light

Light is the night light intensity measured by DMSP (Defense Meteorological Satellite Program) and interpolated at the location of the centroid.

5.3 Distance

Distances are measured in meter from linear features

Dst_Road : Mean euclidian distance to roads (from Open street Map)

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

Dst_River : Mean euclidian distance to rivers (from integrated river database of the Walloon region). Water bodies are not taken into account for this metric

Dst_Forest : Mean euclidian distance to forest blocks. Forest blocks are delineated using by filling « small » gaps (< 100m) and with an area of at least 10 ha. Distances inside forest blocks is negative.

5.4 Land cover features

L_trees length per hectare of tree alignment.

L_hedges length per hectare of hedges.

I_trees number of isolated trees per hectares.

Bibliography

Hijmans, R.J., S.E. Cameron, J.L. Parra, P.G. Jones and A. Jarvis, 2005. Very high resolution interpolated climate surfaces for global land areas. *International Journal of Climatology* 25: 1965-1978.

Radoux, J. & Bogaert, P., 2017, Good Practices for Object-Based Accuracy Assessment, *Remote Sens.* 2017, 9(7), 646; doi:10.3390/rs9070646

Delangre, J., Radoux, J. & Dufrêne, M. 2017 Landscape delineation strategy and size of mapping units impact the performance of habitat suitability models, *Ecological informatics*, in press

Legrain X. & Briec M., 2012. Révision de la Carte Numérique des Sols de Wallonie – Campagne 2011-2012. Rapport final d'activités. Convention financée par le Service Public de Wallonie (DGO3, DDR), sous la direction de Bock L & Colinet G. Gembloux, Belgique : Unité de Science du Sol, Gembloux Agro-Bio Tech (Ulg).

With the support of the Fédération Wallonie-Bruxelles