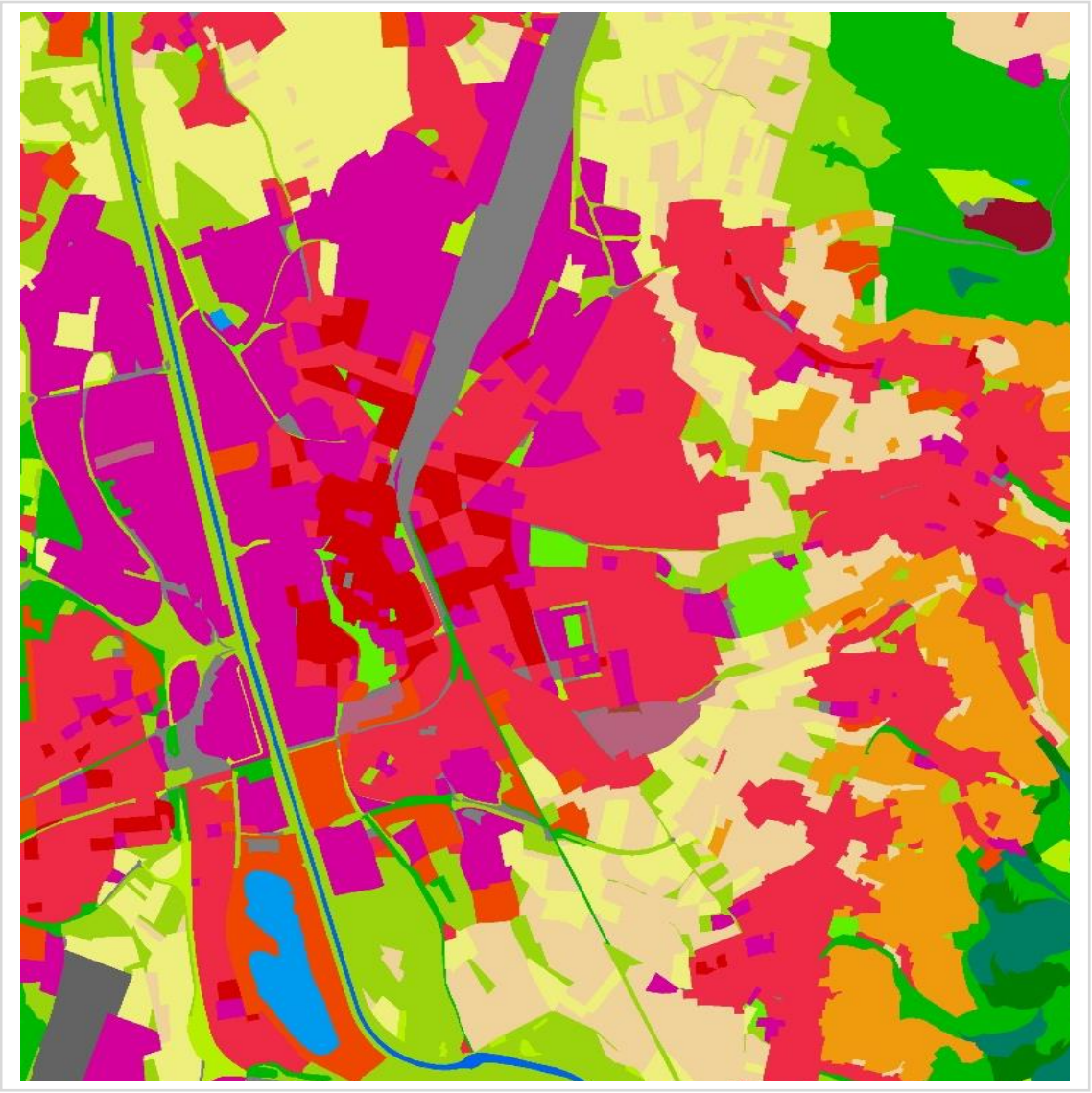
Documentation

Digital land cover model for Germany

LBM-DE2015



Product as of 2021

Content

1 Overview of the dataset

Product:	Land cover model for Germany, Status 2021 (LBM-DE2015)
Content:	Description of land cover and land use in shape of geometrical objects (vector data)
Area:	Federal Republic of Germany
Spatial structure:	• Bundesland (Land/state of the Federal Republic of Germany) • any possible spatial formation of extract is possible
Spatial reference:	• UTM projection in zone 32 or zone 33, ETRS89, ellipsoid GRS80 (EPSG:25832 oder 25833) • Gauß-Krüger-projection in 2nd, 3rd, 4th or 5th meridian stripe, Bessel Ellipsoid, DHDN (EPSG: 31466, 31467, 31468 or 31469) • Further upon request
Accuracy:	Minimum mapping unit = 1 ha, minimum mapping width = 15 m
Up-to-dateness:	Reference year 2015
Data formats:	Shapefile
Provision*:	• Online service via WMS • Record via download or data carrier
Historical Data:	LBM-DE 2009, 2012 available as individual product
Data volume:	Appr. 5 GB
Source:	• polygon features of ATKIS Basic-DLM, • LBM-DE2012, LBM-DE2015, LBM-DE2018 • Satellite imagery of sensors RapidEye and DMC • IMAGE2015 • digital orthophotos (DOPs)

* Please note that not all forms of delivery can be provided with all georeferencing and data formats. If you have any questions, feel free to contact the service center

2 Description of dataset and online services

2.1 Fundamentals

The digital German Land cover model (LBM-DE2015) describes the topographic objects of the landscape in a vector format under the aspects of land cover (LB) and land use (LN). The purpose of the LBM-DE is to record the state of the environment of a specific time

The LBM-DE data is updated periodically (in 3-year intervals) with complete spatial coverage and with respect to a specific reference year. A comparison to previous versions of LBM-DE allows to observe landscape changes in the short and in the long term as well as to evaluate the data and analyse historical changes from different aspects

The LBM-DE data is found in a flat, topologically sound data structure without overlaps or gaps.

The main goal of LBM-DE is the derivation of the CORINE Land Cover (CLC) dataset for the area of the federal republic of Germany. BKG provides herewith – subcontracted by the German Environment Agency (UBA) - the national contribution for the pan-European CLC in the context of the European Copernicus land monitoring service. The delivery of CLC to UBA takes place every 6 years since the year 2000 – last 2018. Furthermore, the BKG has been offering a CLC dataset with a minimum mapping unit of 5 hectares as open data corresponding to the respective LBM-DE versions since 2012.

The derivation of CLC-codes based on the LBM-DE-dataset is conducted via cross-table (see Appendix 3) by combining land cover and land use with respect to the degree of vegetation and the degree of sealing.

2.2 Data sources

For the completion of LBM-DE the original land cover and land use information available from ATKIS Basic-DLM was transferred for the reference year 2012 into a new class system where land cover and land use are modelled separately. This dataset was first updated to LBM-DE2012 by checking the vector dataset against satellite imagery from the reference year 2012 and re-updated in the next cycle for the reference year 2015.

For the LBM-DE2015 Land cover (LB) and land use (LN) were updated and in addition to that the degree of sealing and the degree of vegetation was determined for each object. By means of these attributes the unambiguous derivation of CLC-codes for the pan-European dataset CORINE Land Cover is possible. See Appendix 1for a description of the single land cover (LB) classes and the land use (LN) classes and Appendix 2for a list of CLC-classes with a coloured legend.

2.2.1 ATKIS Basic-DLM vector data

To update LBM-DE2015 selected object types of the ATKIS Basic-DLM were used (in particular from the topics settlement and transport) which are relevant to model information of land cover and land use. In some cases individual attributes of these object types were included to allow further differentiation. To guarantee a consistent data source the data that was available at BKG at the second quarter of 2015 was used and prepared for updates, so a unified data source could be created.

2.2.2 Imagery

To update the LBM-DE2015 a multi-temporal basic was chosen, in which the material of satellite images for the whole of Germany were recorded during the vegetation period of 2015. In addition,

image data from the systems RapidEye and DMC (Disaster Monitoring Constellation) were used. Table 1 shows the details of the ground pixel resolution and the spectral bands of the sensors.

For the update to the LBM-DE2015, additional digital orthophotos of the national survey were used.

Sensor Name	*Ground sampling distance in m*	*Spectral bands*	*wavelengths in nm*
RapidEye	5	1 visible blue	440-510
		2 visible green	520-590
		3 visible red	630-690
		4 red edge	690-730
		5 near infrared	760-880
DMC	22	1 near infrared	770-990
		2 visible red	630-690
		3 visible green	520-600

Table 1: List of used satellite imagery 2015

2.2.3 Time series data LBM-DE2012 and LBM-DE2018

In the course of updating the LBM-DE2018, a synopsis of the time series of the LBM-DE since 2012 was carried out. Based on the latest version of 2018, a back calculation was made for the years 2012 and 2015. The comparability of the data sets is increased as adjustments made in the class definitions over time are compensated. This can also increase the informative value of change analyses.

As part of the joint consideration of the LBM-DE-datasets 2012, 2015 and 2018, notes were created for interactive review based on the change in land cover. These were partly reviewed interactively and partly used for an automatic adjustment of the LBM-DE2015.

First, the dataset was interactively checked and revised to these notes. The 2015 automatic adjustment was performed for the remaining objects that were not interactively edited. Objects that met the conditions defined in

Table 2 for the period 2012 – 2018 did not change in reality and were therefore adjusted to LBM-DE2018. The conditions were defined based on derived CLC-codes. Subsequently, a corresponding adjustment of LB-/LN_AKT was made and updated CLC-codes for 2015 were calculated on it.

Condition					Adjustment	
LBM-DE2012: CLC12		**LBM-DE2015: CLC15**		**LBM-DE2018: CLC18**		**LBM-DE2015: LB_AKT**
xxx		311,312,313		311,312,313		B311,B312,B313
141,32x		32x		32x		B32x
33x		33x		33x		B33x
211	**&**	231	**&**	211	**=**	B211
231		211		231		B231
311		324		311		B311
312		324		312		B312
313		324		313		B313

Table 2: Automatic adjustment of attributes in LBM-DE2015

2.2.4 Auxiliary data

In addition to the satellite imagery as the main source of information, other data sources such as building polygons or digital orthophotos were included in the production process.

2.3 Content

The dataset contains only polygons that abut without gaps and overlaps. Their attributes are described in Table 3.

The minimum mapping unit (MMU) of the dataset is 1 hectare. This MMU does not depend upon the geometry of the input used for the updates. Already existing objects that originally come from the ATKIS Basic-DLM and for which there is no need to be updated are not affected by the MMU.

Any resulting areas (through cutting) that are smaller than 1 hectare (but greater than 0.2 hectares) are valid. The remaining area has to be greater than 0.2 hectares, otherwise the whole area would be evaluated according to the majority principle. Every affected object is assigned its applicable land cover code with the <LB_AKT> attribute.

To avoid the inclusion of insignificant narrow objects the minimum mapping width is 15 meters.

Attribute	Information
OBJECTID	Unique ID of the entry
Shape	Geometry type → always “polygon”
Shape_Length	Circumference of the polygon
Shape_Area	Area of the polygon
LAND	State (=Laender) ID
METHOD_AKT	Update methodology (see Table 4)
LB_AKT	Land cover code (defined by image interpretation)
LN_AKT	Land use code (only updated, if explicitly possible by image interpretation)
ZUS_AKT	Updated additional function F=cemetery, M=military, S=solar, O=location (automatic assignment via the feature type “AX_Ortslage” from the ATKIS Basic-DLM), K=artificially created area, of which the LB suggests a natural formation: e.g. B330, B321, …)
SIE_AKT	Updated degree of sealing based on satellite image classification
VEG_AKT	Updated degree of vegetation based on satellite image classification
LBMDE_ID	unique ID XX**1**xxxxxxxxxxxx
CLC18	CLC-Code (derived from LB_AKT/ LN_AKT/ SIE_AKT/ VEG_AKT partly taking into account ZUS_AKT)

Table 3: Attributes of LBM-DE2015 and their meaning

The attribute METHOD_AKT contains information about the update-process based on the previous LBM-DE2015.

A comparison between imagery and vector data was performed and all detected changes regarding land cover larger than 1 ha were mapped. For all those objects where an updated of land cover was necessary, an update/confirmation of land use and – in case of solar parks – the attribute ZUS_AKT “solar” was carried out. The type of update is recorded in the column METHOD_AKT (see Table 4). For all objects the amount of vegetation and sealing was determined by image classification and assigned to the attributes VEG_ATK and SIE_AKT.

The adjustment for the LBM-DE2015 was done either interactively (METHOD_AKT = 34) or automatically (METHOD_AKT = 35).

Attribute value	meaning
2	All objects that are not to be checked. This includes objects that are members of an area group that is smaller than 1 ha. The area groups are created by means of a dissolve operation via the attribute field “LB_BKG“.
11	All objects that have been checked or edited using interactive (manual) update.
12	All objects that have been checked or edited using automatic update.
9	Updating based on image material subsequently as part of quality control by the BKG.
34	Interactive update based on imagery (Sentinel-2, RapidEye, DOP)
35	Automatic adjustment based on the evaluation of time series (Table 2)

Table 4: Values and meaning of attribute METHOD_AKT in LBM-DE2015

2.4 Evolution of LBM-DE

The time series of the LBM-DE extends from the first acquisition of the data set DLM-DE2009 to the current data set LBM-DE2018. The first version of the DLM-DE2009 was based on the nomenclature of CORINE Land Cover (CLC). With the continuation of LBM-DE in 2012, a separation between land cover (LB) and land use (LN) was introduced. Subsequently, a transformation into classes according the CLC nomenclature happened by means of a cross table.

With the development of the dataset LBM-DE2015, the attributes VEG (degree of vegetation), SIE (degree of sealing) and ZUS (additional information) were introduced.

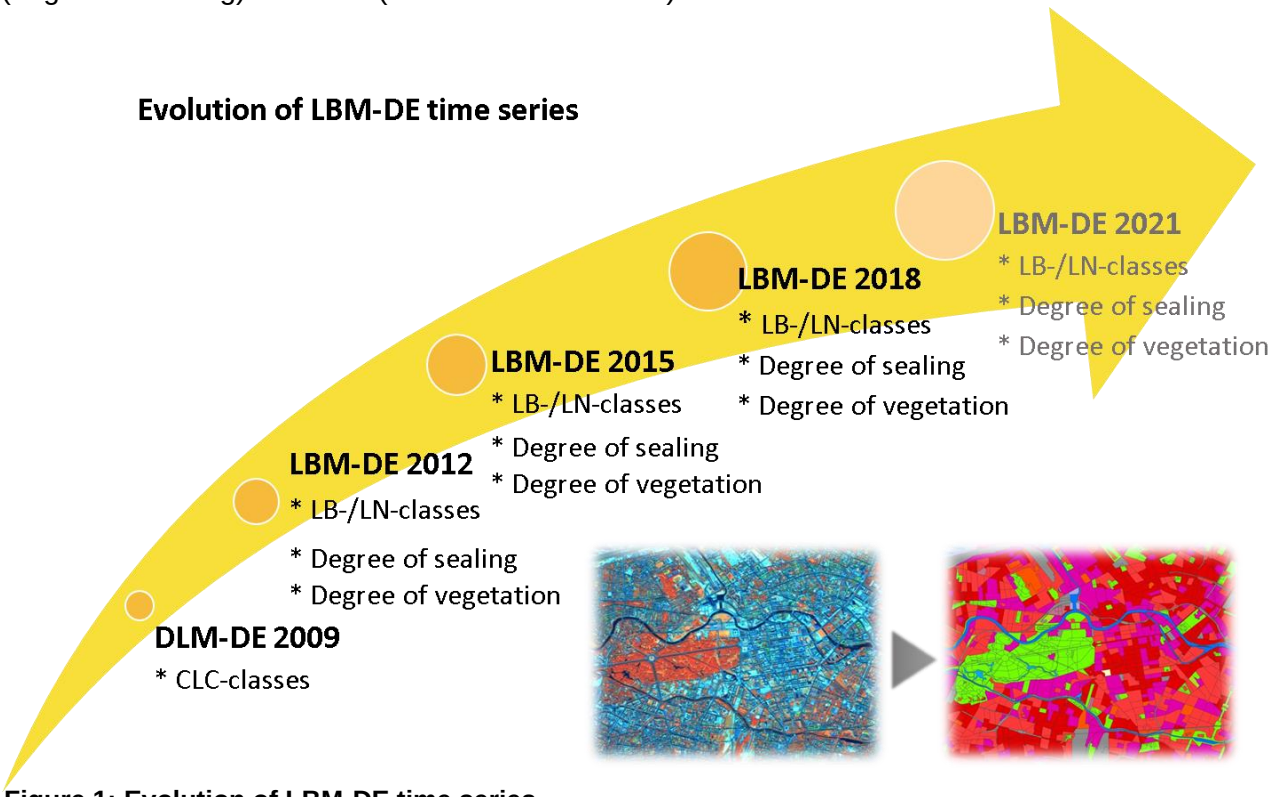


Figure 1: Evolution of LBM-DE time series

Each LBM-DE update also means fundamental improvements to the dataset. Additional data sources (further satellite images and digital orthophotos) can be used to make more precise interpretations or to correct potential errors.

When monitoring and analysing changes using the LBM-DE time series, it must always be kept in mind that they may not be real changes, but may just be the correction of an error from an earlier dataset. Particularly since 2015, since the introduction of sealing and vegetation degree, a land cover analysis must necessarily take into account the respective land use, because only in this way meaningful results can be achieved (see Appendix). For simple analysis, it is therefore recommended to look at CLC codes.

If, for an object, the coding has changed over time within the same thematic complex according to the following table (Table 5), it can be assumed that it is a change due to definition adaptation or re-interpretation with better image data.

Thematic complex	**LB/LN-Code**
Mining and landfill areas	N131, N132, N121
Shrubs, heathland and natural areas	B321, B324, B322, B231
Green and recreational areas	N141, N142
Holiday resort, sparse housing	N112, N142
Airport, port, parking place, recreational areas	N124, N123, N122, N142
Forest	B311, B312, B313
Settlement	N112, N121, N122

Green urban areas	N141, B31x, B231

Table 5: List with themes that have to be treated carefully when doing change analyses

The adjustment of LBM-DE2015 described in chapter Fehler! Verweisquelle konnte nicht gefunden werden. **(also applies analogously to LBM-DE2012) in the context of the time series analysis 2012-2018 greatly reduced these effects. This significantly increased the informative value of change analyses over time.**

In addition, during the LBM-DE2015 update the land use N141 (green urban areas) and N122 (roadside green) was reduced.

Furthermore, a basic update of the classes B423 and B523 was made based on LBM-DE2018.

The content of the attribute ZUS_AKT was automatically extended by the value “O” for location on the basis of the ATKIS Basic-DLM for LBM-DE2018 and thus also retroactive for LBM-DE2015. All LBM-DE objects, which are located to at least 80 % within a location, get this indicator. This allows a better derivation of CLC-class 112 for objects with a very low degree of sealing (< 15) (see 2nd table in Appendix 3).

2.5 Hints on data provision

2.5.1 Data delivery

The dataset is provided only as shape-file. The delivery is carried out via data carrier, usually DVD.

The data to be delivered will be tailored to the area specified by the user. For a nationwide extent, a subdivision is made to federal states.

For data sets that only cover smaller, spatially limited areas, it is alternatively possible to make the data available for download.

2.5.2 Online service

The service centre is providing a standardised OGC (Open Geospatial Consortiums) conform Web Map Service *wms_lbm_<year>* for each release of LBM-DE.

3 Data acquisition

3.1 Test data

Test data can be downloaded from our website under the heading „Test data“. In terms of content and structure, they correspond to the data supplied later and can therefore be used for very concrete application testing purposes.

3.2 Test services

If you are interested, we can set up a two-month access to a test service for you. Please contact the Service Center for further information.

3.3 Ordering of data and services

Orders can be placed via the online ordering system on our website www.bkg.bund.de under the heading “Products & Services”.

Alternatively, you can send your order to the Service Center (DLZ).

4 Terms of Use and references

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5 Contact

Federal Agency for Cartography and Geodesy
Section GDL2 | Service centre (DLZ) | Central Office for Geotopography (ZSGT)
Karl-Rothe-Straße 10-14

D-04105 Leipzig

Phone.: +49(0)341 5634-333
Fax: +49(0)341 5634-415
Email: dlz@bkg.bund.de

Further information and services can be found on our homepage www.bkg.bund.de under the heading „Products & Services“.

Appendix 1 Overview of the LB and LN classes

Land cover

In nearly every case the decision to which class an object should be assigned to is made according to the majority principle: If an object cannot be split because of the minimum mapping unit, the majority of the included LBs determines the object's classification.

By contrast, mixed areas (B110, B121, B233, B242, B313, B413 and B414) are classified according to their structure and the regular distribution of the individual components. If any individual components that are greater than 1 hectare are found in a potential mixed area, they will still have to be assigned to their own class.

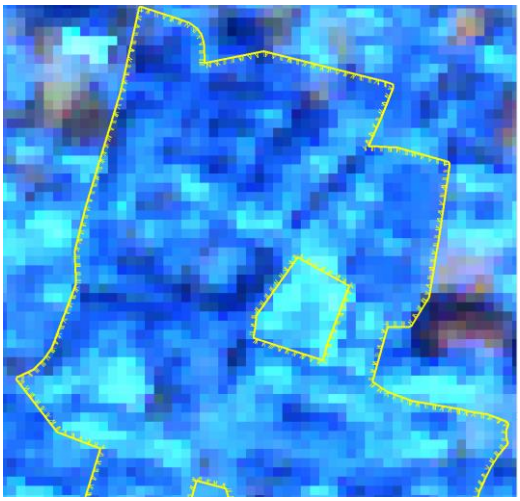
A	Houses	**B110**
	Facilities	**B121**
	Sealed areas without buildings	**B122**
	Mixed areas (regular structure)	**B242**
B	Arable land	**B211**
	Winegrowing	**B221**
	Orchards and soft fruit	**B222**
	Hops	**B224**
C	Homogeneous grassland	**B231**
	Inhomogeneous grassland	**B321**
	Grassland with trees (< 50%)	**B233**
D	Dwarf shrubs (heath)	**B322**
	Bushes, shrubs	**B324**
	Reafforestation, young trees	**B310**
	Deciduous trees	**B311**
	Coniferous trees	**B312**
	Deciduous and coniferous trees	**B313**
E	Sand, stones, soil	**B330**
	Rock	**B332**
	Burnt areas	**B334**
	Snow (permanent) and ice	**B335**
F	Swamp	**B411**
	Bog	**B412**
	Swamp with bushes/trees < 50%	**B413**
	Bog with bushes/trees < 50%	**B414**
G	Mud flat	**B423**
	Watercourses	**B511**
	Waterbodies	**B512**
	Lagoon	**B521**
	Estuary	**B522**
	Open sea	**B523**

The images and descriptions of the land cover classes presented on the following pages are valid entries for assignment to the <LB_AKT> attribute. The table shows the most common combinations between the specific LB class and the LN codes. The combination that appears most often is marked in **bold letters**. Also appropriate borderline values for the degree of sealing and vegetation are shown.

B110: Houses

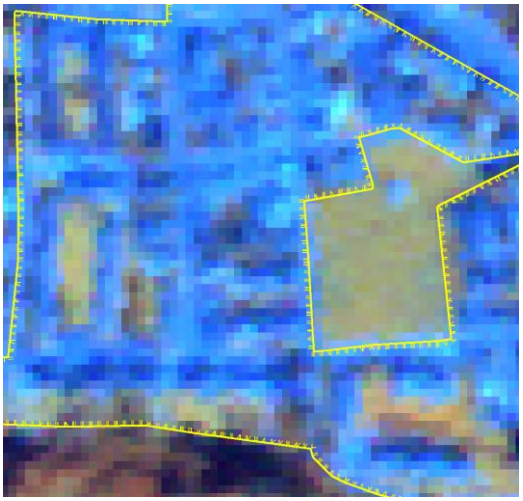
A	Houses	B110
Areas with building structures and a road or traffic network.		

DOP 29.07.2009 + B110



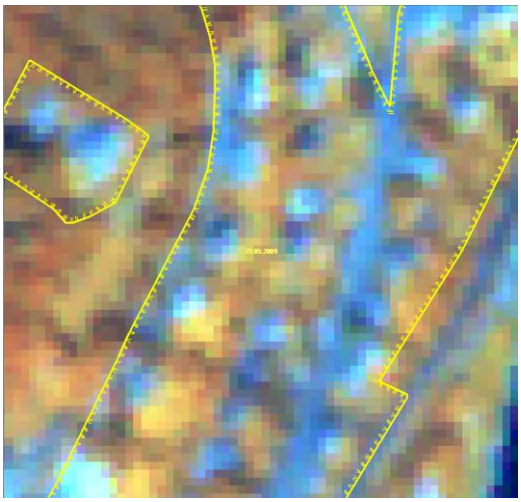
RapidEye 29.07.2009 + B110

DOP 29.07.2009 + B110



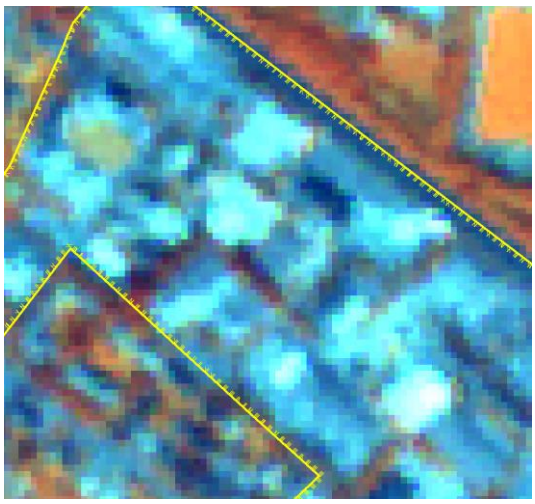
RapidEye 29.07.2009 + B110

DOP 23.05.2009 + B110



RapidEye 27.07.2009 + B110

DOP 23.05.2009 + B110



RapidEye 27.07.2009 + B110

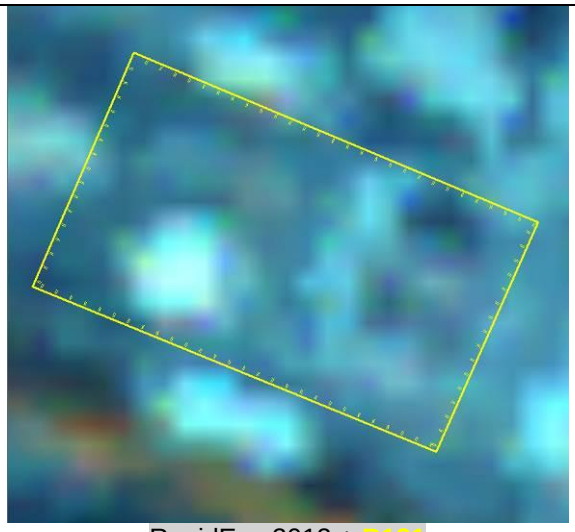
LB	LN	Comment
B110	**N112**	**Residential housing, churches**
	N120	**Industrial and production premises with buildings and/or halls**
	N121	**Museums, administrative and public buildings, commercial businesses, universities, hospitals, …**
	N123	Buildings and/or halls that belong to a port
	N131	Buildings and/or halls that belong to a mineral extraction site
	N132	Buildings and/or halls that belong to a dumpsite or landfill area
	N122	Service stations, train stations
	N124	Airport buildings and/or halls
	N142	Monasteries, gyms, indoor baths

B121: Facilities

A	Facilities	B121

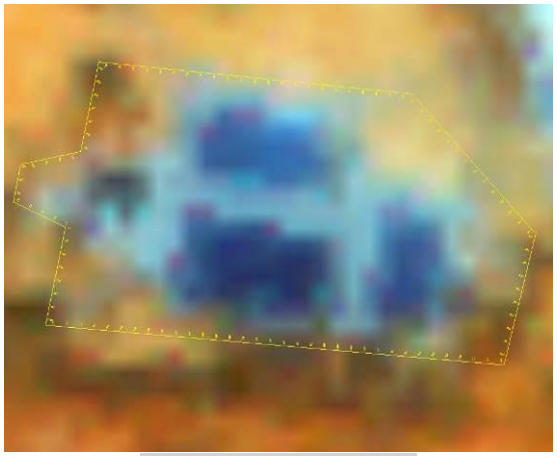
Areas with utilities or special constructions that are used to produce or distribute electricity, heat or water (including sewage works).

DOP 19.08.2012 + B121



RapidEye 2012 + B121

DOP 26.05.2012 + B121



RapidEye 2012 + B121

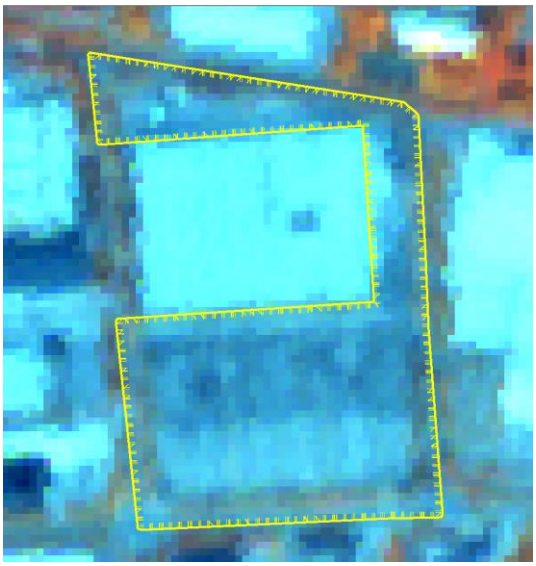
LB	LN	Comment
B121	N120	Power stations, sewage works, refineries, solar parks
	N131	Facilities of mining areas
	N142	Theme parks, leisure pools
	N211	Greenhouses

B122: Sealed areas without buildings

A	Sealed areas without buildings	B122

Areas that have a sealed surface with asphalt, concrete, cobblestones or similar.

DOP 23.05.2009 + B122



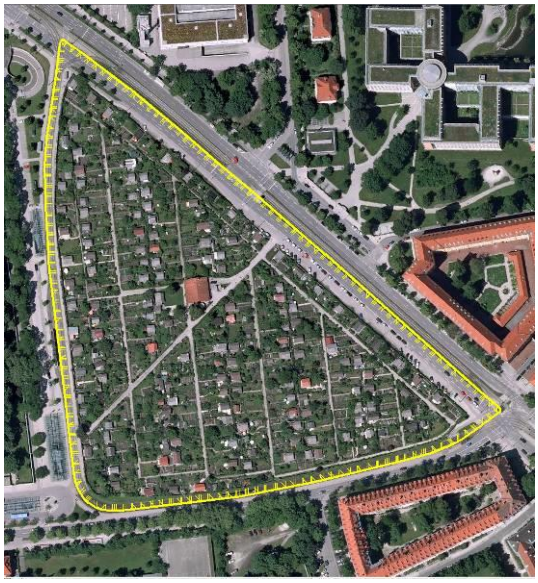
RapidEye 27.07.2009 + B122

LB	LN	Comment
B122	N112	Pedestrian zones
	N120	Sealed areas belonging to productive areas
	N121	Sealed areas belonging to industrial or administrative objects
	N123	Sealed areas belonging to ports
	N131	Sealed areas belonging to mineral extraction sites
	N132	Sealed areas belonging to dumpsites or landfill sites
	N122	**Car and lorry parks, motorways**
	N124	Runways, ramps
	N142	Racing courses, drive-in cinemas

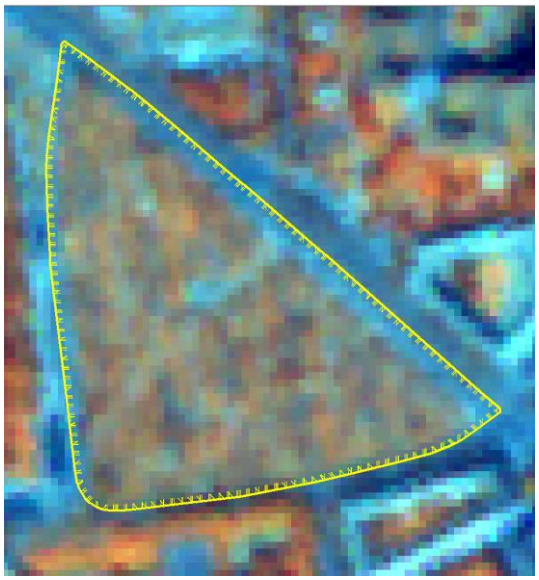
B242: Mixed areas (regular structure)

A	Mixed areas (regular structure)	B242

Mixed areas with anthropogenic characteristics that have a regular structure. There has to be a variation of at least three different land cover classes, of which one has to be sealed.
Allotment gardens, (parks, theme parks, zoos – as long as they meet the description), camping sites and cemeteries



OP 23.05.2009 + B242



RapidEye 27.07.2009 + B242

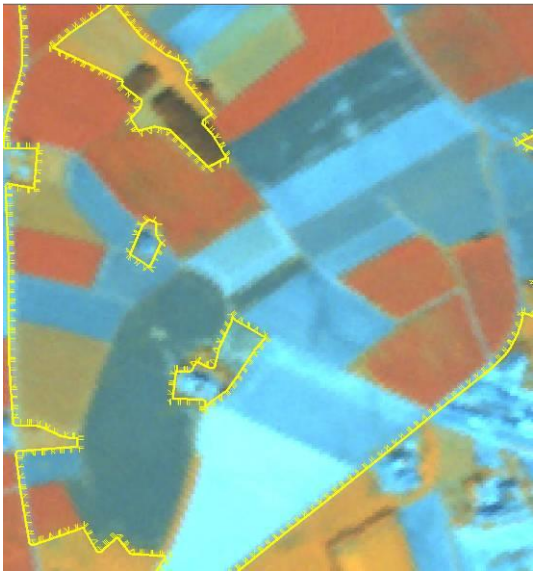
LB	LN	Comment
B242	N112	Housing development
	N142	**Allotment gardens, non-urban cemeteries, camping sites**
	N141	**Urban cemeteries, zoos**

B211: Arable land

B	Arable land	B211

Areas that are ploughed regularly (at least once a year), mostly farmed using crop rotation. Areas that are used to grow grain, vegetables, fodder crops, industrial crops, and root crops.

DOP 23.07.2009 + B211



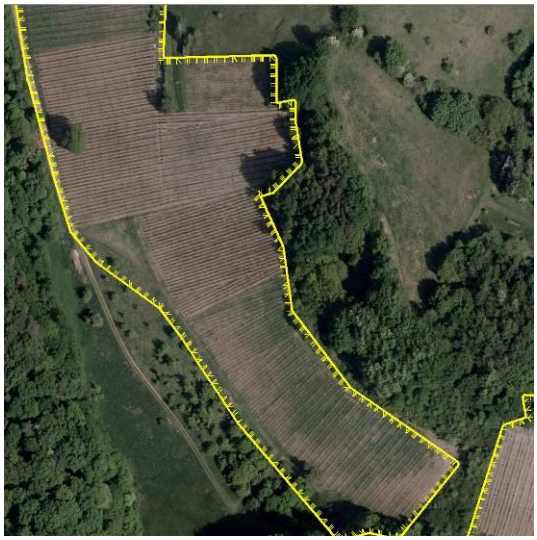
RapidEye 29.07.2009 + B211

LB	LN	Comment
B211	N211	Arable land

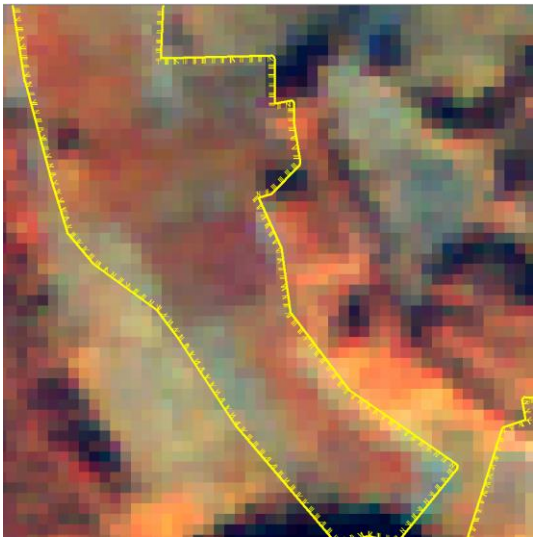
B221: Winegrowing

B	Winegrowing	B221

Areas with grapevines.



DOP 07.05.2011 + B221



RapidEye 27.09.2009 + B221

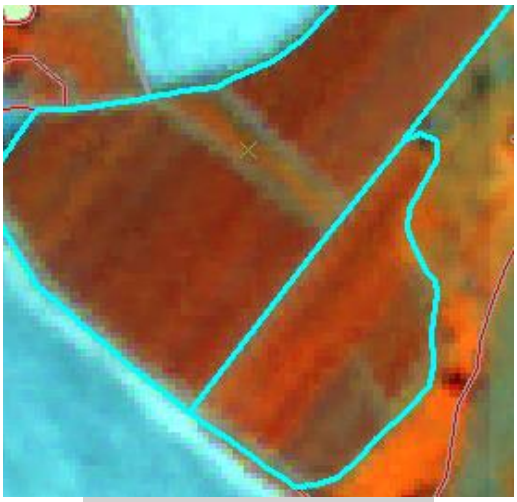
LB	LN	Comment
B221	**N211**	**Vineyard**
	N214	Abandoned vineyard

B222: Orchards and soft fruit populations

B	Orchards and soft fruit populations	B222

Parcels with fruit trees and fruit bushes, where one or more different types of fruit are grown.
They have a plantation structure.

DOP 29.03.2011 + B222



RapidEye 18.08.2012 + B222

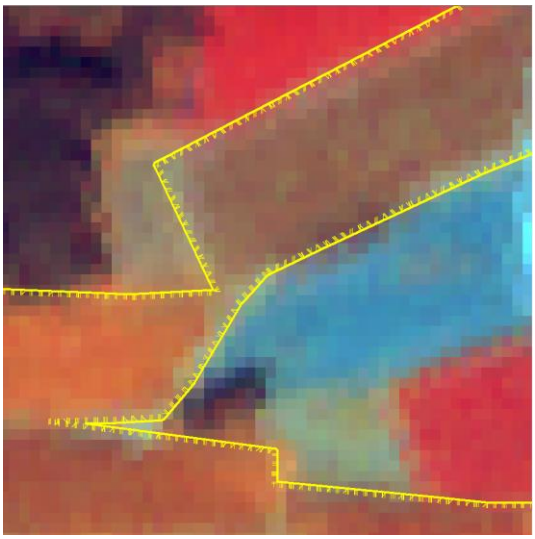
LB	LN	Comment
B222	N211	Fruit plantations

B224: Hops

B	Hops	B224

Fields with frameworks for growing hops.

DOP 10.07.2009 + B224



RapidEye 27.07.2009 + B224

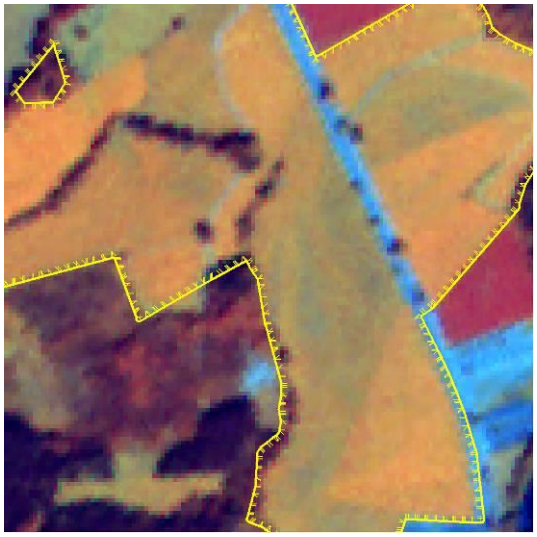
LB	LN	Comment
B224	N211	Hop fields

B231: Homogeneous grassland

C	Homogeneous grassland	B231

Greenfield sites with wide areas of grass which is mown regularly or used as pasture

DOP 29.07.2009 + B231



RapidEye 29.07.2009 + B231

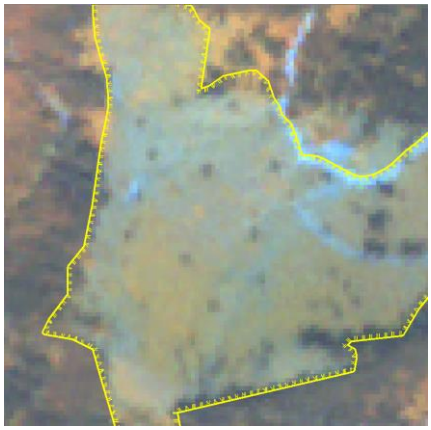
LB	LN	Comment
B231	N120	Grassland in industrial or productional areas
	N121	Grassland in administrative or other public premises
	N123	Grassland at harbours and ports
	N132	Dumpsites and landfill sites with grassland
	N122	“Shamrock“ and roadside verges
	N124	Grassland at airports
	N142	Sport grounds, football fields, camping sites
	N141	Lawns in parks, fields for dog walking, private lawns
	N211	**Fields and pasture for fodder**
	N999	No use

B321: Inhomogeneous grassland

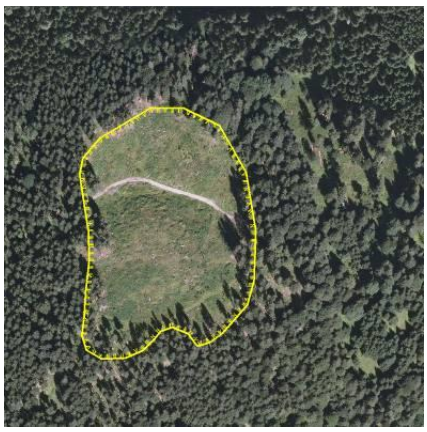
C	Inhomogeneous grassland	B321

Greenfields that are mown or worked on not more than once a year.
Irregular pattern, often interrupted with small bushes, shrubs or other plants.

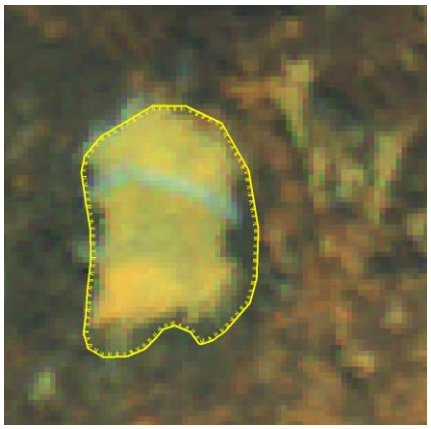
DOP 23.07.2009 + B321



RapidEye 23.07.2009 + B321



DOP 01.09.2009 + B321



RapidEye27.07.2009 + B321

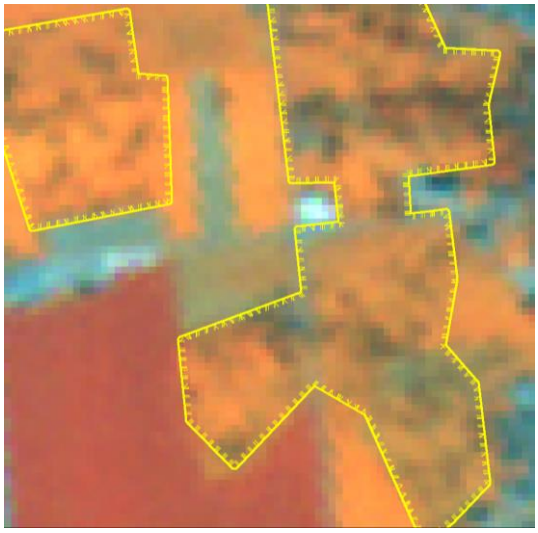
LB	LN	Comment
B321	N131	Ancilary areas of mines (former mining areas)
	N132	Dumpsites and landfill sites with grassland (recultivation)
	N122	“Shamrock“ and roadside verges
	N124	Inhomogeneous grassland at airports
	N214	**Extensively used grassland (including protected areas -> for preserving the open landscape), riverbanks, alpine pastures and other grasslands. N214 is assigned if the corresponding B321 would be classified with CLC-code 321.**
	N311	Grassland on deforestation and windthrow areas, with no new trees or bushes
	N510	Salt marshes (mostly found at the North Sea coastline; smaller areas also at the Baltic Sea coastline; these areas lie higher than the average high-tide line, but are regularly flooded by seawater)
	N999	**No use. N999 is assigned if the corresponding object is B321, but according to the CLC-code still belongs to B231.**

B233: Grassland with trees (< 50%)

C	Grassland with trees (< 50%)	B233

Grassland that has a tree coverage of maximum 50%.

DOP 16.09.2009 + B233



RapidEye 18.08.2009 + B233

LB	LN	Comment
B233	N112	Grassland with trees in housing areas
	N120	Grassland with trees at production sites
	N121	Grassland with trees in administrative or public sites
	N123	Grassland with trees at harbours and ports
	N131	Grassland with trees in mining areas
	N132	Grassland with trees at dumpsites and landfill sites
	N122	“Shamrock“ and roadside grass verges with trees
	N124	Grassland with trees at airports
	N142	**Camping sites, wildlife parks, natural parks**
	N141	**Urban parks,** (house gardens)
	N211	Grassland with trees, intensively farmed
	N214	**Meadows with orchards**
	N311	Natural regeneration areas, forest glades
	N999	No use

B322: Dwarf shrubs (heath)

D	Dwarf shrubs (heath)	B322

Heathland with dwarf shrubs; that is bushes, herbs, grass and / or a few trees (< 50%). A low and uninterrupted vegetation cover exists. The soil is dry and sandy. These landscapes have been or are often used as military training grounds

DOP 01.04.2009 + B322

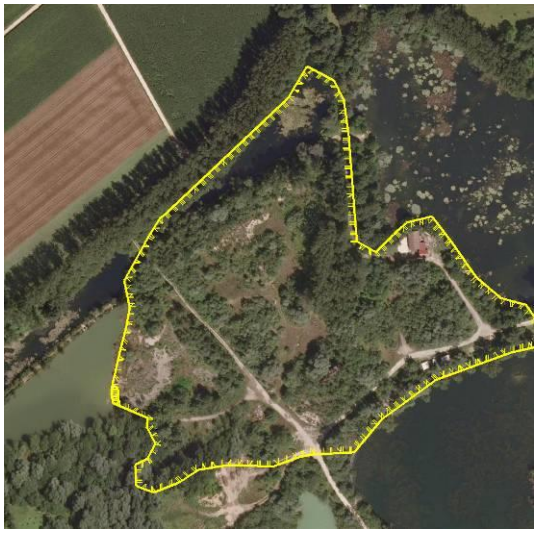
RapidEye 27.07.2009 + B322

LB	LN	Comment
B322	N121	Military training grounds
	N122	Roadside heathland
	N124	Heath on airport premises
	N999	**No use**

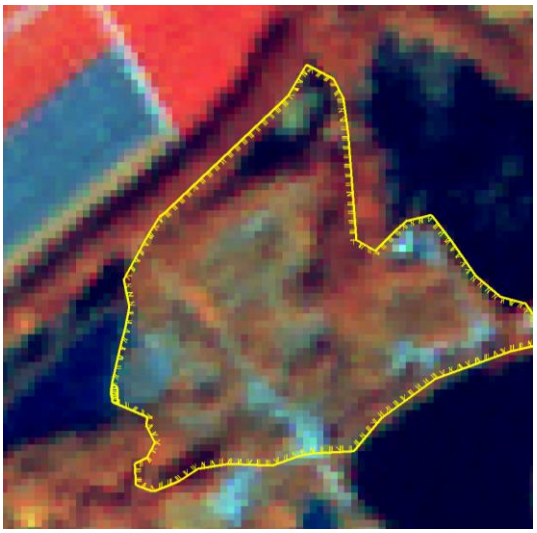
B324: Bushes, shrubs

D	Bushes, shrubs	B324

Vegetation with bushes or shrubs and a few scattered trees. The areas could have developed in the forest because of a slow degeneration or a natural regeneration of the forest (with some scattered young trees up to a height of 5 meters).



DOP 29.07.2009 + B324



RapidEye 29.07.2009 + B324

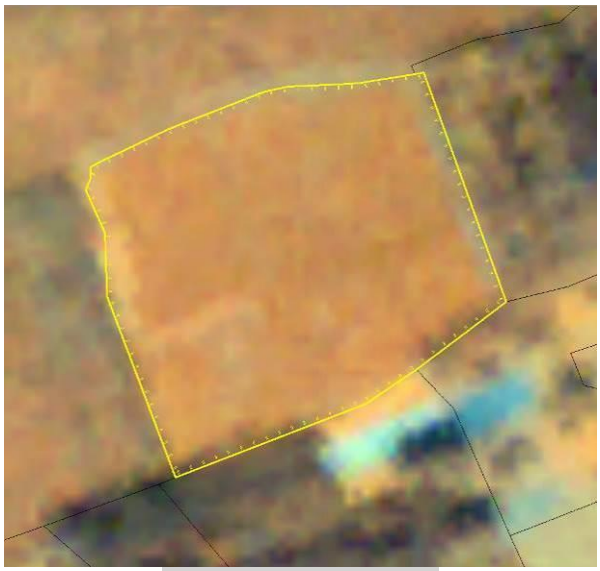
LB	LN	Comment
B324	N112	Buildings / development at the edge of a village
	N120	Unused / overgrown places (at the edge) of industrial areas
	N121	Unused / overgrown places (at the edge) of administrative or public sites
	N123	Unused / overgrown places (at the edge) of harbours or ports
	N131	Unused / overgrown places at mines (disused)
	N132	Unused / overgrown places at dumpsites or landfill sites (disused)
	N122	“Shamrock“ and roadside grass verges with bushes and shrubs
	N124	Unused / overgrown places (at the edge) of airports
	N142	Wildlife park
	N141	Urban woodlands
	N311	**No use, wild bushes**
	N999	**Comment**

B310: Reafforestation, young trees

D	Reafforestation, young trees	B310

Areas in forests with trees that are 5 meters high, or shorter (they developed either because of reforestation or by natural regeneration).

DOP 18.08.2012 + B310



RapidEye 2012 + B324

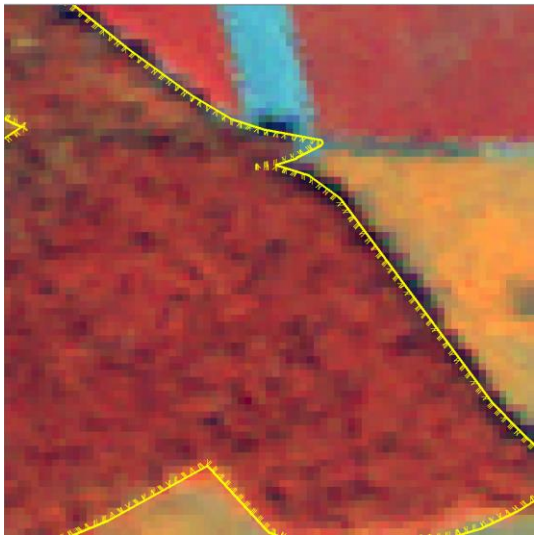
LB	LN	Comment
B310	N211	Tree nursery
	N311	**Reforestation or natural regeneration with growing trees (up to 5 meters)**

B311: Deciduous trees

D	Deciduous trees	B311

Areas that have a tree cover of at least 50%, of which at least 75% are deciduous.

DOP 25.05.2011 + B311



RapidEye 24.08.2009 + B311

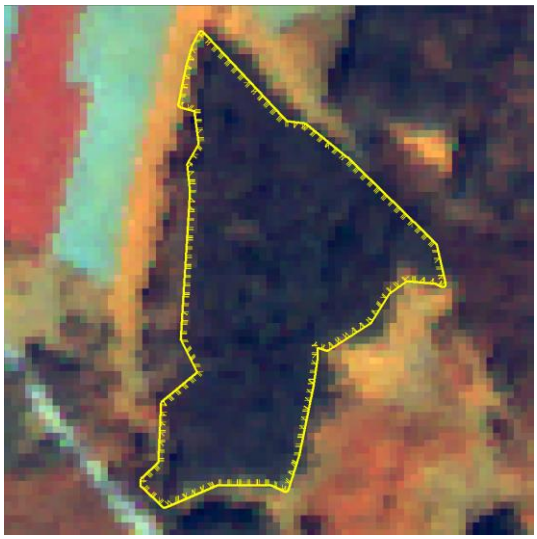
LB	LN	Comment
B311	N112	Buildings under trees at the edge of the village
	N120	(Peripheral) woodland in industrial estates
	N121	(Peripheral) woodland at administrative or public areas
	N123	(Peripheral) woodland at harbours or ports
	N131	(Peripheral) woodland at mines (disused)
	N132	(Peripheral) woodland at dumps and landfill areas (disused)
	N122	“Shamrock“ and roadside trees
	N124	(Peripheral) woodland at airports
	N142	Treetop adventure parks, wildlife parks, forest cemeteries
	N141	Urban woodland
	N211	Short-rotation plantation
	N311	**Deciduous woodlands**
	N999	Forests without any specific use (including national parks)

B312: Coniferous trees

D	Coniferous trees	B312

Areas that have a tree cover of at least 50%, of which at least 75% are coniferous.

DOP 09.05.2011 + B312



RapidEye 29.07.2009 + B312

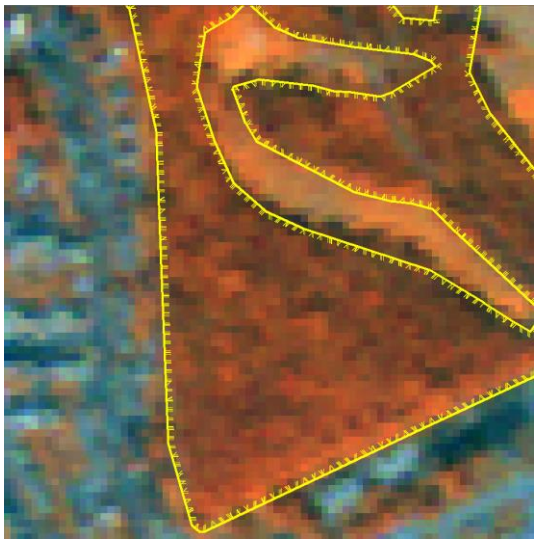
LB	LN	Comment
B312	N112	Buildings under trees at the edge of the village
	N120	(Peripheral) woodland in industrial estates
	N121	(Peripheral) woodland at administrative or public areas
	N123	(Peripheral) woodland at harbours and ports
	N131	(Peripheral) woodland at mines (disused)
	N132	(Peripheral) woodland at dumpsites and landfill sites (disused)
	N122	“Shamrock“ and roadside trees
	N124	(Peripheral) woodland at airports
	N142	Wildlife parks
	N141	Urban woodland
	N211	Short-rotation plantation, Christmas tree plantations
	N311	**Coniferous woodlands**
	N999	Forests without any specific use (including national parks)

B313: Deciduous and coniferous trees

D	Deciduous and coniferous trees	B313

Areas that have a tree cover of at least 50%, of which neither forest type may exceed 75% of the trees. A mix of individual deciduous and coniferous trees or tree groups has to be recognizable.

DOP 06.05.2011 + B313



RapidEye 23.08.2009 + B313

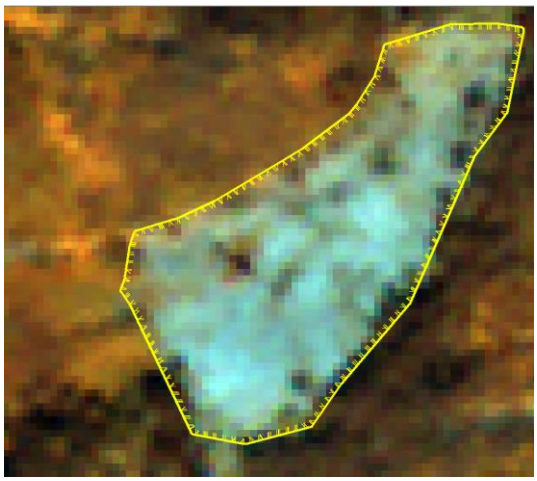
LB	LN	Comment
B313	N112	Buildings under trees at the edge of the village
	N120	(Peripheral) woodland in industrial estates
	N121	(Peripheral) woodland at administrative or public areas
	N123	(Peripheral) woodland at harbours and ports
	N131	(Peripheral) woodland at mines (disused)
	N132	(Peripheral) woodland at dumpsites and landfill sites (disused)
	N122	“Shamrock” and roadside trees
	N124	(Peripheral) woodland at airports
	N142	Treetop adventure parks, wildlife parks, forest cemeteries
	N141	Urban woodland
	N211	Short-rotation plantation
	N311	**Mixed woodland**
	N999	Forests without any specific use (including national parks)

B330: Sand, stones, soil

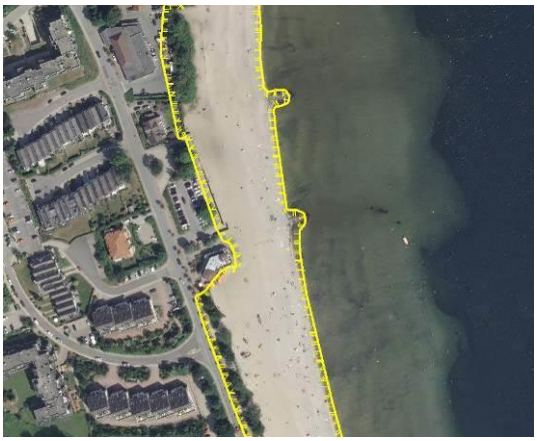
E	Sand, stones, soil	B330

Areas that are not sealed and do not have a lot of vegetation, but have loose rocks, soil and/or sand as a surface. They can be artificially created, like dumps and storage areas, brownfield sites and construction sites, or naturally created, for example dry, steppe-like areas, alpine tundra and erosional areas.

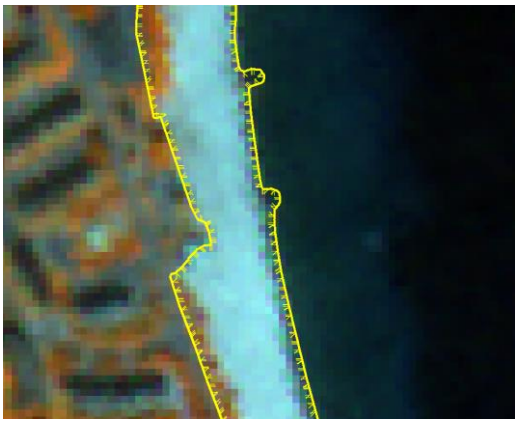
DOP 24.05.2009 + B330



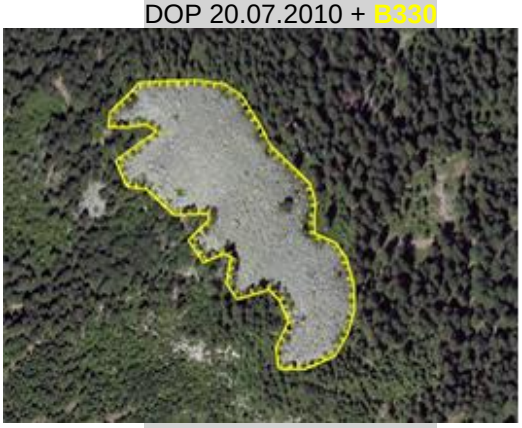
RapidEye 24.05.2009 + B330



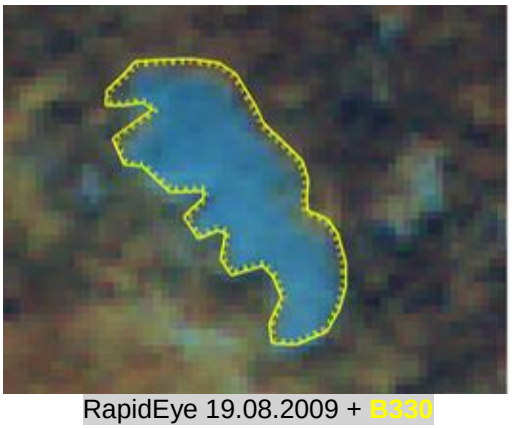
DOP 20.07.2010 + B330



RapidEye 03.07.2009 + B330



DOP 25.05.2011 + B330



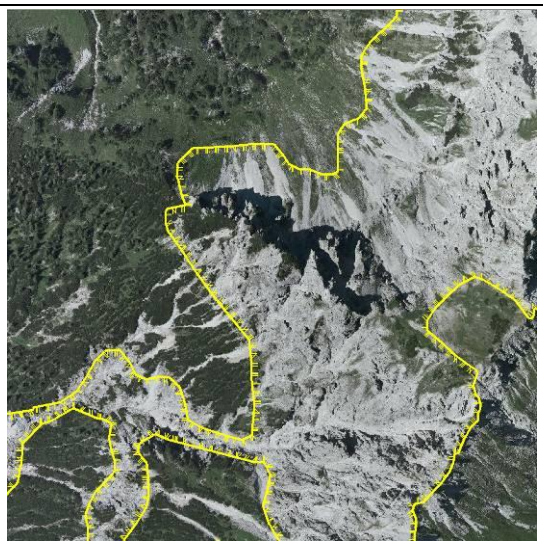
RapidEye 19.08.2009 + B330

LB	LN	Comment
B330	**N122**	Railways
	N131	Sand pits, gravel pits
	N133	Construction sites
	N142	(Artificial) beaches
	N311	Windthrow areas
	N999	Eroded areas in high lands, dunes and other sand plains, natural gravel pits (for example at riverbanks in the alps)

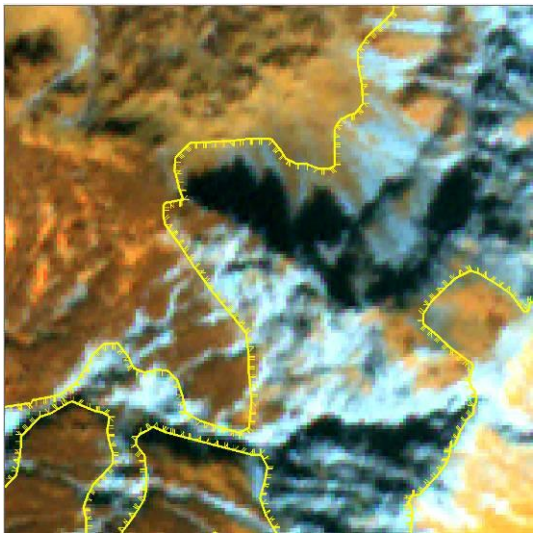
B332: Rock

E	Rock	B332

Rocks and bedrocks.



DOP 29.07.2009 + B332



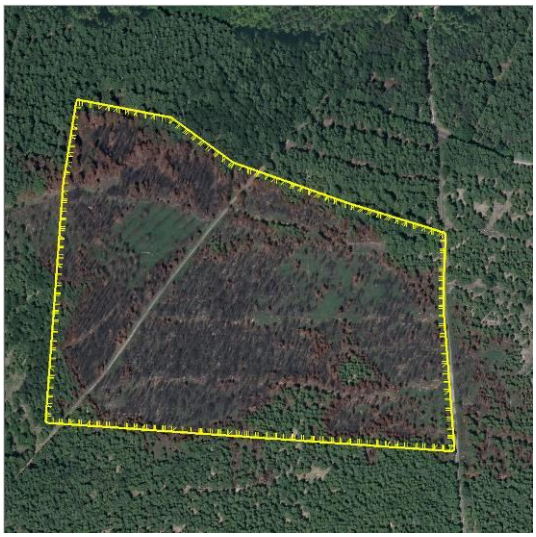
RapidEye 31.08.2009 + B332

LB	LN	Comment
B332	N131	Stone quarry
	N999	**Natural rock without use**

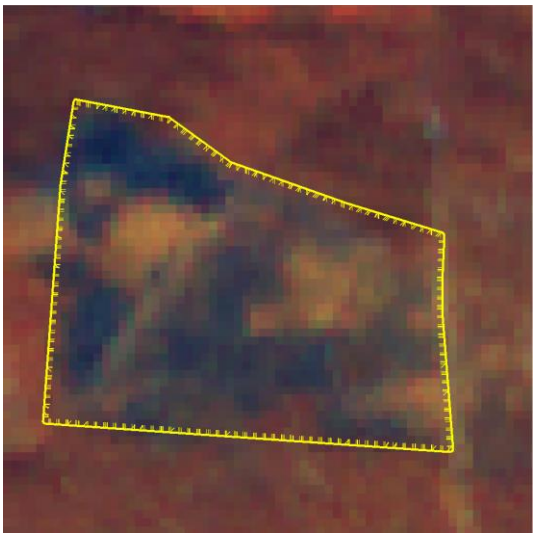
B334: Burnt areas

E	Burnt areas	B334

Areas that were recently exposed to fire and signs of scorching are visible on the vast majority of the objects.



DOP 23.05.2009 + B334



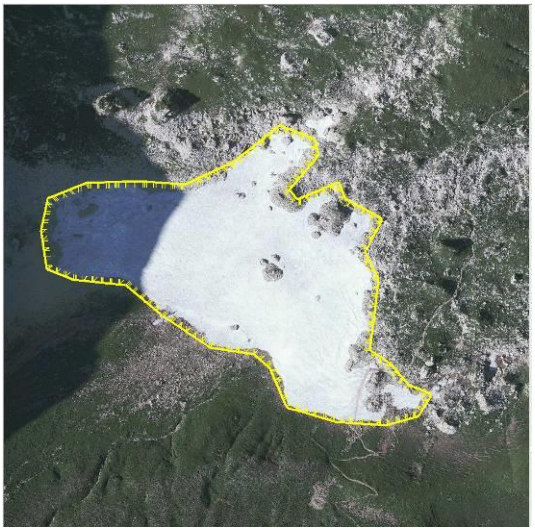
RapidEye 27.07.2009 + B334

LB	LN	Comment
B334	…	Use that existed before the fire spread remains

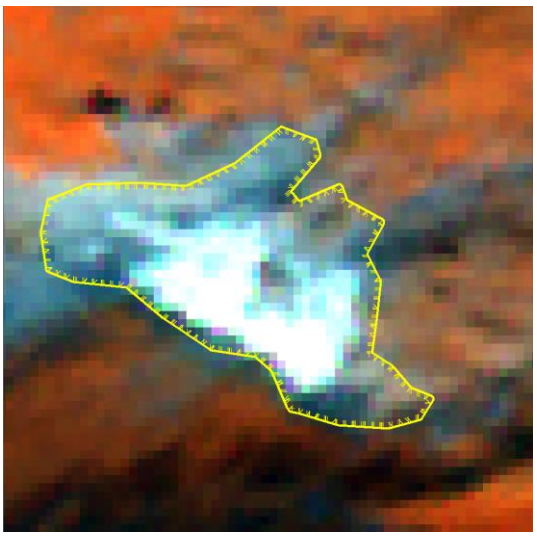
B335: Snow (permanent) and ice

E	Snow (permanent) and ice	B335

Areas that are covered by glaciers and permanent snow.



DOP 29.07.2009 + B335



RapidEye 31.08.2009 + B335

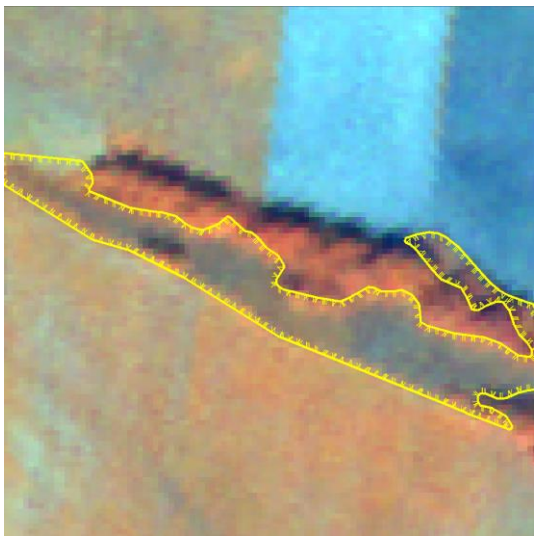
LB	LN	Comment
B335	N999	Glaciers and permanent snow

B411: Swamp

F	Swamp	B411

Areas without trees that are partly, temporarily or permanently wet. The reason for that can be flowing water or stagnant water. Low-lying areas that are usually flooded in winter and are saturated with water throughout the whole year.

DOP 01.04.2009 + B411



RapidEye 09.09.2009 + B411

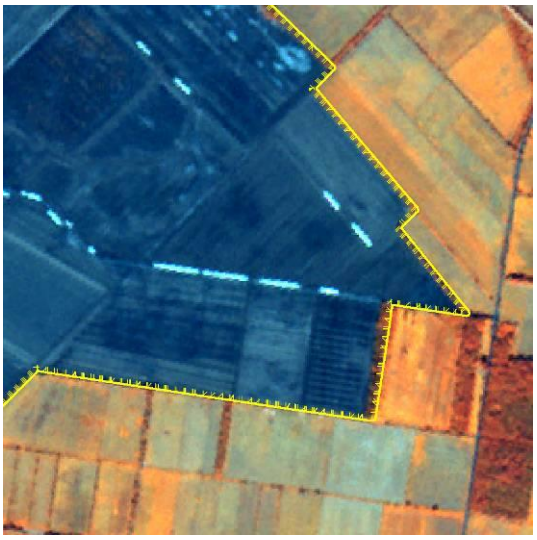
LB	LN	Comment
B411	N999	Swamp

B412: Bog

F	Bog	B412

Wet areas without trees with a surface consisting for the most part of peat and not completely decomposed plant matter. Bog areas can be mineable or not mineable.

DOP 01.04.2011 + B412



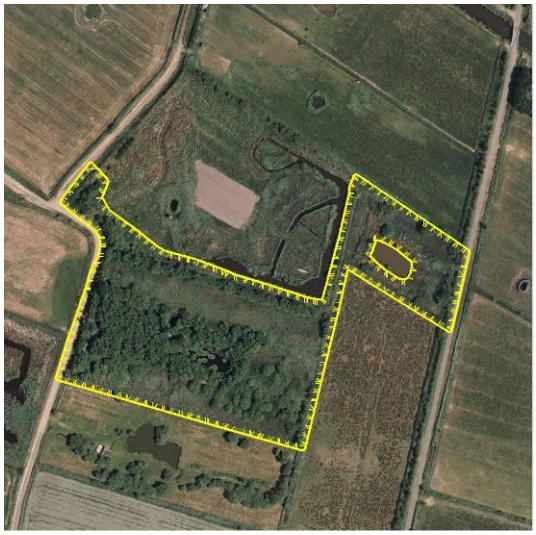
RapidEye 19.08.2009 + B412

LB	LN	Comment
B412	N131	Active peat-ditches
	N999	**Natural or renaturalised bog**

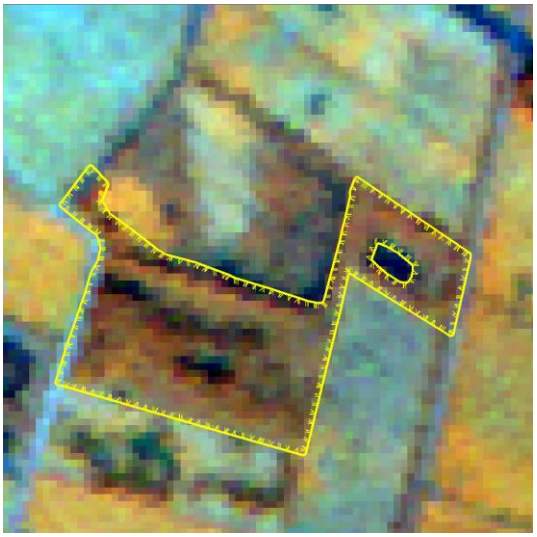
B413: Swamp with bushes/trees

F	Swamp with bushes/trees	B413

Swamps according to the definition of B411 with bushes and/or trees (between 30% - 50% □ the plant cover is interpreted to be in addition to the swamp; according to the definition, if 30% is covered by plants, it does not mean that only 70% is swamp. It is rather the case that the swamp continues under the bushes and trees. However, if the percentage of trees is higher than 50%, the object is recorded as B31x).



DOP 05.06.2008 + B413



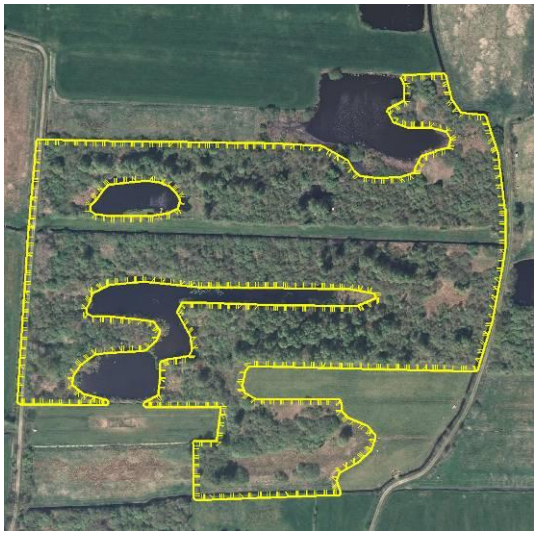
RapidEye 15.09.2009 + B413

LB	LN	Comment
B413	N999	Swamp with bushes/trees

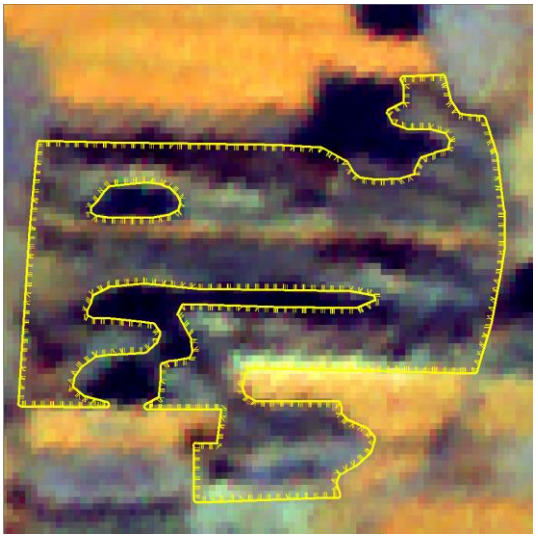
B414: Bog with bushes/trees

F	Bog with bushes/trees	B414

Bog according to the definition of B412 with bushes and/or trees (between 30% to 50% □ the plant cover is interpreted to be an addition to the bog; according to the definition, if 30% is covered by plants, it does not mean that only 70% is swamp. It is rather assumed that the bog continues under the bushes and trees. However, if the percentage of trees is higher than 50% the object is recorded as B31x). No active peat harvesting areas, but areas where peat harvesting is discontinued or which are being renaturalized



DOP 06.05.2008 + B414



RapidEye 15.10.2009 + B414

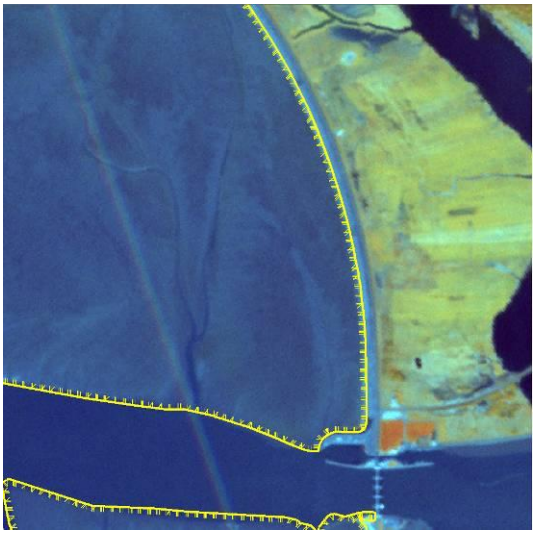
LB	LN	Comment
B414	N999	Bog with bushes/trees

B423: Mud flat

G	Mud flat	B423

Areas at the coast with mud, sand and rocks that are found between average high tide and average low tide and for that reason are dry at low tide, mostly without vegetation.

DOP 09.05.2008 + B423



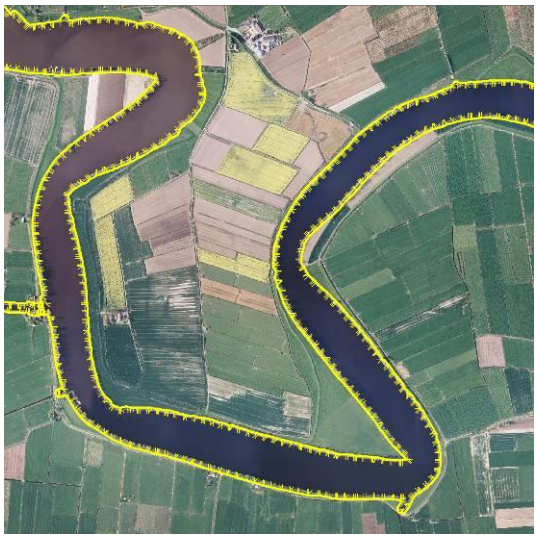
RapidEye 22.05.2010 + B423

LB	LN	Comment
B423	N999	Mud flat

B511: Watercourse

G	Watercourse	B511

Natural or artificially created watercourses for drainage. Canals are also classified as watercourses.



DOP 06.05.2008 + B511

RapidEye 15.10.2009 + B511

LB	LN	Comment
B511	N123	Harbours and ports at watercourses
	N510	**Shippable watercourses**
	N999	**Watercources without any use**

B512: Waterbodies

G	Waterbodies	B512

Stagnant, natural and artificially created waterbodies (fresh water). Only areas that are permanently filled with water count, no flooded areas. Also branches of rivers with stagnant water.

DOP 26.06.2011 + B512

RapidEye 23.09.2009 + B512

LB	LN	Comment
B512	N120	Fish farms
	N123	Harbours and ports at lakes
	N131	**Flooded gravel pits**
	N132	Liquid waste, sludge ponds
	N142	Lakes for bathing
	N510	**Waterbodies that are part of a watercourse for shipping**
	N999	**Waterbodies without any use**

B521: Lagoon

G	Lagoon	B521

Areas with salt- or brackish water near the coastline that are cut off from the sea by a headland or similar objects. These waterbodies can be connected to the sea at a few small points. A connection can be either permanent or periodic (for example depending on the seasons or the tide). A lagoon mostly has shallow water (about 3 -8 meters deep). Also “Bodden” (shallow bays) at the Baltic sea belong to this class.

DOP 29.07.2010 + B521

RapidEye 07.08.2009 + B521

LB	LN	Comment
B521	N999	Lagoons or shallow bays

B522: Estuary

G	Estuary	B522

Wide part of a river mouth (Estuary) into the sea that is exposed to the influence of the tide.

DOP 03.06.2010 + B522

RapidEye 19.08.2009 + B522

LB	LN	Comment
B522	N123	Harbours and ports situated in an estuary
	N510	**Estuary (for shipping)**
	N999	**Estuary**

B523: Open sea

G	Offenes Meer	B523

The open sea up to the mean low tide level.

DOP xx.xx.20xx + B523

RapidEye xx.xx.2009 + B523

LB	LN	Comment
B523	N123	Sea port
	N999	**Open sea**

Land use

Land use (LN)		Description
N112	**Housing**	Housing is the main use (that means at least 1 house to live in per object). Sometimes it is also combined with farms and forestry businesses (rural) or with commercial businesses or administrative buildings (city centre).
N120	**Production**	The use mainly concentrates on industrial production. This includes classic industries, the production of energy, waterworks and sewage works, as well supply and waste disposal facilities.
N121	**Public**	Commerce and services, public buildings (culture, security and law enforcement, religious buildings, administration …).
N123	**Port**	Open spaces with buildings that are intended solely or predominantly for shipping (ports, shipyards, and locks).
N131	**Mining areas**	Areas of surface mining (open pit mining, clay pits, stone quarries, flooded gravel pits …).
N132	**Dumpsites**	Areas where waste and rubbish is piled on the surface.
N122	**Road and railway traffic**	Developed and non-developed areas (also vegetation) used for traffic.
N124	**Air services**	Open spaces with buildings that are used exclusively or predominantly for air services.
N142	**Sports and leisure**	Developed and non-developed areas that are used for sports, leisure and/or recreation. This class contains non-urban parks, zoos, cemeteries, lawns, sports grounds, allotment gardens, theme parks, camping sites, holiday houses and so on.
N141	**Urban green area**	Non-developed urban green areas. This class contains urban parks, zoos, cemeteries and lawns.
N510	**Water**	1) Waterside areas adjacent to coastal areas or mainland areas. This class is used to differentiate lawns and meadows from salt marshes. 2) Waterbodies that are used by ships
N211	**Agriculture (intensively)**	Areas that are regularly ploughed (crop rotation). Meadows, but also areas where fodder grass is harvested mechanically. These areas are identified by intensive use of agriculture. Also tree nurseries belong into this class.
N214	**Extensive use**	Grasslands that are used extensively are only mown once a year. Predominantly in nature reserves and areas intended to preserve the landscape.

Land use (LN)		Description
N311	**Forestry**	Woodlands, but also areas for natural regeneration or forest glades.
N133	**Under construction**	Areas on which construction, ground removal and excavation is in progress. Also parcels set aside for construction and are connected to an existing road network or to a road network that is under construction.
N999	**not relevant**	No important, relevant or identifiable use. Only acceptable, if the land cover class belongs to the groups C-G.

Detailed explanation on land use of selected classes

<table>
<tr><th>N112</th><th>Housing</th></tr>
<tr><td>Additional information</td><td>Housing is the main use of this area.</td></tr>
<tr><td>Possible LB / LN combinations</td><td>
<table>
<tr><th>LN</th><th>LB</th><th>Bemerkung</th><th>SIE_AKT/ VEG_AKT</th></tr>
<tr><td rowspan="5">N112</td><td>B110</td><td>Houses</td><td>SIE_AKT>VEG_AKT & SIE_AKT >= 35</td></tr>
<tr><td>B122</td><td>Pedestrian zones</td><td>> 50</td></tr>
<tr><td>B23x, B31x</td><td>A few built objects with predominant vegetation</td><td>SIE_AKT<VEG_AKT & VEG_AKT >= 35</td></tr>
<tr><td>B330</td><td>A few built objects with predominant gravel or other unsealed surfaces</td><td>SIE_AKT & VEG_AKT <=30</td></tr>
<tr><td>B242</td><td>Bungalow housing estates
The focus is on a regular structure between the objects. (More or less equal distribution of sealed objects, grasslands and trees or bushes).</td><td>> 20 & < 40</td></tr>
</table>
</td></tr>
<tr><td>Prerequisite</td><td>SIE_AKT > 0
At least one house that is not smaller than 50 square meters</td></tr>
<tr><td>Special cases</td><td>Pedestrian zones belong to N112</td></tr>
</table>

<table>
<tr><th>N122</th><th>Road and railway traffic</th></tr>
<tr><td>Additional information</td><td>Roadside greenery are usually classified as N999.
Other uses like N211, N141, N142 have a priority, if they are clearly identifiable
N122 is classified if following elements appear:
Motorways/ roads/ railways,
Car parks,
Motorway junctions, motorway merging points that are smaller than 3 hectares and in keeping with the CLC code (CLC standards have to be considered),
Service stations,
Train stations and peripheral buildings
Accessible areas adjacent to transport ways roadside greenery → N999.
Areas that are surrounded by motorway junctions or similar objects (known as “shamrock areas”) which are bigger than 3 hectares are usually assigned to N999.</td></tr>
<tr><td>Possible LB /LN combinations</td><td><table>
<tr><th>LN</th><th>LB</th><th>Bemerkung</th></tr>
<tr><td rowspan="4">N122</td><td>B122</td><td>Motorways, car parks</td></tr>
<tr><td>B3xx, B23x</td><td>"Shamrock“</td></tr>
<tr><td>B110</td><td>Service stations, train stations with peripheral buildings</td></tr>
<tr><td>B330</td><td>Railways</td></tr>
</table></td></tr>
<tr><td>Invalid combinations with N122</td><td><table>
<tr><th>LB</th><th>Bemerkung</th><th>LN_AKT</th></tr>
<tr><td>B211</td><td>Agricultural areas</td><td>N211</td></tr>
<tr><td>B22x</td><td>Agricultural areas</td><td>N211</td></tr>
<tr><td>B242</td><td>Regular structures</td><td>N142 / N112</td></tr>
</table></td></tr>
<tr><td>Special cases</td><td>A car park
that can be used by public and has no direct connection to areas nearby is classified as N122.
that seems to be part of a public building or a public place needs to be classified into the specific class, for example N120, N121, N142.
Green areas that run along traffic routes are not classified as N122, but are classified according to their use. If the use cannot be identified, it has to be classified as N999.</td></tr>
</table>

<table>
<tr><th>N124</th><th>Air services</th></tr>
<tr><td>Additional information</td><td>„Functional classification“ including every associated area like access routes, security areas, …</td></tr>
<tr><td>Possible LB / LN combinations</td><td>
<table>
<tr><th>LN</th><th>LB</th><th>Bemerkung</th></tr>
<tr><td rowspan="4">N124</td><td>B122</td><td>Runways, car parks</td></tr>
<tr><td>B3xx, B23x</td><td>Grasslands, green areas</td></tr>
<tr><td>B110</td><td>Buildings</td></tr>
<tr><td>B121</td><td>Special infrastructure</td></tr>
</table>
</td></tr>
<tr><td>Invalid combinations with N124</td><td>
<table>
<tr><th>LB</th><th>Bemerkung</th><th>LN_AKT</th></tr>
<tr><td>B211</td><td>Agricultural areas</td><td>N211</td></tr>
<tr><td>B22x</td><td>Agricultural areas</td><td>N211</td></tr>
</table>
</td></tr>
<tr><td>Special cases</td><td>• Military use → N124 → ZUS_AKT = M,
• Unsurfaced runways without any military use (for example gliding, sports) → N142</td></tr>
</table>

<table>
<tr><th>N141</th><th>Urban green area</th></tr>
<tr><td>Additional information</td><td>• Green areas inside or adjacent to urban areas (“Ortslage” in ATKIS)
• Permanently open for public, for recreational purposes, are well-tended
• No “fallow ground“
• Often a network of paths</td></tr>
<tr><td>Possible LB / LN combinations</td><td>
<table>
<tr><th>LN</th><th>LB</th><th>Bemerkung</th></tr>
<tr><td rowspan="2">N141</td><td>B242</td><td>Cemeteries</td></tr>
<tr><td>B3xx, B23x</td><td>Parks, lawns for dog walking</td></tr>
</table>
</td></tr>
<tr><td>Prerequiste</td><td>VEG_AKT > 50</td></tr>
<tr><td>Invalid combinations with N141</td><td>
<table>
<tr><th>LB</th><th>Bemerkung</th><th>LN_AKT</th></tr>
<tr><td>B110</td><td>Housing, industry</td><td>N112/N12x</td></tr>
<tr><td>B122</td><td>Sealed areas</td><td></td></tr>
<tr><td>B22x</td><td>Agricultural areas</td><td>N211</td></tr>
<tr><td>B211</td><td>Agricultural areas</td><td>N211</td></tr>
</table>
</td></tr>
<tr><td>Special cases</td><td>In rural areas these green areas should rather be classified with agricultural use (N211) or N999 than as N141; especially, if they are not open to the public.
<u>Exeption:</u>
Not for public use, but still classified as N141: house gardens, if they were already assigned in ATKIS to a different class than the house they belong to, are classified as N141</td></tr>
</table>

<table>
<tr><th>N142</th><th>Sports and leisure</th></tr>
<tr><td>Additional information</td><td>Areas for sports, leisure and activities and all public green areas and cemeteries outside urban areas (“Ortslage” in ATKIS).</td></tr>
<tr><td>Possible LB / LN combinations</td><td>
<table>
<tr><th>LN</th><th>LB</th><th>Bemerkung</th></tr>
<tr><td rowspan="8">N142</td><td>B110</td><td>Monasteries</td></tr>
<tr><td>B122</td><td>Meeting points, car parks inside the facilities</td></tr>
<tr><td>B3xx, B23x</td><td>Parks, marinas, airports with aircraft that are mainly used for sports activities</td></tr>
<tr><td>B231</td><td>Lawns for dog walking</td></tr>
<tr><td>B121</td><td>Gyms, indoor pools</td></tr>
<tr><td>B242</td><td>Allotment gardens outside urban areas (irrespective of its location)</td></tr>
<tr><td>B242</td><td>Cemeteries outside urban areas</td></tr>
</table>
</td></tr>
<tr><td>Invalid combinations with N142</td><td>
<table>
<tr><th>LB</th><th>Bemerkung</th><th>LN_AKT</th></tr>
<tr><td>B211</td><td>Agricultural areas</td><td>N211</td></tr>
<tr><td>B22x</td><td>Agricultural areas</td><td>N211</td></tr>
</table>
</td></tr>
<tr><td>Special cases</td><td>Runaways with unsolid surfaces define the separation from N124 (see airport services N124).</td></tr>
</table>

<table>
<tr><th>N133</th><th>Under construction</th></tr>
<tr><td>Additional information</td><td>Construction sites are always assigned N133, even if it is already clearly identifiable what kind of building or structure is being developed (subsequent derivation from CLC).</td></tr>
<tr><td>Possible LB / LN connections</td><td>
<table>
<tr><th>LN</th><th>LB</th><th>Bemerkung</th></tr>
<tr><td rowspan="4">N133</td><td>B330</td><td>Work in progress</td></tr>
<tr><td>B3xx, B23x</td><td>With new existing network of paths</td></tr>
<tr><td>B110</td><td>No identifiable use</td></tr>
<tr><td>B121</td><td>No identifiable use</td></tr>
</table>
</td></tr>
<tr><td>Prerequisite</td><td>VEG_AKT < 100</td></tr>
<tr><td>Special cases</td><td>The ongoing process (construction) is important. That means if there are still unused parcels between already constructed roads, they are also classified as N133.</td></tr>
</table>

<table>
<tr><th>N999</th><th>Not relevant</th></tr>
<tr><td>Additional information</td><td>Areas without identifiable or relevant use.</td></tr>
<tr><td>Possible LB / LN combinations</td><td>
<table>
<tr><th>LN</th><th>LB</th><th>Bemerkung</th></tr>
<tr><td rowspan="2">N999</td><td>B3xx, B23x</td><td>Grass verges at waysides, rivers, … (> 15 m)</td></tr>
<tr><td>B31x</td><td>Forests in national parks and small woodland areas without any connection to bigger contiguous areas of woodland.</td></tr>
</table>
</td></tr>
<tr><td>Invalid combinations with N999</td><td>
<table>
<tr><th>LB</th><th>Bemerkung</th><th>LN_AKT</th></tr>
<tr><td>B211</td><td>Agricultural areas</td><td>N211</td></tr>
<tr><td>B22x</td><td>Agricultural areas</td><td>N211</td></tr>
</table>
</td></tr>
</table>

Appendix 2 CORINE Land Cover Nomenclature

Classes in italic print usually not occur in Germany

Level 1	Level 2	Level 3
1. Artificial surfaces	1.1. Urban fabric	1.1.1. Continuous urban fabric
		1.1.2. Discontinuous urban fabric
	1.2. Industrial, commercial and transport units	1.2.1. Industrial or commercial units
		1.2.2. Road and rail networks and associated land
		1.2.3. Port areas
		1.2.4. Airports
	1.3. Mine, dump, and construction sites	1.3.1. Mineral extraction sites
		1.3.2. Dump sites
		1.3.3. Construction sites
	1.4. Artificial non-agricultural vegetated areas	1.4.1. Green urban areas
		1.4.2. Sport and leisure facilities
2. Agricultural areas	2.1.Arable land	2.1.1. Non-irrigated arable land
		2.1.2. Permanently irrigated land
		2.1.3. Rice fields
	2.2. Permanent crops	2.2.1. Vineyards
		2.2.2. Fruit trees and berry plantations
		2.2.3. Olive groves
	2.3. Pastures	2.3.1. Pastures
	2.4. Heterogeneous agricultural areas	*2.4.1. Annual crops associated with permanent crops*
		2.4.2. Complex cultivation pattern
		2.4.3. Land principally occupied by agriculture, with significant areas of natural vegetation
		2.4.4. Agro-forestry areas
3. Forests and semi-natural areas	3.1. Forests	3.1.1. Broad-leaved forest
		3.1.2. Coniferous forest
		3.1.3. Mixed forest
	3.2. Shrub and/or herbaceous vegetation association	3.2.1. Natural grassland
		3.2.2. Moors and heathland
		3.2.3. Sclerophyllous vegetation
		3.2.4. Transitional woodland shrub
	3.3. Open spaces with little or no vegetation	3.3.1. Beaches, dunes, and sand plains
		3.3.2. Bare rock
		3.3.3. Sparsely vegetated areas
		3.3.4. Burnt areas
		3.3.5. Glaciers and perpetual snow
4. Wetlands	4.1. Inland wetlands	4.1.1. Inland marshes
		4.1.2.Peatbogs
	4.2. Coastal wetlands	4.2.1. Salt marshes
		4.2.2. Salines
		4.2.3. Intertidal flats
5. Water bodies	5.1. Inland waters	5.1. 1. Water courses
		5.1.2. Water bodies
	5.2. Marine waters	5.2.1. Coastal lagoons
		5.2.2. Estuaries
		5.2.3. Sea and ocean

Coloured legend for CORINE Land Cover

(Quelle: https://land.copernicus.eu/Corinelandcoverclasses.eps.75dpi.png/image)

Appendix 3 Crosstable for derivation of CORINE Land Cover (CLC)

	LB /LN		SIE	VEG	Housing	Produc-tion	Public	Port	Mining areas	Dump-sites	road and railway traffic	air services	sports and leisure	urban green area	Water	agricul-ture (inten-sively)	extensive use	forestry	under construc-tion	not relevant
					N112	N120	N121	N123	N131	N132	N122	N124	N142	N141	N510	N211	N214	N311	N133	N999
A	Houses	B110	> 70		111	121	121	123	131	132	122	124	142			211			111	
			15-70		112														112	
	Facilities	B121																	121	121
	Sealed areas without buildings	B122			111														133	122
	Mixed areas (regular structure)	B242	0-15		***142***									141			231			142
			15-51		112				131	132										
B	Arable land	B211			211						122					211	211			
	Winegrowing	B221														221	221			
	Orchards and soft fruit populations	B222														222	222			
	Hops	B224																		
C	Homogeneous grassland	B231	15-51		112	121	121	123	131	132	122	124	142	141	421	231	231		133	231
			0-15		142															
	Inhomogeneous grassland	B321															321	324		
	Grassland with trees (< 50%)	B233	15-51		112								142	141		231	222			
			0-15		142															
D	Dwarf shrubs (heath)	B322					121				122	124						322		322
	Bushes, shrubs	B324	15-51		112	121		123	131	132	122		142	141		211		324		324
			0-15		142															
	Reafforestation, young trees	B310																		
	Deciduous trees	B311	15-51		112	121	121	123	131	132	122	124	142	141		312		311		311
			0-15		142															
	Coniferous trees	B312	15-51		112													312		312
			0-15		142															
	Laub- und NadelbäumeDeciduous and coniferous trees	B313	15-51		112											211		313		313
			0-15		142															
E	Sand, stones, soil	B330		> 10		121	121	123	131	132	122	124	142					324	133	333
				< 10																331
	Rock	B332																		332
	Burnt areas	B334			112	334	334	334	334	334	334	334	334	334		211	211	334		334
	Snow (permanent) and ice	B335																		335
F	Swamp	B411																		411
	Bog	B412							412											412
	Swamp with bushes/trees < 50%	B413																		411
	Bog with bushes/trees < 50%	B414																		412
G	Mud flat	B423																		423
	Watercourses	B511						511							511					511
	Waterbodies	B512				512		512	512	132			512		512					512
	Lagoon	B521						521												521
	Estuary	B522						522							522					522
	Open sea	B523						523												523

Depending on the attribute ZUS_AKT, different CLC-codes are assigned in some cases. The following table lists the modification in the CLC derivation:

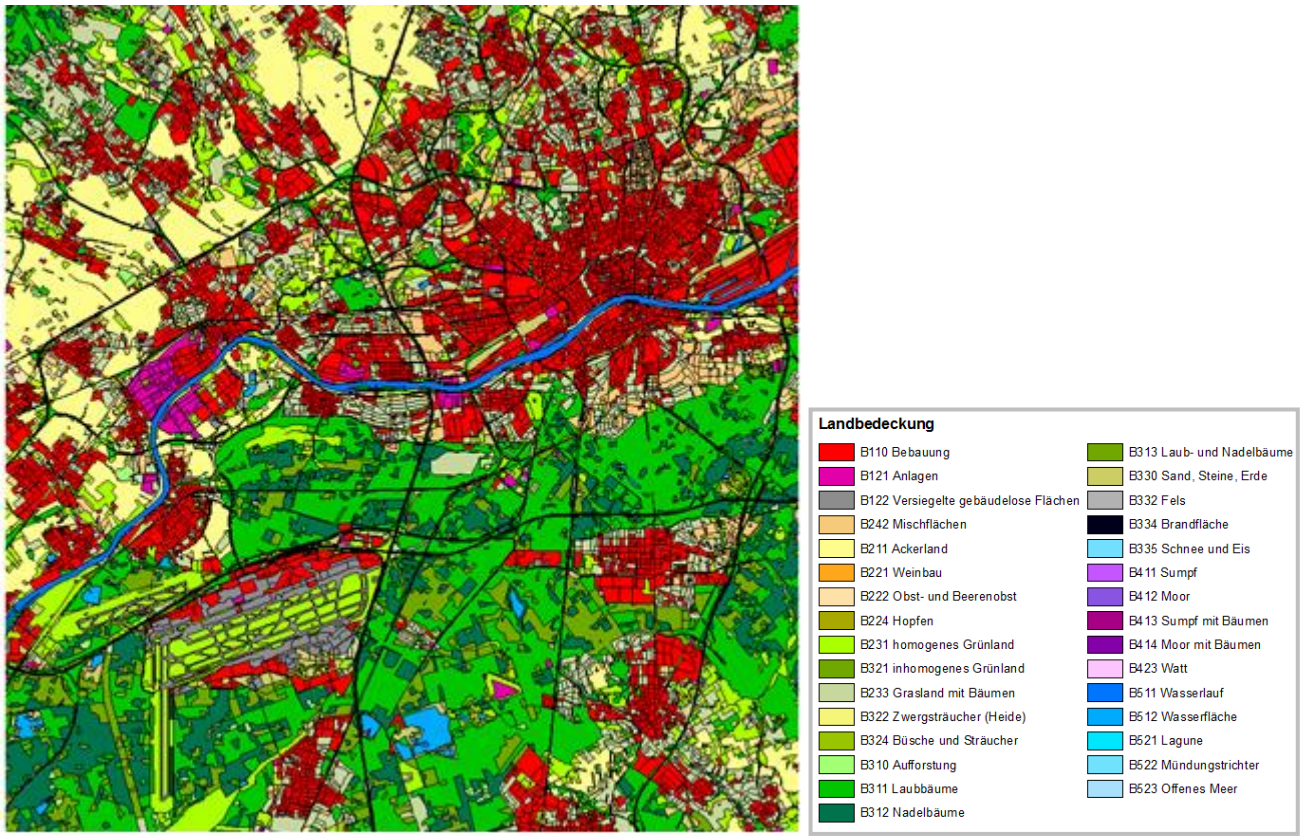
LB	LN	SIE	VEG	ZUS	CLC
B321	N121			M	321
B2xx	N121	<= 5	>= 95	M	321
B311	N121	<= 5	>= 95	M	311
B312					312
B313					313
B324					324
B322					322
B310	N121	<= 5	>= 95	M	324
Bxxx	N112	<15		O	112

Appendix 4 Options for analyses and visualization

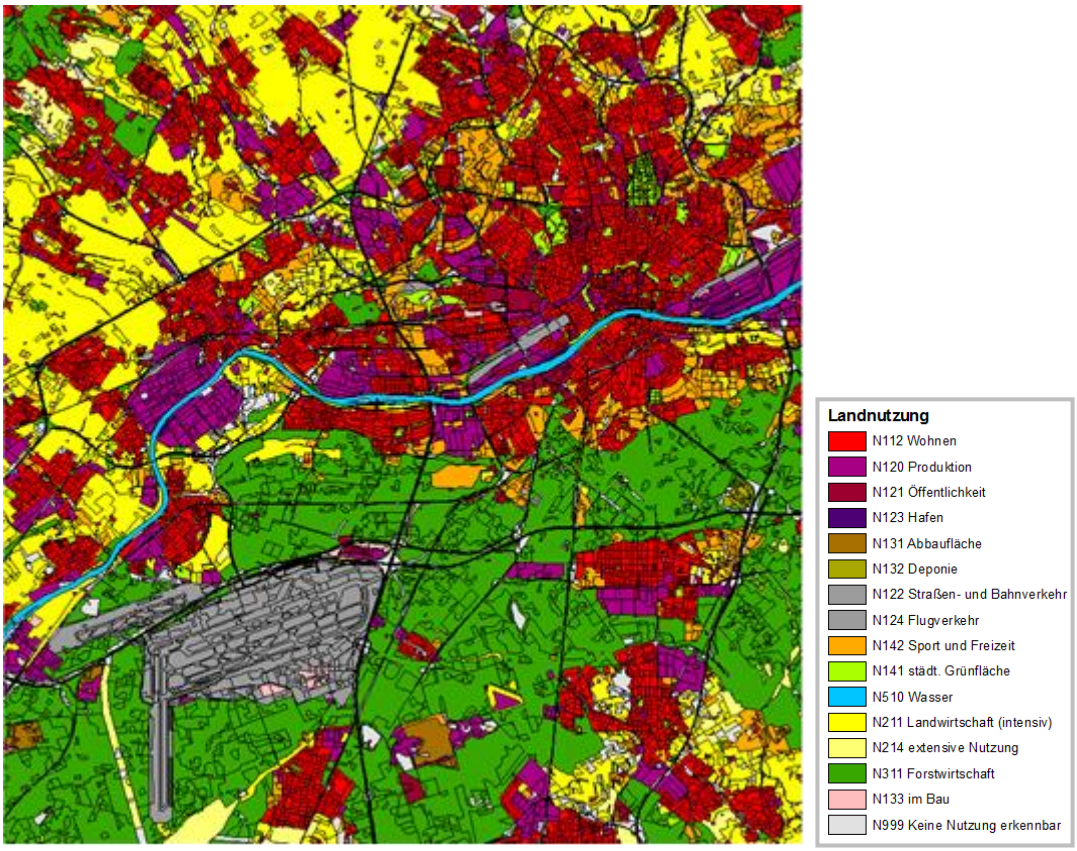
The dataset LBM-DE can be analyzed and visualized according to different criteria. The consideration of dependencies of the relevant attributes for comprehensive description of the objects is of great importance. In the following, the decisive attributes are first explained individually and then with respect to their interaction.

Visualization of single features

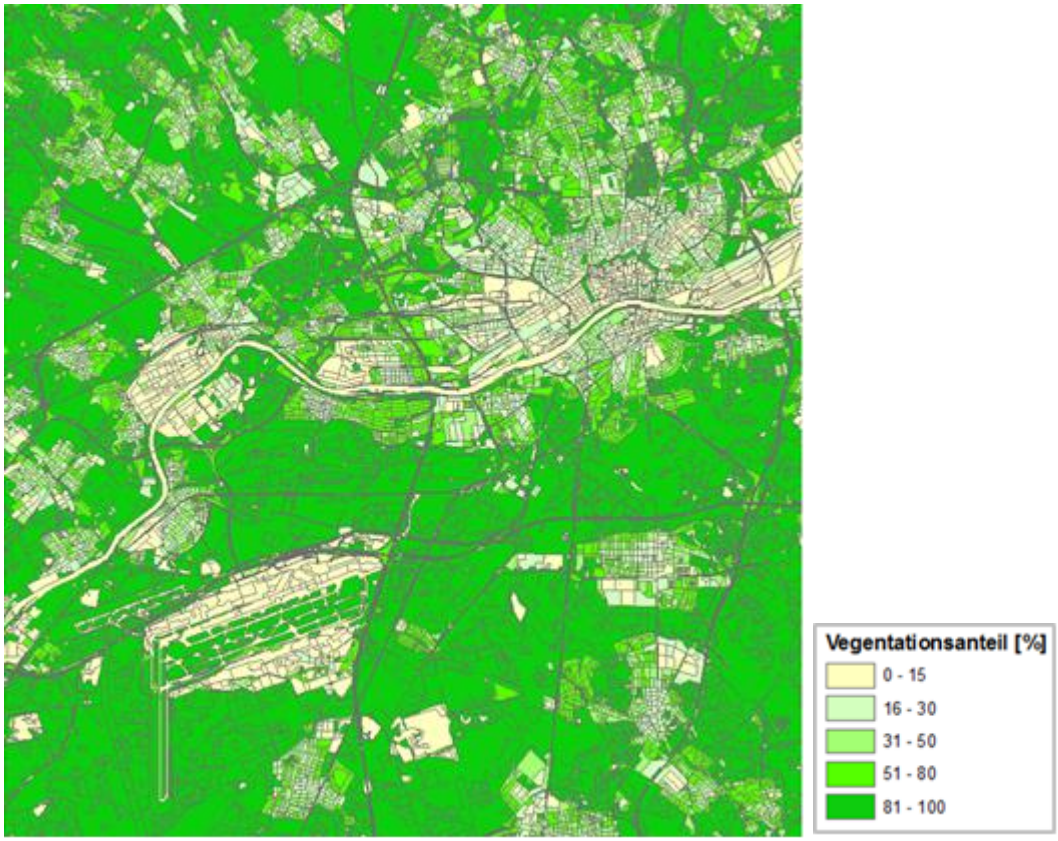
Land cover – LB_AKT



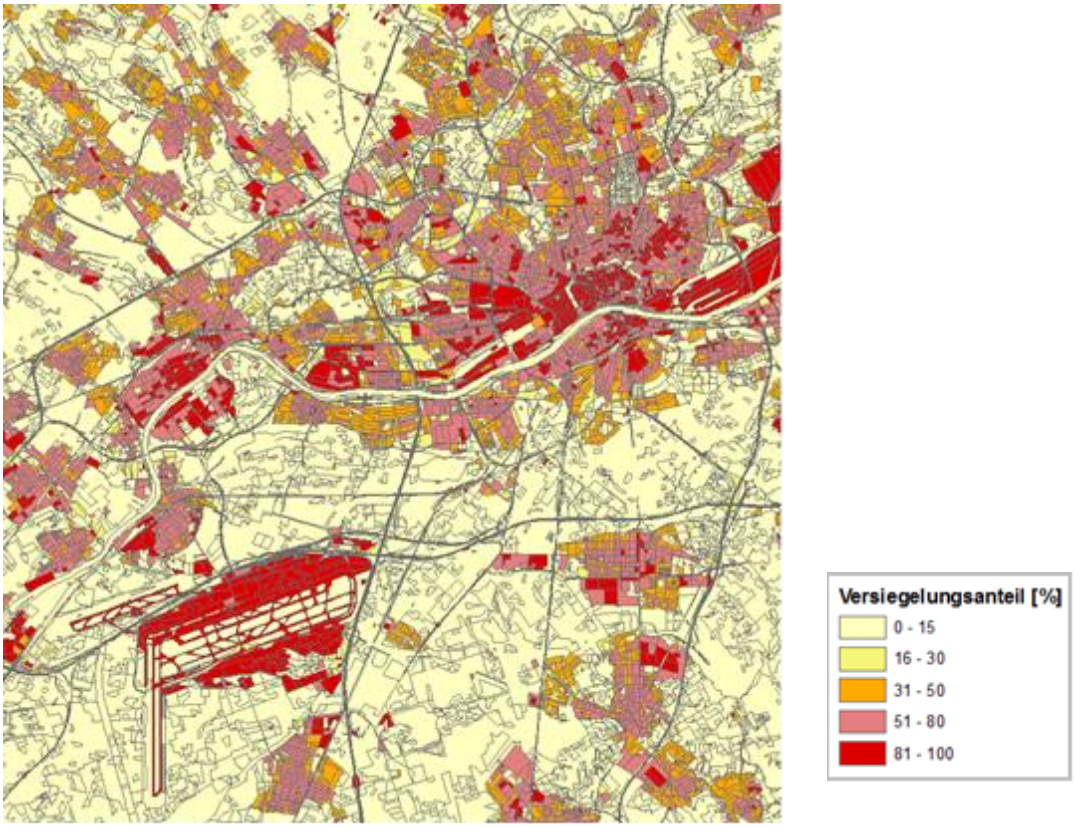
Land use – LN_AKT



Degree of Vegetation – VEG_AKT



Degree of sealing – SIE_AKT



Complex analyzes

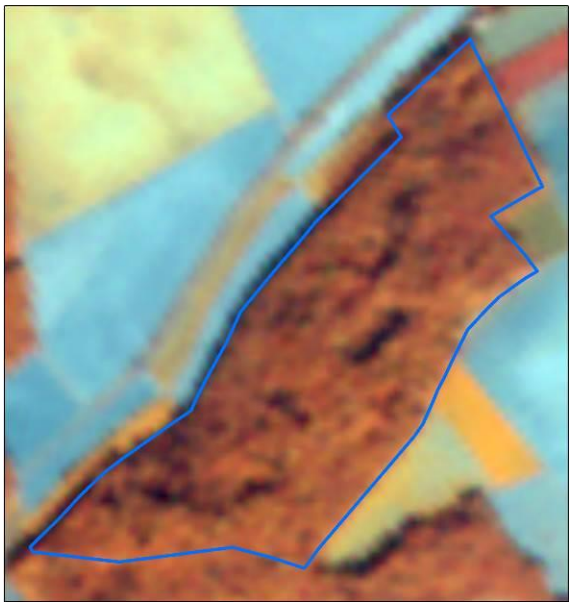
Each object is basically described by the principle of majority. Exceptions to this rule are the classes B110, B121, B233, B242, B313, B413 and B414 (see Appendix 1). Only through the combination with VEG_AKT and SIE_AKT clear decisions about the land cover can be made. The different landscape objects with the same coverage (LB_AKT) can be seen in the following examples of the class "B311: deciduous trees".

In Examples 1-4, the same land cover classes with different land use, degree of vegetation and degree of sealing are shown to provide insight into the complexity of attribute information and decision making.

In Example 1 there is a deciduous tree cover, which is used for forestry. The object does not contain any other cover types, therefore a vegetation of 100 % and no degree of sealing are reported.

Example 1: deciduous forest (forestry)

DOP



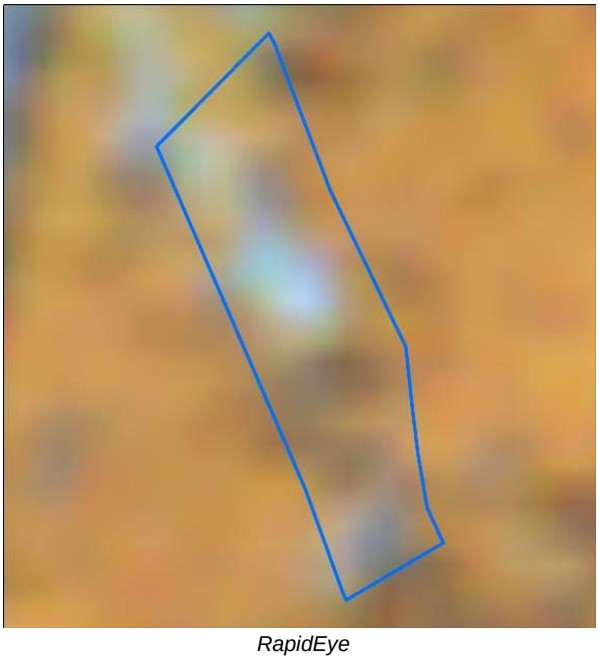
RapidEye

LB_AKT	LN_AKT	VEG_AKT	SIE_AKT	Comment
B311	N311	100	0	common deciduous tree area with forestry use

Example 2 shows land use "N112: Housing". The majority of the object is described by the land cover class "B311: deciduous trees". The vegetation content of the polygon is only 75 percent and the degree of sealing of the object is 25 percent.

Example 2: Residential Buildings

DOP



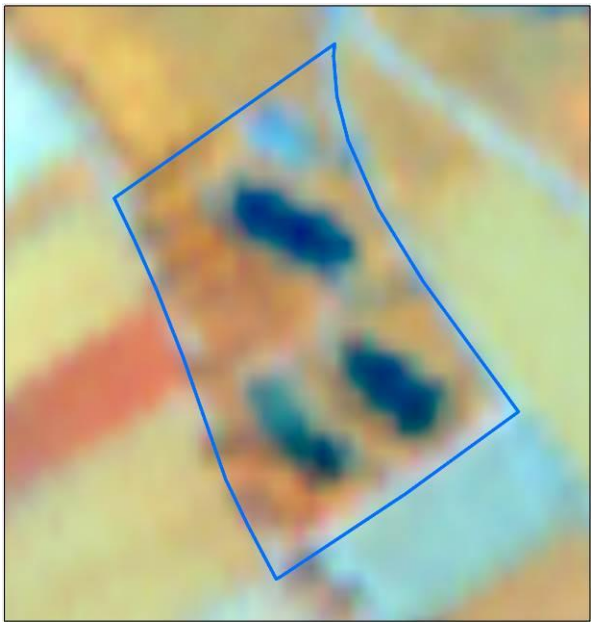
RapidEye

LB_AKT	LN_AKT	VEG_AKT	SIE_AKT	Comment
B311	N112	75	25	Residential area in wooded surroundings

Another example is the fish ponds in Example 3. The decision on the land cover class falls into a two-stage principle. First, the proportion of vegetation and the degree of sealing is determined. In this example, vegetation outweighs 70 percent. Next, it is checked which type of vegetation predominates (grassland or deciduous tree). In this case, the covering of deciduous trees outweighs.

Example 3: Fish farming

DOP



RapidEye

LB_AKT	LN_AKT	VEG_AKT	SIE_AKT	Comment
B311	N120	70	5	Fish farm with tree-lined banks

Cemeteries are predominantly defined as a mixed area (B242). In the example 4 shown, however, it is not a typical mixture class, as the deciduous trees account for 70 percent of the object. Consequently, the coverage in this case is decided by majority vote.

Example 4: Cemetery

DOP

RapidEye

LB_AKT	LN_AKT	VEG_AKT	SIE_AKT	Comment
B311	N141	70	15	Cemetery with copious trees