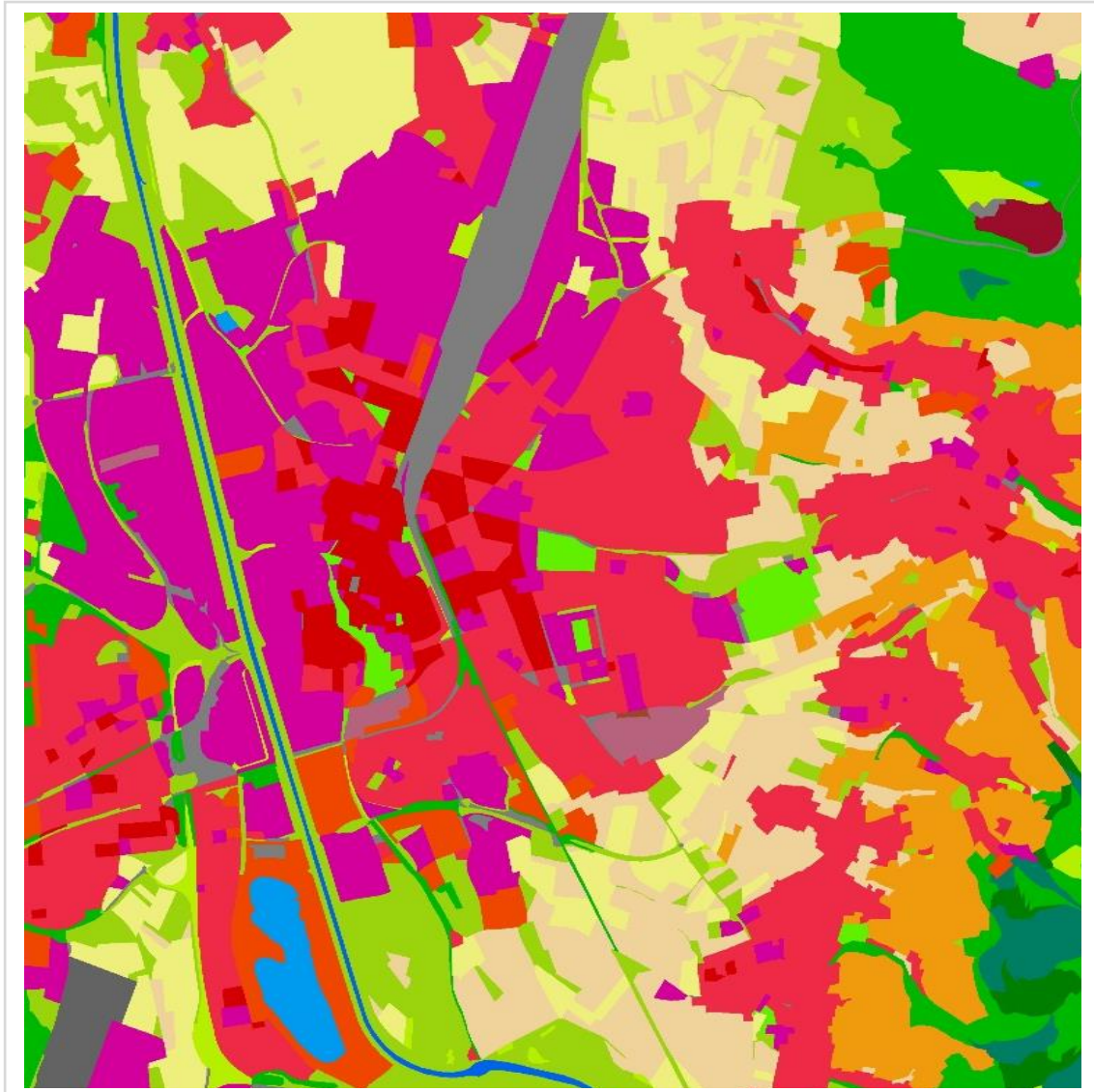




Documentation

Digital land cover model for Germany

LBM-DE2018



Product as of 2020

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1 Overview of the dataset

Product:	Land cover model for Germany, Status 2020 (LBM-DE2018)
Content:	Description of land cover and land use in shape of geometrical objects (vector data)
Area:	Federal Republic of Germany
Spatial structure:	<ul style="list-style-type: none"> • Bundesland (Land/state of the Federal Republic of Germany) • any possible spatial formation of extract is possible
Spatial reference:	<ul style="list-style-type: none"> • 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 2018
Data formats:	Shapefile
Provision*:	<ul style="list-style-type: none"> • Online service via WMS • Record via download or data carrier
Historical Data:	LBM-DE 2009, 2012 and 2015 available as individual products
Data volume:	Appr. 8.9 GB
Source:	<ul style="list-style-type: none"> • polygon features of ATKIS Basic-DLM, • LBM-DE2015, • Satellite imagery of sensors RapidEye, Sentinel2 (ESA), • 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-DE2018) 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 latest version of the LBM-DE2018 was subjected to a DIN-based quality control at the German Federal Agency for Cartography and Geodesy BKG using random sample tests

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.

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. The last one forms the basis for LBM-DE 2018.

For the latest update (reference year 2018) the vector data from ATKIS Basic-DLM (status 2017) was used as thematic source and satellite imagery from 2017 and 2018 was used as raster data source. Land cover (LB) and land use (LN) from LBM-DE2015 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 1 for a description of the single land cover (LB) classes and the land use (LN) classes and Appendix 2 for a list of CLC-classes with a coloured legend.

2.2.1 ATKIS Basic-DLM vector data

To update LBM-DE2018 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 third quarter of 2017 was used and prepared for updates, so a unified data source could be created.

For the adjustment to version 2 the ATKIS Basic-DLM from the second quarter of 2019 was used.

2.2.2 Imagery

To update the LBM-DE2018 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 2017 and some additional from 2018. In particular image data from the RapidEye and Sentinel 2 systems was used. Table 1 shows the details of the ground pixel resolution and the spectral bands of the sensors. For the update of the LBM-DE2018, additional Sentinel 2 image data and also digital orthophotos of the national survey from the reference year 2018 were evaluated.

<i>Sensor Name</i>	<i>Ground sampling distance in m</i>	<i>Spectral bands</i>	<i>wavelengths in nm</i>	
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	
			<i>Average wavelength (nm)</i>	<i>range (nm)</i>
Sentinel-2	60	1 Aerosols	443	20
	10	2 Blue	490	65
	10	3 Green	560	35
	10	4 Red	665	30
	20	5 Red Edge	705	15
	20	6 Red Edge	740	15
	20	7 Red Edge	783	20
	10	8 NIR	842	115
	20	8b Red Edge	865	20
	60	9 water vapour	945	20
	60	10 SWIR (Cirrus)	1375	30
	20	11 SWIR	1610	90
20	12 SWIR	2190	180	

Table 1: List of used satellite imagery 2018

2.2.3 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 2.

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 3)
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 XX1xxxxxxxxxxxx
CLC18	CLC-Code (derived from LB_AKT/ LN_AKT/ SIE_AKT/ VEG_AKT → see Appendix 3)

Table 2: Attributes of LBM-DE2018 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 3). For all objects the amount of vegetation and sealing was determined by image classification and assigned to the attributes VEG_AKT and SIE_AKT.

Attribute value	meaning
31	LB and / or LN updated automatically based on Basic-DLM
32	ZUS_AKT amended with “S” for solar-use (based on Basic-DLM)
33	Objects cut by METHOD_AKT IN (31, 32) angeschnitten wurden.
34	Interactive update based on imagery (Sentinel-2, RapidEye, DOP)

Table 3: Values and meaning of attribute METHOD_AKT

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. On the basis of these additional attributes, an adjustment of the LB / LN classes was performed (see Appendix 4). For

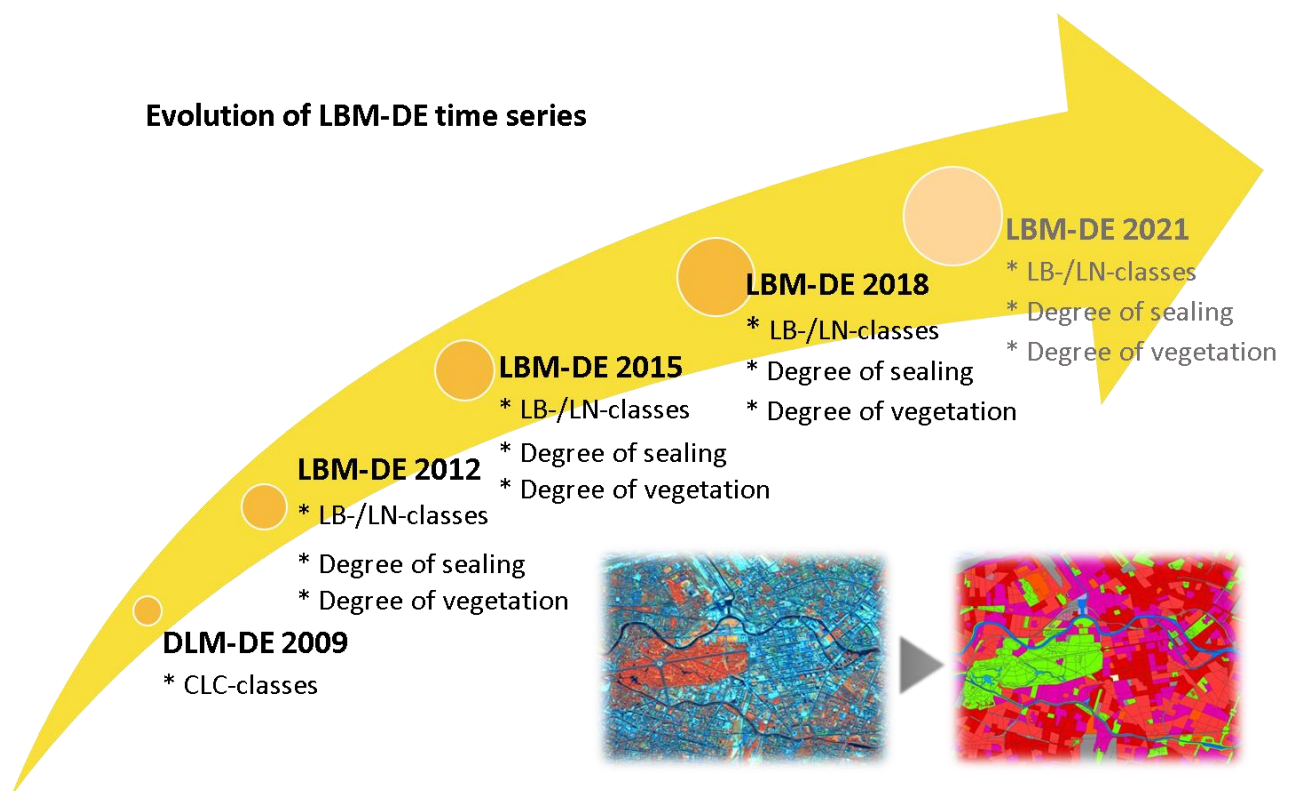


Figure 1: Evolution of LBM-DE time series

example, the previously existing building class B113 was transferred to the building class B110 with a vegetation proportion of over 50%.

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 5). 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 4), 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
Forest	B311, B312, B313
Settlement	N112, N121
Green urban areas	N141, B31x, B231

Table 4: List with themes that have to be treated carefully when doing change analyses

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

With the continuation of the LBM-DE2018 there were no further conceptual changes.

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. The 2018 notes were thematically related mainly to the objects from the agricultural sector, primarily arable land and grassland. Together with the correction of these hints, adjacent objects were also visually checked if necessary.

Furthermore, a basic update of the classes B423 and B523 was made based on suitable Sentinel 2 data.

Similarly, a visual review and adjustments of all B233-objects higher than 1000 m and not in immediate neighbourhood of settlement objects was carried out to ensure an improved coverage of alpine meadows in terms of the CLC nomenclature.

The integration of the ATKIS Basic-DLM results in notes from objects where a clear assignment of the land cover is not possible. This includes e.g. the feature types "AX_Platz" or "AX_Schiffsverkehr". These hints were also visually checked and interactively edited.

In addition, automated geometry adjustment was made for the entire data set to resolve very narrow object parts. However, road objects (B122, N122) are excluded from this.

The content of the attribute ZUS_AKT was automatically extended by the value "O" for location on the basis of the ATKIS Basic-DLM. 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

The data are protected by copyright. They are only provided against a fee. The provisions of the Directive on Fees for the Provision and Use of Geographic Reference Data of the Surveying Authorities of the Laender of the Federal Republic of Germany (AdV Fee Directive - AdV-GR) shall apply. For the acquisition of rights of use, please contact the Central Office for Geotopography of the AdV / Service Center.

Federal Agencies and other holder of rights of use according to § 3 V GeoBund received the data free of charge.

The source has to be referenced. In particular, each user must place the source note to all geodata, metadata and geodata services recognizable and in an optical context. Changes, adaptations, new designs or other modifications must be accompanied by a change notice in the source note.

The source note and change notice are to be designed as follows. When displayed on a website, the source note must be linked to the URL "<http://www.bkg.bund.de>".

© GeoBasis-DE / BKG (year of last data acquisition)

© GeoBasis-DE / BKG (year of last data acquisition) (data changed)

5 Contact

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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


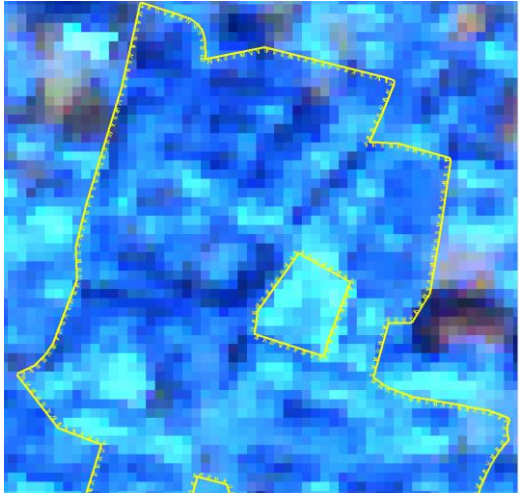

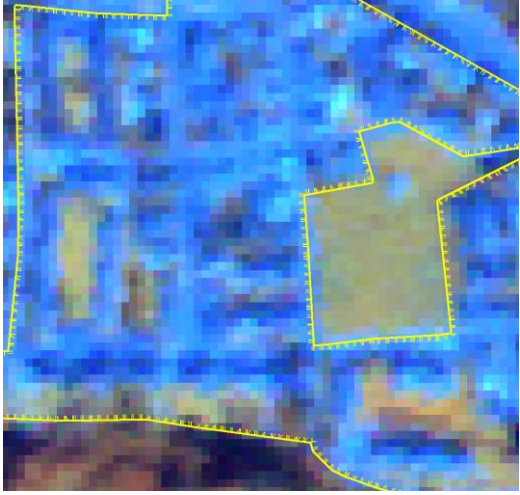
In nearly every case the decision to which class an object should be assigned to is made according to the majority principle: If an object cannot be split because of the minimum mapping unit, the majority of the included LBs determines the object's classification.


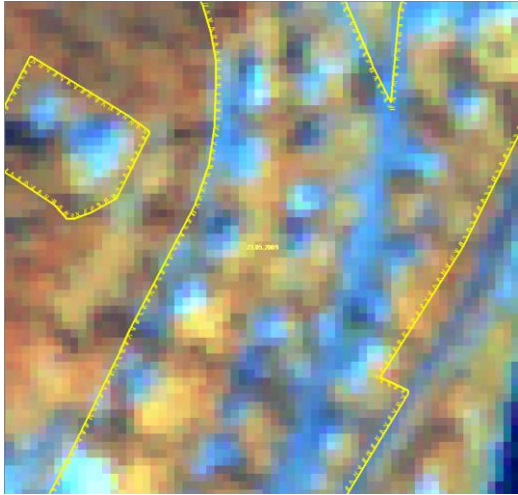

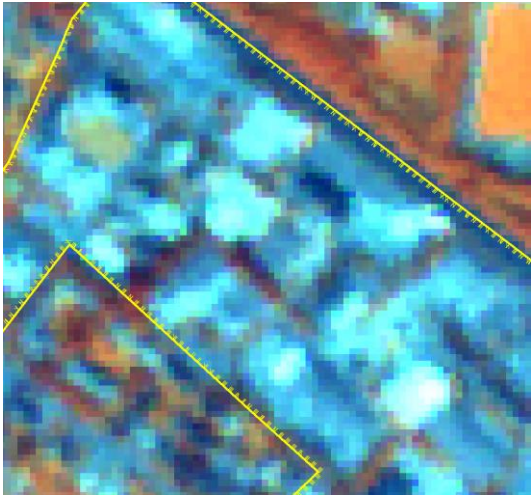
By contrast, mixed areas (B110, B121, B233, B242, B313, B413 and B414) are classified according to their structure and the regular distribution of the individual components. If any individual components that are greater than 1 hectare are found in a potential mixed area, they will still have to be assigned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

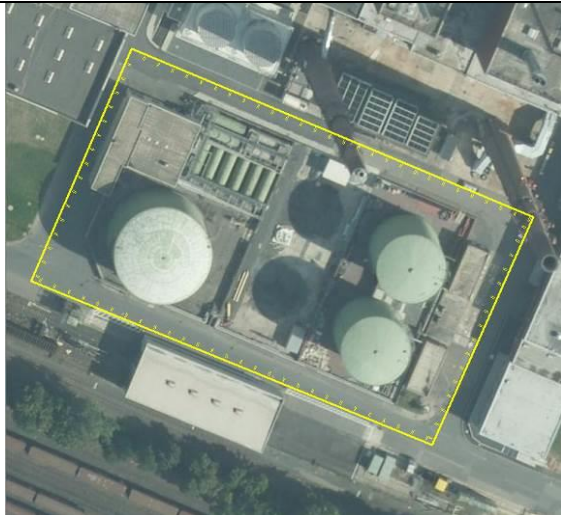
A	Houses	B110
<p>Areas with building structures and a road or traffic network.</p>		
 <p data-bbox="352 1346 651 1379">DOP 29.07.2009 + B110</p>	 <p data-bbox="927 1346 1289 1379">RapidEye 29.07.2009 + B110</p>	
 <p data-bbox="352 1928 651 1962">DOP 29.07.2009 + B110</p>	 <p data-bbox="927 1928 1289 1962">RapidEye 29.07.2009 + B110</p>	

			
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	

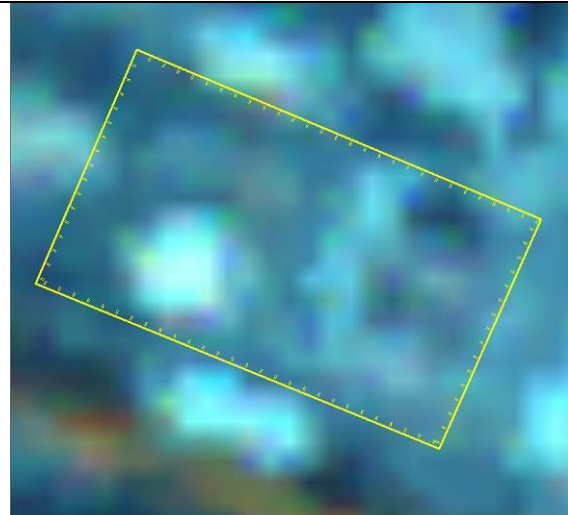
B121: Facilities

A	Facilities	B121
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Areas with utilities or special constructions that are used to produce or distribute electricity, heat or water (including sewage works).



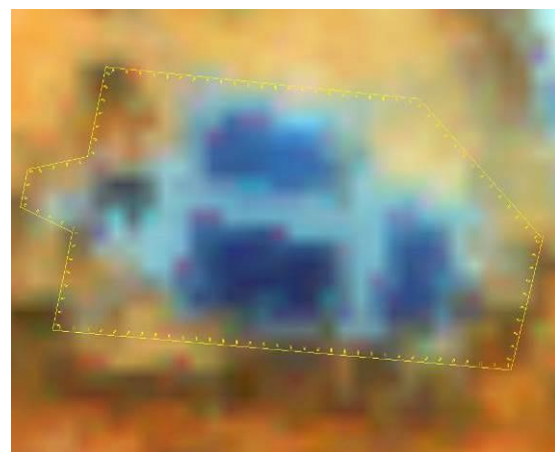
DOP 19.08.2012 + B121



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

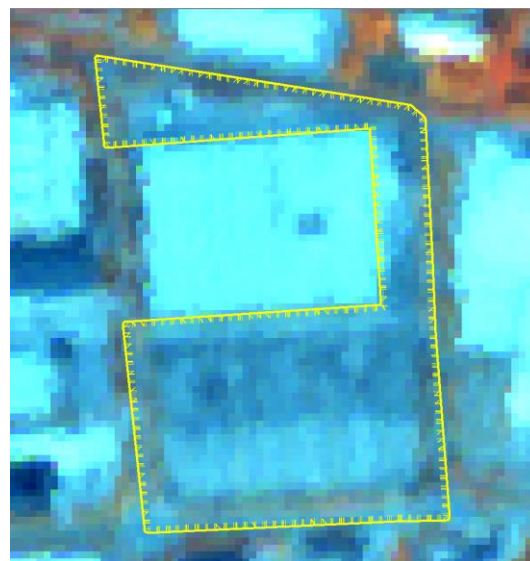
B122: Sealed areas without buildings

A	Sealed areas without buildings	B122
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Areas that have a sealed surface with asphalt, concrete, cobblestones or similar.



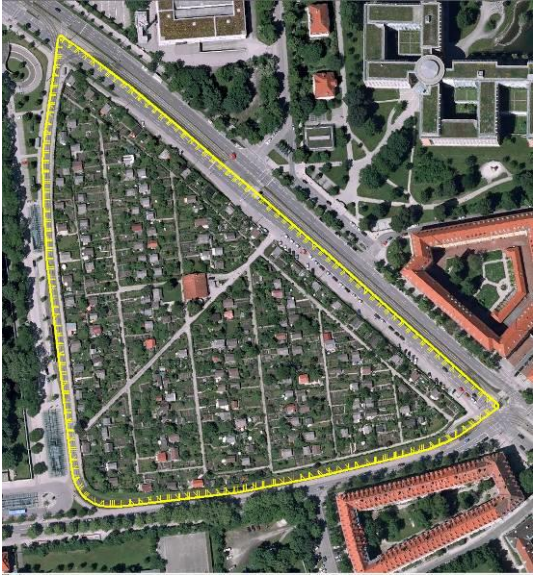
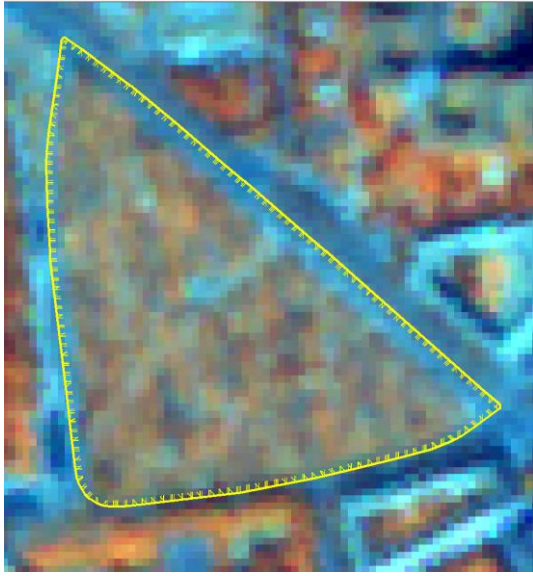
DOP 23.05.2009 + **B122**



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
<p>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</p>			
 <p>OP 23.05.2009 + B242</p>		 <p>RapidEye 27.07.2009 + B242</p>	
LB	LN	Comment	
B242	N112	Housing development	
	N142	Allotment gardens, non-urban cemeteries, camping sites	
	N141	Urban cemeteries, zoos	

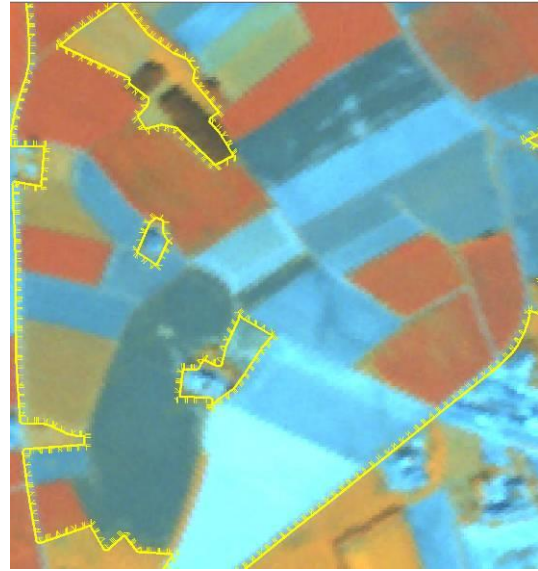
B211: Arable land

B	Arable land	B211
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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

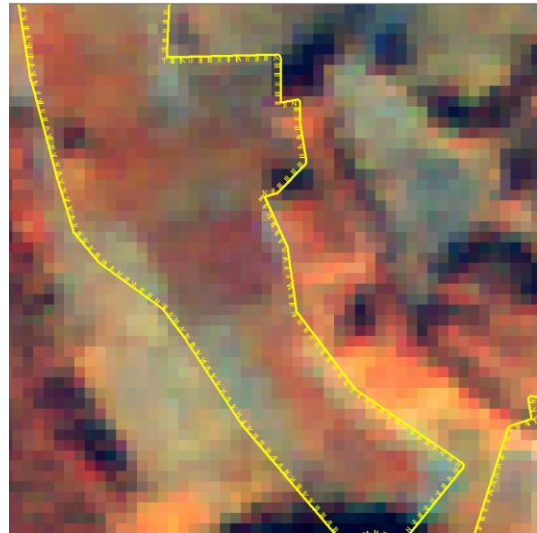
B221: Winegrowing

B	Winegrowing	B221
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Areas with grapevines.



DOP 07.05.2011 + B221


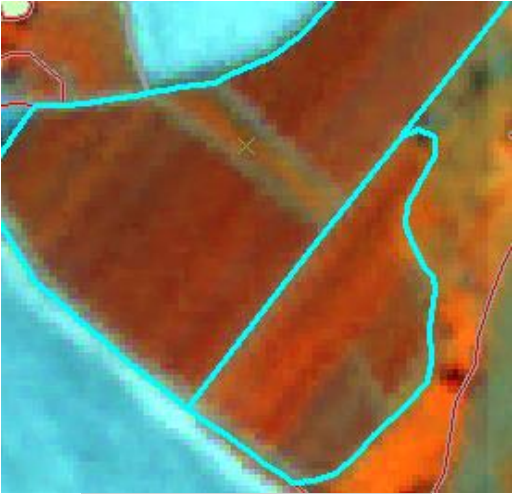


RapidEye 27.09.2009 + B221


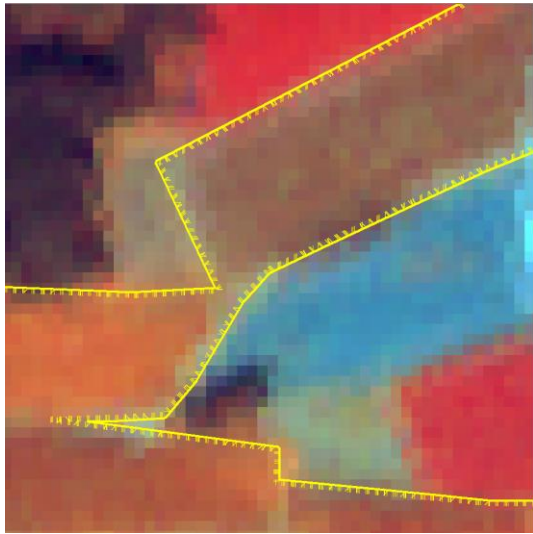
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LB	LN	Comment
B221	N211	Vineyard
	N214	Abandoned vineyard

B222: Orchards and soft fruit populations

B		Orchards and soft fruit populations	B222
<p>Parcels with fruit trees and fruit bushes, where one or more different types of fruit are grown. They have a plantation structure.</p>			
			
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.			
 <p>DOP 10.07.2009 + B224</p>		 <p>RapidEye 27.07.2009 + B224</p>	
LB	LN	Comment	
B224	N211	Hop fields	

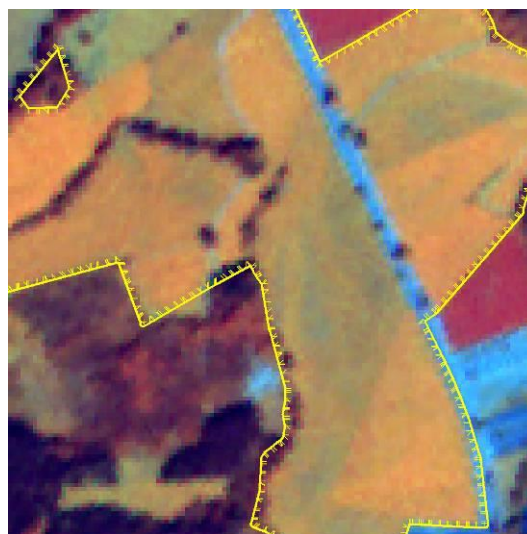
B231: Homogeneous grassland

C	Homogeneous grassland	B231
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Greenfield sites with wide areas of grass which is mown regularly or used as pasture




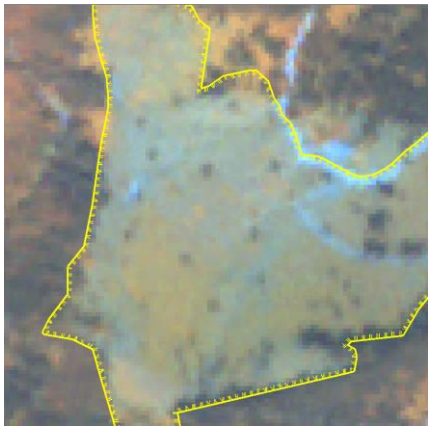

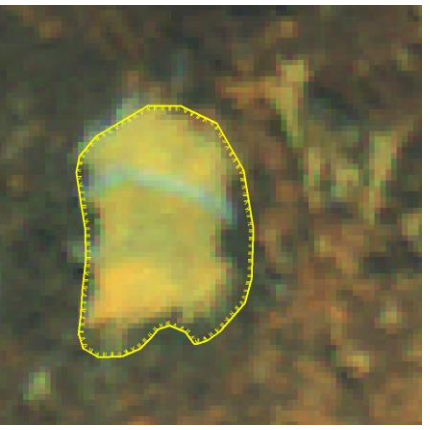
DOP 29.07.2009 + B231



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
<p>Greenfields that are mown or worked on not more than once a year. Irregular pattern, often interrupted with small bushes, shrubs or other plants.</p>		
		<p>DOP 23.07.2009 + B321</p> <p>RapidEye 23.07.2009 + B321</p>
		<p>DOP 01.09.2009 + B321</p> <p>RapidEye 27.07.2009 + B321</p>

LB	LN	Comment
B321	N131	Ancillary 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.	

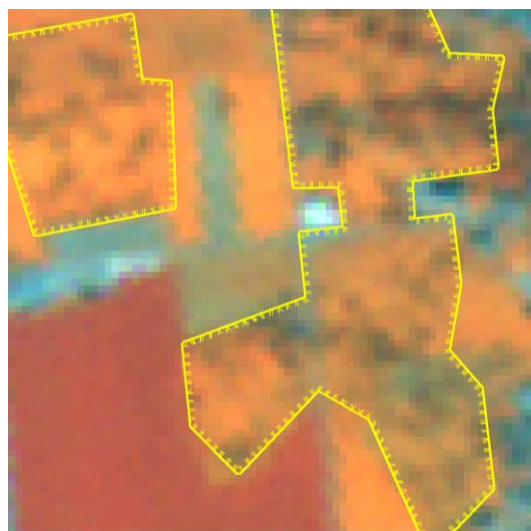
B233: Grassland with trees (< 50%)

C	Grassland with trees (< 50%)	B233
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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
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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



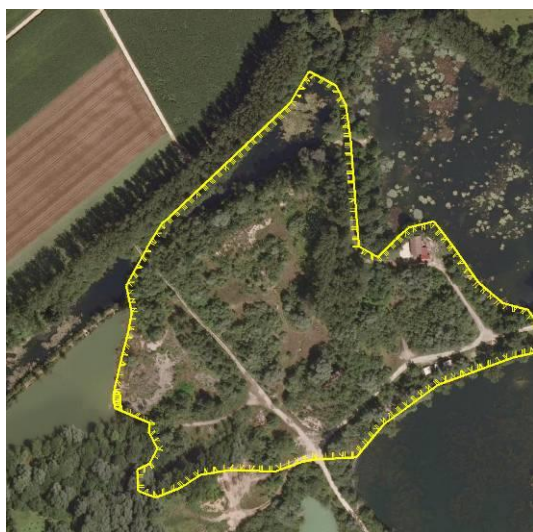
RapidEye 27.07.2009 + B322

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

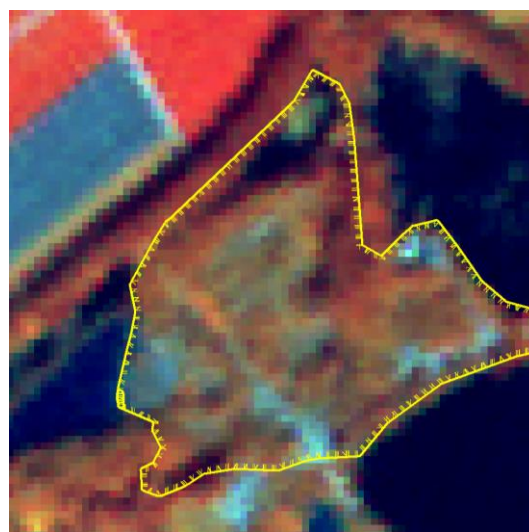
B324: Bushes, shrubs

D	Bushes, shrubs	B324
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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).




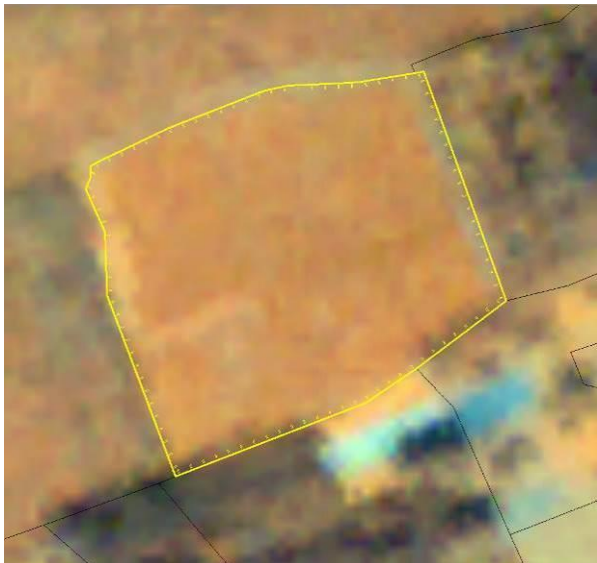
DOP 29.07.2009 + B324



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: Reforestation, young trees

D		Reforestation, young trees	B310
<p>Areas in forests with trees that are 5 meters high, or shorter (they developed either because of reforestation or by natural regeneration).</p>			
 <p>DOP 18.08.2012 + B310</p>		 <p>RapidEye 2012 + B324</p>	
LB	LN	Comment	
B310	N211	Tree nursery	
	N311	Reforestation or natural regeneration with growing trees (up to 5 meters)	

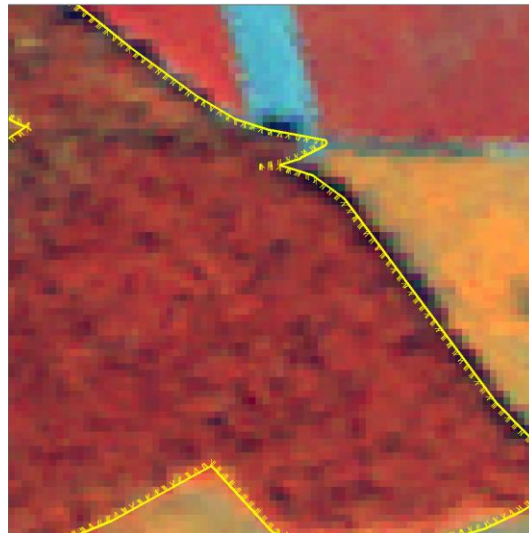
B311: Deciduous trees

D	Deciduous trees	B311
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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)	

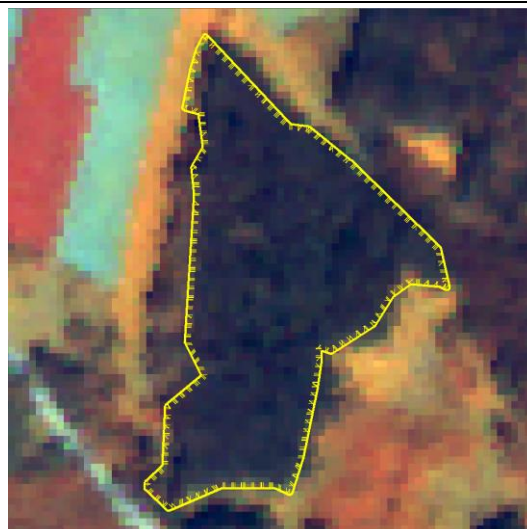
B312: Coniferous trees

D	Coniferous trees	B312
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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)

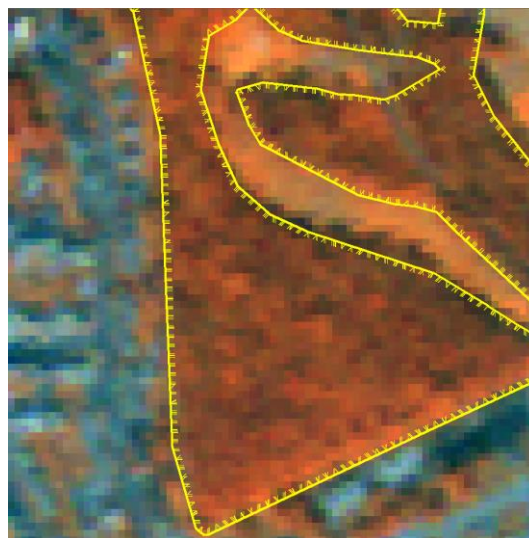
B313: Deciduous and coniferous trees

D	Deciduous and coniferous trees	B313
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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.





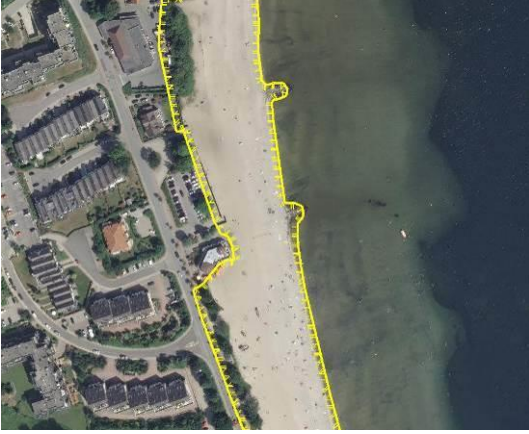



DOP 06.05.2011 + B313



RapidEye 23.08.2009 + B313

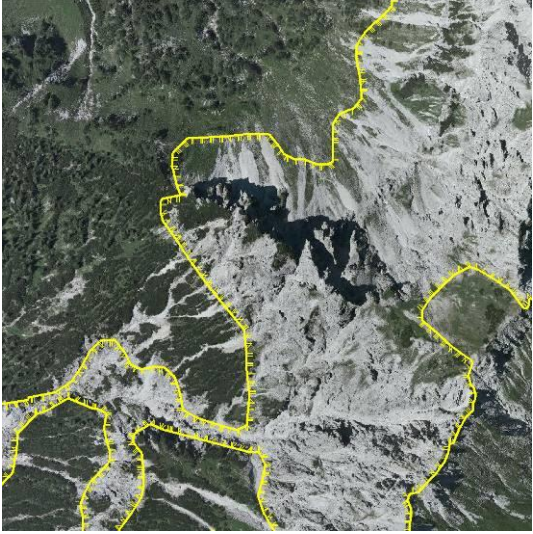
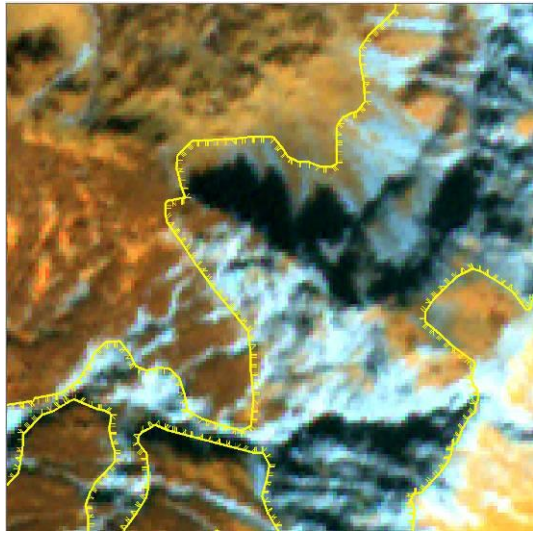
LB	LN	Comment
B313	N112	Buildings under trees at the edge of the village
	N120	(Peripheral) woodland in industrial estates
	N121	(Peripheral) woodland at administrative or public areas
	N123	(Peripheral) woodland at harbours and ports
	N131	(Peripheral) woodland at mines (disused)
	N132	(Peripheral) 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

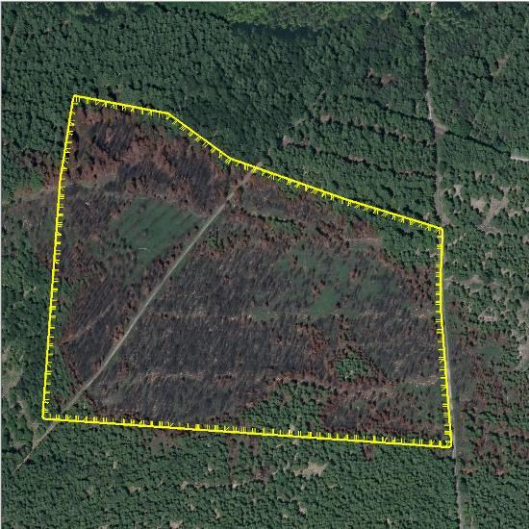
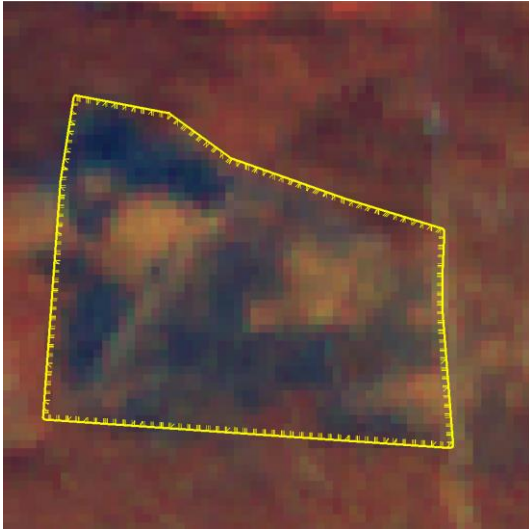
E	Sand, stones, soil	B330
<p>Areas that are not sealed and do not have a lot of vegetation, but have loose rocks, soil and/or sand as a surface. They can be artificially created, like dumps and storage areas, brownfield sites and construction sites, or naturally created, for example dry, steppe-like areas, alpine tundra and erosional areas.</p>		
		
<p>DOP 24.05.2009 + B330</p>	<p>RapidEye 24.05.2009 + B330</p>	
		
<p>DOP 20.07.2010 + B330</p>	<p>RapidEye 03.07.2009 + B330</p>	
		
<p>DOP 25.05.2011 + B330</p>	<p>RapidEye 19.08.2009 + B330</p>	

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)


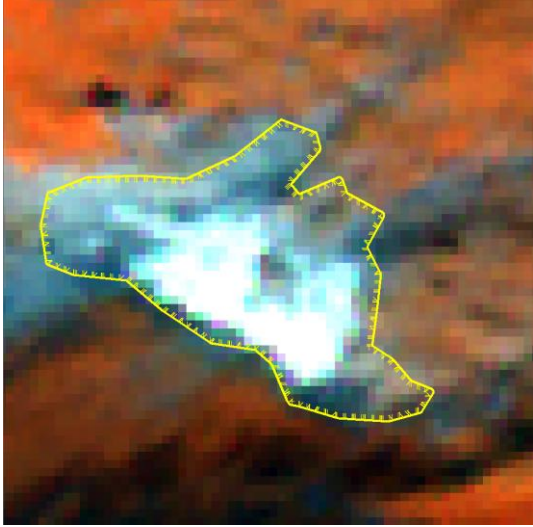
B332: Rock

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	


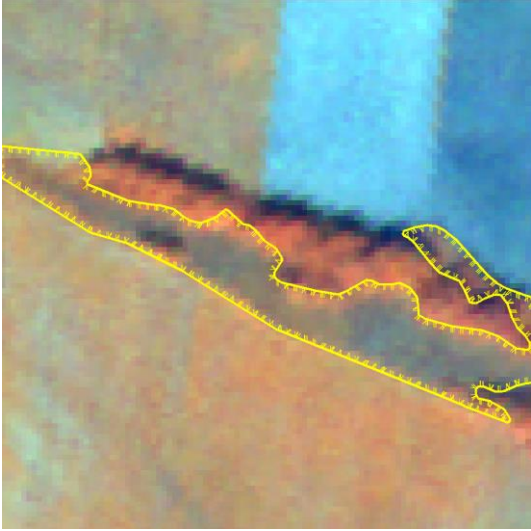
B334: Burnt areas

E	Burnt areas		B334
<p>Areas that were recently exposed to fire and signs of scorching are visible on the vast majority of the objects.</p>			
 <p style="text-align: center;">DOP 23.05.2009 + B334</p>		 <p style="text-align: center;">RapidEye 27.07.2009 + B334</p>	
LB	LN	Comment	
B334	...	Use that existed before the fire spread remains	

B335: Snow (permanent) and ice

E	Snow (permanent) and ice		B335
<p>Areas that are covered by glaciers and permanent snow.</p>			
 <p data-bbox="347 1144 647 1178">DOP 29.07.2009 + B335</p>		 <p data-bbox="938 1144 1294 1178">RapidEye 31.08.2009 + B335</p>	
LB	LN	Comment	
B335	N999	Glaciers and permanent snow	

B411: Swamp

F		Swamp	B411
<p>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.</p>			
 <p>DOP 01.04.2009 + B411</p>		 <p>RapidEye 09.09.2009 + B411</p>	
LB	LN	Comment	
B411	N999	Swamp	

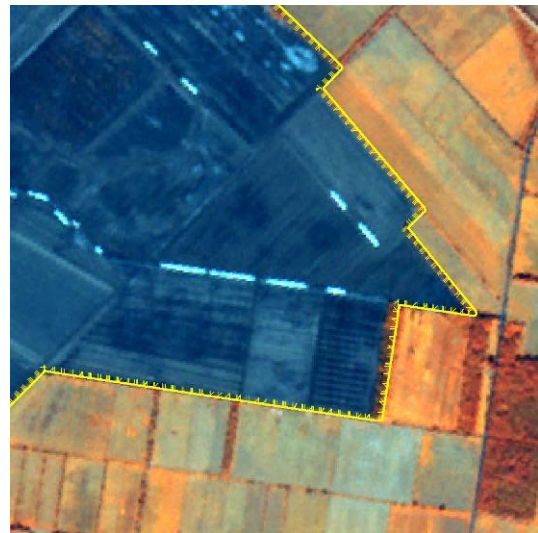
B412: Bog

F	Bog	B412
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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

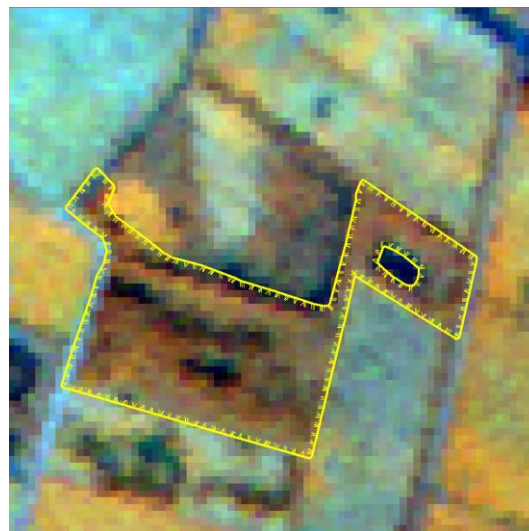
B413: Swamp with bushes/trees

F	Swamp with bushes/trees	B413
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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

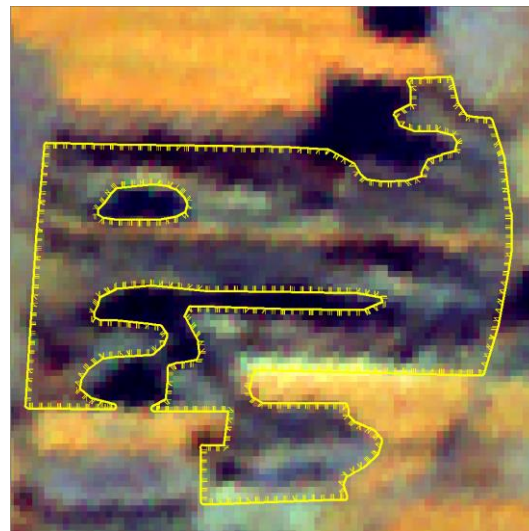
B414: Bog with bushes/trees

F	Bog with bushes/trees	B414
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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




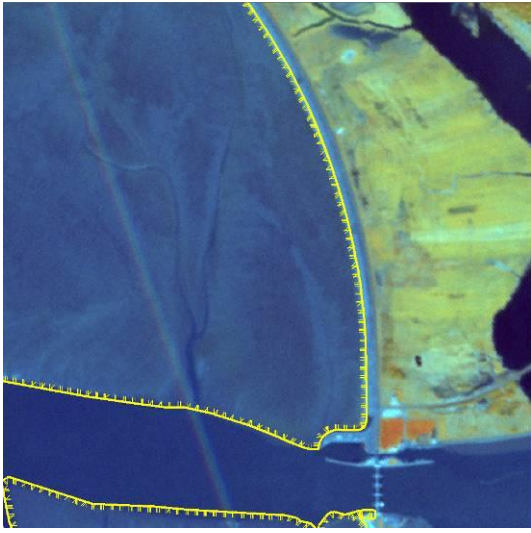
DOP 06.05.2008 + B414



RapidEye 15.10.2009 + B414

LB	LN	Comment
B414	N999	Bog with bushes/trees

B423: Mud flat

G		Mud flat	B423
<p>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.</p>			
			
DOP 09.05.2008 + B423		RapidEye 22.05.2010 + B423	
LB	LN	Comment	
B423	N999	Mud flat	

B511: Watercourse

G	Watercourse	B511
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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	Watercourses without any use

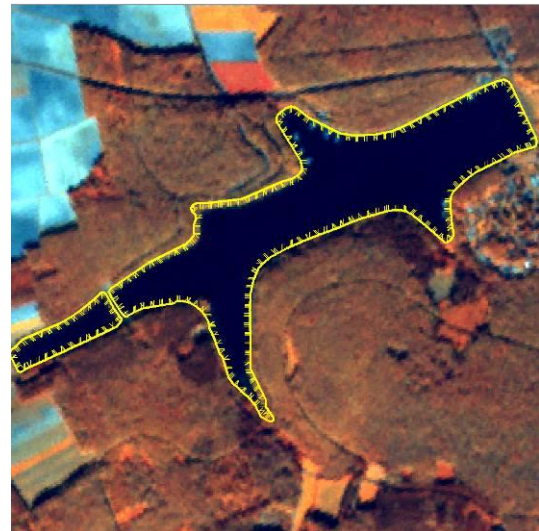
B512: Waterbodies

G	Waterbodies	B512
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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
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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
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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
<p>The open sea up to the mean low tide level.</p>			
			
<p>DOP xx.xx.20xx + B523</p>		<p>RapidEye xx.xx.2009 + B523</p>	
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

N112	Housing			
Additional information	Housing is the main use of this area.			
Possible LB / LN combinations	LN	LB	Bemerkung	SIE_AKT/ VEG_AKT
	N112	B110	Houses	SIE_AKT > VEG_AKT & SIE_AKT >= 35
		B122	Pedestrian zones	> 50
		B23x, B31x	A few built objects with predominant vegetation	SIE_AKT < VEG_AKT & VEG_AKT >= 35
		B330	A few built objects with predominant gravel or other unsealed surfaces	SIE_AKT & VEG_AKT <= 30
B242		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).	> 20 & < 40	
Prerequisite	SIE_AKT > 0 At least one house that is not smaller than 50 square meters			
Special cases	Pedestrian zones belong to N112			

N122	Road and railway traffic																	
Additional information	<p>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:</p> <ul style="list-style-type: none"> • 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 <p>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.</p>																	
Possible LB /LN combinations	<table border="1"> <thead> <tr> <th data-bbox="600 842 730 887">LN</th> <th data-bbox="734 842 944 887">LB</th> <th data-bbox="948 842 1401 887">Bemerkung</th> </tr> </thead> <tbody> <tr> <td data-bbox="600 891 730 925"></td> <td data-bbox="734 891 944 925">B122</td> <td data-bbox="948 891 1401 925">Motorways, car parks</td> </tr> <tr> <td data-bbox="600 929 730 963"></td> <td data-bbox="734 929 944 963">B3xx, B23x</td> <td data-bbox="948 929 1401 963">"Shamrock“</td> </tr> <tr> <td data-bbox="600 967 730 1034">N122</td> <td data-bbox="734 967 944 1034">B110</td> <td data-bbox="948 967 1401 1034">Service stations, train stations with peripheral buildings</td> </tr> <tr> <td data-bbox="600 1039 730 1077"></td> <td data-bbox="734 1039 944 1077">B330</td> <td data-bbox="948 1039 1401 1077">Railways</td> </tr> </tbody> </table>			LN	LB	Bemerkung		B122	Motorways, car parks		B3xx, B23x	"Shamrock“	N122	B110	Service stations, train stations with peripheral buildings		B330	Railways
LN	LB	Bemerkung																
	B122	Motorways, car parks																
	B3xx, B23x	"Shamrock“																
N122	B110	Service stations, train stations with peripheral buildings																
	B330	Railways																
Invalid combinations with N122	<table border="1"> <thead> <tr> <th data-bbox="600 1093 730 1137">LB</th> <th data-bbox="734 1093 1078 1137">Bemerkung</th> <th data-bbox="1082 1093 1273 1137">LN_AKT</th> </tr> </thead> <tbody> <tr> <td data-bbox="600 1142 730 1176">B211</td> <td data-bbox="734 1142 1078 1176">Agricultural areas</td> <td data-bbox="1082 1142 1273 1176">N211</td> </tr> <tr> <td data-bbox="600 1180 730 1214">B22x</td> <td data-bbox="734 1180 1078 1214">Agricultural areas</td> <td data-bbox="1082 1180 1273 1214">N211</td> </tr> <tr> <td data-bbox="600 1218 730 1285">B242</td> <td data-bbox="734 1218 1078 1285">Regular structures</td> <td data-bbox="1082 1218 1273 1285">N142 / N112</td> </tr> </tbody> </table>			LB	Bemerkung	LN_AKT	B211	Agricultural areas	N211	B22x	Agricultural areas	N211	B242	Regular structures	N142 / N112			
LB	Bemerkung	LN_AKT																
B211	Agricultural areas	N211																
B22x	Agricultural areas	N211																
B242	Regular structures	N142 / N112																
Special cases	<p>A car park</p> <ul style="list-style-type: none"> • 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. <p>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.</p>																	

N124	Air services												
Additional information	„Functional classification“ including every associated area like access routes, security areas, ...												
Possible LB / LN combinations	<table border="1"> <thead> <tr> <th>LN</th> <th>LB</th> <th>Bemerkung</th> </tr> </thead> <tbody> <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> </tbody> </table>	LN	LB	Bemerkung	N124	B122	Runways, car parks	B3xx, B23x	Grasslands, green areas	B110	Buildings	B121	Special infrastructure
LN	LB	Bemerkung											
N124	B122	Runways, car parks											
	B3xx, B23x	Grasslands, green areas											
	B110	Buildings											
	B121	Special infrastructure											
Invalid combinations with N124	<table border="1"> <thead> <tr> <th>LB</th> <th>Bemerkung</th> <th>LN_AKT</th> </tr> </thead> <tbody> <tr> <td>B211</td> <td>Agricultural areas</td> <td>N211</td> </tr> <tr> <td>B22x</td> <td>Agricultural areas</td> <td>N211</td> </tr> </tbody> </table>	LB	Bemerkung	LN_AKT	B211	Agricultural areas	N211	B22x	Agricultural areas	N211			
LB	Bemerkung	LN_AKT											
B211	Agricultural areas	N211											
B22x	Agricultural areas	N211											
Special cases	<ul style="list-style-type: none"> • Military use → N124 → ZUS_AKT = M, • Unsurfaced runways without any military use (for example gliding, sports) → N142 												

N141	Urban green area															
Additional information	<ul style="list-style-type: none"> • 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 															
Possible LB / LN combinations	<table border="1"> <thead> <tr> <th>LN</th> <th>LB</th> <th>Bemerkung</th> </tr> </thead> <tbody> <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> </tbody> </table>	LN	LB	Bemerkung	N141	B242	Cemeteries	B3xx, B23x	Parks, lawns for dog walking							
LN	LB	Bemerkung														
N141	B242	Cemeteries														
	B3xx, B23x	Parks, lawns for dog walking														
Prerequisite	VEG_AKT > 50															
Invalid combinations with N141	<table border="1"> <thead> <tr> <th>LB</th> <th>Bemerkung</th> <th>LN_AKT</th> </tr> </thead> <tbody> <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> </tbody> </table>	LB	Bemerkung	LN_AKT	B110	Housing, industry	N112/N12x	B122	Sealed areas		B22x	Agricultural areas	N211	B211	Agricultural areas	N211
LB	Bemerkung	LN_AKT														
B110	Housing, industry	N112/N12x														
B122	Sealed areas															
B22x	Agricultural areas	N211														
B211	Agricultural areas	N211														
Special cases	<p>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.</p> <p><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</p>															

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

N133	Under construction												
Additional information	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).												
Possible LB / LN connections	<table border="1"> <thead> <tr> <th>LN</th> <th>LB</th> <th>Bemerkung</th> </tr> </thead> <tbody> <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> </tbody> </table>	LN	LB	Bemerkung	N133	B330	Work in progress	B3xx, B23x	With new existing network of paths	B110	No identifiable use	B121	No identifiable use
LN	LB	Bemerkung											
N133	B330	Work in progress											
	B3xx, B23x	With new existing network of paths											
	B110	No identifiable use											
	B121	No identifiable use											
Prerequisite	VEG_AKT < 100												
Special cases	The ongoing process (construction) is important. That means if there are still unused parcels between already constructed roads, they are also classified as N133.												

N999	Not relevant									
Additional information	Areas without identifiable or relevant use.									
Possible LB / LN combinations	<table border="1"> <thead> <tr> <th>LN</th> <th>LB</th> <th>Bemerkung</th> </tr> </thead> <tbody> <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> </tbody> </table>	LN	LB	Bemerkung	N999	B3xx, B23x	Grass verges at waysides, rivers, ... (> 15 m)	B31x	Forests in national parks and small woodland areas without any connection to bigger contiguous areas of woodland.	
LN	LB	Bemerkung								
N999	B3xx, B23x	Grass verges at waysides, rivers, ... (> 15 m)								
	B31x	Forests in national parks and small woodland areas without any connection to bigger contiguous areas of woodland.								
Invalid combinations with N999	<table border="1"> <thead> <tr> <th>LB</th> <th>Bemerkung</th> <th>LN_AKT</th> </tr> </thead> <tbody> <tr> <td>B211</td> <td>Agricultural areas</td> <td>N211</td> </tr> <tr> <td>B22x</td> <td>Agricultural areas</td> <td>N211</td> </tr> </tbody> </table>	LB	Bemerkung	LN_AKT	B211	Agricultural areas	N211	B22x	Agricultural areas	N211
LB	Bemerkung	LN_AKT								
B211	Agricultural areas	N211								
B22x	Agricultural areas	N211								

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. <i>Permanently irrigated land</i>
2.1.3. <i>Rice fields</i>			
2.2. Permanent crops		2.2.1. Vineyards	
		2.2.2. Fruit trees and berry plantations	
		2.2.3. <i>Olive groves</i>	
2.3. Pastures		2.3.1. Pastures	
2.4. Heterogeneous agricultural areas		2.4.1. <i>Annual crops associated with permanent crops</i>	
		2.4.2. Complex cultivation pattern	
		2.4.3. Land principally occupied by agriculture, with significant areas of natural vegetation	
		2.4.4. <i>Agro-forestry areas</i>	
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. <i>Sclerophyllous vegetation</i>	
		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. <i>Salines</i>	
		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	Production	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 construction	not relevant		
				N017	N120	N121	N123	N131	N132	N122	N124	N142	N141	N510	N211	N214	N311	N133	N999		
A	Houses	B110	> 70	111														111			
			15-70	112														112			
	Facilities	B121			121	121	123	131	132	122	124	142			211				121	121	
	Sealed areas without buildings	B122		111															133	122	
Mixed areas (regular structure)	B242	0-15	142													231					
		15-51	112					131	132												142
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								142	141		231	231			133		
			0-15	142										421						231	
	Inhomogeneous grassland	B321			121	121	123	131	132	122	124										
Grassland with trees (< 50%)	B233	15-51	112									142	141		231	222			324		
		0-15	142																		
D	Dwarf shrubs (heath)	B322								122								322		322	
	Bushes, shrubs	B324	15-51	112	121	121	123	131	132	122	124	142	141					324		324	
			0-15	142																	324
	Reafforestation, young trees	B310													211						
	Deciduous trees	B311	15-51	112														311		311	
			0-15	142																	312
	Coniferous trees	B312	15-51	112	121	121	123	131	132	122	124	142	141		312						312
Laub- und Nadelbäume/Deciduous and coniferous trees	B313	0-15	142											211			313			313	
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	132			512		512						512	
	Lagoon	B521					521													521	
	Estuary	B522					522							522						522	
	Open sea	B523					523													523	

Digital land cover model for Germany
LBM-DE2018

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					311
B312					312
B313	N121	<= 5	>= 95	M	313
B324					324
B322					322
B310	N121	<= 5	>= 95	M	324
Bxxx	N112	<15		O	112

Appendix 4 Table for adaption of changes in class definitions 2012 → 2015

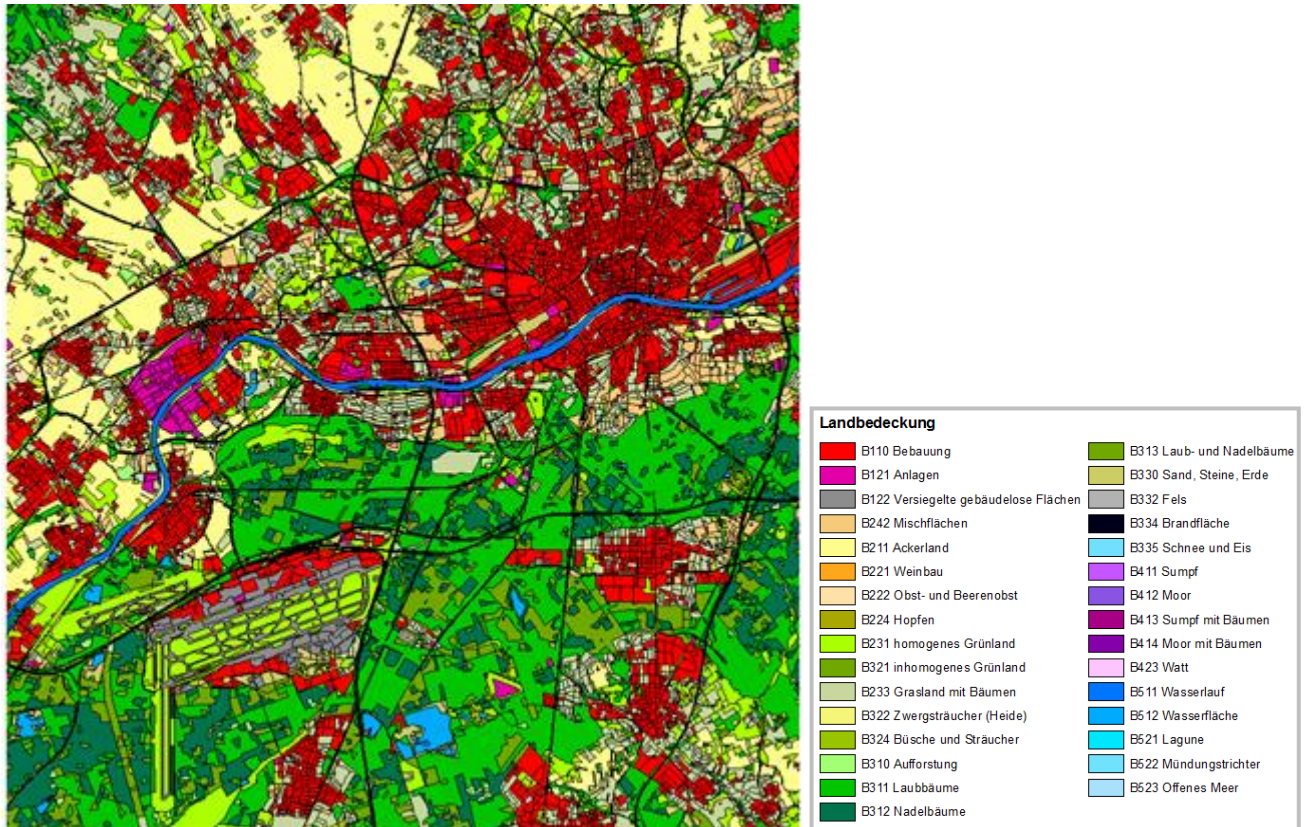
LB-2012	LN-2012		LB-2015	LN-2015	SIE	VEG	Erläuterung
B111	Nxxx		B110	Nxxx	90	10	
B112	Nxxx		B110	Nxxx	65	35	
B113	Nxxx	< 2,5 ha	B233	Nxxx	40	55	
		> 2,5 ha	B242	Nxxx	30	35	
B122	N112		B122	N112	75	5	Fußgängerzone
B133	N112		B330	N112	40	5	Baustelle & ATKIS (AX_Wohnbaufläche)
B2xx	N112		B2xx	N112	10	75	
B3xx	N112		B3xx	N112	10	75	
B122	N142		B122	N142	75	15	Rennstrecke
B122	Nxxx		B122	Nxxx	85	10	Parkplatz z.B. bei Hafen (<=> N122) sonstige Straße, Parkplatz
B121	Nxxx		B121	Nxxx	75	25	Hallen, Anlagen
B133	N122		B330	N122	5	40	Eisenbahn
B133	N12x		B330	Nxxx	15	5	Lager, Parkplatz
B133	N142		B330	N142	15	25	Fußballplatz
B133	N999		B330	N999	0	5	vegetationslose Fläche
B133	Nxxx		B330	Nxxx	0	5	sonstiges
B242	N120		B121	N120	5	80	Solar
B242	N141		B242	N141	20	80	Friedhof (städtisch)
B242	N142		B242	N142	30	70	Friedhof (nicht städtisch), Schrebergarten
B242	N214		B242	N214	10	90	Garten
B242	Nxxx		B242	Nxxx	40	60	sonstiges
B2xx	Nxxx		Bxxx	Nxxx	0	100	B231, B222, ...
B324	N311		B310	N311	0	100	Junge Wald
B324	N211		B310	N211	0	80	Baumschule
B324	Nxxx		B324	Nxxx	0	100	Büsche, Sträucher
B31x	Nxxx		Bxxx	Nxxx	0	100	Wald N999, N311 -> N311
B32x	Nxxx		Bxxx	Nxxx	0	100	B321, B322
B331	N999		B330	Nxxx	0	0	Strand
B331	Nxxx		B330	Nxxx	0	0	sonstige Sandflächen
B332	Nxxx		B332	Nxxx	0	5	Fels
B333	Nxxx		B330	Nxxx	0	30	vegetationsarme Fläche
B336	Nxxx		B330	Nxxx	0	5	
B334	N1xx		B334	Nxxx	50	0	Brandflächen
B334	Nxxx		B334	Nxxx	0	0	
B335	Nxxx		B335	Nxxx	0	0	Schnee, Eis
B411	Nxxx		B411	Nxxx	0	75	
B412	N999		B412	N999	0	75	
B412	Nxxx		B412	Nxxx	0	35	
B413	Nxxx		B413	Nxxx	0	75	
B414	Nxxx		B414	Nxxx	0	75	
B421	Nxxx		B321	N510	0	100	
B423	Nxxx		B423	Nxxx	0	0	
B5xx	Nxxx		B5xx	Nxxx	0	0	

Appendix 5 Options for analyses and visualization

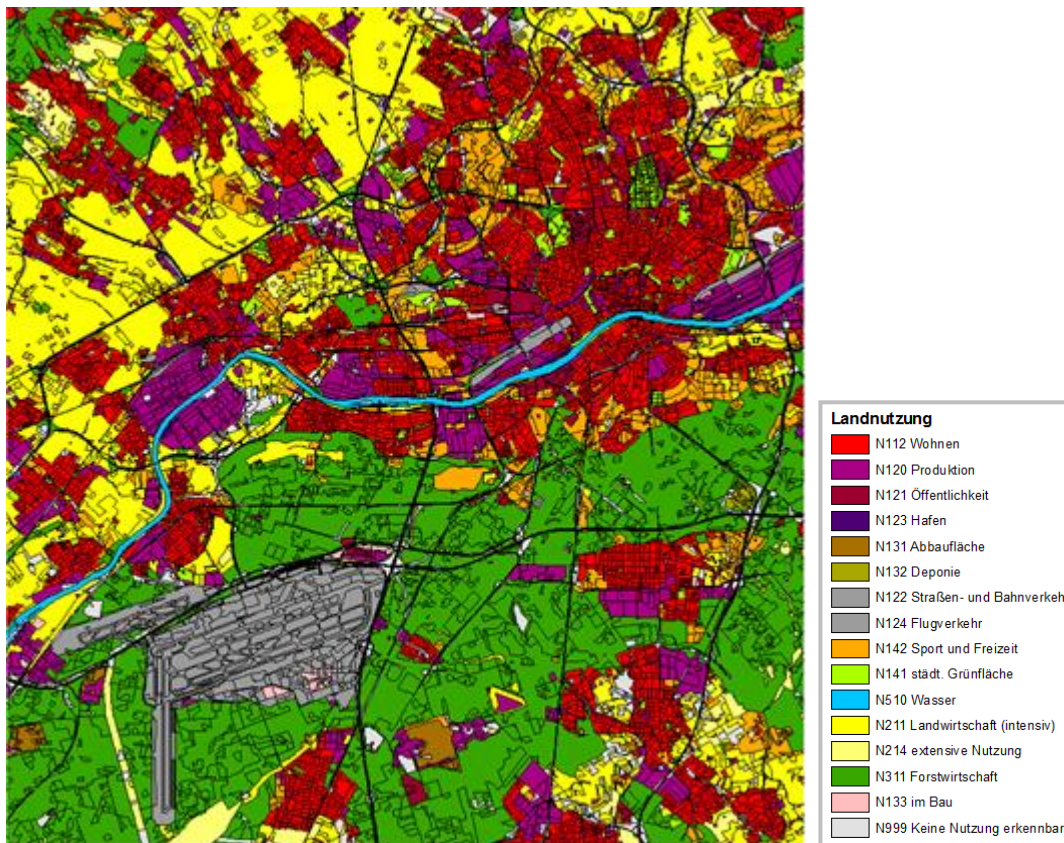
The dataset LBM-DE can be analyzed and visualized according to different criteria. The consideration of dependencies of the relevant attributes for comprehensive description of the objects is of great importance. In the following, the decisive attributes are first explained individually and then with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

Visualization of single features

Land cover – LB_AKT



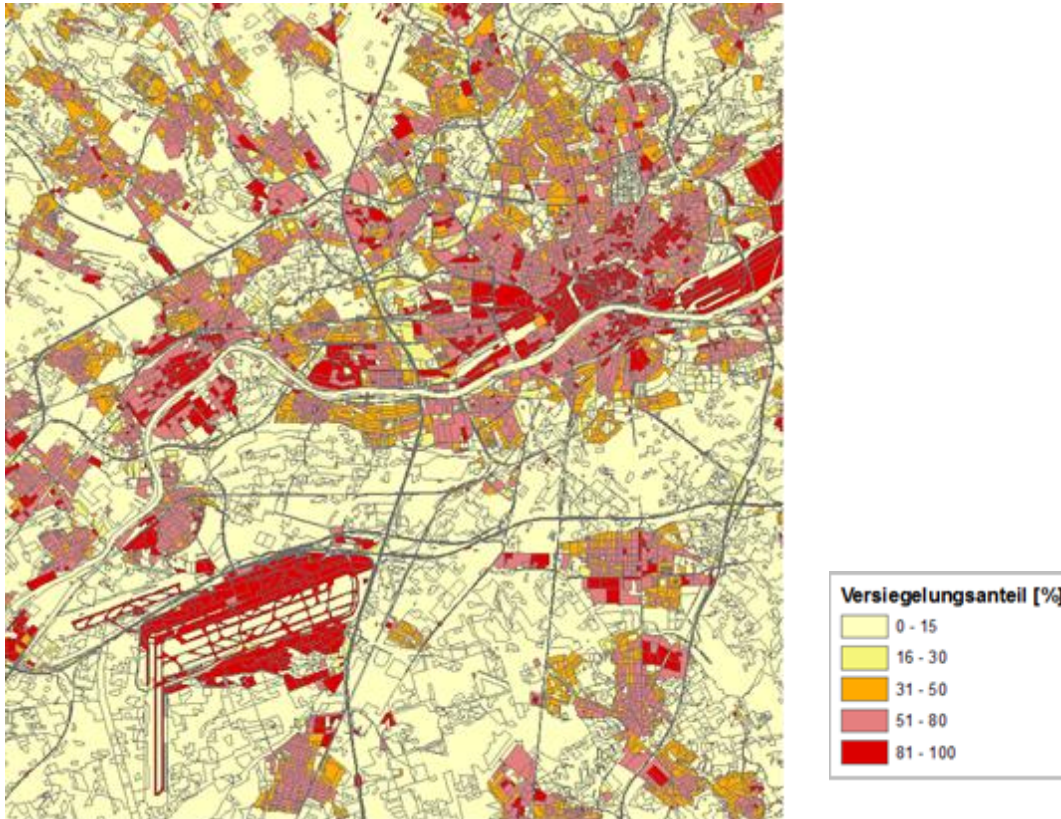
Land use – LN_AKT



Degree of Vegetation – VEG_AKT



Degree of sealing – SIE_AKT



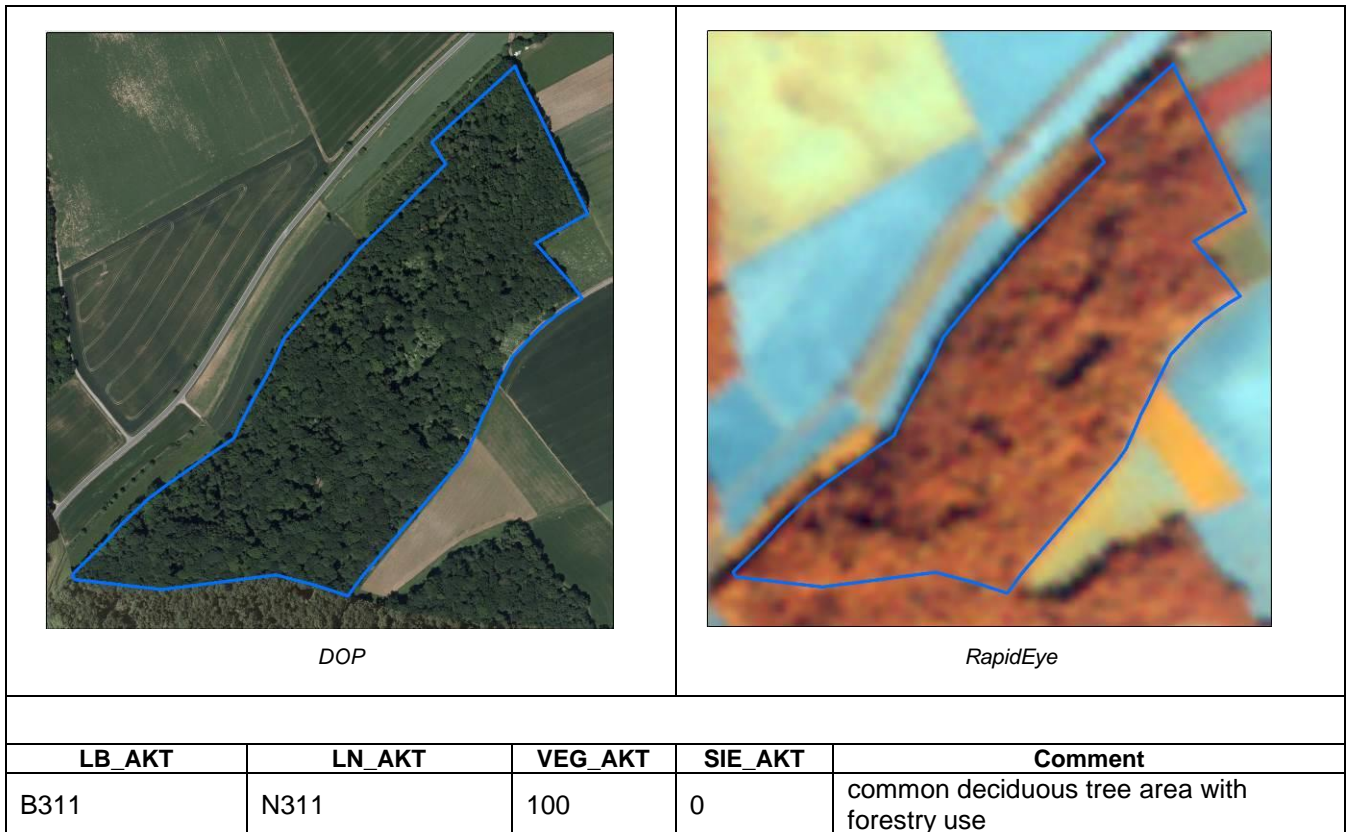
Complex analyzes

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.

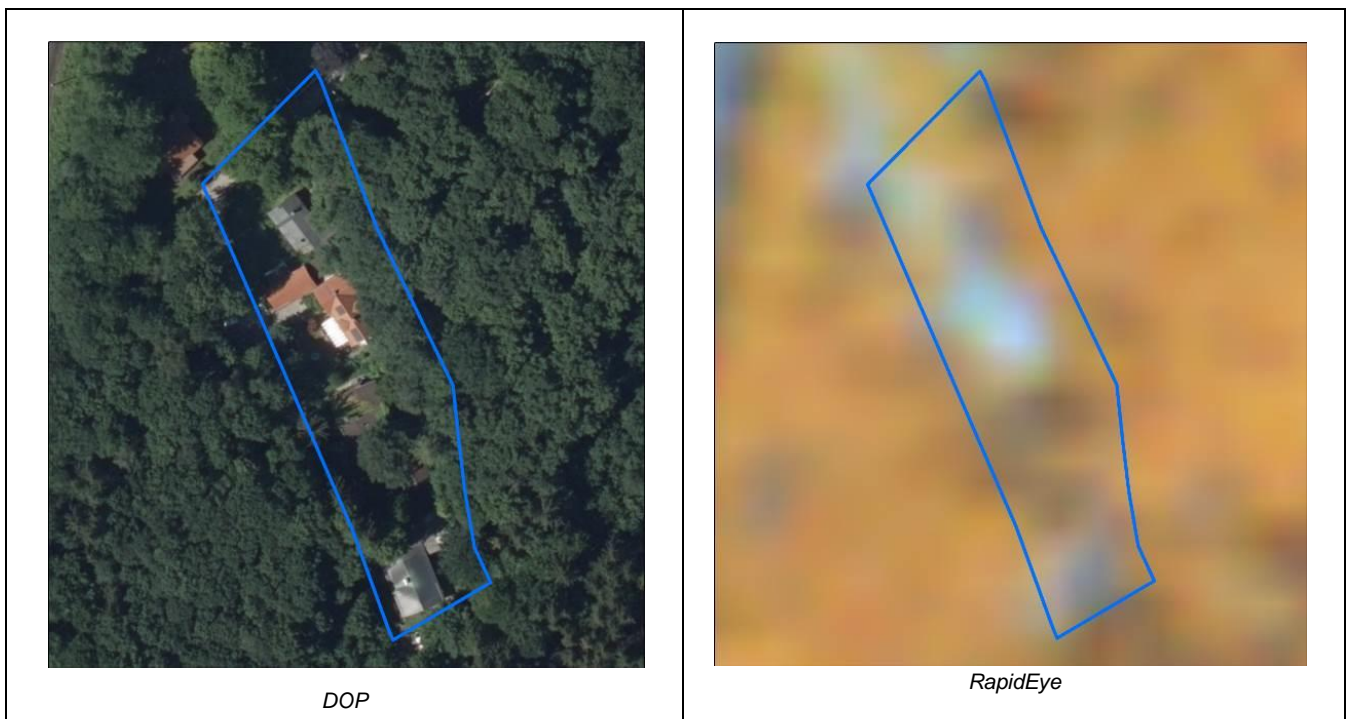
In Example 1 there is a deciduous tree cover, which is used for forestry. The object does not contain any other cover types, therefore a vegetation of 100 % and no degree of sealing are reported.

Example 1: deciduous forest (forestry)



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.


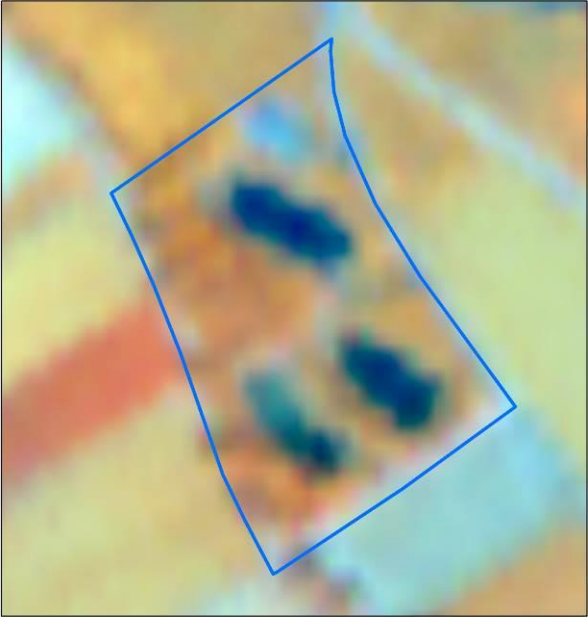
Example 2: Residential Buildings



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

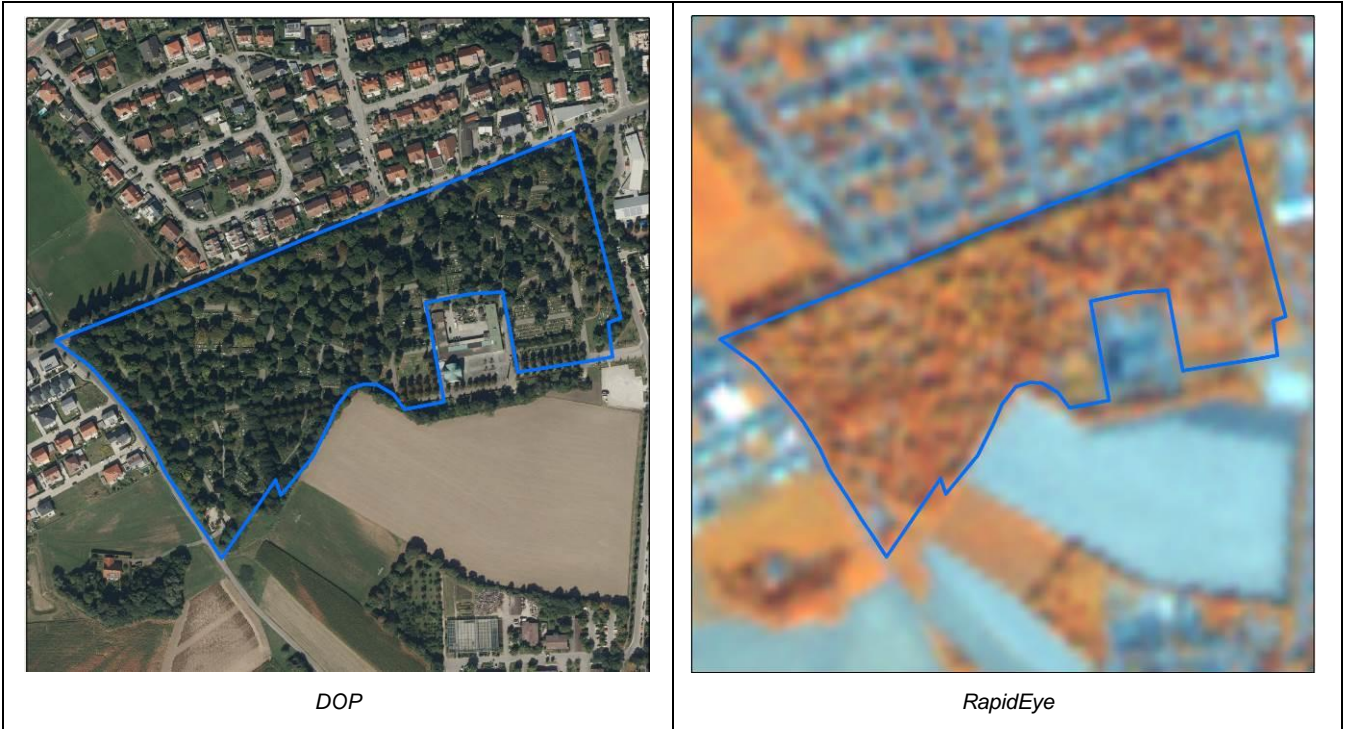
Another example is the fish ponds in Example 3. The decision on the land cover class falls into a two-stage principle. First, the proportion of vegetation and the degree of sealing is determined. In this example, vegetation outweighs 70 percent. Next, it is checked which type of vegetation predominates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

Example 3: Fish farming

 <p><i>DOP</i></p>	 <p><i>RapidEye</i></p>			
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



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