

# Explanatory Documentation of the EAGLE Concept

- Version 3.2 -

Initially prepared and contributed by:  
Stephan Arnold, Barbara Kosztra, Gebhard Banko,  
Pavel Milenov, Geoff Smith, Gerard Hazeu, Michael Bock, Mario Caetano, Christoph Perger

Revised by:  
Stephan Arnold, Geoff Smith, Christoph Perger, Emanuele Mancosu

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**Document History:**

- Version 2.3 was finalized in December 2014.
- Version 2.3.1 contains minor correction of errata (typos, chapter numbers), published in December 2016.
- Version 2.3.2 continued to correct other minor errata (typos, chapter numbers), without substantial change of content, published in May 2020.  
[Tree height threshold was set from 8 to 5 m.]
- Version 3.1 contains substantial changes, mainly in the LCH block. New elements have been added, others replaced or partly renamed. Grouping of matrix elements into modules and segments. The order of appearance in the text chapters follow the structures of the Land Cover Components and Land Use Attributes they relate to; firstly Built-up Characteristics, secondly Vegetation Characteristics, followed by Water Characteristics. It continues with Agricultural Land Management, Forestry Land Management and Mining Details, just as these themes also appear under the LUA block. Afterwards, all other Characteristics follow, which may apply to any LCC or LUA.
- Version 3.1.1 contains some minor corrections and enhancements of version 3.1. The Crop Type list has been added in the documentation, which was before only represented by a placeholder heading, without explicitly listing all crop types. In the matrix however, no change was made, as the Crop Type entries have been part of it already.
- Version 3.1.2 contains corrections of the numbering of listed elements corresponding to the hierarchical numbering in matrix that occurred as typo errors during formatting of documentation. "Back to top" hyperlinks have been added under each paragraph. Land Use Attributes have been extended on 3<sup>rd</sup> level under Secondary production sector; subtypes under forestry land use and mining land use have been removed, because they are better placed and further described under III. LCH matrix block. Some more LCHs have been added.  
New EAGLE matrix block "IV. EAGLE Metadata" has been added, metadata characteristics have been moved there from III. LCH block.  
Version 3.2 received a review of the crop types, eventual cultivation purposes have been removed from crop types and moved to own segment about cultivation purpose. Besides, some more LCH topics have been added/extended, many of them related to agriculture and forestry, like for example: Groundwater, Grazing characters, Cultivation strategy, Crop rotation element, Forest species types, Parameter value ranges.

It is important to state that the EAGLE concept with the data model, the matrix and this explanatory documentation are living documents and do not claim to be completely finalized. They are in the state of constant work in progress. Furthermore, any suggestion for improvement or modification is welcome and will be taken into consideration for future enhancement of the concept.

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## Explanatory Documentation of the EAGLE Concept

### CONTENT [*short overview; for detailed content view see next page*]

<b>Part A: Introduction to the EAGLE concept.....</b>	<b>23</b>
<b>Part B: Thematic Content and Definitions of EAGLE Model Elements .....</b>	<b>31</b>
<b>I. Matrix block: LAND COVER COMPONENTS (LCC) .....</b>	<b>32</b>
<b>1 Abiotic, Non-Vegetated Surfaces and Objects .....</b>	<b>32</b>
<b>2 Biotic, Vegetation .....</b>	<b>36</b>
<b>3 Water .....</b>	<b>39</b>
<b>II. Matrix block: LAND USE ATTRIBUTES (LUA) .....</b>	<b>41</b>
<b>1_Primary Production Sector .....</b>	<b>41</b>
<b>2_Secondary Production Sector .....</b>	<b>43</b>
<b>3_Tertiary Services Sector .....</b>	<b>47</b>
<b>4_Transport Networks, Logistics, Utilities .....</b>	<b>52</b>
<b>5_Residential .....</b>	<b>54</b>
<b>6_Other Uses .....</b>	<b>55</b>
<b>III. Matrix block: LAND CHARACTERISTICS (LCH) .....</b>	<b>57</b>
<b>1 Built-up Characteristics .....</b>	<b>57</b>
<b>2 Physical Characteristics .....</b>	<b>65</b>
<b>3 Biotic Vegetation Characteristics .....</b>	<b>65</b>
<b>4 Water Characteristics .....</b>	<b>72</b>
<b>5 Land Management .....</b>	<b>79</b>
<b>6 Status, Condition .....</b>	<b>124</b>
<b>7 Geographical Characteristics .....</b>	<b>130</b>
<b>8 Spatial Characteristics .....</b>	<b>137</b>
<b>9 Object Characteristics .....</b>	<b>139</b>
<b>References .....</b>	<b>146</b>

## CONTENT *[in full detail]*

<b>Part A: Introduction to the EAGLE concept.....</b>	<b>23</b>
Scope of EAGLE Concept.....	23
Background and motivation .....	23
Given situation.....	Fehler! Textmarke nicht definiert.
Criteria collection .....	23
Guiding questions .....	24
Definition of terms .....	24
Content of EAGLE concept .....	25
a. Structuring of the EAGLE Matrix .....	25
b. Structuring of the EAGLE Data Model .....	29
<b>Part B: Thematic Content and Definitions of EAGLE Model Elements .....</b>	<b>31</b>
Structuring of Land Cover Components:.....	31
Structuring of Land Use Attributes:.....	31
Structuring of Characteristics: .....	31
<b>I. Matrix block: LAND COVER COMPONENTS (LCC) .....</b>	<b>32</b>
<b>1 Abiotic, Non-Vegetated Surfaces and Objects .....</b>	<b>32</b>
<b>1.1 Artificial Surfaces and Constructions.....</b>	<b>32</b>
1.1.1 Sealed Artificial Surfaces and Constructions .....	32
1.1.1.1 Buildings .....	32
1.1.1.1.1 conventional buildings .....	32
1.1.1.1.2 Specific buildings .....	32
1.1.1.2 specific structures and facilities .....	33
1.1.1.3 open sealed surfaces .....	33
1.1.2 Non-Sealed Artificial Surfaces .....	33
1.1.2.1 Open Non-Sealed Artificial Surfaces .....	33
1.1.2.2 waste materials .....	33
<b>1.2 Natural Material Surfaces.....</b>	<b>34</b>
1.2.1 Consolidated Surfaces .....	34
1.2.1.1 bare rock .....	34
1.2.1.2 hard pan .....	34
1.2.2 Unconsolidated Surfaces .....	34
1.2.2.1 Mineral Fragments .....	34
1.2.2.1.1 boulders, stones .....	35
1.2.2.1.2 pebbles, gravel, tuff.....	35
1.2.2.1.3 sand, grit.....	35
1.2.2.1.4 clay, silt .....	35
1.2.2.1.5 mixed unsorted material .....	35
1.2.2.2 bare soils .....	35
1.2.2.3 Natural Deposits.....	35
1.2.2.3.1 inorganic deposits .....	35
1.2.2.3.2 organic deposits, peat .....	36
<b>2 Biotic, Vegetation .....</b>	<b>36</b>
<b>2.1 Woody Vegetation .....</b>	<b>36</b>
2.1.1 trees .....	36
2.1.2 Bushes, Shrubs .....	36

2.1.2.1	regular bushes .....	36
2.1.2.2	dwarf shrubs.....	36
<b>2.2</b>	<b>Herbaceous Vegetation .....</b>	<b>37</b>
2.2.1	Graminoids, grass-like .....	37
2.2.1.1	grasses, sedges, rushes, cereals .....	37
2.2.1.1.1	poaceae, grasses, cereals .....	37
2.2.1.1.2	Cyperaceae, Sedges, Rushes .....	37
2.2.1.2	reeds, bamboos, canes.....	37
2.2.2	Non-graminoids, forbs, ferns .....	38
<b>2.3</b>	<b>Succulents, Cacti .....</b>	<b>38</b>
<b>2.4</b>	<b>Lichens, Mosses, Algae .....</b>	<b>38</b>
2.4.1	lichens .....	38
2.4.2	mosses .....	38
2.4.3	Algae .....	38
2.4.3.1	macro algae .....	38
2.4.3.2	micro algae, plankton.....	39
<b>3</b>	<b>Water .....</b>	<b>39</b>
<b>3.1</b>	<b>Liquid Water Bodies .....</b>	<b>39</b>
3.1.1	Inland Water Bodies.....	39
3.1.1.1	water course.....	39
3.1.1.2	standing water.....	39
3.1.2	marine waters .....	40
<b>3.2</b>	<b>Solid waters .....</b>	<b>40</b>
3.2.1	snow.....	40
3.2.2	ice, glaciers .....	40
<b>II. Matrix block: LAND USE ATTRIBUTES (LUA) .....</b>	<b>41</b>	
<b>1_Primary Production Sector .....</b>	<b>41</b>	
<b>1_1_Agriculture .....</b>	<b>41</b>	
1_1_1	Commercial Crop Production .....	41
1_1_2	Farming Infrastructure .....	41
1_1_2_1	Animal Husbandry .....	41
1_1_2_2	Farming Storage.....	41
1_1_2_3	Other farming infrastructure .....	42
1_1_3	Production For Own Consumption.....	42
<b>1_2_Forestry.....</b>	<b>42</b>	
<b>1_3_Mining And Quarrying .....</b>	<b>42</b>	
<b>1_4_Aquaculture And Fishing .....</b>	<b>42</b>	
1_4_1	Aquaculture.....	42
1_4_2	Professional Wild Fishery .....	42
<b>1_5_Other Primary Production .....</b>	<b>42</b>	
1_5_1	Hunting.....	42
1_5_2	Management Of Migratory Animals .....	43
1_5_3	Picking Natural Products .....	43
1_5_4	Apiculture, Bee hives.....	43
<b>2_Secondary Production Sector .....</b>	<b>43</b>	
<b>2_1_Manufacturing industry .....</b>	<b>43</b>	
2_1_1	Raw Industry .....	43
2_1_1_1	Manufacturing Textile Products .....	43

2_1_1_2_Manufacturing Wood-Based Products .....	43
2_1_1_3_Manufacturing Pulp And Paper Products .....	44
2_1_1_4_Manufacturing Coke, Petroleum And Nuclear Fuels .....	44
2_1_1_5_Manufacturing Chemical Products and Synthetic Fibres .....	44
2_1_1_6_Manufacturing Metallic Products .....	44
2_1_1_7_Manufacturing Nonmetallic Mineral Products .....	44
2_1_1_8_Manufacturing Rubber And Plastic Products .....	44
2_1_1_9_Manufacturing Other Raw Materials .....	44
2_1_2_Heavy End Product Industry.....	44
2_1_2_1_Manufacturing Machinery Products .....	44
2_1_2_2_Manufacturing Vehicles And Transport Equipment .....	45
2_1_2_3_Manufacturing Other Heavy End Products .....	45
2_1_3_Light End Product Industry.....	45
2_1_3_1_Manufacturing Food, Beverages And Tobacco Products .....	45
2_1_3_2_Manufacturing Clothes And Leather Products.....	45
2_1_3_3_Publishing, Printing, Reproduction of Recorded Media.....	45
2_1_3_4_Manufacturing Electrical, Precision And Optical Equipment .....	45
2_1_3_5_Manufacturing Other Light End Products .....	45
<b>2_2_Energy Production .....</b>	<b>45</b>
2_2_1_Nuclear Based Energy Production .....	45
2_2_2_Fossil Fuel Based Energy Production .....	45
2_2_2_1_Coal And Lignite Based Energy Production .....	46
2_2_2_2_Mineral Oil Based Energy Production .....	46
2_2_2_3_Mineral Gas Based Energy Production.....	46
2_2_2_4_Peat And Other Fossil Fuel Based Energy Production.....	46
2_2_3_Biomass Based Energy Production .....	46
2_2_4_Renewable Energy Production .....	46
2_2_4_1_Water Based Energy Production .....	46
2_2_4_2_Solar Based Energy Production .....	46
2_2_4_3_Wind Based Energy Production .....	46
2_2_4_4_Geo-Thermal Based Energy Production.....	46
2_2_4_5_Tide Based Energy Production .....	47
2_2_5_Waste Combustion Based Energy Production.....	47
<b>2_5_Other Industry.....</b>	<b>47</b>
<b>3_Tertiary Services Sector .....</b>	<b>47</b>
<b>3_1_Commercial Services.....</b>	<b>47</b>
3_1_1_Wholesale, Retail Trade, Repair Of Vehicles And Household Goods .....	47
3_1_2_Real Estate Services.....	47
3_1_3_Accommodation And Food Services.....	47
3_1_4_Other Commercial Services .....	47
<b>3_2_Financial, Professional And Information Services .....</b>	<b>48</b>
3_2_1_Financial And Insurance Services .....	48
3_2_2_Professional, Technical And Scientific Services .....	48
3_2_3_Information And Communication Services .....	48
3_2_4_Administrative And Support Services.....	48
3_2_5_Other Financial Professional And Information Services .....	48
<b>3_3_Community Services .....</b>	<b>48</b>
3_3_1_Public Administration, Defense, Justice, Public Security.....	48
3_3_2_Science, Research, Education .....	48
3_3_3_Health And Social Services .....	48
3_3_4_Religious Services .....	49
3_3_4_1_House Of Worship.....	49
3_3_4_2_Monastery.....	49
3_3_4_3_Cemetery .....	49

3_3_5_Other Community Services .....	49
<b>3_4_Cultural, Entertainment And Recreational Services .....</b>	<b>49</b>
3_4_1_Cultural Services .....	49
3_4_1_1_Indoor Cultural Service .....	49
3_4_1_2_Outdoor Cultural Service .....	49
3_4_2_Entertainment .....	50
3_4_3_Sports Infrastructure .....	50
3_4_3_1_Golf Course .....	50
3_4_3_2_Ski Piste .....	50
3_4_3_3_Outdoor Racecourse .....	50
3_4_3_4_Sport Hall .....	50
3_4_3_5_Stadium .....	50
3_4_3_6_Swimming Pool .....	50
3_4_3_7_Sports Ground .....	50
3_4_3_8_Fitness club .....	51
3_4_3_9_Yachtharbour, sport boat marina .....	51
3_4_4_Open Air Recreational Areas .....	51
3_4_4_1_Urban Greenery, City Parks, Playgrounds .....	51
3_4_4_2_(Semi-)Natural Areas Used For Recreation .....	51
3_4_5_Other Recreational Services .....	51
3_4_5_1_Allotment Garden .....	51
3_4_5_2_Amateur Fishing .....	51
<b>3_5_Other Services .....</b>	<b>52</b>
<b>4_Transport Networks, Logistics, Utilities .....</b>	<b>52</b>
<b>4_1_Transport Networks .....</b>	<b>52</b>
4_1_1_Road Network .....	52
4_1_2_Railway Network .....	52
4_1_3_Air Transport .....	52
4_1_4_Water Transport .....	52
4_1_5_Other Transportation Networks .....	52
<b>4_2_Logistics And Storage .....</b>	<b>52</b>
<b>4_3_Uilities .....</b>	<b>53</b>
4_3_1_Power Distribution Services .....	53
4_3_1_1_Electricity Distribution .....	53
4_3_1_2_Gas Distribution .....	53
4_3_1_3_Thermal Energy Distribution .....	53
4_3_2_Water And Sewage Infrastructure .....	53
4_3_2_1_Drinking Water Facilities .....	53
4_3_2_2_Sewage Water Treatment .....	53
4_3_2_3_Water Runoff Retention Basin .....	53
4_3_2_4_Artificial Snow Water Pond .....	53
4_3_2_5_Irrigation And Fire Fighting Water Pond .....	54
4_3_3_Waste Treatment .....	54
4_3_3_1_Dump Site .....	54
4_3_3_1_1_hazardous waste .....	54
4_3_3_1_2_inert or non-hazardous waste .....	54
4_3_3_2_Recycling Facilities .....	54
4_3_4_Other Utilities .....	54
<b>5_Residential .....</b>	<b>54</b>
<b>5_1_Permanent Residential .....</b>	<b>55</b>
<b>5_2_Residential Use With Other Compatible Uses .....</b>	<b>55</b>

<b>5_3_Other Residential.....</b>	<b>55</b>
5_3_1_Temporary Residential, Permanent Structure .....	55
5_3_2_Temporary Dwelling, Non-permanent Structure .....	55
5_3_3_Informal Dwelling.....	55
<b>6_Other Uses .....</b>	<b>55</b>
6_1_Transitional Areas Under Construction .....	55
6_3_Areas Not In Any Economic Use .....	56
6_4_Flood Protection.....	56
<b>III. Matrix block: LAND CHARACTERISTICS (LCH).....</b>	<b>57</b>
<b>1 Built-up Characteristics .....</b>	<b>57</b>
1.1 Soil sealing degree .....	57
1.2 Built-up Pattern .....	57
1.2.1 scattered single houses, discontinuous .....	57
1.2.2 single blocks, discontinuous.....	57
1.2.3 suburban row houses, terraced, semi-detached houses .....	57
1.2.4 city street blocks, closed front .....	58
1.2.5 large complex buildings, big halls.....	58
1.3 Building Nature.....	58
1.3.1 Building Nature Value .....	58
1.4 Other Construction Nature.....	58
1.4.1 Other Construction Nature Value .....	58
1.5 Artificial Surface Material Type .....	59
1.5.1 Mineral Compound .....	59
1.5.1.1 glass.....	59
1.5.1.2 ceramic, clay tiles, bricks.....	59
1.5.1.3 concrete .....	59
1.5.1.4 asbestos fibre cement .....	59
1.5.1.5 non-asbestos fibre cement .....	59
1.5.2 Solar Panels.....	59
1.5.3 Metal.....	59
1.5.3.1 Copper.....	59
1.5.3.2 Zinc.....	59
1.5.3.3 Aluminium .....	60
1.5.3.4 Steel.....	60
1.5.3.5 Iron.....	60
1.5.3.6 Lead .....	60
1.5.4 Hydrocarbon Compound.....	60
1.5.4.1 Tar .....	60
1.5.4.2 Asphalt .....	60
1.5.4.3 Bitumen.....	60
1.5.5 Polymer, Plastic, Synthetic Fibre.....	60
1.5.5.1 hard rubber .....	60
1.5.5.2 hard plastic.....	60
1.5.5.3 plastic foil .....	60
1.5.5.4 synthetic fibre .....	61
1.5.6 Mineral Material .....	61
1.5.6.1 natural stone .....	61
1.5.6.2 slate.....	61
1.5.6.3 pebbles, gravel .....	61
1.5.6.4 sand.....	61



1.5.6.5	ashes, slag .....	61
1.5.7	Organic.....	61
1.5.7.1	Wood.....	61
1.5.7.2	Reed, straw, leaves .....	61
<b>1.6</b>	<b>Artificial Surface Material Arrangement .....</b>	<b>61</b>
1.6.1	seamless sealing.....	61
1.6.2	closed pavement.....	62
1.6.3	permeable paving, grass pavers.....	62
1.6.4	tiles.....	62
<b>1.7</b>	<b>Building Greening Type .....</b>	<b>62</b>
1.7.1	Greened Roof.....	62
1.7.1.1	Low Growing Roof Vegetation .....	62
1.7.1.2	High Growing Roof Vegetation.....	62
<b>1.8</b>	<b>Transportation Network Characteristics .....</b>	<b>62</b>
1.8.1	Road Network Type.....	62
1.8.1.1	Fast Transit Road, Highway .....	63
1.8.1.2	Pedestrian Zone .....	63
1.8.1.3	Associated Walk- Or Cycleway .....	63
1.8.1.4	Walk- and Cycleway .....	63
1.8.1.5	Cycleway.....	63
1.8.1.6	Walkway.....	63
1.8.1.7	Open Square.....	63
1.8.2	placeholder> .....	64
1.8.3	<placeholder> .....	64
1.8.4	Harbour Type .....	64
1.8.4.1	Cargo Port .....	64
1.8.4.2	Passenger Port .....	64
1.8.4.3	Fishing Port.....	64
1.8.4.4	Naval Port.....	64
1.8.4.5	Marina .....	64
1.8.4.6	Local Multifunctional Harbour .....	64
1.8.4.7	Shipyard.....	64
1.8.4.8	Jetty .....	65
<b>2</b>	<b>Physical Characteristics .....</b>	<b>65</b>
2.1	Permafrost zone .....	65
<b>3</b>	<b>Biotic Vegetation Characteristics .....</b>	<b>65</b>
<b>3.1</b>	<b>Leaf form .....</b>	<b>65</b>
3.1.1	needle leaved .....	65
3.1.2	broad leaved .....	65
3.1.3	palm leaved .....	65
3.1.4	non-leafy .....	65
<b>3.2</b>	<b>Foliage persistence .....</b>	<b>65</b>
3.2.1	evergreen .....	66
3.2.2	deciduous.....	66
3.2.2.1	winter deciduous.....	66
3.2.2.2	summer deciduous.....	66
<b>3.3</b>	<b>Leaf anatomy.....</b>	<b>66</b>
3.3.1	sclerophyllous .....	66
<b>3.4</b>	<b>Phenological Plant Life Span.....</b>	<b>66</b>
3.4.1	annual plant .....	67
3.4.2	biennial plant .....	67

3.4.3	perennial plant.....	67
3.4.4	ephemeral plant.....	67
<b>3.5</b>	<b>Plant Location .....</b>	<b>67</b>
3.5.1	terrestrial plant .....	67
3.5.2	epiphyte plant.....	67
3.5.3	aquatic submerged plant .....	68
3.5.4	aquatic emergent plant.....	68
<b>3.6</b>	<b>Growth Form, Habit .....</b>	<b>68</b>
3.6.1	erect growth, single stem .....	68
3.6.2	open, spreading, dense growth, multi-stem.....	68
3.6.3	prostrate, creeping.....	68
3.6.4	clump-forming .....	68
3.6.5	cushion, mat-forming.....	68
3.6.6	climbing.....	69
<b>3.7</b>	<b>Raunkiaer Life Form .....</b>	<b>69</b>
3.7.1	phanerophyte .....	69
3.7.2	epiphyte .....	69
3.7.3	chamaephyte .....	69
3.7.4	hemicryptophyte.....	69
3.7.5	cryptophyte.....	69
3.7.6	therophyte .....	70
3.7.7	aerophyte.....	70
<b>3.8</b>	<b>Vegetation cover transition .....</b>	<b>70</b>
3.8.1	natural succession.....	70
3.8.2	vegetation degradation.....	70
<b>3.9</b>	<b>Plant Species Origin .....</b>	<b>70</b>
3.9.1	native plant .....	70
3.9.2	non-native plant.....	70
3.9.3	endemic plant .....	71
3.9.4	invasive plant .....	71
3.9.5	migratory plant .....	71
3.9.6	genetically modified plant .....	71
<b>3.10</b>	<b>Plant Species Type .....</b>	<b>71</b>
3.10.1	Plant Species.....	71
<b>3.11</b>	<b>Plant Community Type .....</b>	<b>71</b>
3.11.1	Plant Community .....	72
<b>3.12</b>	<b>Plant Growing Season .....</b>	<b>72</b>
3.12.1	plant growing season ongoing .....	72
<b>3.13</b>	<b>Crown Cover Density.....</b>	<b>72</b>
<b>4</b>	<b>Water Characteristics .....</b>	<b>72</b>
<b>4.1</b>	<b>Water Body Formation .....</b>	<b>72</b>
4.1.1	Natural water body .....	72
4.1.2	Controlled, regulated, heavily modified water body .....	73
4.1.3	man-made water body.....	73
<b>4.2</b>	<b>Hydrological Water Regime .....</b>	<b>73</b>
4.2.1	dry water regime.....	73
4.2.2	ephemeral, episodic water regime .....	73
4.2.3	intermittent, seasonal water regime .....	73
4.2.4	perennial water regime.....	74

<b>4.3</b>	<b>Water dynamics.....</b>	<b>74</b>
4.3.1	running water .....	74
4.3.2	almost standing water .....	74
4.3.3	standing water .....	74
<b>4.4</b>	<b>Soil moisture regime, Wetness .....</b>	<b>74</b>
4.4.1	Aquatic, water at surface .....	75
4.4.2	Waterlogged, saturated ground.....	75
4.4.3	wet .....	75
4.4.4	seasonally wet.....	75
4.4.5	mesic .....	75
4.4.6	semi-dry .....	75
4.4.7	dry .....	76
4.4.8	very dry .....	76
4.4.9	xeric.....	76
<b>4.5</b>	<b>Wetness source .....</b>	<b>76</b>
4.5.1	Rainfed source .....	76
4.5.2	surface water source.....	76
4.5.3	subterranean, groundwater source .....	76
<b>4.6</b>	<b>Salinity .....</b>	<b>76</b>
4.6.1	brine.....	77
4.6.2	saline .....	77
4.6.3	brackish.....	77
4.6.4	fresh .....	77
4.6.5	ultra fresh.....	77
<b>4.7</b>	<b>pH value .....</b>	<b>78</b>
<b>4.8</b>	<b>Tidal Phenomena .....</b>	<b>78</b>
4.8.1	tidal influence.....	78
4.8.2	tidal range .....	78
<b>4.9</b>	<b>Groundwater .....</b>	<b>78</b>
4.9.1	Groundwater table level .....	78
<b>4.10</b>	<b>Snow Characteristics .....</b>	<b>78</b>
4.10.1	Snow Height.....	78
<b>4.11</b>	<b>Ice Characteristics .....</b>	<b>79</b>
<b>5</b>	<b>Land Management.....</b>	<b>79</b>
<b>5.1</b>	<b>Agricultural Land Management.....</b>	<b>79</b>
5.1.1	Agricultural Cultivation Form .....	79
5.1.1.1	cropland .....	79
5.1.1.1.1	arable crop land.....	79
5.1.1.1.2	permanent crop land.....	79
5.1.1.2	managed permanent grassland.....	79
5.1.2	Cultivation Practice .....	80
5.1.2.1	crop rotation .....	80
5.1.2.2	no crop rotation .....	80
5.1.2.3	plantation .....	80
5.1.2.4	extensive cultivation practice .....	80
5.1.2.5	agroforestry.....	81
5.1.2.6	shifting cultivation.....	81
5.1.2.7	intercropping.....	81
5.1.2.8	kitchen garden.....	81
5.1.2.9	paddy field cultivation.....	81
5.1.3	Cultivation Installation .....	81

5.1.3.1	greenhouse under glass or foil .....	82
5.1.3.2	under foil on ground .....	82
5.1.3.3	plantation protection net .....	82
5.1.3.4	espalier, trellis, lattice .....	82
5.1.3.5	hydroculture .....	82
5.1.3.6	vertical farming .....	82
5.1.4	Cultivation Measure And Activities .....	82
5.1.4.1	Ploughing and tillage .....	83
5.1.4.1.1	no ploughing .....	83
5.1.4.1.2	ploughing applied, direction unspecified .....	83
5.1.4.1.3	ploughing across the slope .....	83
5.1.4.1.4	ploughing oblique direction .....	83
5.1.4.1.5	ploughing in direction of slope .....	83
5.1.4.2	Fertilization .....	83
5.1.4.2.1	no fertilizing .....	83
5.1.4.2.2	fertilization applied, type unspecified .....	84
5.1.4.2.3	organic fertilizer .....	84
5.1.4.2.3.1	animal manure .....	84
5.1.4.2.3.2	green manure .....	84
5.1.4.2.4	synthetic fertilizer .....	84
5.1.4.3	Weed Control .....	84
5.1.4.3.1	no weed control .....	84
5.1.4.3.2	weed control applied, method unspecified .....	84
5.1.4.3.3	mechanical or biological weed control .....	85
5.1.4.3.4	chemical weed control .....	85
5.1.4.4	Pest Control .....	85
5.1.4.4.1	no pest control .....	85
5.1.4.4.2	pest control applied, method unspecified .....	85
5.1.4.4.3	mechanical or biological pest control .....	85
5.1.4.4.4	chemical pest control .....	85
5.1.4.5	Irrigation .....	85
5.1.4.5.1	no irrigation .....	86
5.1.4.5.2	irrigation applied, method unspecified .....	86
5.1.4.5.3	gravity surface irrigation .....	86
5.1.4.5.4	sprinkler irrigation .....	86
5.1.4.5.5	irrigation carousel .....	86
5.1.4.5.6	drip irrigation .....	86
5.1.4.5.7	subsurface drip irrigation .....	86
5.1.4.5.8	manual irrigation .....	86
5.1.4.6	Irrigation Water Source .....	87
5.1.4.6.1	groundwater .....	87
5.1.4.6.2	reservoir .....	87
5.1.4.6.3	water course .....	87
5.1.4.7	Drainage .....	87
5.1.4.7.1	no drainage .....	87
5.1.4.7.2	drainage applied, method unspecified .....	87
5.1.4.7.3	open ditch drainage .....	87
5.1.4.7.4	subsurface tube drainage .....	87
5.1.4.7.5	filled ditch drainage .....	88
5.1.4.8	Mowing .....	88
5.1.4.8.1	Mowing Intensity .....	88
5.1.4.8.1.1	no mowing .....	88
5.1.4.8.1.2	mowing applied, frequency unspecified .....	88
5.1.4.8.1.3	extensive mowing .....	88
5.1.4.8.1.4	medium intensity mowing .....	88
5.1.4.8.1.5	intensive mowing .....	88
5.1.4.8.2	mowing frequency .....	88

5.1.4.9	shrub clearance .....	89
5.1.4.10	biomass burning .....	89
5.1.4.11	liming .....	89
5.1.4.12	pruning .....	89
5.1.4.13	set aside parcel .....	89
5.1.5	Cultivation Purpose .....	90
5.1.5.1	Alimentary Crop .....	90
5.1.5.1.1	grain production crop .....	90
5.1.5.1.2	table fruit crop .....	90
5.1.5.1.3	liquefaction, fermentation or brewing of Crop .....	90
5.1.5.2	Fodder Crop .....	90
5.1.5.2.1	harvested for silage .....	90
5.1.5.2.2	harvested for dry fodder .....	90
5.1.5.2.3	harvested green for direct forage .....	91
5.1.5.2.4	temporary grasses and grazings .....	91
5.1.5.3	industrial crop .....	91
5.1.5.4	energy crop .....	91
5.1.5.4.1	Bio Gas Crop .....	91
5.1.5.4.2	Liquid Bio Fuel Crop .....	91
5.1.5.4.3	Solid Bio Fuel Crop .....	91
5.1.5.5	ornamental plants .....	92
5.1.5.6	functional crop .....	92
5.1.5.6.1	Soil Protective Cover Crop .....	92
5.1.5.6.2	Soil Nutrient Storage Crop .....	92
5.1.5.6.3	Biodiversity Conservation Crop .....	92
5.1.5.6.4	Carbon Sequestration Crop .....	92
5.1.5.7	Seed Production Crop .....	92
5.1.6	Crop Type .....	92
5.1.6.1	Arable crops .....	93
5.1.6.1.1	Cereals .....	93
5.1.6.1.1.1	common wheat and spelt .....	93
5.1.6.1.1.2	durum wheat .....	93
5.1.6.1.1.3	rye .....	93
5.1.6.1.1.4	barley .....	93
5.1.6.1.1.5	oats .....	93
5.1.6.1.1.6	maize .....	93
5.1.6.1.1.7	rice .....	93
5.1.6.1.1.8	millet .....	93
5.1.6.1.1.9	other cereals .....	93
5.1.6.1.2	Pulses and protein crops .....	93
5.1.6.1.2.1	peas .....	93
5.1.6.1.2.2	beans .....	93
5.1.6.1.2.3	lentils .....	94
5.1.6.1.2.4	sweet lupins .....	94
5.1.6.1.2.5	soya .....	94
5.1.6.1.2.6	chickpeas .....	94
5.1.6.1.2.7	peanuts .....	94
5.1.6.1.2.8	other dry pulses .....	94
5.1.6.1.3	Clover, Vetch, Lupins, Lucerne .....	94
5.1.6.1.4	Root and Tuber Crops .....	94
5.1.6.1.4.1	potatoes .....	94
5.1.6.1.4.2	sweet potatoes .....	94
5.1.6.1.4.3	sugar beet .....	94
5.1.6.1.4.4	fodder beet .....	94
5.1.6.1.4.5	Carrot .....	94
5.1.6.1.4.6	Parsnip .....	94
5.1.6.1.4.7	Horseradish .....	94

5.1.6.1.4.8	Radish .....	94
5.1.6.1.4.9	Beetroot.....	95
5.1.6.1.4.10	White Turnip.....	95
5.1.6.1.4.11	Celery Root .....	95
5.1.6.1.5	Bulb Vegetable Crops .....	95
5.1.6.1.5.1	Onions.....	95
5.1.6.1.5.2	Garlic.....	95
5.1.6.1.5.3	Leeks .....	95
5.1.6.1.6	Cole Crops, Brassica oleracea.....	95
5.1.6.1.6.1	White, Green, Red Cabbage .....	95
5.1.6.1.6.2	Brussels Sprout .....	95
5.1.6.1.6.3	Stem Cabbage, Kohlrabi .....	95
5.1.6.1.6.4	Cauliflower.....	95
5.1.6.1.6.5	Broccoli.....	95
5.1.6.1.6.6	Savoy Cabbage.....	95
5.1.6.1.7	Leaf, Stalk, Flowering Vegetable Crops .....	95
5.1.6.1.7.1	Lettuces, Salads .....	95
5.1.6.1.7.2	Asparagus .....	95
5.1.6.1.7.3	Spinach .....	96
5.1.6.1.7.4	Rods Celery .....	96
5.1.6.1.7.5	Rhubarb .....	96
5.1.6.1.7.6	Artichoke .....	96
5.1.6.1.7.7	Romanesco .....	96
5.1.6.1.8	Fruiting Vegetable Crops.....	96
5.1.6.1.8.1	Tomato .....	96
5.1.6.1.8.2	Bell Pepper .....	96
5.1.6.1.8.3	Chili Pepper .....	96
5.1.6.1.8.4	Eggplant.....	96
5.1.6.1.9	Cucurbit Crops.....	96
5.1.6.1.9.1	Cucumbers.....	96
5.1.6.1.9.2	Zucchini.....	96
5.1.6.1.9.3	Melons.....	96
5.1.6.1.9.4	Pumpkins .....	96
5.1.6.1.10	Oilseed or Fibre Crops .....	96
5.1.6.1.10.1	tobacco .....	97
5.1.6.1.10.2	hops .....	97
5.1.6.1.10.3	rape and turnip rape.....	97
5.1.6.1.10.4	sunflower .....	97
5.1.6.1.10.5	linseed, oil flax .....	97
5.1.6.1.10.6	cotton .....	97
5.1.6.1.10.7	flax .....	97
5.1.6.1.10.8	hemp.....	97
5.1.6.1.10.9	other oilseed or fibre crops .....	97
5.1.6.1.11	aromatic, medicinal, culinary herbs .....	97
5.1.6.1.12	Flowers and ornamental plants.....	97
5.1.6.1.13	strawberries .....	97
5.1.6.1.14	sugarcane .....	97
5.1.6.1.15	other arable crops [5.1.6.1.99].....	97
5.1.6.2	Meadow Grasses and Herbs.....	97
5.1.6.3	Permanent crops .....	97
5.1.6.3.1	Pome Fruits .....	97
5.1.6.3.1.1	Apple.....	98
5.1.6.3.1.2	Pear.....	98
5.1.6.3.1.3	Quince .....	98
5.1.6.3.1.4	Medlar .....	98
5.1.6.3.1.5	Pomegranate .....	98
5.1.6.3.2	Drupes, Stone-Like Fruits .....	98

5.1.6.3.2.1	Sweet Cherry .....	98
5.1.6.3.2.2	Sour Cherry .....	98
5.1.6.3.2.3	Plum .....	98
5.1.6.3.2.4	Mirabelle, Spilling .....	98
5.1.6.3.2.5	Peach, Nectarine .....	98
5.1.6.3.2.6	Apricot .....	98
5.1.6.3.2.7	Avocado .....	98
5.1.6.3.2.8	Mango .....	98
5.1.6.3.2.9	Litchi .....	98
5.1.6.3.2.10	Date Fruit .....	98
5.1.6.3.2.11	Oil Palm .....	98
5.1.6.3.3	Nuts .....	99
5.1.6.3.3.1	Walnuts .....	99
5.1.6.3.3.2	Chestnuts .....	99
5.1.6.3.3.3	Hazelnuts .....	99
5.1.6.3.3.4	Cashew Nuts .....	99
5.1.6.3.3.5	Brazil Nuts .....	99
5.1.6.3.3.6	Pekka Nuts .....	99
5.1.6.3.3.7	Pistachios .....	99
5.1.6.3.3.8	Almond .....	99
5.1.6.3.3.9	Coconuts .....	99
5.1.6.3.4	Citrus fruits .....	99
5.1.6.3.4.1	Oranges .....	99
5.1.6.3.4.2	Lemons .....	99
5.1.6.3.4.3	Limes .....	99
5.1.6.3.4.4	Pomelos .....	99
5.1.6.3.4.5	Grapefruits .....	99
5.1.6.3.4.6	Mandarine .....	100
5.1.6.3.4.7	Clementine .....	100
5.1.6.3.5	Berry Crops .....	100
5.1.6.3.5.1	Raspberries .....	100
5.1.6.3.5.2	Blackberries .....	100
5.1.6.3.5.3	Currants .....	100
5.1.6.3.5.4	Gooseberries .....	100
5.1.6.3.5.5	Blueberries .....	100
5.1.6.3.5.6	Cranberries .....	100
5.1.6.3.5.7	Juniper .....	100
5.1.6.3.5.8	Elderberries .....	100
5.1.6.3.5.9	Cornel .....	100
5.1.6.3.5.10	Passion Fruit .....	100
5.1.6.3.6	Grapes .....	100
5.1.6.3.7	Olives .....	100
5.1.6.3.8	Other Fleshy Fruits .....	100
5.1.6.3.8.1	Banana .....	100
5.1.6.3.8.2	Fig Fruit .....	101
5.1.6.3.8.3	Kiwi .....	101
5.1.6.3.8.4	Papaya .....	101
5.1.6.3.8.5	Ananas .....	101
5.1.6.3.8.6	Custard Apple .....	101
5.1.6.3.8.7	Prickly Pear .....	101
5.1.6.3.8.8	Persimmon .....	101
5.1.6.3.9	Exotic Aromatic and Spice Crops .....	101
5.1.6.3.9.1	Coffee Bush .....	101
5.1.6.3.9.2	Cocoa Tree .....	101
5.1.6.3.9.3	Pepper .....	101
5.1.6.3.9.4	Cinnamon Tree .....	101
5.1.6.3.9.5	Vanilla .....	101

5.1.6.3.9.6	Cloves .....	101
5.1.6.3.9.7	Cardamom .....	101
5.1.6.3.9.8	Ginger .....	101
5.1.6.3.10	Leaf Crops from Woody Plants .....	102
5.1.6.3.10.1	Tea Bush .....	102
5.1.6.3.10.2	Coca Bush .....	102
5.1.6.3.10.3	Mate Tree .....	102
5.1.6.3.11	Woody Plant Nursery .....	102
5.1.6.3.12	Christmas Trees .....	102
5.1.6.3.13	Herbaceous Biomass Crops .....	102
5.1.6.3.14	Woody Biomass Crops .....	102
5.1.6.3.15	Other permanent crops [5.1.6.3.99] .....	102
5.1.6.4	Mushrooms .....	102
5.1.6.5	Aquatic crops .....	102
5.1.6.5.1	Algae crops .....	102
5.1.6.6	Fallow land [5.1.6.98] .....	102
5.1.6.7	Unspecified crop [5.1.6.99] .....	102
5.1.7	Plant growth stage .....	103
5.1.7.1	sowing the seeds .....	103
5.1.7.2	germination, sprouting .....	103
5.1.7.3	vegetative phase .....	103
5.1.7.4	reproductive phase .....	103
5.1.7.5	ripening phase .....	103
5.1.7.6	harvested empty field .....	103
5.1.7.7	crop residues .....	103
5.1.7.8	resprouting on harvested field .....	104
5.1.8	Crop Season .....	104
5.1.8.1	Crop Season Ongoing .....	104
5.1.8.2	Summer Crop Season .....	104
5.1.8.3	Winter Crop Season .....	104
5.1.8.4	Year-round Crop Season .....	104
5.1.8.5	Number Of Crop Seasons .....	104
5.1.9	Crop Rotation Element .....	104
5.1.9.1	Main Crop .....	104
5.1.9.2	Secondary Crop .....	104
5.1.9.3	Side Crop .....	105
5.1.9.4	Cover Crop .....	105
5.1.10	Cultivation Strategy .....	105
5.1.10.1	conventional farming .....	105
5.1.10.2	organic farming .....	105
5.1.11	Grazing .....	105
5.1.11.1	Grazing Intensity .....	105
5.1.11.1.1	no grazing .....	105
5.1.11.1.2	grazing present, intensity unspecified .....	106
5.1.11.1.3	Extensive, freerange grazing .....	106
5.1.11.1.4	intensive grazing .....	106
5.1.11.2	Grazing Lifestock per ha .....	106
5.1.11.3	Grazing Cycle .....	106
5.1.11.3.1	All Year-round Grazing .....	106
5.1.11.3.2	Seasonal Grazing .....	106
5.1.11.3.3	Rotational Grazing, Paddocks .....	106
5.1.11.3.4	Occasional Grazing .....	107
5.1.11.3.5	Unmanaged Natural Grazing .....	107
5.1.11.4	Grazing Routine .....	107
5.1.11.4.1	Day Grazing .....	107
5.1.11.4.2	Night Grazing .....	107
5.1.11.4.3	Day and Night Grazing .....	107



5.1.11.5	Livestock Species Type .....	107
5.1.11.5.1	Cattle .....	107
5.1.11.5.2	Horses .....	107
5.1.11.5.3	Deer .....	107
5.1.11.5.4	Pigs, Boars .....	107
5.1.11.5.5	Sheep .....	108
5.1.11.5.6	Goats .....	108
5.1.11.5.7	Poultry .....	108
5.1.11.5.8	Other Grazing Animals .....	108
<b>5.2</b>	<b>Forest Land Management .....</b>	<b>108</b>
5.2.1	Forest Age Structure .....	108
5.2.1.1	even-aged stands .....	108
5.2.1.2	uneven-aged stands .....	108
5.2.1.3	all-aged stands, old-growth forest .....	109
5.2.2	Forest Age Stage .....	109
5.2.2.1	seedlings .....	109
5.2.2.2	young or mid-aged trees .....	109
5.2.2.3	grown-up or mature trees .....	109
5.2.3	Forest Composition .....	109
5.2.3.1	mixed forest stands .....	109
5.2.3.2	unmixed forest stands .....	110
5.2.4	Forestry Practice .....	110
5.2.4.1	Coppice, low forest .....	110
5.2.4.2	coppice-standard combination .....	110
5.2.4.3	high forest .....	110
5.2.5	Forestry Rotation System .....	110
5.2.5.1	short rotation coppice (SRC) plantation .....	110
5.2.5.2	short rotation forestry (SRF) plantation .....	111
5.2.5.3	intermediate or long rotation forestry .....	111
5.2.5.4	continuous cover forestry .....	111
5.2.6	Forest Rejuvenation .....	111
5.2.6.1	planted rejuvenation .....	111
5.2.6.2	natural forest succession .....	111
5.2.6.2.1	self-seeded forest succession .....	111
5.2.6.2.2	re-sprouting forest .....	112
5.2.7	Silvicultural Measure .....	112
5.2.7.1	forest cleaning, weeding .....	112
5.2.7.2	forest thinning .....	112
5.2.7.3	forest pruning .....	112
5.2.7.4	ring-barking, girdling .....	112
5.2.7.5	interplanting .....	112
5.2.7.6	dead wood removal .....	113
5.2.7.7	forest irrigation .....	113
5.2.7.8	forest drainage .....	113
5.2.7.9	forest liming .....	113
5.2.7.10	forest firebreak .....	113
5.2.8	Silvicultural Harvest and Regeneration Method .....	113
5.2.8.1	clearcutting .....	113
5.2.8.2	shelterwood cutting .....	113
5.2.8.3	femel cutting .....	114
5.2.8.4	strip cutting .....	114
5.2.8.5	selection cutting .....	114
5.2.8.6	coppicing .....	114
5.2.8.7	pollarding .....	115
5.2.9	Forest Product Type .....	115
5.2.9.1	Wood Product .....	115
5.2.9.1.1	timber wood .....	115

5.2.9.1.2	energy wood.....	115
5.2.9.1.3	wood fibre .....	115
5.2.9.2	Non-wood Product .....	115
5.2.9.2.1	cork.....	116
5.2.9.2.2	resin.....	116
5.2.9.2.3	latex, natural rubber .....	116
5.2.9.2.4	incense .....	116
5.2.9.2.5	myrrh.....	116
5.2.10	Forest History Type .....	116
5.2.10.1	primary or virgin forest .....	116
5.2.10.2	secondary or naturally regenerated forest .....	117
5.2.10.3	reforestation .....	117
5.2.10.4	afforestation.....	117
5.2.11	Forest Tree Species.....	117
5.2.11.1	Abies.....	117
5.2.11.2	Acer .....	117
5.2.11.3	Aesculus .....	118
5.2.11.4	Alnus.....	118
5.2.11.5	Betula .....	118
5.2.11.6	Carpinus .....	118
5.2.11.7	Castanea .....	118
5.2.11.8	Cedrus .....	118
5.2.11.9	Corylus.....	118
5.2.11.10	Cupressoideae.....	118
5.2.11.11	Eucalyptus .....	118
5.2.11.12	Fagus .....	118
5.2.11.13	Fraxinus.....	118
5.2.11.14	Ginkgo .....	118
5.2.11.15	Juglans.....	119
5.2.11.16	Larix.....	119
5.2.11.17	Picea.....	119
5.2.11.18	Pinus.....	119
5.2.11.19	Platanus .....	119
5.2.11.20	Populus .....	119
5.2.11.21	Pseudotsuga.....	119
5.2.11.22	Quercus.....	119
5.2.11.23	Salix .....	119
5.2.11.24	Taxus .....	119
5.2.11.25	Tilia.....	119
5.2.11.26	Ulmus .....	119
<b>5.3</b>	<b>Industrial Land Management.....</b>	<b>119</b>
5.3.1	Mining Technique .....	120
5.3.1.1	Surface Open Pit Mining.....	120
5.3.1.2	Underground Mining.....	120
5.3.1.3	Under Water Mining .....	120
5.3.1.4	Salines Extraction Site .....	120
5.3.1.5	Leaching, Solution Mining .....	120
5.3.1.6	Fracking.....	120
5.3.2	Mining Product Type.....	120
5.3.2.1	Fossil Hydrocarbon Fuels.....	120
5.3.2.1.1	Hard Coal.....	120
5.3.2.1.2	Lignite Coal .....	120
5.3.2.1.3	Peat .....	120
5.3.2.1.4	Crude Oil.....	120
5.3.2.1.5	Oil Sands.....	120
5.3.2.1.6	Bituminous Rocks .....	121
5.3.2.1.7	Mineral Gas .....	121

5.3.2.2	Metal Ores.....	121
5.3.2.2.1	Iron Ores.....	121
5.3.2.2.2	Nonferrous Metal Ores .....	121
5.3.2.2.3	Rare Earths .....	121
5.3.2.3	Non-Metallic Minerals.....	121
5.3.2.3.1	Stones And Earths .....	121
5.3.2.3.2	Chemical Minerals.....	121
5.3.2.3.2.1	Salt.....	121
5.3.2.3.3	Precious And Semi-Precious Stones .....	121
5.3.2.4	Other Mining Material .....	121
<b>5.4</b>	<b>Terrain Modification and Land Engineering Measure .....</b>	<b>121</b>
5.4.1	terraced terrain.....	121
5.4.2	artificial terrain modification .....	122
5.4.3	artificial snow preparation .....	122
5.4.4	snow farming area .....	122
5.4.5	avalanche prevention or protection installation .....	122
<b>5.5</b>	<b>Administrative regulations, Use constraints.....</b>	<b>122</b>
5.5.1	Access restriction .....	122
5.5.1.1	Civil, open .....	122
5.5.1.2	civil and military .....	122
5.5.1.3	temporary restricted .....	123
5.5.1.4	military only, restricted .....	123
5.5.2	Protected area type .....	123
5.5.2.1	nature conservation area .....	123
5.5.2.2	landscape conservation area.....	123
5.5.2.3	Natura2000 .....	123
5.5.2.4	Birds retrieval area .....	123
5.5.2.5	Biosphere reserve .....	123
5.5.2.6	Geopark.....	124
5.5.2.7	National Park.....	124
5.5.2.8	other protected area type.....	124
<b>6</b>	<b>Status, Condition.....</b>	<b>124</b>
<b>6.1</b>	<b>Land use status .....</b>	<b>124</b>
6.1.1	under construction .....	124
6.1.2	never been in use.....	125
6.1.3	out of use .....	125
6.1.4	abandoned .....	125
6.1.5	clear cut.....	125
6.1.6	collapsed, destroyed, damaged .....	125
6.1.7	managed nature restoration .....	125
<b>6.2</b>	<b>Damage Reason .....</b>	<b>125</b>
6.2.1	Geological or Hydrological .....	125
6.2.1.1	tsunami.....	126
6.2.1.2	volcanic eruption.....	126
6.2.1.3	earthquake .....	126
6.2.1.4	subsidence and collapse.....	126
6.2.1.5	landslide .....	126
6.2.1.6	snow avalanche .....	126
6.2.1.7	flood .....	126
6.2.2	Meteorological or Climatological .....	127
6.2.2.1	drought.....	127
6.2.2.2	extreme temperatures .....	127
6.2.2.3	storm damage .....	127
6.2.2.4	lightning.....	127

6.2.2.5	storm surge .....	127
6.2.3	Fire .....	127
6.2.3.1	forest fire, wildfire.....	127
6.2.3.2	underground fire .....	128
6.2.4	Biological.....	128
6.2.4.1	insect infestation.....	128
6.2.4.2	mould infestation .....	128
6.2.4.3	epidemic.....	128
6.2.4.4	allergens .....	128
6.2.4.5	animal browsing, overgrazing .....	128
6.2.4.6	animal trampling .....	128
6.2.5	Cosmic.....	128
6.2.5.1	meteorite impact .....	128
6.2.5.2	magnetic disruption .....	129
6.2.5.3	solar and cosmic radiation .....	129
6.2.6	Contamination or pollution.....	129
6.2.6.1	Radioactive contamination .....	129
6.2.6.2	chemical, toxic pollution .....	129
6.2.6.3	soil salinization .....	129
6.2.6.4	oil contaminated .....	129
6.2.6.5	explosives contamination.....	129
6.2.6.6	plastic pollution.....	129
6.2.7	Intentional Or Accidental Structural Damage .....	129
6.2.7.1	structural decay.....	129
6.2.7.2	demolition, explosion.....	129
<b>6.3</b>	<b>Degenerative process.....</b>	<b>130</b>
6.3.1	deforestation .....	130
6.3.2	soil erosion .....	130
6.3.3	desertification .....	130
6.3.4	glacier melting.....	130
<b>7</b>	<b>Geographical Characteristics .....</b>	<b>130</b>
<b>7.1</b>	<b>Habitat Context .....</b>	<b>130</b>
7.1.1	Marine Habitats .....	130
7.1.2	Coastal Habitats .....	130
7.1.3	Inland Surface Waters Habitats .....	131
7.1.4	Mires, Bogs and Fens .....	131
7.1.5	Grasslands and Lands Dominated By Forbs, Mosses Or Lichens .....	131
7.1.6	Heathland, Scrub and Tundra .....	131
7.1.7	Woodland, Forest and Other Wooded Land.....	131
7.1.8	Inland Unvegetated Or Sparsely Vegetated Habitats .....	131
7.1.9	Regularly Or Recently Cultivated Agricultural, Horticultural and Domestic Habitats .....	131
7.1.10	Constructed, Industrial and Other Artificial Habitats .....	131
7.1.11	Habitat Complexes.....	131
7.1.12	Lagoon .....	131
7.1.13	Estuary .....	131
7.1.14	Marine Inlet, Fjord.....	131
7.1.15	Coastal Salt Marsh .....	132
7.1.16	Intertidal Flat .....	132
<b>7.2</b>	<b>Height Zone .....</b>	<b>132</b>
7.2.1	planar zone .....	132
7.2.2	collin zone .....	132
7.2.3	submontane zone .....	132
7.2.4	montane zone .....	132
7.2.5	high montane zone .....	132
7.2.6	subalpine zone .....	133

7.2.7	alpine zone .....	133
7.2.8	nival zone .....	133
<b>7.3</b>	<b>Geographical Context .....</b>	<b>133</b>
7.3.1	inland context .....	133
7.3.2	coastal context .....	133
7.3.3	island context .....	134
7.3.4	oceanic context .....	134
7.3.5	urban context .....	134
7.3.6	rural context .....	134
7.3.7	riparian context .....	134
7.3.8	mountain context .....	134
<b>7.4</b>	<b>Geomorphological landform type .....</b>	<b>134</b>
7.4.1	Geomorphological landform .....	135
<b>7.5</b>	<b>Littoral Zone .....</b>	<b>135</b>
7.5.1	Epilittoral .....	135
7.5.2	Supralittoral .....	135
7.5.3	Eulittoral, Intertidal .....	135
7.5.4	Infralittoral, Sublittoral .....	135
<b>7.6</b>	<b>Physical Climate Zone .....</b>	<b>136</b>
7.6.1	Tropical Climate Zone .....	136
7.6.2	Subtropical Climate Zone .....	136
7.6.3	Temperate Climate Zone .....	136
7.6.4	Polar and Subpolar Climate Zone .....	136
<b>7.7</b>	<b>Terrain Characteristics .....</b>	<b>136</b>
7.7.1	Terrain Parameters .....	136
7.7.1.1	Terrain Elevation .....	136
7.7.1.2	Terrain Slope .....	136
7.7.1.3	Terrain Aspect, Exposition .....	137
<b>8</b>	<b><i>Spatial Characteristics</i> .....</b>	<b>137</b>
<b>8.1</b>	<b>Spatial Distribution Pattern .....</b>	<b>137</b>
8.1.1	Homogeneous, evenly textured .....	137
8.1.2	Heterogeneous, mixed, unevenly textured .....	137
8.1.3	Mosaic pattern .....	137
8.1.4	Scattered pattern .....	138
8.1.5	Regular spacing .....	138
<b>8.2</b>	<b>Linear feature pattern .....</b>	<b>138</b>
8.2.1	hedge rows .....	138
8.2.2	rows of trees .....	138
8.2.3	stone walls .....	138
<b>8.3</b>	<b>Linear technical network .....</b>	<b>139</b>
8.3.1	roads or railways .....	139
8.3.2	pipelines .....	139
<b>8.4</b>	<b>Vertical position .....</b>	<b>139</b>
8.4.1	on ground surface .....	139
8.4.2	suspended, elevated .....	139
8.4.3	under ground .....	139
<b>9</b>	<b><i>Object Characteristics</i> .....</b>	<b>139</b>
<b>9.1</b>	<b>Geometric parameters .....</b>	<b>140</b>
9.1.1	object area size .....	140
9.1.1.1	object area size value from .....	140

9.1.1.2	object area size value to.....	140
9.1.2	object length .....	140
9.1.2.1	object length value from.. .....	140
9.1.2.2	object length value to.. .....	140
9.1.3	object width .....	140
9.1.3.1	object width value from.. .....	141
9.1.3.2	object width value to.. .....	141
9.1.4	object height .....	141
9.1.4.1	object height value from.. .....	141
9.1.4.2	object height value to.. .....	141
9.1.5	area coverage.....	141
9.1.5.1	area coverage value from.....	141
9.1.5.2	area coverage value to.. .....	142
<b>9.2</b>	<b>Occurrence Type .....</b>	<b>142</b>
9.2.1	Percentage occurrence .....	142
9.2.1.1	Percentage occurrence value from.. .....	142
9.2.1.2	Percentage occurrence value to.....	142
9.2.2	Countable occurrence .....	142
9.2.2.1	Countable occurrence value from.....	142
9.2.2.2	Countable occurrence value to.. .....	142
9.2.3	Present occurrence .....	143
<b>9.3</b>	<b>Temporal Parameters.....</b>	<b>143</b>
9.3.1	Instant event date.....	143
9.3.1.1	Instant event date value from.....	143
9.3.1.2	Instant event date value to.. .....	143
9.3.2	duration .....	143
9.3.2.1	duration value from.. .....	144
9.3.2.2	duration value to.....	144
9.3.3	period.....	144
9.3.3.1	period start date .....	144
9.3.3.1.1	period start date value from.. .....	144
9.3.3.1.2	period start date value to.....	144
9.3.3.2	period end date.....	144
9.3.3.2.1	period end date value from.....	144
9.3.3.2.2	period end date value to.. .....	145
9.3.4	recurring frequency.....	145
9.3.4.1	recurring frequency value from.....	145
9.3.4.2	recurring frequency value to.. .....	145
<b>References.....</b>		<b>146</b>

## Part A: Introduction to the EAGLE concept

### Scope of EAGLE Concept

The EAGLE concept embodies the EAGLE matrix and the EAGLE data model as the two outcomes of the EAGLE groups work, as well as the conceptual idea of its application. To help the user understanding the concept, this explanatory documentation has been written.

This documentation consists of two main parts:

- introduction to the topic with scope and background, brief explanation of how to use the matrix and the relation of the EAGLE concept to other existing standards and nomenclatures.
- hierarchically structured explanations and definitions of the EAGLE matrix elements: the Land Cover Components (LCC), the Land Use Attributes (LUA) and the Land Characteristics (LCH).

### Background and motivation

According to the broad field of applications of land cover (LC) and land use (LU) information there are many existing classification systems and nomenclatures. Each of them is addressing the themes LC and LU according to their purposes with partly different definitions and thematic focus. Land cover and land use are strongly interconnected and influence each other, and for many applications both land cover and land use information is needed. Therefore most of the existing classification systems contain to some extent a mixture of land cover and land use class definitions. An overall tendency shows on the one hand a focus on land cover information e.g. in the vegetation area, and on the other hand another focus on land use information in the anthropogenic areas, all occurring within the one and same classification system. So far, it has always been difficult to strictly separate LC from LU information among the existing approaches.

For recent and future land monitoring activities and initiatives it is important to be able to have both a pure land cover and pure land use perspective on landscape separately from each other, as well as being able to re-combine those two themes.

### Criteria collection

In response to existent and upcoming monitoring requirements, driven by European legislation and monitoring activities and user needs on European and national level, a list of criteria for a suitable data model has been collated. From the conceptual point of view, the data model for a future European land monitoring system should:

- Be object-oriented and describe landscape by its elementary properties instead of classifying,
- Separate land cover from land use information,
- Describe land cover and land use in a mutually exclusive and comprehensive way,
- Be scale-independent,
- Allow semantic translation between classification systems,
- Help to solve ambiguous descriptions, semantic gaps or overlaps in certain class definitions,
- Be INSPIRE compliant,
- take into account products from European Earth observation program COPERNICUS,
- Support the bottom-up approach as well as top-down initiatives,
- Store parameterized data such as counts and numerical values,
- Be capable of handling spatial multi-scale dimensions and temporal aspects,
- support backwards compatibility between past time and recent datasets,
- Be flexible enough for inserting new elements in the model.

## Guiding questions

A fundamental criterion for the coherent description of landscape is the separation of LC and LU. The development of the EAGLE concept was based on the seed questions:

- What is the ideal way to model the landscape from a separated and re-combinable perspective of LC and LU?
- What kind of land cover information can be captured from bird's perspective above landscape, mainly with remote sensing data and methods?
- How to integrate further landscape information that is important for land monitoring purposes from other sources of information besides remote sensing to understand the consequences of human interaction with the environment?
- How can an object-oriented modeling approach be applied in the field of land monitoring?
- How to make the data model open for various applications and information sources as well as independent from scale?
- How to maintain backward compatibility to existing historical data sets (e.g. CLC time series)?

To outline the targeted application purpose of the EAGLE concept, three key messages shall be mentioned here:

- The EAGLE matrix aims at being a tool for analytic decomposition of class definitions and for semantic translation between recent or future nomenclatures.
- The EAGLE model offers a conceptual basis for a future harmonized European land monitoring system and is open to be implemented as an object-oriented guideline for mapping and monitoring initiatives.
- The concept can be used as a semantic inventory to pick and combine defining elements for the design of new classes and nomenclatures.
- The EAGLE concept does not represent another classification system but instead a descriptive vehicle for harmonization of LC/LU information supporting both centralized top-down and decentralized bottom-up approaches.

It is important to state that the EAGLE concept with the data model, the matrix and this explanatory documentation are living documents and do not claim to be completely finalized. They are in the state of constant work in progress. Furthermore, any suggestion for improvement or modification is welcome and will be taken into consideration for future enhancement of the concept.

## Definition of terms

For a better understanding of this documentation, at least the terms 'land cover' and 'land use' shall be briefly defined, how they are understood in the context of the EAGLE concept.

*Land cover* is seen as the "physical and biological cover of the Earth's surface including artificial surfaces, agricultural areas, forests, (semi-)natural areas, wetlands, water bodies" in the INSPIRE Directive. It is an abstraction of reality as the Earth's surface is actually populated with landscape elements.

The landscape elements are physical features like buildings, roads, trees, plants, water bodies etc. Inside a unit of land, the combination of these landscape elements together with their (bio-)



physical characteristics form the land cover type of that particular unit. However, mapping and describing land cover within a certain classification system is usually different from the mapping of the individual landscape elements and it is concerned with the portrayal of a continuous surface and not with the individual elements that comprise this surface. In this sense, classified land cover types are understood already as an abstraction of the surface.

In terms of the EAGLE concept, the abstracted representations of the real world landscape elements, that are relevant for land cover modeling, are called ‘land cover components’ (LCC). These land cover components appear to have their specific distribution or mixture and spatial extent. In conventional classification systems, typical spatial constellation of LCCs, that seem common in the area of appearance, are given a name by embracing them in land cover classes, which then are mapped according to mapping guidelines.

*Land use* is defined as the “territory characterized according to its current and future planned functional dimension or socio-economic purpose (e.g. residential, industrial, commercial, agricultural, forestry, recreational)”, as laid out also in the INSPIRE Directive.

Land cover and land use are, however, related and often combined in practical applications. Data sets combining land use and land cover often emphasize land use aspects in intensively used areas (e.g. settlements, croplands) and land cover aspects in extensively used areas (e.g. forest, natural vegetation).

*Land characteristics* are used as a third important term in the context of the here explained concept. They contain further descriptive information on a particular land unit and specify it in more detail with some other information that are not storable neither under “land cover” nor under “land use”. Further explanation on that is given in the following chapter.

## Technical representations of EAGLE concept

The two representations of the EAGLE concept, matrix and model, contain the same information and are based on the same considerations and model elements. According to the application purpose the users can decide to either choose to work with the matrix or with the Unified Modeling Language (UML) model. In this regard, please be aware of the different versions that so far has been released, when comparing matrix with UML model.

### a. EAGLE Matrix Structure

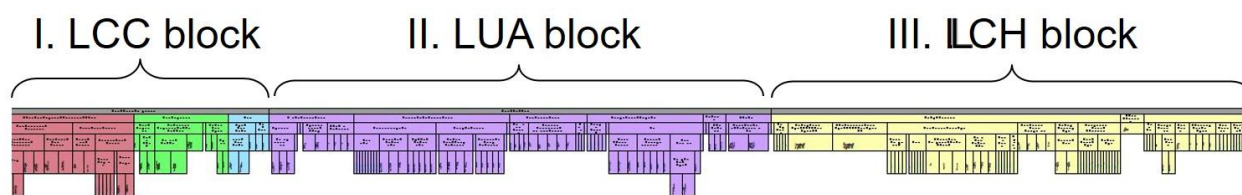
In the EAGLE concept, the basis for the description of landscape is the land cover components. The list of land cover components is intended to be exhaustive and mutually exclusive.

Land cover, land use and other characteristic descriptors can - and mostly must - be used in flexible combination with each other. These combinations attached to a certain class from one classification system can then be compared with the componential description of a class from another classification system.

The EAGLE matrix itself is presented in the form of an Excel cross table and is subdivided into three content-related main blocks. The matrix elements represent elementary landscape descriptors of:

- I. **LAND COVER Components** – LCC, (e.g. trees, bushes, bare soils)
- II. **LAND USE Attributes** – LUA, (e.g. agriculture, forestry, mining, residential areas)
- III. **LAND CHARACTERISTICS** - LCH (e.g. land management type, spatial pattern, (bio)-physical

characteristics, geographical context, geometric or temporal parameters, ecosystems types, status).



**Figure 1: Screenshot of the EAGLE matrix (total view in horizontal form) with the three blocks Land Cover Components (LCC), Land Use Attributes (LUA) and the Land Characteristics (LCH), in hierarchical order with parent and child (sub-ordered) elements.**

Level	Land Cover Components																				
Lv1	ABIOTIC								BIOTIC					WATER							
Lv2	Artificial				Natural				Woody		Herbaceous		Succu lents	Lichen, Mosses, Algae		Liquid	Solid				
Lv3	Sealed		Non- Sealed		Consoli- dated	Un- Consolidated			Trees	Bushes	Grass- like	Forbs Ferns		Lichens	Mosses	Algae	Inland	Marine	Snow	Ice	
Lv3	Buildings	Specific Structures	Open Sealed	Open Non-Sealed	Waste	Bare Rock	Hard Pan	Min. Fragments	Bare Soil	Nat. Deposits				Regular Bushes	Dwarf Shrubs	Grass, Cereals	Reeds, Bambo				[...]

Level	Land Use Attributes																	
Lv1	Primary Production			Secondary Production			Tertiary Production				Transport, Logistic, Utilities		Residentl		[...]			
Lv2	Agriculture	Forestry	Mining	Fishing	Aquaculture, Industry	Manufacture, Energy Prod.	Other Industry	Commercial	Financial, Information	Community Services	Cultural, Recreational	Other Services	Transport Netw.	Logistic, Storage	Utilities	Permanent Resi	Temporary Resi	[...]
Lv3	[...]			[...]	[...]	[...]	[...]	[...]	[...]	[...]	[...]	[...]	[...]	[...]	[...]			

Level	Land Characteristics																
Lv1	Built-up Characteristics			Vegetation Characteristics			[...]	Land Management			[...]	Status		Spatial Patterns		[...]	
Lv2	Soil Sealing Deg.	Built-up Pattern	Building Type	Surface Material	Leaf Form	Growth Form	Phenology	Crown Cover Dens.	Cult. Measures	Crop Type	Forest Practise	Mining Technique	Admin Regulation	Under Construction	Damaged	Heterogenous	Scattered
Lv3	[...]	[...]	[...]	[...]	[...]	[...]	[...]	[...]	[...]	[...]	[...]	[...]	[...]				

**Figure 2: Schematic illustration of the three EAGLE matrix blocks, normally all arranged side by side next to each other. here below each other with reduced level of detail.**

In theory, the structure of the matrix and the “architecture” of the UML model allow the LCC to be combined with any kind of LUA or LCH. In practice however, the user has to be aware of the fact that not all combinations of matrix elements make sense. The architecture of the UML model takes this

into account in a way that the various LCH are arranged as attributive attachments to the LCC or LC Unit on different hierarchical levels.

To find a common language when speaking about the EAGLE matrix, we suggest to use distinct expressions to address specific parts of the matrix.

- Matrix block: the three main blocks of the matrix are the Land Cover Components, the Land Use Attributes and the Land Characteristics. These are the first entry points into the content of the matrix structure
- Matrix module: a collection of matrix elements that refer to a certain topic or phenomenon (e.g. Status), a main Land Cover Component (e.g. Biotic / Vegetation Characteristics) or a certain Land Use Type (e.g. Agricultural Land Management).
- Matrix segment: a section of a matrix module that contains a coherent group of elements under a thematic sub-heading (e.g. Water Regime under the module Water Characteristics). The segments may be subdivided into sub-segments (sub-headings).
- Matrix element: the lowest but most important level of the matrix, where the single values are listed to store the characteristic information of an object in particular. All entries (LCCs, LUAs, LCHs) taken together form the entire matrix (and model respectively).

Depending on the complexity of the matrix modules, they are subdivided into sometimes many, sometimes few segments, sub-segments and elements. Therefore the information carrier elements will not always be placed on the same hierarchical level throughout the entire matrix, but the “depth” of the bottom level may vary from segment to segment.

In Block I. (LCC) and Block II: (LUA), all elements follow a hierarchical order, and are subdivided into more details subtypes. No headings exist, every element can be chosen on every level to describe a land unit regarding existing LCCs (e.g. level 1 LCC *vegetation*, level 2 LCC *woody vegetation*, level 3 LCC *trees*) and LUAs (level 1 LUA *industries*, level 2 LUA *mining*, level 3 LUA *under water mining*). In the LCH block it is different, as the higher leveled matrix entries are basically headings (modules), followed by sub-heading (segments), which can't be chosen to characterize a Land Unit, but firstly to give structure to the matrix elements. Therefore some intermediate level entry does not make sense to consider as information carrier (e.g. “spatial pattern”), but only the particular type of spatial pattern one level further down called e.g. “mosaic pattern”). In exceptional cases – e.g. in the segment of crop types, also elements above the bottom level can be used (e.g. *arable crops* as a group of *cereals*) to further characterize a given LCC or LUA.

## **b. Horizontal and vertical Matrix Form**

The EAGLE matrix exists in two arrangements, a horizontal and a vertical arrangement, while the content of those two forms are identical.

Initially, in the horizontal form, each EAGLE matrix element is stored as one single table column, and many child elements are grouped under a parent element (several table cells unified into one field) on a higher hierarchical level. In the horizontal form, it is visually better recognizable how the higher leveled (parent) elements are subdivided into lower level (child) elements, in separation to neighboring elements (on the same hierarchical level) which again are subdivided into sublevel elements. This results in a fairly broad table from left to right end. The hierarchical levels go from top to bottom (expressed as table lines), and the number of columns is determined by the number of bottom (lowest) level matrix elements, not counting the higher level elements because they are situated as unified table cells above the bottom line.

In the other – vertical – form of the matrix the elements are arranged as table lines. The difference to the horizontal form is that every hierarchical level has its one table line, the parent as well as the

child elements. This form results in a fairly long table from top to bottom end. The hierarchical levels go from left to right (expressed as table columns), and the number of lines is determined by the number of bottom level elements plus every hierarchical parent level above them.

In the fictive case of 6 elements with a hierarchical structure of 2 parent elements, each of them having 3 child elements, the horizontal matrix has 6 columns (and 2 lines), while the vertical matrix has 8 lines (and 2 columns).

**Table 2: Horizontal matrix form**

<i>Level 1</i>	<b>1.</b>			<b>2.</b>		
<i>Level 2</i>	<b>1.1</b>	<b>1.2</b>	<b>1.3</b>	<b>2.1</b>	<b>2.2</b>	<b>2.3</b>

**Table 1: Vertical matrix form**

<i>Level 1</i>	<i>Level 2</i>
<b>1.</b>	
	<b>1.1</b>
	<b>1.2</b>
	<b>1.3</b>
<b>2.</b>	
	<b>2.1</b>
	<b>2.2</b>
	<b>2.3</b>

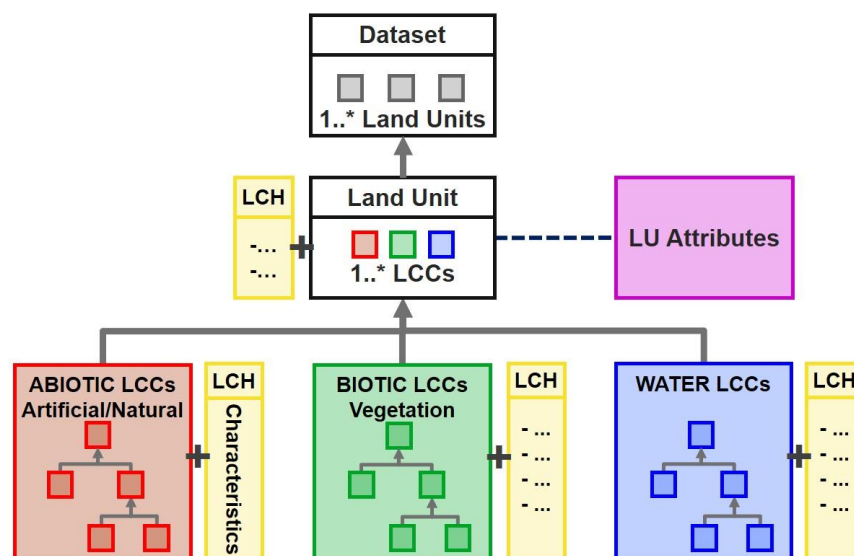
### c. EAGLE Data Model Structure

The EAGLE data model is available as a UML (Unified Modeling Language) class diagram that is following the ISO standard 19109 (Geographic information - Rules for application schema).

The object-oriented data model is designed to be plugged in the data model as specified in the INSPIRE Directive Annex II - Land Cover data specification where a land cover data set consists of a collection of land cover units. At each land cover unit, the land cover has been observed on one or more observation dates. The extension of the EAGLE data model starts at the land cover unit (LCU) level where each unit contains one to many land cover components (LCCs) (simplified situation).

The land cover unit is described as a discrete geometric feature whereas the land cover component is described as a parametric observation; also several LCCs can occur in combination with each other inside the containing land cover unit. Coming from the extension of the INSPIRE Land Cover specification the parametric observation is meant to store either the presence of a particular land cover type, a countable parameter (i.e. number of trees) or a percentage value indicating the covered area within the enclosed geometry.

The data model is expressed in UML and is visualized in a UML chart. It makes it possible to mirror the Land Cover Components from the matrix as UML elements into three main branches of UML-classes “ABIOTIC”, “VEGETATION/BIOTIC” and “WATER”. Any description of landscape unit or decomposing of a given land cover class (as part of a nomenclature) must start with the selection of one or more Land Cover Components



**Figure 3: Simplified graphic on the EAGLE UML data model, with Land Cover Components, enriched by Land Characteristics, one to many of them contained in a Land Unit, combined Land Use Attributes**

The Land Use attributes are strongly related to the existing proposal of the Hierarchical INSPIRE Land Use Classes (HILUCS) and are not included explicitly in the EAGLE UML chart portrayal, but only mentioned through a linked relation. The LUA are attached to the Land Cover Unit.

The Characteristics, which can be chosen to describe further details of the Land Cover Components, are arranged around the Land Cover Components as additional boxes.

Depending on their applicability, they are only valid for specific part of the Land Cover Components and therefore are linked respectively. E.g. the attribute “soil sealing degree” can be applied for any abiotic spatial unit ( - even any biotic in theory), while e.g. the status attribute “clear cut” only relates to vegetation or abiotic natural surfaces materials. Other characteristics like “spatial landscape

patterns” could be used to describe a spatial pattern composed by one element or a mosaic of several landscape components in larger scale.

The complete documentation of the UML data model can be found for downloading on the EAGLE web page in a separate document (EAGLE\_datamodel\_documentation\_v2.3.pdf), the data model itself is provided in an Enterprise Architect file (EAGLE\_model\_v2.3.eap).

## Part B: Thematic Content and Definitions of EAGLE Model Elements

Under this heading follows the main part of the explanatory documentation. All three thematic blocks of the EAGLE model – the Land Cover Components (I.), the Land Use Attributes (II.), and the Land Characteristics (III.) – with their model elements are explained here. Short definitions indicate their semantic content and meaning as well as their role within the data model. For an easier reading and navigation through the model, all elements are listed in a hierarchically numbered order, following a logical categorization with sub types (as child and parent). The sequence of elements (e.g. within a code list) normally do not indicate any principle of dominance or first choice.

It is recommended to read the EAGLE matrix or UML chart of data model in parallel with this documentation for better understanding.

### Land Cover Components Structure:

The LCC part aims at being mutually exclusive and exhaustive, meaning that any kind of land cover type can be expressed by a LCC or a combination of them. They are ordered and subdivided in a logical and hierarchical manner. Every level of LCC can be used as a modeling element to either semantically describe a class definition or to map landscape (e.g. *biotic vegetated areas* or *woody vegetation* or *trees*). There are no segments or sub-headings within this block.

### Land Use Attributes Structure:

The LUA follow in principle the Hierarchical INSPIRE Land Use Classification System (HILUCS). In some cases the EAGLE LUAs have been extended or modified compared to the HILUCS classes to fit the purpose of the EAGLE concept, e.g. being able to describe CLC classes. Here also every level of LUA is a valid element to describe the land use, in a more or less detailed way. There are no segments or sub-headings within this block.

### Structuring of Land Characteristics:

The LCH is the largest block in the EAGLE matrix with the highest number of elements and also of hierarchical levels. Normally, only the bottom level entries ((collection of elements under a certain heading, mostly in form of code lists) are the element to work with. All other entries are parent or sub-parent entries above them, and only give logically grouped and hierarchical structure to the elements. However, as an exception, within some code lists, there is also a segment-internal “micro-hierarchy”, like e.g. under LCH “crop types”.

## I. Matrix block: LAND COVER COMPONENTS (LCC)

### 1 Abiotic, Non-Vegetated Surfaces and Objects

Any unvegetated surfaces, either covered with man-made artificial structures or geologically natural material surfaces (with or without anthropogenic influence or impact).

[Back to top](#)

#### 1.1 Artificial Surfaces and Constructions

All surfaces where natural landscape has been changed by or is under influence of human construction activities by replacing natural surfaces with artificial 2D/3D constructions or abiotic artificial materials. Artificial parts of urban and rural areas, where mankind has built settlement infrastructures.

Includes:

Sealed areas (buildings, other constructions and sealed flat surfaces) and non-sealed areas (no buildings, artificial and unsealed).

Excludes:

Urban greenery may be artificial and under human maintenance and form part of settlements, but after all it is vegetation and not to be placed here but under LCC-2 Biotic Vegetation.

[Back to top](#)

##### 1.1.1 Sealed Artificial Surfaces and Constructions

In the EAGLE context *Sealed Surface* is seen as the sole part of space that is covered with artificial constructions like a building or surfaces like a pavement. Built-up areas in a narrow sense (excluding associated non-sealed areas). Sealed Artificial Surface includes therefore all impervious and sealed surfaces that are covered mainly by buildings and artificial constructions (3D) or impervious surfaces (2D).

Excludes:

Non-sealed areas associated to the Artificial Surfaces and Constructions.

[Back to top](#)

##### 1.1.1.1 Buildings

Constructions above ground that are intended or used for the shelter of humans, animals, things, the production of economic goods or the delivery of services and that refer to any structure permanently constructed or erected on its site (based on INSPIRE Data Specification Buildings). Covered by roof, of human origin, made of and covered by artificial material (e.g. concrete, brick, metal) or natural material (e.g. rock, pale, soil/green roof, wood).

[Back to top](#)

##### 1.1.1.1.1 conventional buildings

The conventional buildings generally are hosting human activities (residential, industrial, commerce and services) and being of large or medium size (around 15-20 m<sup>2</sup> and more). (INSPIRE TWG BU data specifications).

Includes:

e.g. dwelling houses, blocks of flats, city street blocks, stores, supermarkets, office buildings, agricultural buildings, studs, farms, industrial buildings.

[Back to top](#)

##### 1.1.1.1.2 Specific buildings

The specific (significant) buildings are the buildings of significant size or height with specific



physical aspect that make them usable as landmarks and required by use cases such as mapping or travel safety (INSPIRE TWG BU data specifications).

Includes:

e.g. stadiums, churches, towers, greenhouses (Permanent or temporal installation for crop plantation purposes, mainly with light material like either glass or plastic folia).

[Back to top](#)

#### **1.1.1.2 specific structures and facilities**

Self-standing man-made construction that is not considered a building and has a dimensional extension, and typically stands on mainly sealed ground.

Includes:

e.g. bridges, antennae, cranes, chimneys, city walls, fences, monuments, protective dikes and dams, pylons, transformers, power plants, refineries, water sewage plants, recycling facilities, waste storage facilities, bottom-sealed dumpsite, storage tanks, pipelines, solar panels.

[Back to top](#)

#### **1.1.1.3 open sealed surfaces**

Flat surfaces covered by any type of impervious material that is used for artificial surface pavements (e.g. asphalt, concrete, tarmacadam).

Applicable for:

e.g. paved roads, parking lots, squares, storage areas, airport runways, quays, sealed bottom pools, unvegetated cemeteries.

Excludes:

gravel bed of railway track. It is an artificial surface but not impervious.

[Back to top](#)

### **1.1.2 Non-Sealed Artificial Surfaces**

Any artificial areas which are not sealed with built-up or non-built-up constructions. Non-sealed is here seen as permeable to water. However, non-sealed in this sense can still mean that vegetation is hindered to grow. Applies for areas, where the natural surface has been replaced by artificial material, or for areas covered with natural material which has been taken from its place of origin elsewhere and used here for a man-made non-sealed (non-impervious) and non-built-up artificial surface. Includes also waste materials.

[Back to top](#)

#### **1.1.2.1 Open Non-Sealed Artificial Surfaces**

Any open areas where natural surface material has been replaced by artificial material or natural material removed from its place of origin as result of human activity forming a non-sealed (pervious) and non-built-up (basically flat) surface. Although the surface may be compacted it still can be permeable for water. This component also applies for semi-sealed (semi-pervious) surfaces like e.g. grass pavers.

Applicable for:

Logistic and storage areas, festive squares, unpaved roads and parking lots, unvegetated sport fields.

Includes:

Surfaces covered by e.g. gravel, pebble, crushed stone, compacted soil, including non-sealed gravel railway tracks, grass pavers.

[Back to top](#)

#### **1.1.2.2 waste materials**

Areas covered by waste materials. Surfaces covered by e.g. household/communal/industrial waste.

Includes:

construction rubble, slag, cinder, metal, wood, dead organic material.

[Back to top](#)

## 1.2 Natural Material Surfaces

Any kind of surface material that remains in its natural consistence or form, either with or without anthropogenic influence. Consolidated and unconsolidated surfaces.

Includes:

unvegetated rocky mountainous regions, sand, quarries and extraction sites, etc.

[Back to top](#)

### 1.2.1 Consolidated Surfaces

Consolidated Surfaces are natural stone materials of geological origin free of vegetation cover that have continuous solid surface and are less permeable to water compared to other natural surface. As they are natural, this character is not supposed to be given for 100% of such surfaces.

[Back to top](#)

#### 1.2.1.1 bare rock

The rock surface is continuous except perhaps for a few cracks in the material. Some areas may be covered by shallow layers of soil or there could be isolated pockets of soil or a mixture of both. (ISO 19144-2 LCML, ISO/TC 211 N 3265, 2011-12-16, p. 104).

Includes:

e.g. solid (closed) rock formations, fresh lava flows, quarries, mineral extraction sites, open pit mines.

[Back to top](#)

#### 1.2.1.2 hard pan

Hardpans are particular soil layers or surfaces that have been indurated due to chemical or physical processes. Their hardness at the surface is irreversible. They form impenetrable layers for water and/or plant roots. In the context of LCML, these layers are only described when occurring at the surface (ISO 19144-2 LCML, ISO/TC 211 N 3265, 2011-12-16, p. 104).

[Back to top](#)

### 1.2.2 Unconsolidated Surfaces

Any surface with loose mineral particles of any size range, either as outcome of natural physical sedimentation processes or human activity.

Includes:

E.g. mountain slope debris, glacier moraines, river pebble banks, beaches, sand dunes, gravel bed of rail way tracks.

[Back to top](#)

#### 1.2.2.1 Mineral Fragments

Mineral Fragments come to be through mainly physical disintegration of geological formations and are the result of becoming smaller and smaller along time. They are accumulated on site due to sedimentary processes or human activity. Further subdivision is made according to their particle size and constellation.

[Back to top](#)

**1.2.2.1.1 boulders, stones**

Big mineral fragments, normally too heavy to be moved or carried a long distance by human strength, can only be moved by gravitative processes, glaciers or heavy floods, or stay on the spot till they further disintegrate. Particle size of ca. 20 to 200 cm or bigger.

[Back to top](#)

**1.2.2.1.2 pebbles, gravel, tuff**

Middle sized mineral fragments that are moved and accumulated through erosive and sedimentary processes in geomorphological sense. The particle size ranges between 2 cm and 20 cm.

Includes:

e.g. mountain slope debris, gravel river banks, open pit pebble mining of fossil river banks or fluvial sediments, volcanic lapilli fields

[Back to top](#)

**1.2.2.1.3 sand, grit**

Small and very small mineral fragments, loose and shifting sand and grit, can be moved by aeolian erosion and moderate erosive water currencies. Particle size between 0,06 mm and 2 cm.

Includes:

e.g. sand dunes, sand beaches, river sand banks, volcanic ash

[Back to top](#)

**1.2.2.1.4 clay, silt**

Very small mineral fragments, loose and shifting silt, clay surfaces, can be moved by aeolian erosion and moderate erosive water currencies. Particle size is below 0,06 mm.

Includes:

e.g. clay and silt flats, beaches, river sand banks, fine volcanic ash.

[Back to top](#)

**1.2.2.1.5 mixed unsorted material**

Unsorted mineral fragments ranging in size from silt-sized glacial flour to large boulders most frequently unconsolidated debris of glacial origin (moraines, till).

Includes:

e.g. any type of moraine formed by contemporary or former glaciers, any unsorted glacial sediment - till

[Back to top](#)

**1.2.2.2 bare soils**

Mixture of mineral and organic material that is fertile enough and capable of sustaining plant life, but being unvegetated at the moment of observation.

[Back to top](#)

**1.2.2.3 Natural Deposits**

Natural deposits are substrates that accumulate either by processes of chemical sedimentation (in combination with evaporation and crystallization) or by incomplete decay of biotic dead matter.

[Back to top](#)

**1.2.2.3.1 inorganic deposits**

Salt, gypsum and other substrates as a residual of water evaporative processes.

[Back to top](#)

#### **1.2.2.3.2 organic deposits, peat**

Accumulated partially decayed vegetation material (mostly *Sphagnum* moss, but also other plants) formed in wetland conditions, where lack of oxygen slows down decomposition rate.

[Back to top](#)

## **2 Biotic, Vegetation**

Any vegetated land surface, either naturally grown, semi-natural or artificially planted vegetation (e.g. crops, urban parks), with or without anthropogenic influence. Vegetation is subdivided into further components based on plant life forms i.e. woody, herbaceous, lichens/mosses.

[Back to top](#)

### **2.1 Woody Vegetation**

The distinction of woody vegetation into broad leaved plants, needle leaved plants and palm leaf plants can be done by combination with an attribute value of LCH *Leaf Form* under vegetation with the LCH phenology. Further, the LCH *Foliage Persistence* can indicate whether a woody plant species is deciduous or evergreen.

[Back to top](#)

#### **2.1.1 trees**

Perennial woody plant with single, self-supporting main stem or trunk, containing woody tissue and branching into smaller branches and shoots.

Includes:

Needle-leaved, broad-leaved and palm-leaved forestry species, fruit trees, ornamental trees.

Excludes:

Giant bamboo.

[Back to top](#)

#### **2.1.2 Bushes, Shrubs**

Perennial woody plants with shrub growth form i.e. multiple stems arising at or near the base, height usually less than 5 meters. Leaf type can be needle leaf, broadleaf or palm leaf, phenology either evergreen or deciduous, leaf surface type can be regular or sclerophyllous.

Includes:

wild-growing and cultivated (agricultural, ornamental) species.

[Back to top](#)

##### **2.1.2.1 regular bushes**

Perennial woody plants with multiple stems arising at or near the base, with an open and spreading growth form, height is usually less than 5 meters.

[Back to top](#)

##### **2.1.2.2 dwarf shrubs**

Short woody plants characterized by chamaephyte (dwarf-shrub/subshrub) growth form, bearing their buds on persistent shoots close to the ground, usually no more than 25 centimeters. Applicable for stress-tolerant plant groups, making up alpine, arctic or dry ecosystems, growing on nutrient-poor, often acidic soils or rock; also for prostrate shrubs, whose branches lie upon or just above the ground usually because of strong wind.

Includes: heathland/tundra species of e.g. the *Calluna*, *Erica*, *Vaccinium*, *Salix* groups, Mediterranean dwarf- shrub-form species such as *Thymus*, *Lavander*, *Rosmarinus*, alpine species of e.g. *Rhododendron*, *Leontopodium*.

[Back to top](#)

## 2.2 Herbaceous Vegetation

Annual, biennial or perennial plants that do not have a persistent woody stem above the ground (grass-like, forbs, ferns; in botanical term: herb). In contrary to woody plants, which have stems above ground that remain alive during the dormant season and grow shoots the next year from the above-ground parts, shoots of herbaceous plant die down at the end of growing season, so they regenerate themselves from tissues left above or under the ground (e.g. bulbs, rhizomes, tubers, seeds).

[Back to top](#)

### 2.2.1 Graminoids, grass-like

Grasses, or more technically graminoids, are monocotyledonous, usually herbaceous plants with narrow leaves growing from the base. They include the true grasses, of the *Poaceae* (or *Gramineae*) family, as well as the sedges (*Cyperaceae*) and the rushes (*Juncaceae*). The true grasses include cereals, bamboo and the grasses of lawns (turf) and grassland. Sedges include many wild marsh and grassland plants, and some cultivated ones. Belonging here regardless of being wild-growing - forming natural grasslands or being component of other biomes (e.g. wetlands, forest, tundra) or cultivated – forming cropland (arable, meadow, pasture) or grass surfaces / lawn for sports / recreation.

[Back to top](#)

#### 2.2.1.1 grasses, sedges, rushes, cereals

Annual or perennial graminoid plants, naturally growing or cultivated, with potential height not exceeding 2 meter.

Excludes: reeds and bamboo.

[Back to top](#)

##### 2.2.1.1.1 poaceae, grasses, cereals

Annual or perennial graminoid plants, naturally growing or cultivated, with potential height not exceeding 2 meter. Normally growing on mesic to dry soils, having hollow stalks with knots.

Includes: most grass species and cereals (e.g. wheat, barley, maize, rice).

[Back to top](#)

##### 2.2.1.1.2 Cyperaceae, Sedges, Rushes

Growing predominantly on wet soils, peat producers, mostly perennial with a grassy habit. The stalks are usually massive, rarely knotted and triangular.

[Back to top](#)

##### 2.2.1.2 reeds, bamboos, canes

Perennial graminoid plants potentially capable of reaching > 2 m height.

Includes:

common reed (*Phragmites australis*), high-growing bamboo species, tall bulrushes and sedges, sugar cane.

Special case giant bamboo:

The giant bamboo reeds grow significantly higher (10-40 m) than one would expect from “normal”

herbaceous vegetation types. Therefore, areas where giant bamboo is growing are often addressed as “forest” areas, because of the sheer height of the plants. The habitat type is different from normal herbaceous plants, as there can be a second layer understory growth like in tree forests underneath and in the shadow of the bamboo “canopy”. In such cases, it is important to enter the height of objects as a parameter in the EAGLE matrix / model (see LCH ) for a clear distinction and to flexibly include or exclude such areas from target classes according to any given classification system. Giant bamboo areas might be included to “Forest” areas respectively might be excluded from classes like “Grasslands”, although biologically speaking bamboo belongs to herbaceous vegetation.

### **2.2.2 Non-graminoids, forbs, ferns**

Naturally growing or cultivated herbaceous plants that are not graminoids, basically forbs and ferns. Many arable crop types – apart from cereals – are non-graminoid plants. Includes: e.g. sunflower, vegetables, dry pulses, hop, strawberries, oil crops.

[Back to top](#)

## **2.3 Succulents, Cacti**

Water-retaining plants adapted to dry climatic conditions by storing water in their leaves, stems and roots, called succulents or fat plants. They occur in steppe and semi-desert, alpine conditions, but also on soils with high mineral (salt) content, such as seashores, salt lakes, salt marshes. Applicable for indigenous as well as for introduced species.

Includes:

cacti, agave, species of Crassulaceae, Sempervivum, Sedum groups, succulent halophytes (salt-tolerant plants) e.g. Salicornia.

[Back to top](#)

## **2.4 Lichens, Mosses, Algae**

### **2.4.1 lichens**

Composite organisms formed by a symbiotic relationship of a fungus and a photosynthetic partner (usually green algae or cyanobacteria).

[Back to top](#)

### **2.4.2 mosses**

Non-vascular plants in the land plant division Bryophyta. They are small (a few centimeters tall) herbaceous (non-woody) plants that absorb water and nutrients mainly through their leaves and but also photosynthesize.

[Back to top](#)

### **2.4.3 Algae**

Algae are a very large group of different eukaryotic plant organisms that usually live in a habitat under or close to the water surface. There are also some algae that live on solid ground like rocks or tree stems in sufficiently humid micro climate conditions. From a biological perspective it is difficult to group them systematically, which is out of scope here. They can have all kinds of different plant sizes and growth forms. For this data model it seems reasonable to distinguish between *macro algae* like seaweeds and kelp that have similar twig-like shape to terrestrial plants, and micro algae.

[Back to top](#)

#### **2.4.3.1 macro algae**

*Macro algae* are water plants that grow in a twig-like manner with “leaves” and reach a certain size. The plants can reach several meters of length. They grow either rooted under water and/or are floating on the water surface. Seaweed or kelp are also commonly used terms for macro algae.

[Back to top](#)

#### **2.4.3.2 micro algae, plankton**

*Micro algae* are organisms normally bound to water in the form of uni-cellular or small multi-cellular organisms or clusters. They can also grow in terrestrial surrounding on solid surfaces like rocks or tree stems.

[Back to top](#)

### **3 Water**

The chemical substance of H<sub>2</sub>O, either in liquid or in frozen solid state of aggregation.

[Back to top](#)

#### **3.1 Liquid Water Bodies**

Water (H<sub>2</sub>O) in liquid state of aggregation regardless of location, shape, salinity and origin (natural or artificial). This element applies for at least to some extend stable formations, that may or may not be permanently filled with water. Whether it is a permanent or only episodic or periodic water body can be further described with the Water Regime segment under Land Characteristics of LCH block in EAGLE matrix.

Excludes: During flood events temporarily flooded areas, which are normally occupied with other Land Cover Components and which are not part of the water body bed, are not considered a water body.

[Back to top](#)

##### **3.1.1 Inland Water Bodies**

All kinds of water surfaces on the inland with no direct interference or interchange with open sea water, regardless of salinity and origin (natural or artificial).

[Back to top](#)

##### **3.1.1.1 water course**

Water surfaces in fluent state.

Includes: rivers, streams, creeks, channels, waterways.

Special case Estuary:

Estuaries is not represented within the EAGLE model as an explicit LCC. It is more a geographical term than a LCC, and moreover rather difficult to delineate. Also, how to categorize an estuary as coastal water / transitional water / marine water depends somehow on the users perspective.

However, the EAGLE group suggests to describe an estuary with LCC water course in combination with water characteristics (salinity, tidal influence). Basically, the water course is the primary source and reason for the existence of an estuary. Therefore it is considered reasonable to use LCC water course.

[Back to top](#)

##### **3.1.1.2 standing water**

Water surfaces of non-flowing water, mainly lakes and ponds, or cut-off river meanders.

Includes: natural lakes (both freshwater and salty), fishponds, man-made reservoirs, oxbow lakes, pools with non-sealed bottom, irrigation ponds, ponds for artificial snow production, rivers dammed for hydroelectric power production, ponds for firefighting.

[\*Back to top\*](#)

### **3.1.2 marine waters**

Open sea, zone seaward of the average high tide line. May stand under tidal influence, forming intertidal flats along cost lines.

[\*Back to top\*](#)

## **3.2 Solid waters**

Solid water is H<sub>2</sub>O in frozen form.

[\*Back to top\*](#)

### **3.2.1 snow**

Snow cover that persists throughout the year, above or beyond the climatic snow line (nival zone).

[\*Back to top\*](#)

### **3.2.2 ice, glaciers**

Persistent ice cover formed by accumulation and compaction of snow over time.

[\*Back to top\*](#)



## II. Matrix block: LAND USE ATTRIBUTES (LUA)

This matrix block contains all kinds of land use types, here called Land Use Attributes (LUA). It is best to select the lowest possible land use type, as far as information about it is available. Still, they can be selected on any higher hierarchical level if the lowest more detailed level is not known. Also, they can occur in combinations. Technically speaking, their cardinality is 1..n (one to many).

### 1\_Primary Production Sector

Areas where the production of goods is directly based on local natural resources. The primary sector transforms natural resources into primary products. Most products from this sector are either raw materials for other industries (e.g. food, metal, wood industry), or are directly consumed by end-users. Major subsectors of primary production are agriculture, animal husbandry, agribusiness, fishing, forestry and mining and quarrying activities. Areas where the manufacturing industries aggregate, package, purify or process the primary products close to the primary producers are to be included, especially if the raw material is unsuitable for sale or difficult to transport long distances.

[Back to top](#)

#### 1\_1\_Agriculture

Production of crop (plants, fungi, etc.) and animal products for food, for sale, own consumption or industrial purposes. It includes plants for biofuels and growing of crops in open fields as well as in greenhouses. Also set-aside fallow land in the crop rotation belongs to this class. The preparation of products for the primary markets is included, field construction (e.g. agricultural land terracing, drainage, preparing rice paddies etc.) as well as landscape care and maintenance.

[Back to top](#)

##### 1\_1\_1\_Commercial Crop Production

Arable land, permanent crops and grasslands in agricultural use (both sown and self-seeded grasslands, in open land as well as in greenhouses). The products can be used for human or animal feed, for bio-energy production or industrial purposes.

[Back to top](#)

##### 1\_1\_2\_Farming Infrastructure

Farm dwellings, animal husbandry infrastructure (animal dwellings and processing facilities linked to farms), manure storage and other farming infrastructure (e.g. buildings linked to plant handling and processing in farms).

[Back to top](#)

##### 1\_1\_2\_1\_Animal Husbandry

This sub-class applies for animal dwelling and shelter, also for organized feeding. It includes raising of mammals, birds, land mollusks, insects.

[EAGLE extension, *not in HILUCS*]

[Back to top](#)

##### 1\_1\_2\_2\_Farming Storage

This sub-class applies for storage areas or buildings like maize silage or barns. [EAGLE extension, *not in HILUCS*]

[Back to top](#)

### **1\_1\_2\_3\_Other farming infrastructure**

This sub-class applies for farming infrastructure that is not for animal dwelling, or storage, but for plant handling and processing and similar processes.

[EAGLE extension, not in HILUCS]

[Back to top](#)

### **1\_1\_3\_Production For Own Consumption**

Production of plants or animals for own consumption (kitchen gardens, private animal sheds etc.)

[Back to top](#)

## **1\_2\_Forestry**

Production of round wood and other wood based primary products. Besides the production of timber, forestry activities result in products that undergo little processing, such as firewood, charcoal and round wood used in an unprocessed form (e.g. pit-props, pulpwood etc.). Forest tree nurseries, storage and transport areas linked to logging trees and woody plants for bio fuels are also included. These activities can be carried out in natural or planted forests.

[Back to top](#)

## **1\_3\_Mining And Quarrying**

Mining and quarrying in the form of the extraction of minerals and materials occurring naturally as solids (coal, ores, gravel, sand, salt), liquids (petroleum), gases (natural gas) or biomass (peat).

Extraction can be achieved by different methods such as underground or surface mining or extraction, well operation etc. Originally, in the HILUCS classes this use type was subdivided into three subtypes according to the criteria of mining products, which have been moved to the LCH block in the EAGLE matrix.

[Back to top](#)

## **1\_4\_Aquaculture And Fishing**

This class includes professional fishing and aquaculture.

[Back to top](#)

### **1\_4\_1\_Aquaculture**

This class includes areas used for fish hatcheries and managed grow-out sites, as well as for amphibians, crocodiles, water mollusks.

[Back to top](#)

### **1\_4\_2\_Professional Wild Fishery**

This class includes water areas used for professional (off-shore) fishing of wild living seafood.

[Back to top](#)

## **1\_5\_Other Primary Production**

Professional hunting, gathering of wild growing non-wood forestry products, husbandry of migratory animals and any other primary production not included in the values 1\_1\_Agriculture, 1\_2\_Forestry, 1\_3\_MiningAndQuarrying, 1\_4\_AquacultureAndFishing or any of their narrower values.

[Back to top](#)

### **1\_5\_1\_Hunting**

This class includes areas used for professional hunting. The areas can be fenced or open.

[Back to top](#)

### **1\_5\_2\_Management Of Migratory Animals**

Areas used for keeping and feeding migratory animals such as reindeer and deer.

[Back to top](#)

### **1\_5\_3\_Picking Natural Products**

Areas which are used for picking up natural non wood based products such as not cultivated berries, mosses, lichen etc.) for commercial purposes.

[Back to top](#)

### **1\_5\_4\_Apiculture, Bee hives**

This class indicates that a certain area is used for honey making, with one or more bee populations present. Similar to hunting or fishing it is difficult to delineate the outer boundary if it.

[EAGLE extension, not in HILUCS]

[Back to top](#)

## **2\_Secondary Production Sector**

Industrial and manufacturing activities which take the output of the primary sector and manufacture finished goods and intermediate products for other business. This class also includes the storage and transport areas linked directly to manufacturing activities. The branches of industries covered by this class are the processing of: food, textile, leather, wood and wood product, pulp, paper, publishing, printing, recording, petroleum and other fuels, chemicals, chemical products, man-made fibres, rubber and plastic products, non-metallic mineral products, basic metals and metal products, fabricated metal product, machinery and equipment, electrical and optical equipment, transport equipment and furniture.

[Back to top](#)

### **2\_1\_Manufacturing industry**

The three subtypes of secondary production sector in HILUCS (raw, heavy end, light end production) have received here an intermediate LUA heading in EAGLE matrix, embracing them three altogether, which differs here from original HILUCS structure.

[Back to top](#)

#### **2\_1\_1\_Raw Industry**

This class includes the industrial activities transforming the output primary sector into manufactured raw products.

[Back to top](#)

##### **2\_1\_1\_1\_Manufacturing Textile Products**

This class includes areas used for the preparation and spinning of textile fibres, sewing threads, textile weaving, and for the tanning and dressing of leather.

[Back to top](#)

##### **2\_1\_1\_2\_Manufacturing Wood-Based Products**

This class includes the areas used for wood and wood-based products like sawmilling and planning of wood, manufacturing of veneer sheets, plywood, laming boards, fibre boards,

carpentry and joinery, cork, straw and plaiting products.

[Back to top](#)

### **2\_1\_1\_3\_Manufacturing Pulp And Paper Products**

This class includes the areas used for the manufacturing of pulp, paper, paperboard, paper based sanitary goods, wallpapers.

[Back to top](#)

### **2\_1\_1\_4\_Manufacturing Coke, Petroleum And Nuclear Fuels**

This class includes the areas used for the manufacturing of coke, refined petroleum and processing of nuclear fuel.

[Back to top](#)

### **2\_1\_1\_5\_Manufacturing Chemical Products and Synthetic Fibres**

This class includes the areas used for the manufacturing of basic chemicals, agro-chemicals, paints, pharmaceuticals, soap, detergents, glues, other chemical products and man-made synthetic fibres. Excludes:

Natural fibre production like out of cotton, flax, hemp, linen.

[Back to top](#)

### **2\_1\_1\_6\_Manufacturing Metallic Products**

This class includes the areas used for the manufacturing, processing and casting of iron, steel and basic precious and non-ferrous metals. It also includes the manufacturing of metal products.

[Back to top](#)

### **2\_1\_1\_7\_Manufacturing Nonmetallic Mineral Products**

Manufacturing of glass, bricks, ceramics, concrete, cement, lime, plaster, cutting and shaping of stone and other non-metallic mineral products.

[Back to top](#)

### **2\_1\_1\_8\_Manufacturing Rubber And Plastic Products**

Areas used for manufacturing of tyres, tubes, plastic packing goods and other rubber and plastic products.

[Back to top](#)

### **2\_1\_1\_9\_Manufacturing Other Raw Materials**

Areas for the production of raw materials not included in any other of the narrower values of 2\_1\_RawIndustry.

[Back to top](#)

## **2\_1\_2\_Heavy End Product Industry**

Areas used for activities transforming raw manufactured products into heavy manufactured products.

[Back to top](#)

### **2\_1\_2\_1\_Manufacturing Machinery Products**

Manufacturing of machines for production, agricultural, forestry and other purposes (excluding aircrafts and vehicles), manufacturing of weapons, ammunition and domestic appliances.

[Back to top](#)

## **2\_1\_2\_2\_Manufacturing Vehicles And Transport Equipment**

This class includes the areas used for the manufacturing of motor vehicles and transport equipment like aircrafts, space crafts, ships, boats, railway and tramway equipment, motorcycles, bicycles and other transport equipment.

[Back to top](#)

## **2\_1\_2\_3\_Manufacturing Other Heavy End Products**

Production of other heavy end products not included in any other of the narrower values of 2\_2\_HeavyEndProductIndustry.

[Back to top](#)

## **2\_1\_3\_Light End Product Industry**

Areas used for activities transforming raw manufactured products into light manufactured products.

[Back to top](#)

### **2\_1\_3\_1\_Manufacturing Food, Beverages And Tobacco Products**

This class includes areas used for the manufacturing of meat, fish, fruit and vegetables, oils and fats or derived products, dairy products, grain mill and starch products, prepared animal feeds, other food products, beverages and tobacco products.

[Back to top](#)

### **2\_1\_3\_2\_Manufacturing Clothes And Leather Products**

Manufacturing of wearing apparel, leather clothes, dressing, accessories, dyeing of fur and manufacturing of fur products, luggage, bags, saddles and footwear.

[Back to top](#)

### **2\_1\_3\_3\_Publishing, Printing, Reproduction of Recorded Media**

This class includes the areas used for publishing and printing of books, newspapers, journals and the publishing and reproduction of sound recordings.

[Back to top](#)

### **2\_1\_3\_4\_Manufacturing Electrical, Precision And Optical Equipment**

This class includes the areas used for the manufacturing of office machinery, computers, motors, generators, electricity distribution and control apparatus, wires and cables, accumulators, batteries, lamps, radios, TVs, phones, electronic valves and tubes, medical, precision and optical instruments, watches and other electrical and optical equipment.

[Back to top](#)

### **2\_1\_3\_5\_Manufacturing Other Light End Products**

This class includes the manufacturing of furniture, jewelry, musical instruments, sports goods, games, toys and other miscellaneous products.

[Back to top](#)

## **2\_2\_Energy Production**

This class includes the areas used for production of (electric or heat) energy.

[Back to top](#)

### **2\_2\_1\_Nuclear Based Energy Production**

This class includes areas where nuclear power plants are operated.

[Back to top](#)

### **2\_2\_2\_Fossil Fuel Based Energy Production**

Power plants using fossil fuels (coal, oil, natural gas, peat and other fossil fuels).

[Back to top](#)

### **2\_2\_2\_1\_Coal And Lignite Based Energy Production**

Power plants using coal or lignite as combustion material. [EAGLE extension, not in HILUCS]

[Back to top](#)

### **2\_2\_2\_2\_Mineral Oil Based Energy Production**

Power plants using mineral oil as combustion material. [EAGLE extension, not in HILUCS]

[Back to top](#)

### **2\_2\_2\_3\_Mineral Gas Based Energy Production**

Power plants using gas as combustion material. [EAGLE extension, not in HILUCS]

[Back to top](#)

### **2\_2\_2\_4\_Peat And Other Fossil Fuel Based Energy Production**

Power plants using peat and others as combustion material. [EAGLE extension, not in HILUCS]

[Back to top](#)

### **2\_2\_3\_Biomass Based Energy Production**

Combustion power plants using biomass based fuels (wood and other plant based solid and liquid fuels, biogas and other biofuels).

[Back to top](#)

### **2\_2\_4\_Renewable Energy Production**

Hydro-, solar, wind, thermal (aero, geo and hydro), tidal, wave etc. energy and other renewable energy (except biomass energy, which is covered by the value 2\_2\_3\_BiomassBasedEnergyProduction).

[Back to top](#)

#### **2\_2\_4\_1\_Water Based Energy Production**

This class applies for areas that are used to produce electric energy allowing water currents in rivers or falling water from higher positioned reservoirs to spin water turbines. [EAGLE extension, not in HILUCS]

Excludes:

Tidal wave based energy production

[Back to top](#)

#### **2\_2\_4\_2\_Solar Based Energy Production**

This class applies for areas that are used to produce electric or heat energy by collection the sun's insolation energy with photovoltaic panels or fluid-based heat sun collectors. This class can apply both for solid ground or floating on water. [EAGLE extension, not in HILUCS]

[Back to top](#)

#### **2\_2\_4\_3\_Wind Based Energy Production**

This class applies for areas (inland or off-shore) that are used to produce electric energy by allowing atmospheric air currents to spin propeller driven wind turbines. [EAGLE extension, not in HILUCS]

[Back to top](#)

#### **2\_2\_4\_4\_Geo-Thermal Based Energy Production**

This class applies for areas that are used to produce thermal or electric energy by making use of the rising ground temperature in the Earth's crust. [EAGLE extension, not in HILUCS]

[Back to top](#)

### **2\_2\_4\_5\_Tide Based Energy Production**

This class applies for areas in coastal zones that are used to produce electric energy by making use of the water currents caused by tidal waves and flows to spin turbines. [EAGLE extension, not in HILUCS]

[Back to top](#)

### **2\_2\_5\_Waste Combustion Based Energy Production**

This class includes areas where energy is produced by burning waste. [EAGLE extension, not in HILUCS]

[Back to top](#)

### **2\_5\_Other Industry**

Production of other industrial products not included in any other of the narrower values of 2\_SecondaryProduction.

[Back to top](#)

## **3\_Tertiary Services Sector**

Services that are products for other businesses and consumers both private and public services. It encompasses whole sale and retail trade, repair services, hotels and restaurants, financial services, real estate, business services, rental services, public administration, defense and social security, education, health and social work and other community, social and personal services.

[Back to top](#)

### **3\_1\_Commercial Services**

This class includes the areas used for the provision of commercial services

[Back to top](#)

#### **3\_1\_1\_Wholesale, Retail Trade, Repair Of Vehicles And Household Goods**

Wholesale and retail sale of motor vehicles, fuel, agricultural raw materials, live animals, ores, metals, chemicals, timber, machinery, ships, furniture, household goods, textiles, food, beverages, tobacco products, pharmaceutical products, second hand goods, other products, waste and scrap. This class also includes the repair of vehicles, personal and household goods.

[Back to top](#)

#### **3\_1\_2\_Real Estate Services**

This class includes the areas used for the provision of real estate and renting services.

[Back to top](#)

#### **3\_1\_3\_Accommodation And Food Services**

This class includes the areas used for provision of hotel, holiday village, camping site, restaurant, bar and canteen services.

[Back to top](#)

#### **3\_1\_4\_Other Commercial Services**

Other commercial services not included in any other of the narrower values of 3\_1\_CommercialServices, such as beauty and wellbeing services.

[Back to top](#)

## **3\_2\_Financial, Professional And Information Services**

This class includes areas used for the provision of financial, professional or information services.

[Back to top](#)

### **3\_2\_1\_Financial And Insurance Services**

This class includes the areas used for the provision of banking, credit, insurance, and other financial services.

[Back to top](#)

### **3\_2\_2\_Professional, Technical And Scientific Services**

This class includes the areas used for the provision of IT consulting, data processing, research and development, legal, accountancy, business management, architectural, engineering, advertising, testing, investigation, consulting, research, development and other professional services.

[Back to top](#)

### **3\_2\_3\_Information And Communication Services**

This class includes the areas used for the provision of publishing, sound recording, TV-programme, motion picture, radio broadcasting, post and telecommunication, computer and data processing services.

[Back to top](#)

### **3\_2\_4\_Administrative And Support Services**

This class includes the areas used for the provision of travel agency, rental, cleaning, security and other administrative and support services.

[Back to top](#)

### **3\_2\_5\_Other Financial Professional And Information Services**

Other financial, professional and information services not included in any other of the narrower values of 3\_2\_FinancialProfessionalAndInformationServices.

[Back to top](#)

## **3\_3\_Community Services**

This class includes the areas used for the provision of services for the community.

[Back to top](#)

### **3\_3\_1\_Public Administration, Defense, Justice, Public Security**

This class includes the areas used for the provision of generic administrative, defense, justice, public security, fire and compulsory social security services.

[Back to top](#)

### **3\_3\_2\_Science, Research, Education**

This class includes the areas used for the provision of primary, secondary, higher, adult and other educational services.

[Back to top](#)

### **3\_3\_3\_Health And Social Services**



This class includes the areas used for the provision of human and animal health and social work services.

[Back to top](#)

### **3\_3\_4\_Religious Services**

This class includes the areas used for the provision of religious services.

[Back to top](#)

#### **3\_3\_4\_1\_House Of Worship**

This class applies for churches, mosques, synagogues, and other house types of confession. This use type can include administrative buildings, mostly associated to the church, synagogue etc. itself.

[EAGLE extension, not in HILUCS]

[Back to top](#)

#### **3\_3\_4\_2\_Monastery**

This class applies for monasteries where a group of people (mostly men and women separate, but not necessarily) live and organized themselves to dedicate their life time to the practicing of their religion according to certain religious principles and rituals.

[EAGLE extension, not in HILUCS]

[Back to top](#)

#### **3\_3\_4\_3\_Cemetery**

This class applies for cemeteries of all kinds of confession, as well as historical cemeteries. [EAGLE extension, not in HILUCS]

[Back to top](#)

### **3\_3\_5\_Other Community Services**

This class includes areas used for other community services (e.g. cemeteries).

[Back to top](#)

## **3\_4\_Cultural, Entertainment And Recreational Services**

This class includes the areas used for the provision of cultural, entertainment or recreational services.

[Back to top](#)

### **3\_4\_1\_Cultural Services**

This class includes the provision of artistic, library, museum, zoos, botanical gardens, historical sites and other cultural services.

[Back to top](#)

#### **3\_4\_1\_1\_Indoor Cultural Service**

This class includes the provision of indoor cultural services such as libraries, museums, theatres.

[EAGLE extension, not in HILUCS].

[Back to top](#)

#### **3\_4\_1\_2\_Outdoor Cultural Service**

This class includes the provision of outdoor cultural services like e.g. zoos, botanical gardens.

[EAGLE extension, not in HILUCS]

[Back to top](#)

### **3\_4\_2\_Entertainment**

This class includes the provision of entertainment services like amusement parks, theme parks, betting and gambling activities (casinos) and other entertainment services.

[Back to top](#)

### **3\_4\_3\_Sports Infrastructure**

This class includes the areas used for the provision of sports infrastructure, such as stadiums, sports halls, swimming pools, fitness facilities, ski resorts, golf courses and other sports infrastructure.

[Back to top](#)

#### **3\_4\_3\_1\_Golf Course**

This class applies for golf courses.

(EAGLE extension, has been added as EAGLE-extension to HILUCS code list in UML model)

[Back to top](#)

#### **3\_4\_3\_2\_Ski Piste**

This class applies for ski pistes. A ski piste is part of a slope for the execution of wintersport of alpine skiing, but also other for the usage of other sliding devices on snow surface like now boarding.

[EAGLE extension, not in HILUCS]

[Back to top](#)

#### **3\_4\_3\_3\_Outdoor Racecourse**

This class applies for outdoor race courses like car race courses, bike courses, moto-cross or mountain bike courses, horse race course, skate parks.

[EAGLE extension, not in HILUCS]

[Back to top](#)

#### **3\_4\_3\_4\_Sport Hall**

This class includes the areas of sports halls which have at least the size as a whole to perform team ball games like basketball, volleyball, handball etc.

[EAGLE extension, not in HILUCS]

[Back to top](#)

#### **3\_4\_3\_5\_Stadium**

This class includes the areas of stadiums, where a sports ground (turf, sand, artificial grass etc.) is surrounded by roofed or non-roofed tribunes for audience.

[EAGLE extension, not in HILUCS]

[Back to top](#)

#### **3\_4\_3\_6\_Swimming Pool**

This class includes the areas of indoor swimming halls or outdoor swimming pools.

[EAGLE extension, not in HILUCS]

[Back to top](#)

#### **3\_4\_3\_7\_Sports Ground**

This class applies for sport fields where outdoor sports are practiced. It is not roofed, and is not surrounded by a tribune structure, like it would be in a stadium.

[EAGLE extension, not in HILUCS]

[Back to top](#)

### **3\_4\_3\_8\_Fitness club**

This class applies for indoor sports and fitness clubs (boxing, wrestling, fighting, body workouts, gymnastics etc.).

Excludes:

It is different from sport halls which have at least the size as a whole to perform team ball games like basketball, volleyball, handball etc.

[EAGLE extension, not in HILUCS]

[Back to top](#)

### **3\_4\_3\_9\_Yachtharbour, sport boat marina**

This class applies for land areas that belong to a sport boat harbor. It can also be applied to the water area (harbor basin) that belongs to it.

[EAGLE extension, not in HILUCS]

[Back to top](#)

## **3\_4\_4\_Open Air Recreational Areas**

This class includes open air recreational areas e.g. urban parks, playgrounds, national parks, and natural areas used for recreational purposes (e.g. forests, heathland, moors, mountains, agricultural areas, ponds, lakes, rivers).

[Back to top](#)

### **3\_4\_4\_1\_Urban Greenery, City Parks, Playgrounds**

This class includes open air recreational areas e.g. urban greenery, parks, playgrounds.

[EAGLE extension, not in HILUCS]

[Back to top](#)

### **3\_4\_4\_2\_(Semi-)Natural Areas Used For Recreation**

This class includes open air recreational areas e.g. national parks and natural areas used for recreational purposes (e.g. forests, heathland, moors, mountains, agricultural areas, ponds, lakes, rivers).

[EAGLE extension, not in HILUCS]

[Back to top](#)

## **3\_4\_5\_Other Recreational Services**

Other recreational services not included in any of the other narrower values of 3\_4\_CulturalEntertainmentAndRecreationalServices.

[Back to top](#)

### **3\_4\_5\_1\_Allotment Garden**

This class includes small-parceled city gardens that can be used for subsistence, but mainly are used for leisure and recreational purpose.

[EAGLE extension, not in HILUCS]

[Back to top](#)

### **3\_4\_5\_2\_Amateur Fishing**

This class is applicable for water areas (ponds, lakes, rivers) and associated land used for amateur or

hobby fishing. It basically addresses inland areas. [EAGLE extension, not in HILUCS]

Excludes:

Off-shore fishing activities, be it professional or amateur.

[Back to top](#)

### **3\_5\_Other Services**

This class includes the areas used for the provision of other services not included in parts 3.1-3.4 of HILUCS.

[Back to top](#)

## **4\_Transport Networks, Logistics, Utilities**

Basic infrastructure and networks of the society. All the other sectors are using the infrastructure and networks to produce the goods and services and they are also vital for residential areas. It includes land used for water supply, collection, treatment and recycling of sewage and waste, transport, networks, storage and communication.

[Back to top](#)

### **4\_1\_Transport Networks**

This class includes the infrastructure related to transport.

[Back to top](#)

#### **4\_1\_1\_Road Network**

This class includes the areas used for road transport e.g. roads, parking areas, service stations.

[Back to top](#)

#### **4\_1\_2\_Railway Network**

This class includes the areas used for rail transport e.g. rails, railway stations and yards etc.

[Back to top](#)

#### **4\_1\_3\_Air Transport**

This class includes the areas used for air transport e.g. airports and related services.

[Back to top](#)

#### **4\_1\_4\_Water Transport**

This class includes the areas used for water transport e.g. ports, rivers, docks and related services.

[Back to top](#)

#### **4\_1\_5\_Other Transportation Networks**

Areas used for other transport not included in any of the other narrower values of

4\_1\_TransportNetworks.

[Back to top](#)

### **4\_2\_Logistics And Storage**

This class includes areas used for the storing of industrial or trading goods, which are not directly connected and associated to industrial areas. It includes as well the installations that are needed to facilitate the logistics and storage.

[Back to top](#)

## **4\_3\_Utilities**

This class includes the infrastructure related to utilities.

[Back to top](#)

### **4\_3\_1\_Power Distribution Services**

This class includes the areas used for the distribution of electricity, gas and thermal energy.

This class includes the pipelines used for transporting mineral oil and gas.

[Back to top](#)

#### **4\_3\_1\_1\_Electricity Distribution**

This class addresses the areas used for the distribution of electricity.

[EAGLE extension, not in HILUCS]

[Back to top](#)

#### **4\_3\_1\_2\_Gas Distribution**

This class addresses the areas used for the distribution of gas.

[EAGLE extension, not in HILUCS]

[Back to top](#)

#### **4\_3\_1\_3\_Thermal Energy Distribution**

This class addresses the areas used for the distribution of thermal heat.

[EAGLE extension, not in HILUCS]

[Back to top](#)

### **4\_3\_2\_Water And Sewage Infrastructure**

This class includes the areas used for the extraction, collection, purification storage and distribution of water and collection and treatment of sewage (including the pipelines).

[Back to top](#)

#### **4\_3\_2\_1\_Drinking Water Facilities**

This class applies for facilities and associated areas that are dedicated to the extraction and treatment, storage and distribution of drinking water.

[EAGLE extension, not in HILUCS]

[Back to top](#)

#### **4\_3\_2\_2\_Sewage Water Treatment**

This class applies for water sewage facilities and associated areas that are dedicated to the treatment of waste water.

[EAGLE extension, not in HILUCS]

[Back to top](#)

#### **4\_3\_2\_3\_Water Runoff Retention Basin**

This class applies for water basins with the intention to hold back water run off in a water course.

The aim is here to lower the hazard of flooding.

[EAGLE extension, not in HILUCS]

[Back to top](#)

#### **4\_3\_2\_4\_Artificial Snow Water Pond**

This class applies for water ponds that are maintained to store water for the production of artificial snow in ski resort areas.

[EAGLE extension, not in HILUCS]

[Back to top](#)

#### **4\_3\_2\_5\_Irrigation And Fire Fighting Water Pond**

This class applies for water basins that store water for the purpose of fire extinction or for the irrigation of agricultural (or even forest) land.

[EAGLE extension, not in HILUCS]

[Back to top](#)

#### **4\_3\_3\_Waste Treatment**

This class includes the areas used for the collection, treatment and recycling of waste (dumpsites, waste incineration, composting, hazardous waste treatment and recycling facilities).

[Back to top](#)

##### **4\_3\_3\_1\_Dump Site**

This class applies for areas used for the collection and deposit of waste.

[EAGLE extension, not in HILUCS]

[Back to top](#)

##### **4\_3\_3\_1\_1\_hazardous waste**

Waste material which has a contaminating effect on the environment or people, causes damage to nature of life-threatening health problems and needs to be handled and managed in special containments and/or sealed waste deposit sites. Practically and unfortunately such waste material can also occur without appropriate protective measures. What is and what is not considered as hazardous waste also depends on national legal definitions [EAGLE extension, not in HILUCS]

[Back to top](#)

##### **4\_3\_3\_1\_2\_inert or non-hazardous waste**

Waste material which does not have a dangerous effect on the environment or people (e.g. construction rubble and normal household waste). [EAGLE extension, not in HILUCS]

[Back to top](#)

##### **4\_3\_3\_2\_Recycling Facilities**

This class includes the areas used for the recycling of waste or used material that is prepared to be re-introduced to a product life cycle. This material for example can be paper, all kinds of plastic packaging and plastic bottles, glasses, but also biomass or biological waste turned into humus.

[EAGLE extension, not in HILUCS]

[Back to top](#)

#### **4\_3\_4\_Other Utilities**

This class includes areas used for other utilities not included in the classes 4.3. Utilities.

[Back to top](#)

### **5\_Residential**

This class includes areas used dominantly for housing of people. The forms of housing vary significantly between, and through, residential areas. These areas include single family housing,

multi-family residential, or mobile homes in cities, towns and rural districts if they are not linked to primary production. It permits high density land use and low density uses. This class also includes residential areas mixed with other non-conflicting uses and other residential areas (e.g. temporarily used areas).

[Back to top](#)

## **5\_1\_Permanent Residential**

This area includes residential areas dominated by houses of any size (detached houses surrounded by gardens and/or yards, a mix of single houses, semi-detached houses, terraced houses, town houses, row houses and blocks of flats, high raised houses) used as permanent residence.

[Back to top](#)

## **5\_2\_Residential Use With Other Compatible Uses**

This class includes residential areas mixed with other non-conflicting uses (e.g. various services, light industries etc.).

[Back to top](#)

## **5\_3\_Other Residential**

This class includes areas dominantly for temporary dwellings (camps of migrant people), holiday residences (summer cottages), etc.

[Back to top](#)

### **5\_3\_1\_Temporary Residential, Permanent Structure**

This class includes areas for holiday residences (summer cottages), etc.

[EAGLE extension, not in HILUCS]

[Back to top](#)

### **5\_3\_2\_Temporary Dwelling, Non-permanent Structure**

This class includes areas dominated e.g. by areas used for temporary dwellings like refugee camps or for migrant people.

[EAGLE extension, not in HILUCS]

[Back to top](#)

### **5\_3\_3\_Informal Dwelling**

This class includes areas dominated informal dwelling structures like slums, favelas etc. that appear inside or at the outskirts of bigger cities and agglomerations. Basically, they are constructed outside any legal or planning framework, but due to strong settlement pressure and lack of alternatives, these areas over time become “quasi-permanent” settlement areas.

[EAGLE extension, not in HILUCS]

[Back to top](#)

## **6\_Other Uses**

Areas not included in the values 1\_PrimaryProduction, 2\_SecondaryProduction, 3\_TertiaryProduction, 4\_TransportNetworksLogisticsAndUtilities, 5\_ResidentialUse or any of their narrower values. Areas under construction are included here.

[Back to top](#)

### **6\_1\_Transitional Areas Under Construction**

This class includes areas under construction. This class should be used only for existing land use and not for planned land use.

[Back to top](#)

### **6\_3\_Areas Not In Any Economic Use**

This class includes areas which are in natural state and without other economic use.

[Back to top](#)

### **6\_4\_Flood Protection**

This class includes areas which are used for flood protection purposes, e.g. polder which can be flooded on purpose to lower the peak inundation wave of a river stream.

[EAGLE extension, not in HILUCS]

[Back to top](#)



### III. Matrix block: LAND CHARACTERISTICS (LCH)

This matrix block contains all kinds of land characteristics (LCH) that further describe and give more detailed aspects and information to either land cover elements, land use types, or more general geographic properties or geometric and temporal parameters. These characteristics are also structured hierarchically in many segments, which have their own heading. The order of LCH relates roughly to the sequence of LCC (Abiotic, Biotic, Water) and LUA (Land Management = Agriculture, Forestry, Mining, etc.) as they appear listed in the matrix, followed by and more neutral aspects like status, spatial patterns, geometric and temporal object characters.

#### 1 Built-up Characteristics

##### 1.1 Soil sealing degree

Data type: integer percentage value

The parameter for soil sealing degree indicates the proportion of sealed surface in relation to a given spatial unit that it refers to. The soil sealing degree is therefore expressed with percentage values. An example for such a dataset is the Copernicus product High Resolution Layer for Imperviousness (“Soil Sealing”).

[Back to top](#)

##### 1.2 Built-up Pattern

Data type: code list

The category of built-up patterns describes the size and distribution of buildings in space. Five different variations of built-up patterns can be distinguished.

[Back to top](#)

###### 1.2.1 scattered single houses, discontinuous

Data type: code list value

The area characterized with this built-up pattern contains some few buildings, which are distributed in space with clear distance between them. The houses are not dominant features in the area. This character is meant to be applied in sparsely populated rural areas.

[Back to top](#)

###### 1.2.2 single blocks, discontinuous

Data type: code list value

The area characterized with this built-up pattern contains buildings of large size with several floors and can have more than one entry door. The need for efficient usage of space for apartments or offices results often in the being built high. The buildings normally have some free space in between them for day light and fresh air circulation. Typically these block buildings occur in urban agglomeration zones and give housing or office room for a relatively high number (hundreds and more) of persons. An extreme example is a sky-scraper.

[Back to top](#)

###### 1.2.3 suburban row houses, terraced, semi-detached houses

Data type: code list value

This built-up pattern occurs mainly in suburban parts of settlements. A significant part of the parcel is occupied by house gardens. The front of houses may be closely constructed, but the bigger part of

the total area is not sealed.

[Back to top](#)

#### 1.2.4 city street blocks, closed front

Data type: code list value

This built-up pattern occurs mainly in city centers and densely populated city quarters. A street block is here considered as the area surrounded by streets on all sides. The street block is continuously filled with buildings side to side along the street. Typically, the houses have 2 or more stores. The house fronts along the streets closed with buildings with no room between them. Also the backyards are mainly occupied with sealed surfaces. Some vegetated parts may occur in the inner part of the block.

[Back to top](#)

#### 1.2.5 large complex buildings, big halls

Data type: code list value

This kind of building type embraces very large buildings which cover several thousands of square meters and are mainly stand-alone objects, or parts of large industrial areas.

Examples: football stadium, congress hall, Cathedral, airport terminals, train stations etc.

[Back to top](#)

### 1.3 Building Nature

Data type: code list

In this character type the nature of a building is expressed. It is based on the INSPIRE data specifications on buildings (BU) and addresses building sub-types like arch, bunker, canopy, castle, cave building, chapel, church, greenhouse, lighthouse, mosque, shed, silo, stadium, synagogue, temple, tower, windmill. The list can be extended.

[Back to top](#)

#### 1.3.1 Building Nature Value

Data type: code list value

This character is connected to LCC 1.1.1.1.2 *Specific buildings* and can be used to further describe it. For practical reasons the code list values from INSPIRE theme Buildings are not listed here entirely.

[Back to top](#)

### 1.4 Other Construction Nature

Data type: code list

In this character type the nature of artificial constructions other than buildings is expressed. It is based on the INSPIRE data specifications on OtherConstructionNatureValue and addresses construction types like acoustic fence, antenna, bridge, dam, chimney, city wall, crane, storage tank, monument, open air pool, protective structure, pylon, retaining wall, solar panel, substation, tunnel, wind turbine. The list can be extended.

[Back to top](#)

#### 1.4.1 Other Construction Nature Value

Data type: code list value

This character is connected to LCC 1.1.1.2 specific structures *and* facilities and can be used to further describe it. For practical reasons the code list values from INSPIRE theme Buildings are not listed here entirely.

[Back to top](#)

## 1.5 Artificial Surface Material Type

Data type: code list

This category contains a list of man-made surface material, which are common in urban and settlement fabric. It is basically meant to address soil sealing materials and roof materials. As some material both can occur on the ground and on roofs, the code list shall be used for both possible locations. In terms of data model relations, these characters are supposed to be used either in connection with LCCs of Sealed or Non-Sealed Artificial Surfaces. The list contains categories and sub types, which both can be used as a value to characterize an LCC, depending on available information details about the material itself.

[Back to top](#)

### 1.5.1 Mineral Compound

Data type: code list value

Mineral Compounds are artificial materials made out of mined earthen matter that is processed by mixing several components and/or adding water or heat.

[Back to top](#)

#### 1.5.1.1 glass

Data type: code list value

#### 1.5.1.2 ceramic, clay tiles, bricks

Data type: code list value

Ceramic is a form of burnt clay minerals, which is used e.g. for tiles or bricks.

#### 1.5.1.3 concrete

Data type: code list value

#### 1.5.1.4 asbestos fibre cement

Data type: code list value

#### 1.5.1.5 non-asbestos fibre cement

Data type: code list value

### 1.5.2 Solar Panels

Data type: code list value

### 1.5.3 Metal

Data type: code list value

[Back to top](#)

#### 1.5.3.1 Copper

Data type: code list value

#### 1.5.3.2 Zinc

Data type: code list value

### **1.5.3.3 Aluminium**

Data type: code list value

### **1.5.3.4 Steel**

Data type: code list value

### **1.5.3.5 Iron**

Data type: code list value

### **1.5.3.6 Lead**

Data type: code list value

## **1.5.4 Hydrocarbon Compound**

Data type: code list value

Hydrocarbon compounds are artificial materials that are based on crude oil. They are the residues of refined mineral oil after extraction the more volatile substances. Sometimes mixed with mineral fragments (sand, gravel) they are used to on artificial surfaces like roads or roofs to seal and/or harden them, to make them impermeable.

Practically, such surfaces can also have a natural origin, where mineral oil emerges by nature on the surface, combines with sands, and hardens out to some kind of natural asphalt, but those spots are very rare.

[Back to top](#)

### **1.5.4.1 Tar**

Data type: code list value

### **1.5.4.2 Asphalt**

Data type: code list value

### **1.5.4.3 Bitumen**

Data type: code list value

## **1.5.5 Polymer, Plastic, Synthetic Fibre**

Data type: code list value

This segment lists artificial materials that are artificially created by chemical processing of solid hydrocarbon-based components but also other substances in an industrial manner. Polymers are formed out of monomers through polyreactions.

[Back to top](#)

### **1.5.5.1 hard rubber**

Data type: code list value

### **1.5.5.2 hard plastic**

Data type: code list value

### **1.5.5.3 plastic foil**

Data type: code list value

#### **1.5.5.4 synthetic fibre**

Data type: code list value

### **1.5.6 Mineral Material**

Data type: code list value

These kinds of mineral materials come out of quarries, mountain slopes, mining lakes, river beds, sand dunes, beaches or any other natural mineralization or sedimentation ground in an unchanged form without any chemical processing besides extraction the material itself. They are basically stones from geological formations or volcanic activities in different fragmented, bigger or smaller sizes and shapes.

[Back to top](#)

#### **1.5.6.1 natural stone**

Data type: code list value

#### **1.5.6.2 slate**

Data type: code list value

#### **1.5.6.3 pebbles, gravel**

Data type: code list value

#### **1.5.6.4 sand**

Data type: code list value

#### **1.5.6.5 ashes, slag**

Data type: code list value

### **1.5.7 Organic**

Data type: code list value

[Back to top](#)

#### **1.5.7.1 Wood**

Data type: code list value

#### **1.5.7.2 Reed, straw, leaves**

Data type: code list value

## **1.6 Artificial Surface Material Arrangement**

Data type: code list

This list contains some types of material arrangements which indicate how the materials itself or elements made out of a chosen material are put together, be it on ground surface or on roofs.

[Back to top](#)

### **1.6.1 seamless sealing**

Data type: code list value

The material brought onto surface in a seamless manner without any interruption in form of a continuous layer.

[Back to top](#)

### 1.6.2 closed pavement

Data type: code list value

The material brought onto surface in form of single elements that have direct contact to each other. In between, they build seams, but no gaps.

[Back to top](#)

### 1.6.3 permeable paving, grass pavers

Data type: code list value

The paving material (impermeable itself) is arranged in such a manner that water can infiltrate in between the elements through a pattern of small gaps.

[Back to top](#)

### 1.6.4 tiles

Data type: code list value

The paving or roofing material is arranged in form of tiles, that may or may not overlap partly with each other.

[Back to top](#)

## 1.7 Building Greening Type

Data type: code list

This category applies for greening measures on buildings and constructions on roof tops and theoretically also on facades.

[Back to top](#)

### 1.7.1 Greened Roof

Data type: code list value

This character applies for roof tops that are greened with vegetation.

[Back to top](#)

#### 1.7.1.1 Low Growing Roof Vegetation

Data type: code list value

This character applies for roof tops that are greened with low growing vegetation like herbaceous plants, lichens and mosses, or dwarf shrubs.

[Back to top](#)

#### 1.7.1.2 High Growing Roof Vegetation

Data type: code list value

This character applies for roof tops that are greened with high growing vegetation like woody plants such as trees and bushes. They may appear as a roof gardens.

[Back to top](#)

## 1.8 Transportation Network Characteristics

Data type: code list value

This segment contains a number of characteristics that apply for the transportation land use sector.

[Back to top](#)

### 1.8.1 Road Network Type

Data type: code list

This category contains a list of characteristics that indicate the main mean of road transportation as road network type, including pedestrian walk ways and cycle ways.

[Back to top](#)

#### **1.8.1.1 Fast Transit Road, Highway**

Data type: code list value

[Back to top](#)

#### **1.8.1.2 Pedestrian Zone**

Data type: code list value

This area is reserved for pedestrians only, sometimes also open for bicycles. Motorized traffic is forbidden or restricted to a very limited extent (e.g. logistics for retail shops). Normally, pedestrian zones are located in city centers, squares or shopping streets and often occupy the entire open space between buildings or artificial surfaces in that so assigned area.

[Back to top](#)

#### **1.8.1.3 Associated Walk- Or Cycleway**

Data type: code list value

Linear part of the transportation road network which is associated to a road and runs parallel to the road, can be separated from it by a narrow strip of vegetation. It is used for pedestrians and/or as bicycles lanes.

[Back to top](#)

#### **1.8.1.4 Walk- and Cycleway**

Data type: code list value

Linear part of the transportation network which is used both for pedestrians and as bicycles lanes. It has its own track, independent and in some distance from a road.

[Back to top](#)

#### **1.8.1.5 Cycleway**

Data type: code list value

Linear part of the transportation network which is used only as bicycles lanes.

[Back to top](#)

#### **1.8.1.6 Walkway**

Data type: code list value

Linear part of the transportation network which is foreseen only for pedestrians.

[Back to top](#)

#### **1.8.1.7 Open Square**

< Data type: code list value

Non-linear part of the transportation network, mostly with a rectangular or rounded shape. Squares can have a broad variety of spatial extent. They may be assigned to pedestrian zone, or can also function as a roundabout in road traffic.

[Back to top](#)

## 1.8.2 placeholder>

## 1.8.3 <placeholder>

## 1.8.4 Harbour Type

Data type: code list

This category contains a number of characteristics that apply for the shipping transportation sector, especially for areas where ships and vessels can dock or be loaded/unloaded .

[Back to top](#)

### 1.8.4.1 Cargo Port

Data type: code list value

Port where traded goods are shipped in and out. Usually, container terminals are associated with cargo ports.

[Back to top](#)

### 1.8.4.2 Passenger Port

Data type: code list value

Port where people are shipped in and out as passengers.

[Back to top](#)

### 1.8.4.3 Fishing Port

Data type: code list value

Port for ships that bring seafood from there fishing tours in the open sea.

[Back to top](#)

### 1.8.4.4 Naval Port

Data type: code list value

Port for military ships.

[Back to top](#)

### 1.8.4.5 Marina

Data type: code list value

Port for yachts and sport boats, for recreational and leisure purpose.

[Back to top](#)

### 1.8.4.6 Local Multifunctional Harbour

Data type: code list value

Port which is not specified or restricted to a specific type of ships, or boats and serves multiple harbor functions.

[Back to top](#)

### 1.8.4.7 Shipyard

Data type: code list value

Areas at the shore or along rivers, normally associated to a port, where vessels are built, maintained or repaired. For that purpose, vessels are fixed in a normal dock (floating in water) or in a dry dock, without water contact.

[Back to top](#)



#### 1.8.4.8 Jetty

Data type: code list value

Lengthy man-made construction towards the sea as a landing stage connected to the shore line, where vessels can dock to be loaded and unloaded, or passengers can go on and off board. Jetties are also to unload explosive or hazardous substances like mineral gas or oil, in a secure distance from vulnerable infrastructure on land.

[Back to top](#)

## 2 Physical Characteristics

### 2.1 Permafrost zone

Data type: Boolean value

Area where the ground is frozen because of temperature below 0° C throughout the period of at least two years without melting. It can be found either in polar/sub-polar regions or in high mountain areas in the nival height zone.

[Back to top](#)

## 3 Biotic Vegetation Characteristics

### 3.1 Leaf form

Data type: code list

The leaf form helps to characterize woody plants by their leaves. It is a commonly used criterion to further distinguish trees and shrubs. Here three kinds of leaf forms are differentiated:

[Back to top](#)

#### 3.1.1 needle leaved

Data type: code list value

[Back to top](#)

#### 3.1.2 broad leaved

Data type: code list value

[Back to top](#)

#### 3.1.3 palm leaved

Data type: code list value

[Back to top](#)

#### 3.1.4 non-leafy

Data type: code list value

This character applies for leave-less plants.

[Back to top](#)

### 3.2 Foliage persistence

Data type: code list

The foliage persistence indicates if a plant loses its leaves at the end of a vegetation period (in Europe normally during autumn times) and grows new leaves in spring time, or if the plant keeps the leaves/needles of a longer period (several years). The process of dropping or shedding the leaves is called abscission, and applies both for needle and broad leaved plants.

[Back to top](#)

### 3.2.1 evergreen

Data type: code list value

The plant keeps its leaves/needles over a multi-annual period.

[Back to top](#)

### 3.2.2 deciduous

Data type: code list value

The plant loses its leaves/needles at the end of every vegetation cycle, basically every year.

[Back to top](#)

#### 3.2.2.1 winter deciduous

Data type: code list value

The plant loses its leaves/needles yearly at the end of every vegetation period. Winter deciduous plants lose their leaves because of freezing temperatures in winter times, when water turns into ice below 0° C and could not circulate anymore within the plant, and would also destroy plant tissue during freezing.

[Back to top](#)

#### 3.2.2.2 summer deciduous

Data type: code list value

The plant loses its leaves/needles yearly before or during the summer time, when temperatures are so hot that the plant would lose too much water through transpiration and dry out.

[Back to top](#)

## 3.3 Leaf anatomy

Data type: code list

The leaf anatomy describes the outer “architecture” of the plant leaf, how the skin of a leaf is “designed”.

[Back to top](#)

### 3.3.1 sclerophyllous

Data type: code list value

Sclerophyllous leaves are adapted to long periods of dryness and heat. The plants feature hard leaves, short internodes (the distance between leaves along the stem) and leaf orientation which is parallel or oblique to direct sunlight. The leaves are characterized by their relatively small, stiff and have a leathery or waxy coating, to reduce loss of moisture due to transpiration, in adaptation to dry and hot weather periods throughout the year.

Sclerophyllous is not seen as a sort of leaf form and is not contrary to broad-leaved or needle-leaved. In fact, a plant can be sclerophyllous and broad- or needle (narrow) leaved at the same time. That is why it is handled here as stand-alone matrix element.

Examples are cork oaks or olive trees.

[Back to top](#)

## 3.4 Phenological Plant Life Span

Data type: code list

This character code list expresses the duration of the life time of a plant.

[Back to top](#)

### 3.4.1 annual plant

Data type: code list value

Annuals are plants that go through their entire lifecycle in one growing season.

[Back to top](#)

### 3.4.2 biennial plant

Data type: code list value

Biennial are plants whose lifecycle spans two years, so they flower and produce seeds in their second year.

[Back to top](#)

### 3.4.3 perennial plant

Data type: code list value

Perennials are plants that can survive unfavorable season (winter) and live for more than two years.

[Back to top](#)

### 3.4.4 ephemeral plant

Data type: code list value

Ephemeral is a plant that has several life cycles in a growing season and can increase in numbers rapidly.

[Back to top](#)

## 3.5 Plant Location

Data type: code list

The plant location character describes where the vegetation is growing: on solid ground (terrestrial), in the water as aquatic submerge plants (under water surface) or as aquatic emergent plants that float on the water surface and/or grow above it.

[Back to top](#)

### 3.5.1 terrestrial plant

Data type: code list value

Terrestrial vegetation grows on solid ground of land. Also, herbaceous plants that can be found in wetlands and grow in standing or running water (like reeds) are considered as terrestrial.

[Back to top](#)

### 3.5.2 epiphyte plant

Data type: code list value

Epiphyte plant is an organism that grows on the surface of a plant and derives its moisture and nutrients from the air, rain, water (in marine environments) or from debris accumulating around it. Epiphytes take part in nutrient cycles and add to both the diversity and biomass of the ecosystem in which they occur, like any other organism. They are an important source of food for many species. Typically, the older parts of a plant will have more epiphytes growing on them. Epiphytes differ from parasites in that they grow on other plants for physical support and do not necessarily affect the host negatively.

[Back to top](#)

### 3.5.3 aquatic submerged plant

Data type: code list value

Aquatic submerged vegetation grows under the water surface. Their main life space is under water without reaching the surface. Typical examples are *algae*.

[Back to top](#)

### 3.5.4 aquatic emergent plant

Data type: code list value

Aquatic emergent vegetation are water plants, but they grow mainly floating on the water surface or have their main life space floating on water surface. An example is a sweet water sea rose.

[Back to top](#)

## 3.6 Growth Form, Habit

Data type: code list

This segment lists different kinds of plant growth forms, describing the plants shape and how the plant forms its branches.

[Back to top](#)

### 3.6.1 erect growth, single stem

Data type: code list value

Growth form of a woody plant that has a single main stem. Under normal condition the stem grows in an upright fashion. Typical example for erect growth form is a tree.

[Back to top](#)

### 3.6.2 open, spreading, dense growth, multi-stem

Data type: code list value

Growth form of a woody plant that has a several smaller stems that grow from the ground in a spreading manner upwards and to the sides. Typical examples for spreading growth form are bushes and shrubs.

[Back to top](#)

### 3.6.3 prostrate, creeping

Data type: code list value

The branches or shoots of a prostrate plant mostly lie upon or just above the ground and grow horizontally, rather than being held erect (as it would be with the branches of trees). There are both woody as well as herbaceous plants that show such growth form.

[Back to top](#)

### 3.6.4 clump-forming

Data type: code list value

A clumping plant forms a mound or thicket, with their shoots growing outward from the center and maintaining a compact shape. Clumping plants encompass many varieties, from tall bamboos down to smaller sedges and rushes. Also some grass species grow in clumps.

[Back to top](#)

### 3.6.5 cushion, mat-forming

Data type: code list value

A cushion plant is a compact, low-growing, pillow-like or mat-forming plant that is found in alpine, subalpine, arctic, or subarctic environments. The growth is limited in height above the ground (a few inches at most), and have slow growth in a nutrient-poor environment with delayed reproductivity and reproductive cycle adaptations. The branches of the plant are held close together, and none of them stands out to reduce exposure to unfavorable environmental climate conditions. It can be found on dwarf woody shrubs and non-woody plants.

See also: [https://en.wikipedia.org/wiki/Cushion\\_plant](https://en.wikipedia.org/wiki/Cushion_plant)

[Back to top](#)

### 3.6.6 climbing

Data type: code list value

Growth form of a plant that uses other plants or objects as physical sustaining support to climb towards the sunlight, because it cannot develop its own sustaining stems (unlike a tree). Such plants can either live as parasites and extract nutrition from their host plant (e.g. a tree), or feed themselves from the ground. Examples for climbing growth form are ivy, lianas, pepper, vanilla plant or grapevine.

[Back to top](#)

## 3.7 Raunkiaer Life Form

Data type: code list

For detailed definitions see [https://en.wikipedia.org/wiki/Raunki%C3%A6r\\_plant\\_life-form](https://en.wikipedia.org/wiki/Raunki%C3%A6r_plant_life-form)

[Back to top](#)

### 3.7.1 phanerophyte

Data type: code list value

For detailed definitions see [https://en.wikipedia.org/wiki/Raunki%C3%A6r\\_plant\\_life-form](https://en.wikipedia.org/wiki/Raunki%C3%A6r_plant_life-form)

[Back to top](#)

### 3.7.2 epiphyte

Data type: code list value

For detailed definitions see [https://en.wikipedia.org/wiki/Raunki%C3%A6r\\_plant\\_life-form](https://en.wikipedia.org/wiki/Raunki%C3%A6r_plant_life-form)

[Back to top](#)

### 3.7.3 chamaephyte

Data type: code list value

For detailed definitions see [https://en.wikipedia.org/wiki/Raunki%C3%A6r\\_plant\\_life-form](https://en.wikipedia.org/wiki/Raunki%C3%A6r_plant_life-form)

[Back to top](#)

### 3.7.4 hemicryptophyte

Data type: code list value

For detailed definitions see [https://en.wikipedia.org/wiki/Raunki%C3%A6r\\_plant\\_life-form](https://en.wikipedia.org/wiki/Raunki%C3%A6r_plant_life-form)

[Back to top](#)

### 3.7.5 cryptophyte

Data type: code list value

For detailed definitions see [https://en.wikipedia.org/wiki/Raunki%C3%A6r\\_plant\\_life-form](https://en.wikipedia.org/wiki/Raunki%C3%A6r_plant_life-form)

[Back to top](#)

### 3.7.6 therophyte

Data type: code list value

For detailed definitions see [https://en.wikipedia.org/wiki/Raunki%C3%A6r\\_plant\\_life-form](https://en.wikipedia.org/wiki/Raunki%C3%A6r_plant_life-form)

[Back to top](#)

### 3.7.7 aerophyte

Data type: code list value

For detailed definitions see [https://en.wikipedia.org/wiki/Raunki%C3%A6r\\_plant\\_life-form](https://en.wikipedia.org/wiki/Raunki%C3%A6r_plant_life-form)

[Back to top](#)

## 3.8 Vegetation cover transition

Data type: code list

This segment addresses the transition status, in which a land unit is, regarding its vegetation cover, whether it is regenerating through natural succession, or it is degrading over time.

[Back to top](#)

### 3.8.1 natural succession

Data type: code list value

This Character addresses the process of and land unit being in the transition state of natural succession.

[Back to top](#)

### 3.8.2 vegetation degradation

Data type: code list value

This Character addresses the process of and land unit being in the transition state of vegetation degradation.

[Back to top](#)

## 3.9 Plant Species Origin

Data type: code list

This segment gives information about the origin of plant species from the perspective of its current growing site where it is found growing in this particular case.

[Back to top](#)

### 3.9.1 native plant

Data type: code list value

This species origin type indicates that this plant species can be found in this specific geographically determined region, area or environment. The presence of the respective species is not necessarily exclusively restricted to this particular area, where it grows (in contrary to *endemic*). Normally, native (indigenous) plants are found on this particular site since long time (centuries).

[Back to top](#)

### 3.9.2 non-native plant

Data type: code list value

This species origin type indicates that a plant species normally cannot be found in this specific geographically determined region, area or environment.

[Back to top](#)

### 3.9.3 endemic plant

Data type: code list value

This species origin type indicates that a plant species can only and exclusively be found in this specific geographically determined region, area or environment. It is a special case of *native* species. A threshold for the minimum or maximum scale of such an endemic area does not exist; it can go from micro habitat level to continental dimension.

[Back to top](#)

### 3.9.4 invasive plant

Data type: code list value

This species origin type indicates that a plant species that has its original life zone in another region and is intruding at the moment into another area. In many cases, the distribution of invasive plants is – intentionally or not – supported by human transportation activities. This process often goes along with outcompeting and repression of other native plants and a disturbance of the ecological equilibrium of native plants associations.

[Back to top](#)

### 3.9.5 migratory plant

Data type: code list value

This species origin type indicates that the growing conditions of the original habitat type of a plant or plant association is changing, e.g. due to external climatic or ecological factors. This process makes the species adapt to the new habitat conditions and migrate into another (neighboring) area, where the migrating species find comparable conditions similar to its former native habitat. The phenomenon of migrating species follows rather long-term effects based on changes in natural environment (man-made or not), in contrary to *invasive* behavior.

[Back to top](#)

### 3.9.6 genetically modified plant

Data type: code list value

This character applies for plant species that are not entirely of natural origin, but have genetically modified, as it is used in crop species types to raise the yield or make them more resistant to toxic substances or unfavorable environmental conditions like drought.

[Back to top](#)

## 3.10 Plant Species Type

Data type: code list

It is suggested here to address the issues of plant species types as handle in the INSPIRE data specifications for the theme *Species Distribution*. Under the data type *SpeciesNameType* the species type can be described with a collection of code lists.

[Back to top](#)

### 3.10.1 Plant Species

Data type: code list value / text string

## 3.11 Plant Community Type

Data type: code list

This character is not yet finalized. The European Vegetation Survey (EVS) scheme could be taken as

the reference scheme. As a reference the *PhytoSociologicalScheme* can be used.

[Back to top](#)

### 3.11.1 Plant Community

Data type: code list value / text string

## 3.12 Plant Growing Season

Data type: date

With this character (and in combination with the temporal parameters under *LCH-9\_3\_3 Period, Period Start Date respectively Period End Date*) the start and ending of the growing season of native and local plants in natural outdoor climate and soil conditions can be indicated. Regarding crop cultivation cycles with the purpose of harvest, another character *LCH-5\_1\_8 Crop Season* shall be used.

[Back to top](#)

### 3.12.1 plant growing season ongoing

Data type: calendar date

This LCH indicates whether according to a given data definition the plant growing seasons for a certain plant or plant community is ongoing or not, according to its natural average phenological appearance. For further detailed information – if available in data source – the beginning and end of plant growing season can be handled in combination with the LCH 9.3 Temporal Parameters.

Excludes:

For crop growing season please refer to “*LCH-5\_1\_8 Crop Season*”.

[Back to top](#)

## 3.13 Crown Cover Density

Data type: integer percentage value

The parameter for crown cover density indicates the share of a certain spatial land cover unit that is over-shielded by the crowns of trees (or bushes). Clearly to say that underneath the crown cover there is other land cover besides the tree (other trees, bushes, bare soil, grasses, mosses etc.). It is up to the user himself whether he wants to add up all area to no more than 100%, or if he allows the surface to have a third (vertical) dimension and reach area values above 100% of the area after adding up all kinds of vegetation.

[Back to top](#)

## 4 Water Characteristics

This heading contains a collection of characters and parameters that apply for water surfaces or have a relation to the physical element of water.

[Back to top](#)

### 4.1 Water Body Formation

Data type: code list

This character describes the degree of “naturalness” of a water course or water body and to what extent its existence has its origin on nature or if it has been influenced by or embedded in anthropogenic structures. Three subtypes can be distinguished:

[Back to top](#)

#### 4.1.1 Natural water body



Data type: code list value

The river or lake has its natural extent, no artificial river banks are present, the water regime is not influenced by any water retention installations.

[Back to top](#)

#### **4.1.2 Controlled, regulated, heavily modified water body**

Data type: code list value

The lake or river embedded in man-made structures, which have the function of stabilizing the river banks or controlling the water regime. Most navigable rivers are in a way controlled or regulated.

#### **4.1.3 man-made water body**

Data type: code list value

This character shall be applied for entirely artificial man-made linear or area-shaped water bodies, where without human interaction no natural water course or body would occur. Examples – among others – are artificial canals for shipping transportation or water reservoirs for irrigation, firefighting, artificial snow making in alpine regions.

[Back to top](#)

### **4.2 Hydrological Water Regime**

Data type: code list

This segment can store the kind of inland water regime, in other words the hydrological persistence, expressing the frequency and duration of how long a water body or water course is present and fluent (This character can also be used in combination with temporal parameters under LCH 9.3 Temporal Parameters). Four subtypes of water regimes are distinguished.

Excludes:

This characteristic does not apply for the description of open sea or areas under tidal influence.

[Back to top](#)

#### **4.2.1 dry water regime**

Data type: code list value

The water body bed is normally dry without any water being present. Surface water flow occurs very unregularly and only after heavy rainfall. Water body bed can be filled with sand, gravel or may be vegetated. Common phenomena in arid and semi-arid climate regions. Some expressions for a dry creek bed are “wadi” [arab.] or “rambla” [span.].

[Back to top](#)

#### **4.2.2 ephemeral, episodic water regime**

Data type: code list value

Surface water presence occurs not regularly but only during or after precipitation when there is enough surface water run-off or accumulated surface water. All waterways that cease surface flow at some points in time and space along their course. Still a certain level of seasonality can be observed.

[Back to top](#)

#### **4.2.3 intermittent, seasonal water regime**

Data type: code list value

Surface water is present periodically throughout a part of the year, typically the wet season (e.g. rainy season, snow melt season). Besides the water not being constantly present, it still occurs

seasonally and regularly every year. In dry years, regular seasonal regime can change to episodic regime.

[Back to top](#)

#### 4.2.4 perennial water regime

Data type: code list value

Surface water is present through the whole year. The river or lake is filled constantly with water (variations on water level included).

[Back to top](#)

### 4.3 Water dynamics

Data type: code list

This character can store the dynamics of a water regime expressing if water is constantly flowing/streaming from one point to another point. Such water current occurs because of the inclination of the terrain, or doesn't occur when the terrain has no inclination. Sometimes also tidal influence causes water currents. Three types of water dynamics are described:

[Back to top](#)

#### 4.3.1 running water

Data type: code list value

Water body with constantly moving water particles due to a current that leads to an exchange or renewal of water at the observed location. Running water normally comes along with a certain degree of erosive or sedimentation effect on the ground.

Examples: River, Stream, Creek.

[Back to top](#)

#### 4.3.2 almost standing water

Data type: code list value

Minimal movement of water particles. It occurs basically in flat terrains where inclination is almost but not equal to 0. Almost standing water is still moving, but with such low velocity that it cause practically no or very little erosive effect.

Examples: regulated river, canal, drainage ditch.

[Back to top](#)

#### 4.3.3 standing water

Data type: code list value

Stagnant water body without any movement of water particles. E.g. lakes, puddles, ponds.

[Back to top](#)

### 4.4 Soil moisture regime, Wetness

Data type: code list

The following wetness characters are categorized referring to the Environmental Qualifiers of the General Habitat Categories (GHC), as laid out in the "Manual for Habitat and Vegetation Surveillance and Monitoring". The soil moisture is dependent on external and internal factors like precipitation, evaporation, capillary rise and infiltration. Further, to measure soil moisture, two complementary parameters are of importance: the volumetric water content (VWC) and the soil water tension (SWT). VWC expresses the share in % of water volume in a given soil volume, and SWT measured the force necessary for plant roots to extract water from the soil.

[Back to top](#)

#### **4.4.1 Aquatic, water at surface**

Data type: code list value

This character indicates that surface water is present on a particular land unit, for example inside wetlands or other landscape types which are not addressed as a waterbody. It means a piece of land has such a high degree of soil wetness that shallow water is covering the surface due to high groundwater level, specific terrain and soil conditions (peat, naturally impermeable soil layers).

[Back to top](#)

#### **4.4.2 Waterlogged, saturated ground**

Data type: code list value

This character indicates that the soil is saturated (soaked) with water, meaning basically all soil pores are filled with water in the absence of soil air. This is the case for example because ground water level is high in general, or because of frequent heavy or enduring rainfall that makes the ground more or less permanently wet.

[Back to top](#)

#### **4.4.3 wet**

Data type: code list value

This character indicates that the soil condition is wet, meaning that many soil pores are filled with water, but still soil air is also present in the pores. Through capillary flow, a substantial amount of water can move upwards into the upper soil layers from ground water levels near the surface. This soil condition is present throughout the entire year.

[Back to top](#)

#### **4.4.4 seasonally wet**

Data type: code list value

This character indicates that the soil condition is wet (see explanation of “wet”), meaning that many soil pores are filled with water, but still soil air is also present in the pores. The difference is that such soil conditions are only seasonally present and not throughout the entire year. The reason for this may be a humid raining season, or seasonally flooding, which both cause a high ground water level.

[Back to top](#)

#### **4.4.5 mesic**

Data type: code list value

In soils with a mesic regime, sufficient soil moisture is almost constantly available for vegetation. The soil is often well drained, but provides enough soil water to not put plants under drought stress which are not used to it. This regime goes together with temperate climate zones. Precipitation is well balanced and distributed more or less equally over the year(s).

[Back to top](#)

#### **4.4.6 semi-dry**

Data type: code list value

Semi-dry soil regimes are characterized by a sequence of rainy and dry episodes throughout the year, where dry episodes dominate. The ground is often very well drained, so that precipitation infiltrates quickly into lower levels of the ground where it is out of reach for surface vegetation.

The soil has a low moisture storage capacity, with only little capillary flow.

[Back to top](#)

#### 4.4.7 **dry**

Data type: code list value

This character indicates that the soil moisture condition is dry, meaning that throughout the year hardly any moisture is available for plants. The situation of drought can last over several years.

However, with the event of occasional precipitation, some biotic vegetation is capable to survive and withstand the long periods of drought.

...

[Back to top](#)

#### 4.4.8 **very dry**

Data type: code list value

This soil moisture condition does not allow any grow of vegetation and is basically free of any biotic life form. It occurs typically in dry deserts.

#### 4.4.9 **xeric**

Data type: code list value

This character applies for the typical Mediterranean climate conditions with humid and cool winters and hot and dry summers.

...

[Back to top](#)

### 4.5 **Wetness source**

Data type: code list

This character can store the source of the wetness of the terrain. From which source water is coming that causes wet conditions. Three types of wetness sources are described:

[Back to top](#)

#### 4.5.1 **Rainfed source**

Data type: code list value

Wetness relying on rainfall.

[Back to top](#)

#### 4.5.2 **surface water source**

Data type: code list value

Wetness relying on inflow of surface water.

[Back to top](#)

#### 4.5.3 **subterranean, groundwater source**

Data type: code list value

Wetness relying on subterranean or ground water, in combination with capillary flow.

[Back to top](#)

### 4.6 **Salinity**

Data type: code list

This parameter can store the value for the salinity of water or soil. It applies for both water or soil. Usually it is expressed by a value measured in per percent (pct) or parts per thousand (ppt). Salinity is the saltiness or dissolved salt content of a body of water. Generally, it is the concentration of mineral salts dissolved in water. Salinity may be expressed in terms of a concentration, the physical method to conclude on the concentration is by capturing the electrical conductivity.

[Back to top](#)

#### **4.6.1 brine**

Data type: code list value

Brine water is saturated or nearly saturated with salt, with a concentration of 50 ppt and above. Also inland plains or lakes with no water outflow drainage in arid or semi-arid climate zones may contain water that can have even a higher degree of salinity than ocean water.

Example: Dead Sea, salt concentration ca. 330 ppt.

[Back to top](#)

#### **4.6.2 saline**

Data type: code list value

In the common understanding, saline water is water in the ocean and terrestrial salt lakes. It has a salt concentration between 30 and 50 ppt. Saline water contains a significant concentration of dissolved salts.

Examples: Atlantic Ocean, Pacific Ocean: average salt concentration 35 ppt; Red Sea: ca. 40 ppt; Mediterranean Sea: ca. 38 ppt; Salars in the Anden mountains.

[Back to top](#)

#### **4.6.3 brackish**

Data type: code list value

Brackish water condition is in between saline and fresh water, with a salinity range between 5 to 30 ppt. Brackish water is water that has more salinity than fresh water, but not as much as seawater. It may result from mixing of seawater with fresh water, as in estuaries, or it may occur in brackish fossil aquifers.

Example: Lagoons, Estuaries under tidal influence, or also lakes in plains without outflow drainage may have brackish water conditions. Baltic Sea: salt concentration 8 ppt; Black Sea: salt concentration 18 ppt.

[Back to top](#)

#### **4.6.4 fresh**

Data type: code list value

Fresh water has a very low degree of salinity from 0.1 to 0.5 ppt. It is a precondition for water to be drinkable (ca. 0.1 ppt).

Example: Running water or ground water have naturally fresh water condition, if not disturbed by saline intermixture.

[Back to top](#)

#### **4.6.5 ultra fresh**

Data type: code list value

Ultra-fresh water is practically salt-free, as it is with condensed water vapour. Water with nearly no salinity. The salinity is equivalent or nearly equivalent to that of rain water, if no other air particles or

aerosols are absorbed from the atmosphere. All kinds of precipitation (rain, snow, dew, hoar frost etc.) in theory start to fall as ultra-fresh water.

[Back to top](#)

## 4.7 pH value

Data type: Numeric value

The pH value is used to describe the acidity respectively the basicity of an aqueous (water based) solution. It is a measure for the concentration of hydrogen ions in the solution, how acid or alkaline it is. The scale reaches from 0 (acidic) to 14 (basic), where 7 is neutral (pure water).

[Back to top](#)

## 4.8 Tidal Phenomena

Data type: heading

This category contains information about characteristics of areas that stand under tidal influence, meaning the regular and cyclic flooding by the tidal waves that sweep around the globe drawn by gravitational forces.

[Back to top](#)

### 4.8.1 tidal influence

Data type: Boolean value

This character contains the information if a piece of land is under tidal influence. It can be either expressed by only a Boolean value (yes/no) or in combination with an integer value to store the average difference in meters/centimeters of water level height caused by the tides.

[Back to top](#)

### 4.8.2 tidal range

Data type: Numeric value

This character gives information about the in-situ height difference in meters of the water level between low tide and high tide water level.

[Back to top](#)

## 4.9 Groundwater

Data type: heading

### 4.9.1 Groundwater table level

Data type: numeric value

This character gives information about the height in meters of the water table level below and relative to the terrain surface.

[Back to top](#)

## 4.10 Snow Characteristics

Data type: heading

This category contains information about characteristics of snow covered surfaces.

[Back to top](#)

### 4.10.1 Snow Height

Data type: numeric value

Snow height in meters.

[Back to top](#)

## 4.11 Ice Characteristics

Data type: heading

This category contains information about characteristics of ice covered surfaces (land and water). *[So far, the heading is a placeholder for future entries on ice characteristics in the model/matrix.]*

[Back to top](#)

# 5 Land Management

## 5.1 Agricultural Land Management

### 5.1.1 Agricultural Cultivation Form

Data type: code list

- The term agriculture cultivation type addresses the form and appearance of agricultural land, which is influenced by the crop types which are cultivated or grown on it, and by the sum of cultivation measures that give this type of land its character. There are three main cultivation forms of agricultural land.

[Back to top](#)

#### 5.1.1.1 cropland

Data type: code list value

This cultivation form “cropland” embraces both arable crop land and permanent cropland. It is land suitable or used for the cultivation of crops. It contains all cultivated land where any kind of crop is planted, cultivated and harvested. Permanent grassland (managed) does not belong to this type and is handled separately.

[Back to top](#)

##### 5.1.1.1.1 arable crop land

Data type: code list value

The term arable crop land describes a kind of crop land which is used for planting annual or multi-annual crops. It may underlay crop rotation cycles. The soil needs to be ploughing or otherwise prepared for sowing, normally with the help of some sort of machinery or manual tools. Arable crop land includes not only actively cropped land but also set aside and fallow land (according to EU Common Agriculture Policy), as it is part of crop cycles on arable land. Also the waterlogged cultivation such as rice fields is included here.

[Back to top](#)

##### 5.1.1.1.2 permanent crop land

Data type: code list value

The term permanent crop land describes a kind of crop land which is used for planting permanent crops, mostly woody crop species like fruit/ nuts/ olive trees, vineyards etc. The plants are often planted in a regular pattern that allows enough space for growing and for harvesting.

[Back to top](#)

##### 5.1.1.2 managed permanent grassland

Data type: code list value

Permanent grassland is land used permanently (for several consecutive years, normally 5 years or more) to grow herbaceous plants for the purpose of fodder, forage or bio-energy plants and alike. It can be intentionally be sown or naturally self-seeded and is not included in the crop rotation on the holding. Normally it is not ploughed, if so, only with limited frequency or in specific periods. No crops are grown. If information is available, with LCH temporal duration it can be indicated for how many years minimum it is considered to be grassland.

[Back to top](#)

### 5.1.2 Cultivation Practice

Data type: code list

Cardinality: 1..n

Cultivation practices form a collection or sequence of cultivation measures. It gives also indication on the cropping cycle applied and the spatial arrangement of the plants.

[Back to top](#)

#### 5.1.2.1 crop rotation

Data type: code list value

This characteristic indicates if a piece of land is under crop rotation. This kind of measure stretches over a multi-annual period and can follow several different sequential variants. The character of crop rotation is meant to be applied on arable land where usually annual crops are grown. The change from arable cropland to permanent crop land is not understood as “rotation”, but as a change in the cultivation practice.

[Back to top](#)

#### 5.1.2.2 no crop rotation

Data type: code list value

This characteristic indicates if a piece of land is not under crop rotation. Instead, the same crop is cultivated year after year over a longer period..

[Back to top](#)

#### 5.1.2.3 plantation

Data type: code list value

This form of planting aims at high economic efficiency in terms of industrialized practices for minimal resources input and high yields. It is a large-scale estate meant for farming specialized in cash crops. Crop plants are arranged normally in rows. Depending on the crop species, branches of the plants may be tightened to wires or poles to grow them in a homogenous way for rationalized crop production.

[Back to top](#)

#### 5.1.2.4 extensive cultivation practice

Data type: code list value

Extensive orchards are an extensive form of using fruit / nut tree, partly also berry shrubs, for fruit / nut production, or also olive trees. This kind of cultivation practice is of value for habitats of insects, birds and small mammals. German expression for this kind of cultivation pattern is “Streuobstwiese” (with grass underneath) or “Streuobstacker” (with ploughed topsoil).

[Back to top](#)



### 5.1.2.5 agroforestry

Data type: code list value

As the name already indicates, this type of land use is a combination of agricultural land use with forestry-like use. The ground between openly standing or scattered trees is grazed by cattle or life stock, or arable crops are planted between the trees. . In German speaking countries this landscape type is called “Hain”, “Hudewald” or “Waldweide”. In the Mediterranean countries it is called Dehesa or Montado and still can be found more often.

[Back to top](#)

### 5.1.2.6 shifting cultivation

Data type: code list value

Shifting cultivation (slash & burn) is a type of crop rotation in combination with a fallow land phase which is applied mainly by subsistent farmers in tropical regions. Rain forest is cut down to gain space for growing crops. The biomass that has been cut down is burnt, the ashes serve as nutrition for the crops. The cultivation period is limited to a few years due to the limited soil fertility. After a crop cultivation period the soil is left fallow so a secondary vegetation succession can take place. After a certain time, this land undergoes again the cycle of slash and burn practice.

[Back to top](#)

### 5.1.2.7 intercropping

Data type: code list value

Intercropping is a multiple cropping practice that involves growing two or more crops in proximity at the same time and in the same space. The most common goal of intercropping is to be more space-efficient with the resource of cultivated land. The space in between plants of one crop type, that is not needed, can be occupied by another crop type. Like this, the production results in overall higher yields compared to for example growing crops one after the other in a crop rotating manner. Further, intercropping can reduce the risk of soil erosion or of plant pests, and can balance the content enhancement and exploitation of soil nutrients through the combined crop species. Examples of intercropping strategies are planting a deep-rooted crop with a shallow-rooted crop, or planting a tall crop (nut trees) with a shorter crop that requires partial shade (arable crop).

[Back to top](#)

### 5.1.2.8 kitchen garden

Data type: code list value

Kitchen garden is a term to describe a form of horticulture basically for own consumption, in contrary to commercial crop production, where small sized patches of all kinds of fruits, vegetables and herbs are grown.

[Back to top](#)

### 5.1.2.9 paddy field cultivation

Data type: code list value

A paddy field is a temporarily flooded parcel of arable land used for growing semi-aquatic rice. In Europe this is the only method applied for rice production.

[Back to top](#)

## 5.1.3 Cultivation Installation

Data type: code list

This list of characters contains a number of technical installations that help to foster plant growth,

raise the yield or help to protect the fruits.

[Back to top](#)

#### **5.1.3.1 greenhouse under glass or foil**

Data type: code list value

This character applies for crops that are grown under permanently installed glass or mounted foil. Like that, the growing conditions are not affected by external climate or weather conditions. Instead, temperature, artificial insolation, water supply as well as the provision of chemical substances are in control of the farmer.

[Back to top](#)

#### **5.1.3.2 under foil on ground**

Data type: code list value

This character applies for crops that are grown on arable land under foil, where the foil is not suspended but lays directly on the ground or over the plant. This way a greenhouse-like microclimate is created under the foil, which protects the soil and crop from direct rainfall impact, frost or high evapotranspiration.

[Back to top](#)

#### **5.1.3.3 plantation protection net**

Data type: code list value

This character indicates that the cultivated crops, mostly permanent crops, are protected against external factors (e.g. birds or hail damage) that could diminish the quality or quantity yield.

[Back to top](#)

#### **5.1.3.4 espalier, trellis, lattice**

Data type: code list value

The espalier cultivation practice is a form of controlling the growth of woody plants (here basically fruit trees and shrubs) by pruning and tying branches to a frame, which results in a more or less 2-dimensional growth of the plants, arranged in a linear form.

#### **5.1.3.5 hydroculture**

Data type: code list value

Hydroculture is a method of growing plants, usually crops, in the absence of natural soil, by using mineral nutrient solutions in an aqueous solvent. Terrestrial plants may be grown with only their roots exposed to the nutritious liquid, or, in addition, the roots may be physically supported by an inert medium.

[Back to top](#)

#### **5.1.3.6 vertical farming**

Data type: code list value

This character applies for the indoor cultivation of crops in multiple stores, either in a multi-store building with greenhouse conditions, or in a greenhouse with vertically arranged multiple racks or shelf layers.

[Back to top](#)

### **5.1.4 Cultivation Measure And Activities**

Data type: code list

Cultivation measures are activities that are applied to treat the soil and maintain the crop land in a favorable, fertile and productive condition. It are all the processes involved in the production of plant-based foods, from planting to harvesting. Normally, these generic measures are widely applied and come along with common agricultural land use. There are a number of subtypes of cultivation measures.

[Back to top](#)

#### **5.1.4.1 Ploughing and tillage**

Data type: code list

This list of values indicates whether or not a parcel is ploughed, and – if known – in which direction according to the slope.

[Back to top](#)

##### **5.1.4.1.1 no ploughing**

Data type: code list value

[Back to top](#)

##### **5.1.4.1.2 ploughing applied, direction unspecified**

Data type: code list value

Ploughing is applied but the direction is unknown , respectively unspecified in the data source.

[Back to top](#)

##### **5.1.4.1.3 ploughing across the slope**

Data type: code list value

Ploughing direction is parallel to contour lines of the terrain.

[Back to top](#)

##### **5.1.4.1.4 ploughing oblique direction**

Data type: code list value

Ploughing direction is in diagonal direction in relation to the fall line of the slope.

[Back to top](#)

##### **5.1.4.1.5 ploughing in direction of slope**

Data type: code list value

Ploughing direction is perpendicular to contour lines of the terrain and follows the fall line of the slope, like water would flow.

[Back to top](#)

#### **5.1.4.2 Fertilization**

Data type: code list

Fertilization is an agricultural measure to increase or maintain the fertility in the soil by bringing in nutrients from plant residues, manure or chemical fertilizers. This character indicates, if a piece of land is fertilized or not.

[Back to top](#)

##### **5.1.4.2.1 no fertilizing**

Data type: code list value

This character indicates that this piece of land is not under fertilization activity.

[Back to top](#)

#### **5.1.4.2.2 fertilization applied, type unspecified**

Data type: code list value

This character indicates that a land parcel is fertilized in principle, but the kind of used fertilizer (see above) is not known.

[Back to top](#)

#### **5.1.4.2.3 organic fertilizer**

Data type code list value

Organic fertilizer is natural material in the form of organic biomass or animal excrements/manure which is brought onto the parcels and/or ploughed in.

[Back to top](#)

##### **5.1.4.2.3.1 animal manure**

Data type: code list value

*Animal manure* is a natural kind of fertilizer where organic material in the form of animal excrements / manure is brought onto the parcels and/or ploughed in.

[Back to top](#)

##### **5.1.4.2.3.2 green manure**

Data type: code list value

*Green manure* is organic biomass that is grown on or brought onto the parcels and ploughed in. Can be organic residue from other sources or grown as interim crop in between two cropping phases or after main crop.

[Back to top](#)

#### **5.1.4.2.4 synthetic fertilizer**

Data type: code list value

Synthetic industrial fertilizers are made out of chemical substances based on minerals through industrial processes.

[Back to top](#)

#### **5.1.4.3 Weed Control**

Data type: code list

Weed control is an agricultural measure to protect the planted crop from concurrent consumer vegetation (e.g. other herbaceous plants) regarding consumption of water, light or nutrients.

This can be done mechanically, biologically or chemically by application of herbicides.

[Back to top](#)

##### **5.1.4.3.1 no weed control**

Data type: code list value

This character indicates that this piece of land is not under weed control.

[Back to top](#)

##### **5.1.4.3.2 weed control applied, method unspecified**

Data type code list value

Weed control is applied but the method is unspecified or unknown.

[Back to top](#)

#### **5.1.4.3.3 mechanical or biological weed control**

Data type code list value

Weed control is applied by mechanical (e.g. tilling) or biological (make use of natural weed enemies) techniques.

[Back to top](#)

#### **5.1.4.3.4 chemical weed control**

Data type code list value

Weed control is executed by application of chemical substances, like herbicides.

[Back to top](#)

#### **5.1.4.4 Pest Control**

Data type: code list

Pest control is an agricultural measure to protect the planted crop from harmful insects or other organisms that damage the crop and thus lower the yield or shorten the lifetime of the crop plant. This can be done mechanically, biologically or chemically by application of pesticides.

[Back to top](#)

##### **5.1.4.4.1 no pest control**

Data type: code list value

This character indicates that this piece of land is not under pest control.

[Back to top](#)

##### **5.1.4.4.2 pest control applied, method unspecified**

Data type code list value

Pest control is applied but the method is unspecified or unknown.

[Back to top](#)

##### **5.1.4.4.3 mechanical or biological pest control**

Data type code list value

Pest control is applied by mechanical (e.g. traps) or biological (make use of natural enemies) techniques.

[Back to top](#)

##### **5.1.4.4.4 chemical pest control**

Data type code list value

Pest control is executed by application of chemical substances, like pesticides.

[Back to top](#)

#### **5.1.4.5 Irrigation**

Data type: code list

Irrigation is an agricultural measure of bringing out water on the land. It is applied to temporarily or permanently increase the humidity of the top soil and to enable or enhance the plants' transpiration and capture of nutrients from the soil. This character indicates, if a piece of land is irrigated. The

irrigation method describes the way how water is brought onto the field for plant irrigation.

[Back to top](#)

#### **5.1.4.5.1 no irrigation**

Data type: code list value

[Back to top](#)

#### **5.1.4.5.2 irrigation applied, method unspecified**

Data type: code list value

Irrigation of the plants is present, but particular method is unspecified or unknown.

[Back to top](#)

#### **5.1.4.5.3 gravity surface irrigation**

Data type: code list value

Through surface irrigation the water is led to the plants over the ground through small channels, either by flooding the whole parcel or leading the water along small furrows between the crops, using gravity as a force.

[Back to top](#)

#### **5.1.4.5.4 sprinkler irrigation**

Data type: code list value

Irrigation of the plants by propelling the water under high pressure as artificial rain over the parcels, normally in a periodical manner with mobile devices, but can also appear as permanent and fixed installations.

[Back to top](#)

#### **5.1.4.5.5 irrigation carousel**

Data type: code list value

Irrigation of the plants by means of a normally permanently installed sustaining structure above the field, which circulates regularly around a center point of the installation, and distributing water over the field in a circular movement (e.g. clock-wise).

[Back to top](#)

#### **5.1.4.5.6 drip irrigation**

Data type: code list value

Irrigation of the plants by leading the water directly to the plants drop by drop with perforated fine tubes on the ground or with micro-sprayers to create fog-like conditions.

[Back to top](#)

#### **5.1.4.5.7 subsurface drip irrigation**

Data type: code list value

Irrigation of the plants by leading the water directly to the plants through perforated fine tubes or tapes that are installed under ground at or below the plant root level.

[Back to top](#)

#### **5.1.4.5.8 manual irrigation**

Data type: code list value

Irrigation of the plants applied by hand, manually.

[Back to top](#)

#### **5.1.4.6 Irrigation Water Source**

Data type: code list

The Irrigation Source describes where the water for irrigation is taken from.

[Back to top](#)

##### **5.1.4.6.1 groundwater**

Data type: code list value

Irrigation water is taken out of the ground from ground water aquifers, normally by wells or pumps.

[Back to top](#)

##### **5.1.4.6.2 reservoir**

Data type: code list value

Irrigation water is taken from a water reservoir like an artificial lake hold back by a dam, or a natural lake. The reservoir can be fed by a natural water course or also can be a rain-fed water cistern.

[Back to top](#)

##### **5.1.4.6.3 water course**

Data type: code list value

Irrigation water is taken from a running water course like a river or creek.

[Back to top](#)

#### **5.1.4.7 Drainage**

Data type: code list

Drainage as an agricultural measurement is the discharge of water from the soil over and through the soil, resulting in a lowering of the groundwater level. The water can be discharged through drains or ditches.

[Back to top](#)

##### **5.1.4.7.1 no drainage**

Data type: code list value

This character indicates that no drainage activity takes place on the piece of land.

[Back to top](#)

##### **5.1.4.7.2 drainage applied, method unspecified**

Data type: code list value

Drainage is apparently installed, but particular method is unspecified or unknown.

[Back to top](#)

##### **5.1.4.7.3 open ditch drainage**

Data type: code list value

This character indicates that the land is drained by open lengthy ditches or trenches where water can seep out of the surrounding terrain; water may or may not be present on surface of ditch.

[Back to top](#)

##### **5.1.4.7.4 subsurface tube drainage**

Data type: code list value

This character indicates that land is drained with perforated tubes or pipes that are dug in the ground under the surface where water can percolate into the tube to be discharged.

[Back to top](#)

#### **5.1.4.7.5 filled ditch drainage**

Data type: code list value

This character indicates that the land is drained by ditches or trenches that are filled with loose material where water can easily percolate through. The filling of this material levels out the surface above the bottom of the ditch with the surrounding terrain on both sides, so that the ditch itself is not an obstacle for trespassing.

[Back to top](#)

#### **5.1.4.8 Mowing**

Data type: heading

This character expresses the kind of mowing activities on a piece of land. A collection of subtypes describe the frequency of mowing during a year.

[Back to top](#)

##### **5.1.4.8.1 Mowing Intensity**

Data type: code list

###### **5.1.4.8.1.1 no mowing**

Data type: code list value

Parcel is not mowed.

[Back to top](#)

###### **5.1.4.8.1.2 mowing applied, frequency unspecified**

Data type: code list value

Mowing activity is present, but intensity / frequency is not known.

[Back to top](#)

###### **5.1.4.8.1.3 extensive mowing**

Data type: code list value

Parcel is mowed one time (1x) per year.

[Back to top](#)

###### **5.1.4.8.1.4 medium intensity mowing**

Data type: code list value

Parcel is mowed two times (2x) per year.

[Back to top](#)

###### **5.1.4.8.1.5 intensive mowing**

Data type: code list value

Parcel is mowed more than two times (> 2x) per year.

[Back to top](#)

##### **5.1.4.8.2 mowing frequency**



Data type: integer

Indicates, how often a land unit is mowed per year. When barcoding this element, it is best to combine it with the parameter LCH 9.3.4 recurring frequency.

[Back to top](#)

#### **5.1.4.9 shrub clearance**

Data type: boolean value

The practice of shrub clearance is applied on grassland areas with the aim to avoid the stepwise succession growing of bushes, shrubs or trees. Like this, the area is kept as an open grassland which is often used for grazing.

[Back to top](#)

#### **5.1.4.10 biomass burning**

Data type: boolean value

Biomass burning is a form of growth control or removal of un-wanted plants on cultivated land by setting it on fire. This measure has also a soil ameliorating effect of by leaving the ashes of burnt biomass on the ground.

[Back to top](#)

#### **5.1.4.11 liming**

Data type: boolean value

Liming is a form of ameliorating the soil by bringing out calcium carbonate with the effect of lowering the soil acidity. It is typically used in coniferous forest areas, but application also in agricultural areas is possible.

[Back to top](#)

#### **5.1.4.12 pruning**

Data type: boolean value

[Back to top](#)

Pruning is a kind of horticultural and silvicultural measure for plant growth control which is used to control the growth of plants. It involves the selective removal of parts of a plant by cutting the branches, twigs, buds, or roots. Reasons to prune plants include deadwood removal, shaping (by controlling or directing growth), improving or maintaining health, reducing risk from falling branches, preparing nursery specimens for transplanting, and both harvesting and increasing the yield or quality of flowers and fruits. It is often used in combination with sustaining installation on permanent woody crops and aims at keeping the branches low for easier fruit harvest and also to stimulate the plant's crop or biomass production.

[Back to top](#)

#### **5.1.4.13 set aside parcel**

Data type: boolean value

This character indicates if a cultivated land parcel is set aside (i.e. taken out of crop production), meaning that the crop production is paused for one or more growing seasons, and the parcel is either exposed to natural succession or covered with an intermediate vegetation cover to protect the soil from erosion or improve the soil structure or soil fertility. The purpose of setting aside a parcel is to let the soil recover from intensive cultivation. It can be part of a crop rotation cycle.

[Back to top](#)

### 5.1.5 Cultivation Purpose

Data type: code list

This category lists a number of cultivation purposes, what the crops are grown for. It can be that the very same crop (e.g. maize) is grown on one parcel as fodder crop, on another parcel as energy crop, and on yet another parcel as food article sugar maize.

[Back to top](#)

#### 5.1.5.1 Alimentary Crop

Data type: code list value

This sub-class applies for all kinds of crop production for the human food consumption, for example vegetables, cereals, fruit (be it processed or unprocessed).

Excludes:

Production of fodder crops to feed animals are excluded. It is also part of the entire human food chain, but this crop production purpose has its own model element.

[Back to top](#)

##### 5.1.5.1.1 grain production crop

Data type: code list value

This sub-class applies for crop production of cereal grains.

[Back to top](#)

##### 5.1.5.1.2 table fruit crop

Data type: code list value

This sub-class applies for all kinds of crops that are produced for the consumption of whole fruits.

[Back to top](#)

##### 5.1.5.1.3 liquefaction, fermentation or brewing of Crop

Data type: code list value

This sub-class applies for all kinds of crops that are produced for the liquefaction, fermentation or brewing of crop, for example to making juice, wine, edible oil, aromatic extract and alike.

[Back to top](#)

#### 5.1.5.2 Fodder Crop

Data type: code list value

This sub-class applies for all kinds of crop production that are meant to be fed to animals in the context of husbandry, fodder beet, silage maize or alfalfa.

[Back to top](#)

##### 5.1.5.2.1 harvested for silage

Data type: code list value

This sub-class applies for all kinds of crops that are stored and conserved after harvest in a fodder silo, either being a permanently installed and fixed containment or more or less airtight sealed in a foil covered pile. During silage, the process of fermentation helps to conserve the harvested fodder.

[Back to top](#)

##### 5.1.5.2.2 harvested for dry fodder

Data type: code list value

This sub-class applies basically for parcels with herbaceous plants that are left on the parcel after being mowed for drying. The result after drying is hay or straw, which is a form of fodder conservation.

[Back to top](#)

#### **5.1.5.2.3 harvested green for direct forage**

Data type: code list value

This sub-class applies basically for parcels with herbaceous plants that are cut fresh and green for immediate feeding to animals.

[Back to top](#)

#### **5.1.5.2.4 temporary grasses and grazings**

Data type: code list value

This sub-class applies for parcels with temporary herbaceous plants for grazing, hay or silage as a part of a normal crop rotation, lasting at least one crop year and less than five years, sown with grass or grass mixtures. The areas are broken up by ploughing or other tilling or the plants are destroyed by other means as by herbicides before they are sown again. This purpose can be combined with other characteristics from this fodder crop segment.

[Back to top](#)

#### **5.1.5.3 industrial crop**

Data type: code list value

This sub-class applies for all kinds of crop production that are meant to be used in industrial or manufacture processes, for example cotton, linen.

[Back to top](#)

#### **5.1.5.4 energy crop**

Data type: code list value

This sub-class applies for all kinds of crop production that are meant to be used for energy production, e.g. in a bio-gas facility.

[Back to top](#)

##### **5.1.5.4.1 Bio Gas Crop**

Data type: code list value

This sub-class applies for all kinds of crop production that are meant to be used for energy production, e.g. in a bio-gas facility.

[Back to top](#)

##### **5.1.5.4.2 Liquid Bio Fuel Crop**

Data type: code list value

This sub-class applies for parcels where crops are grown to gain liquid bio fuels, like e.g. rapeseed oil, bio-ethanol from sugar cane or maize.

[Back to top](#)

##### **5.1.5.4.3 Solid Bio Fuel Crop**

Data type: code list value

This sub-class applies for parcels where crops are grown to gain solid bio fuels, like e.g. energy wood.

[Back to top](#)

### 5.1.5.5 ornamental plants

Data type: code list value

This sub-class applies for all kinds of plant production for ornamental and functional purposes, e.g. to be planted later in urban parks, in residential gardens or other in public spaces.

[Back to top](#)

### 5.1.5.6 functional crop

Data type: code list value

This sub-class applies for crop production with functional purposes other than for consumption (food, fodder, industrial, energy). Crops produced for e.g. alimentation and where the residues are used for energy production. These sub-types of functional crop purposes can be combined with each other, or also with other cultivation purposes.

[Back to top](#)

#### 5.1.5.6.1 Soil Protective Cover Crop

Data type: code list value

This sub-class applies for parcels with crops that help to protect the soil from erosion or from drying out.

[Back to top](#)

#### 5.1.5.6.2 Soil Nutrient Storage Crop

Data type: code list value

This sub-class applies for parcels with crops that help to enrich the soil with nutrients like natural nitrogen.

[Back to top](#)

#### 5.1.5.6.3 Biodiversity Conservation Crop

Data type: code list value

This sub-class applies for parcels with crops that help to protect or preserve or reestablish a better biodiversity.

[Back to top](#)

#### 5.1.5.6.4 Carbon Sequestration Crop

Data type: code list value

This sub-class applies for parcels with the main target to extract carbon dioxide from the atmosphere and bind it on the biomass or in the ground.

[Back to top](#)

### 5.1.5.7 Seed Production Crop

Data type: code list value

This sub-class applies for parcels with crops to produce seeds.

[Back to top](#)

## 5.1.6 Crop Type

Data type: code list

The crop types can be ordered in different ways. The here applied manner aims to focus on the form of the crop, or which part of the plant is harvested. This crop type list follows a compromise between botanical aspects and commonly used aspects to group crops by their apparent form. The latter aspect

does not always go conform with botanical hierarchy. For example almonds or coconuts botanically belong to stone fruit, but are grouped here with “nuts”, because they are called so and not the flesh of fruit but the core is the targeted part of the fruit. Olives are also stone fruits, grapes are a sort of berries but both of them receive a stand-alone position because of their outstanding importance in European crop production. Further, this crop type list tries to avoid naming crops after the aspect of their cultivation purpose but instead categorizes them according to the part of the plant that is the harvest target. Cultivation purpose was given its own matrix segment.

[Back to top](#)

#### **5.1.6.1 Arable crops**

Data type: code list value

##### **5.1.6.1.1 Cereals**

Data type: code list value

###### **5.1.6.1.1.1 common wheat and spelt**

Data type: code list value

###### **5.1.6.1.1.2 durum wheat**

Data type: code list value

###### **5.1.6.1.1.3 rye**

Data type: code list value

###### **5.1.6.1.1.4 barley**

Data type: code list value

###### **5.1.6.1.1.5 oats**

Data type: code list value

###### **5.1.6.1.1.6 maize**

Data type: code list value

###### **5.1.6.1.1.7 rice**

Data type: code list value

###### **5.1.6.1.1.8 millet**

Data type: code list value

###### **5.1.6.1.1.9 other cereals**

Data type: code list value

##### **5.1.6.1.2 Pulses and protein crops**

Data type: code list value

###### **5.1.6.1.2.1 peas**

Data type: code list value

###### **5.1.6.1.2.2 beans**

Data type: code list value

#### **5.1.6.1.2.3 lentils**

Data type: code list value

#### **5.1.6.1.2.4 sweet lupins**

Data type: code list value

#### **5.1.6.1.2.5 soya**

Data type: code list value

#### **5.1.6.1.2.6 chickpeas**

Data type: code list value

#### **5.1.6.1.2.7 peanuts**

Data type: code list value

#### **5.1.6.1.2.8 other dry pulses**

Data type: code list value

#### **5.1.6.1.3 Clover, Vetch, Lupins, Lucerne**

Data type: code list value

#### **5.1.6.1.4 Root and Tuber Crops**

Data type: code list value

##### **5.1.6.1.4.1 potatoes**

Data type: code list value

##### **5.1.6.1.4.2 sweet potatoes**

Data type: code list value

##### **5.1.6.1.4.3 sugar beet**

Data type: code list value

##### **5.1.6.1.4.4 fodder beet**

Data type: code list value

##### **5.1.6.1.4.5 Carrot**

Data type: code list value

##### **5.1.6.1.4.6 Parsnip**

Data type: code list value

##### **5.1.6.1.4.7 Horseradish**

Data type: code list value

##### **5.1.6.1.4.8 Radish**

Data type: code list value

**5.1.6.1.4.9 Beetroot**

Data type: code list value

**5.1.6.1.4.10 White Turnip**

Data type: code list value

**5.1.6.1.4.11 Celery Root**

Data type: code list value

**5.1.6.1.5 Bulb Vegetable Crops**

Data type: code list value

**5.1.6.1.5.1 Onions**

Data type: code list value

**5.1.6.1.5.2 Garlic**

Data type: code list value

**5.1.6.1.5.3 Leeks**

Data type: code list value

**5.1.6.1.6 Cole Crops, Brassica oleracea**

Data type: code list value

**5.1.6.1.6.1 White, Green, Red Cabbage**

Data type: code list value

**5.1.6.1.6.2 Brussels Sprout**

Data type: code list value

**5.1.6.1.6.3 Stem Cabbage, Kohlrabi**

Data type: code list value

**5.1.6.1.6.4 Cauliflower**

Data type: code list value

**5.1.6.1.6.5 Broccoli**

Data type: code list value

**5.1.6.1.6.6 Savoy Cabbage**

Data type: code list value

**5.1.6.1.7 Leaf, Stalk, Flowering Vegetable Crops**

Data type: code list value

**5.1.6.1.7.1 Lettuces, Salads**

Data type: code list value

**5.1.6.1.7.2 Asparagus**

Data type: code list value

#### **5.1.6.1.7.3 Spinach**

Data type: code list value

#### **5.1.6.1.7.4 Rods Celery**

Data type: code list value

#### **5.1.6.1.7.5 Rhubarb**

Data type: code list value

#### **5.1.6.1.7.6 Artichoke**

Data type: code list value

#### **5.1.6.1.7.7 Romanesco**

Data type: code list value

#### **5.1.6.1.8 Fruiting Vegetable Crops**

Data type: code list value

##### **5.1.6.1.8.1 Tomato**

Data type: code list value

##### **5.1.6.1.8.2 Bell Pepper**

Data type: code list value

##### **5.1.6.1.8.3 Chili Pepper**

Data type: code list value

##### **5.1.6.1.8.4 Eggplant**

Data type: code list value

#### **5.1.6.1.9 Cucurbit Crops**

Data type: code list value

##### **5.1.6.1.9.1 Cucumbers**

Data type: code list value

##### **5.1.6.1.9.2 Zucchini**

Data type: code list value

##### **5.1.6.1.9.3 Melons**

Data type: code list value

##### **5.1.6.1.9.4 Pumpkins**

Data type: code list value

#### **5.1.6.1.10 Oilseed or Fibre Crops**

Data type: code list value



**5.1.6.1.10.1 tobacco**

Data type: code list value

**5.1.6.1.10.2 hops**

Data type: code list value

**5.1.6.1.10.3 rape and turnip rape**

Data type: code list value

**5.1.6.1.10.4 sunflower**

Data type: code list value

**5.1.6.1.10.5 linseed, oil flax**

Data type: code list value

**5.1.6.1.10.6 cotton**

Data type: code list value

**5.1.6.1.10.7 flax****5.1.6.1.10.8 hemp**

Data type: code list value

**5.1.6.1.10.9 other oilseed or fibre crops**

Data type: code list value

**5.1.6.1.11 aromatic, medicinal, culinary herbs**

Data type: code list value

**5.1.6.1.12 Flowers and ornamental plants**

Data type: code list value

**5.1.6.1.13 strawberries**

Data type: code list value

**5.1.6.1.14 sugarcane**

Data type: code list value

**5.1.6.1.15 other arable crops [5.1.6.1.99]**

Data type: code list value

**5.1.6.2 Meadow Grasses and Herbs**

Data type: code list value

**5.1.6.3 Permanent crops**

Data type: code list value

**5.1.6.3.1 Pome Fruits**

Data type: code list value

**5.1.6.3.1.1 Apple**

Data type: code list value

**5.1.6.3.1.2 Pear**

Data type: code list value

**5.1.6.3.1.3 Quince**

Data type: code list value

**5.1.6.3.1.4 Medlar**

Data type: code list value

**5.1.6.3.1.5 Pomegranate**

Data type: code list value

**5.1.6.3.2 Drupes, Stone-Like Fruits**

Data type: code list value

**5.1.6.3.2.1 Sweet Cherry**

Data type: code list value

**5.1.6.3.2.2 Sour Cherry**

Data type: code list value

**5.1.6.3.2.3 Plum**

Data type: code list value

**5.1.6.3.2.4 Mirabelle, Spilling**

Data type: code list value

**5.1.6.3.2.5 Peach, Nectarine**

Data type: code list value

**5.1.6.3.2.6 Apricot**

Data type: code list value

**5.1.6.3.2.7 Avocado**

Data type: code list value

**5.1.6.3.2.8 Mango**

Data type: code list value

**5.1.6.3.2.9 Litchi**

Data type: code list value

**5.1.6.3.2.10 Date Fruit**

Data type: code list value

**5.1.6.3.2.11 Oil Palm**

Data type: code list value

#### **5.1.6.3.3 Nuts**

Data type: code list value

##### **5.1.6.3.3.1 Walnuts**

Data type: code list value

##### **5.1.6.3.3.2 Chestnuts**

Data type: code list value

##### **5.1.6.3.3.3 Hazelnuts**

Data type: code list value

##### **5.1.6.3.3.4 Cashew Nuts**

Data type: code list value

##### **5.1.6.3.3.5 Brazil Nuts**

Data type: code list value

##### **5.1.6.3.3.6 Pekka Nuts**

Data type: code list value

##### **5.1.6.3.3.7 Pistachios**

Data type: code list value

##### **5.1.6.3.3.8 Almond**

Data type: code list value

##### **5.1.6.3.3.9 Coconuts**

Data type: code list value

#### **5.1.6.3.4 Citrus fruits**

Data type: code list value

##### **5.1.6.3.4.1 Oranges**

Data type: code list value

##### **5.1.6.3.4.2 Lemons**

Data type: code list value

##### **5.1.6.3.4.3 Limes**

Data type: code list value

##### **5.1.6.3.4.4 Pomelos**

Data type: code list value

##### **5.1.6.3.4.5 Grapefruits**

Data type: code list value

**5.1.6.3.4.6 Mandarin**

Data type: code list value

**5.1.6.3.4.7 Clementine**

Data type: code list value

**5.1.6.3.5 Berry Crops**

Data type: code list value

**5.1.6.3.5.1 Raspberries**

Data type: code list value

**5.1.6.3.5.2 Blackberries**

Data type: code list value

**5.1.6.3.5.3 Currants**

Data type: code list value

**5.1.6.3.5.4 Gooseberries**

Data type: code list value

**5.1.6.3.5.5 Blueberries**

Data type: code list value

**5.1.6.3.5.6 Cranberries**

Data type: code list value

**5.1.6.3.5.7 Juniper**

Data type: code list value

**5.1.6.3.5.8 Elderberries**

Data type: code list value

**5.1.6.3.5.9 Cornel**

Data type: code list value

**5.1.6.3.5.10 Passion Fruit**

Data type: code list value

**5.1.6.3.6 Grapes**

Data type: code list value

**5.1.6.3.7 Olives**

Data type: code list value

**5.1.6.3.8 Other Fleshy Fruits**

Data type: code list value

**5.1.6.3.8.1 Banana**

Data type: code list value

#### **5.1.6.3.8.2 Fig Fruit**

Data type: code list value

#### **5.1.6.3.8.3 Kiwi**

Data type: code list value

#### **5.1.6.3.8.4 Papaya**

Data type: code list value

#### **5.1.6.3.8.5 Ananas**

Data type: code list value

#### **5.1.6.3.8.6 Custard Apple**

Data type: code list value

#### **5.1.6.3.8.7 Prickly Pear**

Data type: code list value

#### **5.1.6.3.8.8 Persimmon**

Data type: code list value

#### **5.1.6.3.9 Exotic Aromatic and Spice Crops**

Data type: code list value

##### **5.1.6.3.9.1 Coffee Bush**

Data type: code list value

##### **5.1.6.3.9.2 Cocoa Tree**

Data type: code list value

##### **5.1.6.3.9.3 Pepper**

Data type: code list value

##### **5.1.6.3.9.4 Cinnamon Tree**

Data type: code list value

##### **5.1.6.3.9.5 Vanilla**

Data type: code list value

##### **5.1.6.3.9.6 Cloves**

Data type: code list value

##### **5.1.6.3.9.7 Cardamom**

Data type: code list value

##### **5.1.6.3.9.8 Ginger**

Data type: code list value

**5.1.6.3.10 Leaf Crops from Woody Plants**

Data type: code list value

**5.1.6.3.10.1 Tea Bush**

Data type: code list value

**5.1.6.3.10.2 Coca Bush**

Data type: code list value

**5.1.6.3.10.3 Mate Tree**

Data type: code list value

**5.1.6.3.11 Woody Plant Nursery**

Data type: code list value

**5.1.6.3.12 Christmas Trees**

Data type: code list value

**5.1.6.3.13 Herbaceous Biomass Crops**

Data type: code list value

E.g. Miscanthus, Sida, Igniscum, Silphium, Sorghum.

**5.1.6.3.14 Woody Biomass Crops**

Data type: code list value

E.g. Willow, Wicker, Poplar.

**5.1.6.3.15 Other permanent crops [5.1.6.3.99]**

Data type: code list value

**5.1.6.4 Mushrooms**

Data type: code list value

**5.1.6.5 Aquatic crops**

Data type: code list value

**5.1.6.5.1 Algae crops**

Data type: code list value

**5.1.6.6 Fallow land [5.1.6.98]**

Data type: code list value

Parcels formerly used as agricultural land which are temporary (at least 3 years) or permanently not cultivated, and have no crop cover, and are not part of a cultivation cycle anymore.

Excludes:

Set aside parcels which are not meant to be harvested, but still are greened and part of a crop rotation cycle, are not seen as fallow land. For Set aside parcels see LCH 5.1.4.13 “set aside parcel”.

**5.1.6.7 Unspecified crop [5.1.6.99]**

Data type: code list value

Parcel is under cultivation but crop species is unknown.

### 5.1.7 Plant growth stage

Data type: code list

The different vegetative (or development) stages of the crops like germination, seedling, vegetative, budding, flowering and ripening.

[Back to top](#)

#### 5.1.7.1 sowing the seeds

Data type: code list value

Seeds have been brought out onto the parcel, however germination and appearance of plant growth is not yet visible.

[Back to top](#)

#### 5.1.7.2 germination, sprouting

Data type: code list value

The plant growth phase when the seed is starting to grow from the beginning and develop sprouts.

[Back to top](#)

#### 5.1.7.3 vegetative phase

Data type: code list value

The plant growth phase when the sprouts evolve in a young plant in growing leafs, shooting and tillering.

[Back to top](#)

#### 5.1.7.4 reproductive phase

Data type: code list value

The plant growth phase when it is booting, building heads and flowers.

[Back to top](#)

#### 5.1.7.5 ripening phase

Data type: code list value

The plant growth phase when it develops fruit, in the state of maturation and ripening, followed by senescence.

[Back to top](#)

#### 5.1.7.6 harvested empty field

Data type: code list value

Parcel has been harvested, no crop residues are left over, spontaneous green through resprouting of weeds has not yet started.

#### 5.1.7.7 crop residues

Data type: code list value

Parcel has been harvested and some crop residues are still standing or laying on the parcel, e.g. grain straw or stubbles, left behind fruit from harvesting procedure. This element can be combined with other Plant Growth Stage LCH 5.1.7.8 “resprouting on harvested field”.

Excludes:

If this element applies, it excludes the element LCH 5.1.7.6 “harvested empty field”.

### 5.1.7.8 resprouting on harvested field

Data type: code list value

Parcel has been harvested and some weed and/or seeds from harvested crop are resprouting on the field, which results in a spontaneous arbitrary re-greening. This element can be combined with other Plant Growth Stage LCH 5.1.7.7 “crop residues”.

Excludes:

If this element applies, it excludes the element LCH 5.1.7.6 “harvested empty field”.

## 5.1.8 Crop Season

Data type: code list

[Back to top](#)

### 5.1.8.1 Crop Season Ongoing

Data type: code list value

[Back to top](#)

### 5.1.8.2 Summer Crop Season

Data type: code list value

[Back to top](#)

### 5.1.8.3 Winter Crop Season

Data type: code list value

[Back to top](#)

### 5.1.8.4 Year-round Crop Season

Data type: code list value

[Back to top](#)

### 5.1.8.5 Number Of Crop Seasons

Data type: integer value

[Back to top](#)

## 5.1.9 Crop Rotation Element

Data type: code list

This segment contains a list of the roles that certain crops play as part of the crop rotation sequence.

[Back to top](#)

### 5.1.9.1 Main Crop

Data type: code list value

This element applies for the first and main crop of the year. It is normally seeded after the harvest of the previous year. When cultivated as main (and first) crop it normally brings the highest yield. The main crop can be followed by other sub-subsequent crops.

[Back to top](#)

### 5.1.9.2 Secondary Crop

Data type: code list value

This element applies for the second (or third) crop that follows the already harvested main crop of the running year. When being called “secondary” does not mean it is inferior to the main crop, only that



the yield is not expected to be that high compared to the crop type if it would have been seeded in the previous autumn or winter.

[Back to top](#)

### 5.1.9.3 Side Crop

Data type: code list value

This element applies for collateral or additional crops that are cultivated at the same time along with the main or also the secondary crop. The reason to do so can be to support biodiversity or to improve soil nutrient content. The side crop has also an economic value when harvested.

[Back to top](#)

### 5.1.9.4 Cover Crop

Data type: code list value

This element applies for sub-sequent crops where the cultivation purpose lays more in the soil protection or to prevent soil erosion, to support biodiversity or soil nutrient content. The harvesting value is inferior, compared to its function.

[Back to top](#)

## 5.1.10 Cultivation Strategy

Data type: code list

This heading contains overall strategies how agriculture is exercised and which bundle of methods are implied.

[Back to top](#)

### 5.1.10.1 conventional farming

Data type: code list value

This character applies for conventional agricultural systems which make use of industrial fertilizers, herbicides and pesticides and heavy machinery to maximize harvest yield.

[Back to top](#)

### 5.1.10.2 organic farming

Data type: code list value

This character applies for organic or “Eco”-farming as agricultural systems which try to (or by convention must) avoid industrial fertilizers, herbicides and pesticides. Instead, biological or mechanical plant protection measures are exercised, in combination with natural fertilizers like green manure.

[Back to top](#)

## 5.1.11 Grazing

Data type: heading

This character expresses if a piece of land is used for grazing, subtypes indicate the grazing intensity (according to the EU IACS).

[Back to top](#)

### 5.1.11.1 Grazing Intensity

Data type: code list

[Back to top](#)

#### 5.1.11.1.1 no grazing

Data type: code list value

No grazing activity is observed for this piece of land.

[Back to top](#)

#### **5.1.11.1.2 grazing present, intensity unspecified**

Data type: code list value

Grazing is present, but intensity is not known.

[Back to top](#)

#### **5.1.11.1.3 Extensive, freerange grazing**

Data type: code list

Extensive grazing means two or less livestock units per hectare.

[Back to top](#)

#### **5.1.11.1.4 intensive grazing**

Data type: code list value

Intensive grazing means more than 2 livestock units per hectare.

[Back to top](#)

#### **5.1.11.2 Grazing Livestock per ha**

Data type: integer value

Indicates, how many livestock units (animals) per hectare are grazing on a particular parcel.

[Back to top](#)

#### **5.1.11.3 Grazing Cycle**

Data type: code list

[Back to top](#)

##### **5.1.11.3.1 All Year-round Grazing**

Data type: code list value

Life stock animals are fed on the pasture grazing ground throughout the entire year. Can be combined with grazing routine, whether animals are brought to a shelter during the day or the night, or kept outside day and night.

[Back to top](#)

##### **5.1.11.3.2 Seasonal Grazing**

Data type: code list value

Life stock animals are fed on the pasture grazing ground for only part of the year. Can be combined with grazing routine, whether animals are brought to a shelter during the day or the night, or kept outside day and night.

[Back to top](#)

##### **5.1.11.3.3 Rotational Grazing, Paddocks**

Data type: code list value

Life stock animals are fed on the pasture grazing ground in a rotational manner with rather short intervals, from parcel to parcel. Can be combined with grazing routine, whether animals are brought to a shelter during the day or the night, or kept outside day and night.

[Back to top](#)

#### **5.1.11.3.4 Occasional Grazing**

Data type: code list value

Life stock animals are fed on the pasture grazing ground only occasionally or irregularly interrupted.

[Back to top](#)

#### **5.1.11.3.5 Unmanaged Natural Grazing**

Data type: code list value

Life stock animals feed themselves on the grazing ground in an unmanaged manner. This is typical for wildlife or migratory animals.

[Back to top](#)

#### **5.1.11.4 Grazing Routine**

Data type: code list

[Back to top](#)

##### **5.1.11.4.1 Day Grazing**

Data type: code list value

Life stock animals are kept on the grazing ground only during the day.

[Back to top](#)

##### **5.1.11.4.2 Night Grazing**

Data type: code list value

Life stock animals are kept on the grazing ground only during the night.

[Back to top](#)

##### **5.1.11.4.3 Day and Night Grazing**

Data type: code list value

Life stock animals are kept on the grazing ground during day and night.

[Back to top](#)

#### **5.1.11.5 Lifestock Species Type**

Data type: code list

[Back to top](#)

##### **5.1.11.5.1 Cattle**

Data type: code list value

[Back to top](#)

##### **5.1.11.5.2 Horses**

Data type: code list value

[Back to top](#)

##### **5.1.11.5.3 Deer**

Data type: code list value

[Back to top](#)

##### **5.1.11.5.4 Pigs, Boars**

Data type: code list value

[Back to top](#)

#### **5.1.11.5.5 Sheep**

Data type: code list value

[Back to top](#)

#### **5.1.11.5.6 Goats**

Data type: code list value

[Back to top](#)

#### **5.1.11.5.7 Poultry**

Data type: code list value

[Back to top](#)

#### **5.1.11.5.8 Other Grazing Animals**

Data type: code list value

[Back to top](#)

### **5.2 Forest Land Management**

Forest Land includes all land with woody vegetation consistent with thresholds used to define Forest land in the national greenhouse gas inventory. It also includes systems with a vegetation structure that currently fall below, but in situ could potentially reach the threshold values used by a country to define the Forest Land category. (Source: 2006 IPCC Guidelines) According to FAO 2015 Forest land must span more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ. This segment addresses different characters that further describe the form specific techniques of forestry management. By combining the following characteristics listed under this segment different types of forest constellations can be described. To separate between native forests (forests that do not contain any non-native trees) and non-native forest (forests containing both native and non-native tree species) use the code list 3.9 Plant *Species* Origin.

[Back to top](#)

#### **5.2.1 Forest Age Structure**

Data type: code list

The forestry age structure gives indication about the cultivation cycles of the addressed forest area and its structure, which is influenced by the forestry practice, silvicultural measures, forestry rotation system, and silvicultural regeneration method.

[Back to top](#)

##### **5.2.1.1 even-aged stands**

Data type: code list value

This characteristic indicates that on a forest parcel all trees are of the same age, because they were planted at the same time, or are by nature of the same generation of trees.

[Back to top](#)

##### **5.2.1.2 uneven-aged stands**

Data type: code list value

A forest parcel where trees are of different ages.

[Back to top](#)

### 5.2.1.3 all-aged stands, old-growth forest

Data type: code list value

In principle, this character applies for forest parcels predominantly composed of self-sown native tree species, independently from any human intervention or afforestation planting. The age of trees and species combination result from natural growth conditions. Naturally aged forest might be managed to some degree, or be entirely unmanaged (untouched, non-intervention forest, or a strict forest reserve). (Natural Forest standard, Glossary of Terms V1.2).

[Back to top](#)

## 5.2.2 Forest Age Stage

Data type: code list

This Character addresses the level of approximate age that the trees have reached at the moment of observation.

[Back to top](#)

### 5.2.2.1 seedlings

Data type: code list value

This character expresses a very early stage of tree plant growth with an age range of 0 – 5 years. This threshold is not meant to be hard fixed, but as an orientation.

[Back to top](#)

### 5.2.2.2 young or mid-aged trees

Data type: code list value

This character expresses an early stage of tree plant growth with an age range of 5 – 15 years. This threshold is not meant to be hard fixed, but as an orientation.

[Back to top](#)

### 5.2.2.3 grown-up or mature trees

Data type: code list value

This character expresses an advanced stage of tree growth with an age range of from 20 years and beyond. A tree becomes mature when it starts producing fruits or flowers. How long it will stay productive depends on the species. This threshold is not meant to be hard fixed, but as an orientation. Additional age stages can be added in the model.

[Back to top](#)

## 5.2.3 Forest Composition

Data type: code list

This Character indicates whether a forest parcel is composed of a mixture of different tree species (can be of the same leaf type), or if a forest parcel consists of more or less the same tree species.

[Back to top](#)

### 5.2.3.1 mixed forest stands

Data type: code list value

This Character indicates that the forest parcel is composed of a mixture of different tree species (can be of the same leaf type).

[Back to top](#)

### 5.2.3.2 unmixed forest stands

Data type: code list value

This Character indicates that the forest parcel consists of more or less the same tree species, be it in a monoculture manner, or naturally growing single species tree stands.

[Back to top](#)

## 5.2.4 Forestry Practice

Data type: code list

Under this segment the main forestry practices are listed, describing the overall strategy how to principally cultivate and harvest woodland.

[Back to top](#)

### 5.2.4.1 Coppice, low forest

Data type: code list value

A coppice forest (de: *Niederwald*) is a traditionally managed woodland, normally with broadleaved trees. This form involves cutting back the trees every 15 to 25 years. The method exploits the capacity of many species of trees to put out new shoots from their stump or roots if cut down. In a coppiced wood, which is called a copse, young tree stems are repeatedly cut down to near ground level, resulting in a stool. New growth emerges, and after a number of years, the coppiced tree is harvested, and the cycle begins anew.

[Back to top](#)

### 5.2.4.2 coppice-standard combination

Data type: code list value

This form of forest practice (de: *Mittelwald*) combines Coppice forest (see above) and High Forest (see below).

[Back to top](#)

### 5.2.4.3 high forest

Data type: code list value

High forest (de: *Hochwald*) is a type of woodland where tree growth originated from self-seeded or planted seedlings and developed in an erect form of the stem. In contrast to a low forest (coppice forest, see above), a high forest in a grown-up stage usually consists of tall, mature trees with a closed canopy. High forests can occur naturally or they can be the result of a plantation and maintenance process. Under human forest management, two form of high forest exist, the parcel-based high forest, or the Plenter forest (see also silvicultural harvesting and regeneration methods)

[Back to top](#)

## 5.2.5 Forestry Rotation System

The forest rotation system indicates, how long the time intervals are, within which the trees are grown before the trees are felled. The term rotation stands here for forestry cycle.

Data type: code list

[Back to top](#)

### 5.2.5.1 short rotation coppice (SRC) plantation

Data type: code list value

Short rotation Coppicing (SRC) refers to the growing of trees (usually willow or poplar) in extremely

dense stands, harvested at 2-5 years intervals and regenerated from the stools, which are expected to survive 5 rotations at least, before plants need to be replaced by re-planting.

[Back to top](#)

#### **5.2.5.2 short rotation forestry (SRF) plantation**

Data type: code list value

Short rotation forestry (SRF) consists of planting a site and then felling the trees when they have reached a size of typically 10-20 cm diameter at breast height. Depending on tree species this usually takes between 6 and 20 years, and is therefore intermediate in timescale between Short rotation Coppicing (SRC) and conventional long rotation forestry.

[Back to top](#)

#### **5.2.5.3 intermediate or long rotation forestry**

Data type: code list value

Intermediate or long rotation forest is the most common type of forest management practice. The harvesting of the wood takes place when stands have reached an age around 40-50 years and beyond.

[Back to top](#)

#### **5.2.5.4 continuous cover forestry**

Data type: code list value

This rotation system is an approach to the sustainable management of forests whereby forest stands are maintained in a permanent manner and with irregular structure, which is created and sustained through the selection and harvesting of individual trees. It is a continuous cover forestry (CCF), clear cutting is not applied. These stands normally involve a mixture of different tree species and ages.

[Back to top](#)

### **5.2.6 Forest Rejuvenation**

Data type: code list

#### **5.2.6.1 planted rejuvenation**

Data type: code list value

Forest plants are seeded or planted by intention. The rejuvenation process of the forest is initiated by human interaction. In some cases not the entire forest unit is planted, but only in parts, combined with some degree of natural succession. In such a case, the parcel can be described by choosing both types of rejuvenation (man-made and natural).

[Back to top](#)

#### **5.2.6.2 natural forest succession**

Data type: code list value

Forest rejuvenation takes place on a natural basis, no human intervention is involved in the regeneration of the forest. (Does not exclude interventions at a later stage of growth).

[Back to top](#)

##### **5.2.6.2.1 self-seeded forest succession**

Data type: code list value

Forest rejuvenation evolves on the basis self-seeded spreading of plants seeds by themselves in a natural manner.

[Back to top](#)

#### 5.2.6.2.2 re-sprouting forest

Data type: code list value

A special form of natural succession – although eventually triggered by human intervention e.g. after coppicing – is the regrowth of shoots out of the roots and branches or out of a cut down or broken tree stump.

[Back to top](#)

### 5.2.7 Silvicultural Measure

Data type: code list

This segment contains a list of silvicultural measures that are applied to the forest. They are applied to the plants and the soil. In analog to *cultivation measures* also *forestry measures* are activities that are applied to forest parcels in order to support a healthy and efficient growth of trees or to maintain the forest in the intended condition.

[Back to top](#)

#### 5.2.7.1 forest cleaning, weeding

Data type: code list value

Cleaning and weeding take place in a very early growth stage in the first years of seedlings developing to young forest stands. The parcel is cleared of unfavorable and concurrent consumer vegetation (herbaceous vegetation, other tree exemplars) that grow in direct surrounding of favorable forest plants, regarding their unwanted consumption of light, water, nutrients or growing space. This procedure can be done in a mechanical or chemical manner.

[Back to top](#)

#### 5.2.7.2 forest thinning

Data type: code list value

Thinning is applied to a forest stand to reduce the number of individual trees and to provide better growing conditions to the best developed exemplars. In reducing the number of trees, the provided light, water, nutrients and space. Such selective removal of trees not only help to improve the growth rate but also the health condition of the remaining trees. Overcrowded trees are under competitive stress from their neighbors. Thinning can also contribute to increase the resistance of the stand to environmental stress.

[Back to top](#)

#### 5.2.7.3 forest pruning

Data type: code list value

Pruning is a horticultural and silvicultural method involving the selective removal of certain parts of a plant, such as branches, buds, or roots. Pruning is applied with the aim of either influence the growth form of a plant, remove dead or damaged parts of the plant, or to raise the production of fruit. In the context of silviculture, pruning helps also to create greater timber value by reducing the number of branches and knots, and to make the tree focus in vertical growth or crown development.

[Back to top](#)

#### 5.2.7.4 ring-barking, girdling

Data type: code list value

[Back to top](#)

#### 5.2.7.5 interplanting



Data type: code list value

Diversification of tree species among monocultures with plantation of young mixed stands. Often applied to alter monoculture forestry stands into mixed (needle leaved & broad leaved tree stands).

[Back to top](#)

#### **5.2.7.6 dead wood removal**

Data type: code list value

[Back to top](#)

#### **5.2.7.7 forest irrigation**

Data type: code list value

[Back to top](#)

#### **5.2.7.8 forest drainage**

Data type: code list value

[Back to top](#)

#### **5.2.7.9 forest liming**

Data type: code list value

[Back to top](#)

#### **5.2.7.10 forest firebreak**

Data type: code list value

[Back to top](#)

### **5.2.8 Silvicultural Harvest and Regeneration Method**

Data type: code list

In Forestry, the harvest of timber is very much connected and interlinked with methods of forest regeneration. Therefore, these two aspects come together in the heading of this segment. Here, several forms of forest harvest are listed. The list tries to capture the most common methods, many other variations exist besides.

[Back to top](#)

#### **5.2.8.1 clearcutting**

Data type: code list value

With the *clear-cut* method, all trees of a parcel are felled at once, no other trees are left standing for further growth. A clear cut is therefore the last step in the process of timber production. After a clear cut – if forestry use is continued on the land unit - , a new plantation cycles starts with replanting seedlings or leave the unit to natural succession. Other than forestry continuation, also other land use type can take over after a final clear cut. Then it is not anymore under forestry management. This harvesting method can be seen connected with all forestry rotation systems.

[Back to top](#)

#### **5.2.8.2 shelterwood cutting**

Data type: code list value

Shelterwood (de: *Schirmschlag*)cutting is applied to a mature forest stand. It refers to the progression of forest cuttings by felling more and more single trees, step by step in an evenly distributed manner throughout the woodland parcel. The process stretches over several years, and each time after a

felling event, more open space and light becomes available for the rejuvenation on the ground, which takes place in the shadow of the left over still standing shelter trees. Like that, it leads to the establishment of a new generation of seedlings of a particular species or group of species through natural succession without planting. The result of this harvest and regeneration method is a new even-aged forest stand (with only few years difference in age). This harvesting method is connected with long rotation forestry.

[Back to top](#)

### 5.2.8.3 femel cutting

Data type: code list value

In the process of Femel cut (Femelschlag), which is similar to the shelterwood cut (Schirmschlag), the mature trees are also felled over a period of a few years. The difference is in the island-like or grouped distribution of harvested trees. In that manner, a mix of shadow-affine and sunlight affine tree species can regenerate in a balanced manner on the parcel. Through the subsequent phases of cutting, the initial spots of clear areas grow bigger in a concentric way, and all of these spots are distributed in a mosaic pattern on the woodland parcel. This harvesting method is connected with long rotation forestry.

[Back to top](#)

### 5.2.8.4 strip cutting

Data type: code list value

Also the strip cutting method (de: *Saumschlag*) is applied to fell the trees in mature forest stands not all at once, but stepwise, stretched over several years. The progression of the felling starts at the outer edge of a woodland parcel, and moves year by year towards the opposite side of the parcel. In doing so, the light and micro-weather conditions change slowly, as more trees are taken out, and also different species can succeed, having different ecological requirements. The cutting is executed in such a way, that the still standing trees protect the cleared area with the succeeding seedlings from the main wind direction. This harvesting method is connected with long rotation forestry.

[Back to top](#)

### 5.2.8.5 selection cutting

Data type: code list value

With the *selection logging* method (de: *Plenterwald*), not all trees of a parcel are felled at once, but only a number of selected trees that are chosen to be already in the right mature condition for harvesting. Some other trees are left standing either because they have not yet any value for logging or for further growth. This harvesting method is connected with long rotation forestry. Decisions on the felling or keeping of trees are made not only based on their maturity and timber value but also based on the characteristics and ecological processes inherent to the stand site (nature-oriented forestry). The selection cutting system is seen to be a very sustainable form of forestry, where felling of trees, rejuvenation and regrowth throughout different age classes and mixed species is in an equilibrium, which ensures a continuous forest cover. However, if selection logging is applied continuously intensive beyond any sustainable rationale, selection logging leads to forest degradation, where natural succession can't keep up due to ecological conditions.

[Back to top](#)

### 5.2.8.6 coppicing

Data type: code list value

Coppicing (de: *Niederwald*) is a woodland management measure of repeated cutting down of tree

stems near the ground, generating regrowth of new shoots from the coppiced tree (stool). New shoots are harvested in 3-50 year cycles, cycle length being dependent on species (e.g. willow, birch, hazel, poplar, hornbeam, beech, ash, alder, oak) and use of harvested wood (e.g. brushwood, charcoal, poles, withies for wicker-work, firewood, timber). This harvesting method is connected to short rotation forestry systems.

[Back to top](#)

#### **5.2.8.7 pollarding**

Data type: code list value

Pollarding is similar to coppicing, with the difference that the tree is not cut near ground level, but a few meters above ground. The effect of pollarding causes the tree to re-sprout at the head level new thin shoots. The purpose behind this method is to make the tree produce biomass with a lot of leaves which can be used as fodder or straw. Nowadays, it is also applied for esthetic reasons, e.g. along alleys or in urban green areas. With pollarding, the plant can be held in a more or less juvenile state, whereas the trunk can have a high age.

[Back to top](#)

### **5.2.9 Forest Product Type**

Data type: code list

The forestry product type indicates for what kind of products the trees are used: wood, fibre, bio-energy and/or non-wood forest product.

[Back to top](#)

#### **5.2.9.1 Wood Product**

Data type: code list value

[Back to top](#)

##### **5.2.9.1.1 timber wood**

Data type: code list value

Timber is harvested wood which is used as construction material, e.g. for furniture, buildings, bridges or any other sustaining structure.

[Back to top](#)

##### **5.2.9.1.2 energy wood**

Data type: code list value

Energy wood is harvested to be used as a combustible material to generate energy through burning the wood or for charcoal production.

[Back to top](#)

##### **5.2.9.1.3 wood fibre**

Data type: code list value

Fibre as the forestry product type indicates that the harvested wood is used for the production of cellulose as a basic material for pulp or paper.

[Back to top](#)

#### **5.2.9.2 Non-wood Product**

Data type: code list value

Goods derived from forests that are tangible and physical objects of biological origin other than

wood. Specifically includes the following regardless of whether from natural forests or plantations: gum arabic, rubber/latex and resin; Christmas trees, cork, bamboo and rattan. Generally excludes products collected in tree stands in agricultural production systems and any woody raw materials and products (FAO 2015).

[Back to top](#)

#### **5.2.9.2.1 cork**

Data type: code list value

The so called “virgin cork” (to obtain insulating cork boards), is harvested when the cork oak tree is already 25/30 years old, The cork bark used to manufacture the cork stoppers, the so called „female cork“ is harvested 10-12 years. A tree can be harvested a dozen times in its lifetime.

[Back to top](#)

#### **5.2.9.2.2 resin**

Data type: code list value

Resin is usually collected by causing minor damage to the tree by making a hole far enough into the trunk to puncture the vacuoles, to let sap exit the tree, known as tapping, and then letting the tree repair its damage by filling the wound with resin.

[Back to top](#)

#### **5.2.9.2.3 latex, natural rubber**

Data type: code list value

Latex is the milky fluid that oozes from any wound to the tree bark of the rubber tree (*Hevea brasiliensis* or others). Basically cultivated on plantations in the tropics and subtropics, especially in South America, Southeast Asia and Western Africa.

[Back to top](#)

#### **5.2.9.2.4 incense**

Data type: code list value

A Sort of resin which carries etheric aromas, extracted from *Boswellia* tree species. It is used for religious or cultic rituals when burnt to spread aromatic smoke.

[Back to top](#)

#### **5.2.9.2.5 myrrh**

Data type: code list value

Myrrh is a gum-resin extracted from a number of small, thorny tree species of the genus *Commiphora*. Myrrh resin has been used throughout history as a perfume, incense and medicine.

[Back to top](#)

### **5.2.10 Forest History Type**

Data type: code list

#### **5.2.10.1 primary or virgin forest**

Data type: code list value

Naturally regenerated forest of native species, where there are no clearly visible indications of human activities and the ecological processes are not significantly disturbed. There has been no known significant human intervention or the last significant human intervention was long enough ago to have allowed the natural species composition and processes to have become re-established. . Natural damage to the forest as through fire, avalanche, drought or other natural

hazards are not in contradiction to the character of primary forest.

[Back to top](#)

#### **5.2.10.2 secondary or naturally regenerated forest**

Data type: code list value

Naturally regenerated forest where there are clearly visible indications of human activities.

Includes selectively logged-over areas, areas regenerating following agricultural land areas or recovering from human-induced fires. Includes forests with a mix of naturally regenerated trees and planted/seeded trees, and where the naturally regenerated trees are expected to constitute more than 50 percent of the growing stock at stand maturity or forests where it is not possible to distinguish whether planted or naturally regenerated.

[Back to top](#)

#### **5.2.10.3 reforestation**

Data type: code list value

Re-establishment of forest through planting and/or deliberate seeding on land classified as forest or already in forestry use. Includes planting/seeding of temporarily unstocked forest areas as well as planting/seeding of areas with forest cover. Includes coppice from trees that were originally planted or seeded.

Excludes natural regeneration of forest (FAO 2015). According to UN IPCCC's LULUCF (Land Use, Land Use Change, Forest) reporting practices, a time interval of under 20 years can be used here as a threshold for "new" forest.

Example: New planting of seedlings after a clear cut event on forestry used area for timber production, or after a storm damage event.

[Back to top](#)

#### **5.2.10.4 afforestation**

Data type: code list value

Establishment of forest plantations through planting and/or deliberate seeding on land that, until then, was not classified as forest. Implies a transformation from non-forest to forest. According to UN IPCCC's LULUCF (Land Use, Land Use Change, Forest) reporting practices, a time interval of under 20 years can be used here as a threshold for "new" forest.

Example: Long tradition agricultural areas, grasslands or fallow lands are planted with trees; re-naturated extraction sites are filled up with earth or sand to grow additional forest.

[Back to top](#)

### **5.2.11 Forest Tree Species**

Data type: code list

[Back to top](#)

#### **5.2.11.1 Abies**

Data type: code list value

[Back to top](#)

#### **5.2.11.2 Acer**

Data type: code list value

[Back to top](#)

**5.2.11.3 Aesculus**

Data type: code list value

[Back to top](#)

**5.2.11.4 Alnus**

Data type: code list value

[Back to top](#)

**5.2.11.5 Betula**

Data type: code list value

[Back to top](#)

**5.2.11.6 Carpinus**

Data type: code list value

[Back to top](#)

**5.2.11.7 Castanea**

Data type: code list value

[Back to top](#)

**5.2.11.8 Cedrus**

Data type: code list value

[Back to top](#)

**5.2.11.9 Corylus**

Data type: code list value

[Back to top](#)

**5.2.11.10 Cupressoideae**

Data type: code list value

[Back to top](#)

**5.2.11.11 Eucalyptus**

Data type: code list value

[Back to top](#)

**5.2.11.12 Fagus**

Data type: code list value

[Back to top](#)

**5.2.11.13 Fraxinus**

Data type: code list value

[Back to top](#)

**5.2.11.14 Ginkgo**

Data type: code list value

[Back to top](#)

**5.2.11.15 Juglans**

Data type: code list value

[\*Back to top\*](#)

**5.2.11.16 Larix**

Data type: code list value

[\*Back to top\*](#)

**5.2.11.17 Picea**

Data type: code list value

[\*Back to top\*](#)

**5.2.11.18 Pinus**

Data type: code list value

[\*Back to top\*](#)

**5.2.11.19 Platanus**

Data type: code list value

[\*Back to top\*](#)

**5.2.11.20 Populus**

Data type: code list value

[\*Back to top\*](#)

**5.2.11.21 Pseudotsuga**

Data type: code list value

[\*Back to top\*](#)

**5.2.11.22 Quercus**

Data type: code list value

[\*Back to top\*](#)

**5.2.11.23 Salix**

Data type: code list value

[\*Back to top\*](#)

**5.2.11.24 Taxus**

Data type: code list value

[\*Back to top\*](#)

**5.2.11.25 Tilia**

Data type: code list value

[\*Back to top\*](#)

**5.2.11.26 Ulmus****5.3 Industrial Land Management**

Data type: code list

### **5.3.1 Mining Technique**

Data type: code list

#### **5.3.1.1 Surface Open Pit Mining**

Data type: code list value

#### **5.3.1.2 Underground Mining**

Data type: code list value

#### **5.3.1.3 Under Water Mining**

Data type: code list value

#### **5.3.1.4 Salines Extraction Site**

Data type: code list value

[Back to top](#)

#### **5.3.1.5 Leaching, Solution Mining**

Data type: code list value

[Back to top](#)

#### **5.3.1.6 Fracking**

Data type: code list value

[Back to top](#)

### **5.3.2 Mining Product Type**

Data type: code list

This category contains a list of various mining product types, partly grouped.

[Back to top](#)

#### **5.3.2.1 Fossil Hydrocarbon Fuels**

Data type: code list value

[Back to top](#)

##### **5.3.2.1.1 Hard Coal**

Data type: code list value

##### **5.3.2.1.2 Lignite Coal**

Data type: code list value

[Back to top](#)

##### **5.3.2.1.3 Peat**

Data type: code list value

##### **5.3.2.1.4 Crude Oil**

Data type: code list value

##### **5.3.2.1.5 Oil Sands**

Data type: code list value



#### **5.3.2.1.6 Bituminous Rocks**

Data type: code list value

E.g. sedimentary rocks, usually shale, sandstone, limestone or dolostone/dolomite, that contain traces of tar, bitumen, asphalt, petroleum or carbon.

#### **5.3.2.1.7 Mineral Gas**

Data type: code list value

#### **5.3.2.2 Metal Ores**

Data type: code list value

##### **5.3.2.2.1 Iron Ores**

Data type: code list value

##### **5.3.2.2.2 Nonferrous Metal Ores**

Data type: code list value

E.g. Aluminium, Copper, Nickel, Cobalt, Lithium, Gold, Silver etc.

##### **5.3.2.2.3 Rare Earths**

Data type: code list value

These 17 elements: Dysprosium, Neodym, Praseodym, Terbium, Thulium, Holmium, Lanthan, Europium, Gadolinium, Lutetium, Promethium, Samarium, Scandium, Ytterbium, Yttrium, Erbium, Cer

#### **5.3.2.3 Non-Metallic Minerals**

Data type: code list value

##### **5.3.2.3.1 Stones And Earths**

Data type: code list value

##### **5.3.2.3.2 Chemical Minerals**

Data type: code list value

###### **5.3.2.3.2.1 Salt**

Data type: code list value

##### **5.3.2.3.3 Precious And Semi-Precious Stones**

Data type: code list value

#### **5.3.2.4 Other Mining Material**

Data type: code list value

### **5.4 Terrain Modification and Land Engineering Measure**

Data type: code list

#### **5.4.1 terraced terrain**

Data type: code list value

This linear character describes the modification of land surface to equal out a slope with regularly arranged platforms in a stepwise manner. It requires earthworks to make the terraces. Terraces are

mainly arranged for agricultural purposes (but not exclusively) in areas where the original relief energy is too high for agricultural activities like sowing, mowing, ploughing, harvesting or flooding irrigation. Typically, the terraces' edges follow the isohypes of equal height of the slope.

[Back to top](#)

#### **5.4.2 artificial terrain modification**

Data type: code list value

This character describes heavily transformed surface, for example with the purpose to level out too steep terrain or in contrary to create higher relief energy. A special case of application is the leveling and earth modelling of ski pistes in mountainous regions.

[Back to top](#)

#### **5.4.3 artificial snow preparation**

Data type: code list value

This character indicates if a piece of land, in particular a ski piste, is prepared with artificial snow, which is made with snow cannons along the ski piste. It is done to meliorate the skiing conditions over the season and also to prolong the duration of skiing season. For this kind of snow-making, often water reservoirs are necessary that can be found nearby the skiing area as small ponds in the slope.

[Back to top](#)

#### **5.4.4 snow farming area**

Data type: code list value

This character indicates areas which are used to either collect snow (artificial or natural) over the cold (winter) season, with or without using particular installations or terrain modification. The snow is then covered with specific substances to preserve the snow from melting throughout the warm summer season.

[Back to top](#)

#### **5.4.5 avalanche prevention or protection installation**

Data type: code list value

This character indicates the presence of specific technical installations or constructions that prevent avalanches to occur or protect area affected or damaged by avalanches.

[Back to top](#)

### **5.5 Administrative regulations, Use constraints**

Data type: code list

#### **5.5.1 Access restriction**

Data type: code list

[Back to top](#)

##### **5.5.1.1 Civil, open**

Data type: code list value

Areas of this LCH are publically open to civil society, meaning all people have access to this area.

[Back to top](#)

##### **5.5.1.2 civil and military**

Data type: code list value

Areas of this LCH are accessible to both civilians and to military.

[Back to top](#)

### **5.5.1.3 temporary restricted**

Data type: code list value

Areas of this LCH are bound to access restrictions of a limited time span, for example after a severe natural disaster or a contamination event.

[Back to top](#)

### **5.5.1.4 military only, restricted**

Data type: code list value

Areas of this LCH are only accessible by the military, others have no access to this area, (or only under special allowance conditions).

[Back to top](#)

## **5.5.2 Protected area type**

Data type: code list

[Back to top](#)

### **5.5.2.1 nature conservation area**

Data type: code list value

This area is under strict nature protection status by law. Many human activities like e.g. hiking of the trails, fire making, agricultural, forestry, industrial or urban construction activities etc. are forbidden.

[Back to top](#)

### **5.5.2.2 landscape conservation area**

Data type: code list value

This area is under landscape protection status. It means that human activities are allowed to some extent (including agriculture and forestry), but the overall appearance of the landscape character shall be preserved. This can include access restrictions for individual traffic by car.

[Back to top](#)

### **5.5.2.3 Natura2000**

Data type: code list value

This area is listed under European law as a Natura 2000 protected site.

[Back to top](#)

### **5.5.2.4 Birds retrieval area**

Data type: code list value

This area has strict access limitations, either throughout the entire year or to protect birds during their breeding phase.

[Back to top](#)

### **5.5.2.5 Biosphere reserve**

Data type: code list value

In areas designated as UNESCO Biosphere Reserves, the focus is on the harmonised management of biological and cultural diversity. It can have a zonal structure, where the inner core areas underlay more strict protection regulation than the outer areas around the center of the reserve area.

[Back to top](#)

#### 5.5.2.6 Geopark

Data type: code list value

UNESCO Global Geoparks are single, unified geographical areas where sites and landscapes of international geological significance are managed with a holistic concept of protection, education and sustainable development.

[Back to top](#)

#### 5.5.2.7 National Park

Data type: code list value

A national park is a larger area where nature conservation is the primary purpose, often in combination with recreational use. It stands under authoritative administration, who also provides decent touristic infrastructure. Often it is a reserve of natural, semi-natural, or developed land that a sovereign state declares or owns. The applied rules that count inside a national park, and how it is administered may differ from country to country. Throughout all national parks the common idea is the conservation of 'wild nature' for posterity and as a symbol of national pride.

[Back to top](#)

#### 5.5.2.8 other protected area type

Data type: code list value

[Back to top](#)

## 6 Status, Condition

Data type: code list

Under this segment of LCH, a number of characters are listed that describe the status or the condition of a land unit, and – if damaged – also the reason why.

[Back to top](#)

### 6.1 Land use status

Data type: code list

This Characteristic indicates the status of a Land Unit, in which status or condition it is.

[Back to top](#)

#### 6.1.1 under construction

Data type: code list value

This character applies for areas under construction development, like soil or bedrock excavations or earthworks. It is assigned for areas where landscape is affected by human activities, changed or modified into artificial and man-made surfaces, being in a state of anthropogenic transition. The final use and form of the area being built is already determined, but not necessarily known by one who captures the status.

[Back to top](#)

### 6.1.2 never been in use

Data type: code list value

Area is not in use and has never been, as far as no traces of human activities can be recognized.

[Back to top](#)

### 6.1.3 out of use

Data type: code list value

Area is temporary out of use, but probably will return to being used.

[Back to top](#)

### 6.1.4 abandoned

Data type: code list value

This character expresses that an area belongs is not in use and can't be used any more for the original purpose without major reparation/renovation work.

[Back to top](#)

### 6.1.5 clear cut

Data type: code list value

Area has been cleared of woody vegetation cover (trees or shrubs).

[Back to top](#)

### 6.1.6 collapsed, destroyed, damaged

Data type: code list value

Status of an object which is not intact or functional anymore due to destruction or collapse. It refers mostly to infrastructural objects or utilities like buildings, constructions or complexes.

[Back to top](#)

### 6.1.7 managed nature restoration

Data type: code list value

This character applies for areas which are brought back to a natural or at least semi-natural state, so that for example soil sealing elements are removed, ground is decontaminated, vegetation is seeded, naturally given soil moisture condition are restored, etc. Examples are the restoration of natural beds of water courses by giving them more space for meandering, flooding or filling of open pit mines, eventually combined with new vegetation cover etc.

[Back to top](#)

## 6.2 Damage Reason

Data type: code list

This segment contains a collection of possible damage reasons that can affect land units. It is oriented towards the INSPIRE code list on NaturalHazardCategoryValues, that focuses on natural disaster events and calamities. Here, the list is extended to also man-made damaging impact factors.

[Back to top](#)

### 6.2.1 Geological or Hydrological

Data type: code list value

Processes that have a geological (geosphere) or hydrological (hydrosphere) nature (or origin). Some of the processes here included are clearly addressed as geological in the scientific literature, such as volcanic hazards or earthquake hazards, whereas other processes cannot be understood without

geological and hydrological input, such as certain types of landslides (that can be triggered and mobilised by water), or floods (highly dependent on soil infiltration properties, topography, water table fluctuations), etc.

[Back to top](#)

#### **6.2.1.1 tsunami**

Data type: code list value

Long wave disruption in a large water body reaching emerged land. It can occur as a massive destructive ocean wave caused by sub-marine earthquake or volcanic eruption, or also as an inland water wave caused by a huge landslide plunging into a lake, or by a meteorite impact.

[Back to top](#)

#### **6.2.1.2 volcanic eruption**

Data type: code list value

An opening, or rupture, in the Earth's crust that allows hot magma, ash and gases to escape. Process directly linked to volcanic eruptions are expected to be included in this category, such as lahars, pyroclastic flow, ash fall, volcanic explosions, freatic explosions, etc.

[Back to top](#)

#### **6.2.1.3 earthquake**

Data type: code list value

Earthquake hazards involve the propagation of elastic waves at or near the surface after the release of tectonic stress or other natural sources, such as volcanic explosions or meteorite impacts. Liquefaction, ground shaking and other effects directly caused by seismic waves should also be included in this category.

[Back to top](#)

#### **6.2.1.4 subsidence and collapse**

Data type: code list value

Subsidence and collapse involve mainly vertical downwards ground movement of the surface of the Earth due to different processes of rock or soil weathering or rock compaction to a point where the rock structure cannot bear its own load (collapse) or causing relatively slow downwards movements (subsidence). Subsidence and collapse can be associated with carbonate rocks in karstic areas, but it can occur in other regions such as loessic soils or compressible soils.

[Back to top](#)

#### **6.2.1.5 landslide**

Data type: code list value

Processes of downhill slope movements of soil, rock, and organic materials related to different types of ground failure. Some common terms used for describing different types of landslides include but are not restricted to slides, rock fall, debris flow.

[Back to top](#)

#### **6.2.1.6 snow avalanche**

Data type: code list value

A snow mass with typically a volume greater than 100 m<sup>3</sup> and a minimum length of 50 meters that slides rapidly downhill. Snow avalanches usually incorporate materials swept along the path of the snow avalanche, such as trees, rocks, etc. Avalanche formation is the result of a complex interaction between terrain, snow pack and meteorological conditions.

[Back to top](#)

#### **6.2.1.7 flood**

Data type: code list value

Processes of inundation of usually dry (emerged) land, or temporary covering by water of land not

normally covered by water. Floods can be of many types (flash floods, river overflow, tidal floods), and can have many triggers (precipitation, natural water reservoir dam failure, river channel obstruction, etc). Tsunamis and a storm surges are usually considered as a different natural hazard.

[Back to top](#)

## **6.2.2 Meteorological or Climatological**

Data type: code list value

Processes that have a meteorological (atmospheric) or climatic (changes in the long-run of environmental variables) nature (or origin).

[Back to top](#)

### **6.2.2.1 drought**

Sustained and extensive occurrence of below-average water availability, caused by climate variability. Drought should not be confused with aridity, which is a long-term average feature of a dry climate. Likewise, drought should not be confused with water scarcity, which reflects conditions of long-term imbalances between water availability and demands. Droughts can affect both high and low rainfall areas and can develop over short periods of weeks and months or much longer periods of several seasons, years and even decades.

[Back to top](#)

### **6.2.2.2 extreme temperatures**

Data type: code list value

An abnormal temperature rise (heat) or decrease (frost) lasting longer than usual temperature rise or drop. Heat waves or cold waves.

[Back to top](#)

### **6.2.2.3 storm damage**

Data type: code list value

Violent winds with high speed and destructive power like tornados, hurricanes etc.

[Back to top](#)

### **6.2.2.4 lightning**

Data type: code list value

Discharge of atmospheric electricity, mostly on connection with thunderclouds (cumulonimbus), but can also occur in dry conditions (absence of rain clouds).

[Back to top](#)

### **6.2.2.5 storm surge**

Data type: code list value

Water pushed from the sea onto the land caused by an atmospheric disruption such as a hurricane or a rapid change in atmospheric pressure. Although a storm surge is a kind of flood, it is usually considered as a separated class.

[Back to top](#)

## **6.2.3 Fire**

Data type: code list value

This category includes all types of processes that involve the occurrence and spreading of fire.

[Back to top](#)

### **6.2.3.1 forest fire, wildfire**

Data type: code list value

Fire occurrence and spreading on vegetated land. Forest fire means fire which breaks out and spreads on forest and other wooded land or which breaks out on other land and spreads to forest and other

wooded land. The definition of forest fire excludes prescribed or controlled burning, usually with the aim of reducing or eliminating the quantity of accumulated fuel on the ground (Regulation EC 2152/2003 - Forest Focus). Wildland Fire: Any fire occurring on wildland regardless of ignition sources, damages or benefits (FAO, 2011, Wildland Fire Management Terminology, FAO, updated September 2010).

[Back to top](#)

#### **6.2.3.2 underground fire**

Data type: code list value

Fire spreading below the surface, typically occurring in soils rich of peat or coal.

[Back to top](#)

### **6.2.4 Biological**

Data type: code list value

Processes that are directly linked to living organisms or products produced by living organisms.

[Back to top](#)

#### **6.2.4.1 insect infestation**

Data type: code list value

[Back to top](#)

#### **6.2.4.2 mould infestation**

Data type: code list value

[Back to top](#)

#### **6.2.4.3 epidemic**

Data type: code list value

An outbreak of a disease that spreads rapidly among individuals in an area or population.

[Back to top](#)

#### **6.2.4.4 allergens**

Data type: code list value

Biological products or substances (such as pollen) that might cause allergy over a large number of people.

[Back to top](#)

#### **6.2.4.5 animal browsing, overgrazing**

Data type: code list value

Damaged vegetation by animals biting and chewing off plant parts, or animals too extreme grazing (tearing out even root parts) leaves vegetation no time to recover.

[Back to top](#)

#### **6.2.4.6 animal trampling**

Data type: code list value

Animal trampling causes degeneration of vegetation cover.

[Back to top](#)

### **6.2.5 Cosmic**

Data type: code list value

Processes from outer space.

[Back to top](#)

#### **6.2.5.1 meteorite impact**



Data type: code list value

Solid materials from outer space reaching the Earth.

[Back to top](#)

#### **6.2.5.2 magnetic disruption**

Data type: code list value

[Back to top](#)

#### **6.2.5.3 solar and cosmic radiation**

Data type: code list value

Radiation from outer space (UV, gamma ray, etc).

[Back to top](#)

#### **6.2.6 Contamination or pollution**

Data type: code list

[Back to top](#)

##### **6.2.6.1 Radioactive contamination**

Data type: code list value

[Back to top](#)

##### **6.2.6.2 chemical, toxic pollution**

Data type: code list value

[Back to top](#)

##### **6.2.6.3 soil salinization**

Data type: code list value

[Back to top](#)

##### **6.2.6.4 oil contaminated**

Data type: code list value

[Back to top](#)

##### **6.2.6.5 explosives contamination**

Data type: code list value

Area contaminated by military ammunition or industrial explosive materials.

[Back to top](#)

##### **6.2.6.6 plastic pollution**

Data type: code list value

Contaminated or polluted by either micro or macro plastic.

[Back to top](#)

#### **6.2.7 Intentional Or Accidental Structural Damage**

Data type: code list value

[Back to top](#)

##### **6.2.7.1 structural decay**

Data type: code list value

[Back to top](#)

##### **6.2.7.2 demolition, explosion**

Data type: code list value

[Back to top](#)

### 6.3 Degenerative process

Data type: code list

[Back to top](#)

#### 6.3.1 deforestation

Data type: code list value

Loss of tree cover by natural or man-made processes like drought, storm damage, clear cuts, soil erosion etc.

[Back to top](#)

#### 6.3.2 soil erosion

Data type: code list value

Physical loss of (fertile) top soil through erosive transport of material due to wind, water flow or gravitational processes.

[Back to top](#)

#### 6.3.3 desertification

Data type: code list value

Transition from vegetated land to desert conditions. It happens due to long-lasting lack of precipitation over the stretch of several years due to climate change or droughts, often in combination with human or animal impacts like salinization of the soil (due to bad irrigation management), cutting off water streams, overgrazing or deforestation. Like that, the surface loses continuously its vegetation cover and turns into bare and dry surface, often accompanied by aeolian sediments (sand and dust) that cover the surface.

[Back to top](#)

#### 6.3.4 glacier melting

Data type: code list value

Areas where glaciers have reduced in their spatial (vertical or horizontal) extent by melting due to raising average temperatures.

[Back to top](#)

## 7 Geographical Characteristics

### 7.1 Habitat Context

Data type: Code list

The entries under habitat context describe the environmental surrounding in its role as a habitat where human beings, animals or plants live, roam or grow. The definitions of the habitat context largely follow the EUNIS habitat types (<https://eunis.eea.europa.eu/habitats.jsp>)

[Back to top](#)

#### 7.1.1 Marine Habitats

Data type: Code list value

[Back to top](#)

#### 7.1.2 Coastal Habitats

Data type: Code list value

[Back to top](#)

### **7.1.3 Inland Surface Waters Habitats**

Data type: Code list value

[Back to top](#)

### **7.1.4 Mires, Bogs and Fens**

Data type: Code list value

[Back to top](#)

### **7.1.5 Grasslands and Lands Dominated By Forbs, Mosses Or Lichens**

Data type: Code list value

[Back to top](#)

### **7.1.6 Heathland, Scrub and Tundra**

Data type: Code list value

[Back to top](#)

### **7.1.7 Woodland, Forest and Other Wooded Land**

Data type: Code list value

[Back to top](#)

### **7.1.8 Inland Unvegetated Or Sparsely Vegetated Habitats**

Data type: Code list value

[Back to top](#)

### **7.1.9 Regularly Or Recently Cultivated Agricultural, Horticultural and Domestic Habitats**

Data type: Code list value

[Back to top](#)

### **7.1.10 Constructed, Industrial and Other Artificial Habitats**

Data type: Code list value

[Back to top](#)

### **7.1.11 Habitat Complexes**

Data type: Code list value

[Back to top](#)

### **7.1.12 Lagoon**

Data type: Code list value

[Back to top](#)

### **7.1.13 Estuary**

Data type: Code list value

[Back to top](#)

### **7.1.14 Marine Inlet, Fjord**

Data type: Code list value

[Back to top](#)

### **7.1.15 Coastal Salt Marsh**

Data type: Code list value

[Back to top](#)

### **7.1.16 Intertidal Flat**

Data type: Code list value

[Back to top](#)

## **7.2 Height Zone**

Height zones or altitudinal zoning in general is applied to give structure to the phenomenon that nature changes with increasing altitude in mountainous regions due to varying environmental and climate conditions. Factors like air temperature, air humidity, soil/rock composition, solar radiation, geographical aspect/exposure (azimuth) are important factors in determining altitudinal zones.

Altitudinal zones therefore do not simply relate to absolute elevation or measurable height above sea level. On the same height about sea level, two different altitudinal zones can occur in the southern and northern exposure side of a mountain range.

Data type: code list

[Back to top](#)

### **7.2.1 planar zone**

Data type: code list value

Low land flat and plain areas, with the average temperatures of the local climate zone. Ideal terrain conditions for agricultural and settlement activities.

[Back to top](#)

### **7.2.2 collin zone**

Data type: code list value

Hilly areas with a slightly undulating terrain surface. Usually the upper limit for vine growing areas.

[Back to top](#)

### **7.2.3 submontane zone**

Data type: code list value

Zone with stronger relief energy, valleys and middle range mountain peaks. Cultivation of crops is – if at all – an exception.

[Back to top](#)

### **7.2.4 montane zone**

Data type: code list value

Clearly low average temperatures, peak area of middle mountain ranges, transition between sub- and high mountain zone.

[Back to top](#)

### **7.2.5 high montane zone**

Data type: code list value

Upper boundary of broad leaved forests, dominated by coniferous trees. Only seasonal inhabitable.

[Back to top](#)

### 7.2.6 subalpine zone

Data type: code list value

Upper boundary of forests, transitional zone between scattered tree growth and dwarf pines.

[Back to top](#)

### 7.2.7 alpine zone

Data type: code list value

This zone he zone stretches between the upper tree line, where trees end to grow, and lower snowline, where nival zone begins. This zone can further be broken down into Sub-Nival and Treeless Alpine (low-Alpine). Vegetation cover is restricted to herbaceous and sporadic dwarf shrubs or dwarfs trees.

Sub-Nival: This zone is under influence of low temperatures, seasonal frost and strong winds.

Vegetation cover is patchy, restricted to favorable growing locations, and limited to herbaceous vegetation types typical for arctic regions. Snow cover is found for part of the year.

Low-Alpine: Vegetation cover is continuous, dominated by alpine meadows, shrubs and sporadic dwarf trees. Due to consistent freezing temperatures tree growth is severely limited.

[Back to top](#)

### 7.2.8 nival zone

Data type: code list value

Highest altitudinal zone, throughout the entire or most of the year covered with snow / ice. This zone is the origin of glaciers. Vegetation is non-existent in this zone, apart from extremely scarce micro organisms.

[Back to top](#)

## 7.3 Geographical Context

Data type: code list

The geographical context gives an indication about the larger context of a land unit, in what kind of spatial surrounding it is embedded. The borders of such regions are often rather fluent, and it is rather difficult to draw a distinct boarder line between them. Still, it can help to understand the overall landscape situation in general. These categories are not connected to any formalistic terms that may have fiscal or legal consequences for the described land unit. This code list is open and may be extended by the user. Also, the geographical context types are on purpose not mutually exclusive in their meaning and can overlap in space.

[Back to top](#)

### 7.3.1 inland context

Data type: code list value

The *inland* areas are the opponent of *coastal* areas. These areas are distant enough from the coast and are not anymore directly influenced by it.

[Back to top](#)

### 7.3.2 coastal context

Data type: code list value

The *coastal* context gives an indication about land being close to the sea shore areas. The vicinity to the coast has an influence on the location of cities, harbors as well as on socio-economic activities

factors like commercial and industrial activities, tourism, but also cultural aspects. Along coastal areas, specific landscape types or habitats can be found in contrary to more distant locations from the coast.

[Back to top](#)

### 7.3.3 island context

Data type: code list value

*Island* areas are under influence of the surrounding sea. This has an effect on the transportation connectivity to the mainland. It is a special geographic situation. An island also can have *inland* and *coastal* areas.

[Back to top](#)

### 7.3.4 oceanic context

Data type: code list value

*Oceanic* areas are located at open sea, with considerable distance to any coastline, from the continental shelf zone towards deep sea areas.

[Back to top](#)

### 7.3.5 urban context

Data type: code list value

*Urban* addresses the context of cities and their sub-urban areas. Besides some other landscape types, areas occupied with settlements have a dominant appearance. Also more or less dense transportation networks are part of urban areas. The population density is rather high.

[Back to top](#)

### 7.3.6 rural context

Data type: code list value

*Rural* areas are dominated by agricultural land or forests. Settlement areas are present but play an inferior role. This type of landscape context does not include bigger cities (which would be *urban* context). The population density is rather medium to low.

[Back to top](#)

### 7.3.7 riparian context

Data type: code list value

*Riparian* areas are found along river banks. They are exposed to a rivers variance in water level and to seasonal or occasional inundations. The terrain is mostly flat. In riparian areas specific types of vegetation with hydrophilic plants can be found that are adapted to the situation of being flooded.

[Back to top](#)

### 7.3.8 mountain context

Data type: code list value

*Mountain* regions are under the influence of mountains. These kind of spatial context includes the valleys between the mountains themselves. Mountainous regions are characterized by high relief energy of the terrain. Different climate and vegetation zones as well as different forms of human settlements and cultivation practices can be found here.

[Back to top](#)

## 7.4 Geomorphological landform type

Data type: heading

With this character, a geomorphological form can be noted manually as text string. In the current version of EAGLE matrix / model this character is a kind of placeholder. To cover all kinds of geomorphological forms and make a comprehensive code list is at this stage not foreseen. It may be considered to integrate such a code list at a later stage.

Examples:

Cave, Cliff, Coral reef, Doline (Karstic), Drumlin, Fumarole, Geysir, Glacier moraine, Gorge, Gully, Lava field, Meteor crater, Sand bank, Sand dune, Volcanic caldera, Volcanic cone, Volcanic crater.

[Back to top](#)

#### **7.4.1 Geomorphological landform**

Data type: text string

[Back to top](#)

### **7.5 Littoral Zone**

Data type: code list

This category applies for coastal shorelines as well as for inland river banks and lakesides. It helps to subdivide the littoral complex into zones that can be used to describe habitat types (basically wetlands and alike) in the vicinity of water surfaces.

[Back to top](#)

#### **7.5.1 Epilittoral**

Data type: code list value

The epilittoral zones is beyond any direct influence of water cover along a sea shore line or a inland lakeside. The area is only influenced indirectly by a high ground water level and moist (and eventually salty) soil conditions. Only extreme storm surges reach here, or rare inland flood events along riparian areas. Vegetation cover, if present, is dominated by hygrophilous plants.

[Back to top](#)

#### **7.5.2 Supralittoral**

Data type: code list value

The supralittoral zone is the splash and spray zone high enough above the water line to not be frequently covered with water or waves. Still this area is influenced by spray water, either in coastal areas from sea water or along inland water bodies. Only during storm surges or irregular water peak level events these areas are exposed to being flooded.

Example: Coastal saltmarshes or young dunes in transition from halophilous pioneer vegetation to halophile vegetation.

[Back to top](#)

#### **7.5.3 Eulittoral, Intertidal**

Data type: code list value

In coastal areas, the eulittoral or intertidal zone stretches from the low tide line to the high tide water line. It is subjected to constant change between being submerged and uncovered from water by the tides. Connected to inland water bodies it is the river bank or lakeside where waves constantly run ashore. Due to its high erosive and/or sedimentary dynamics, plants usually are not able to take roots.

[Back to top](#)

#### **7.5.4 Infralittoral, Sublittoral**

Data type: code list value

As part of coastal areas as well as connected to inland water bodies, the sublittoral or also called subtidal zone addresses the area where the earth's surface is normally constantly covered by water. In coastal areas the sublittoral zone stretches from the low tide line across the shallow sea towards the continental shelf. It is inhabited by algae, corals etc. where photosynthesis is still possible under water. In inland water bodies, the sublittoral or infralittoral zone embraces the area of a lake, where taller terrestrial plants can still build roots. This zone often is also the breeding zone for water animals.

[Back to top](#)

## 7.6 Physical Climate Zone

Data type: code list

This list contains different types of general climate zones in a coarse approach. Sometimes it may be useful or necessary to assign a climate zone to certain elements, like for example certain vegetation (or crop) types which are native in particular climate zones.

[Back to top](#)

### 7.6.1 Tropical Climate Zone

Data type: code list value

[Back to top](#)

### 7.6.2 Subtropical Climate Zone

Data type: code list value

[Back to top](#)

### 7.6.3 Temperate Climate Zone

Data type: code list value

[Back to top](#)

### 7.6.4 Polar and Subpolar Climate Zone

Data type: code list value

[Back to top](#)

## 7.7 Terrain Characteristics

### 7.7.1 Terrain Parameters

Data type: Heading

This parameter collection carries parametric measurable information about elevation, slope and aspect of terrain point. These data is best handled in form of raster data.

[Back to top](#)

#### 7.7.1.1 Terrain Elevation

Data type: numeric value

This parameter carries the absolute height above sea level in meters.

[Back to top](#)

#### 7.7.1.2 Terrain Slope

Data type: numeric value

This parameter carries the steepness or gradient of an ascending terrain. It can be measured in



percentage (ratio between vertical difference in height and horizontal distance) or in angle degrees, where 100% corresponds with 90°. In EAGLE context is proposed to use angle degrees.

[Back to top](#)

### 7.7.1.3 Terrain Aspect, Exposition

Data type: numeric value

This parameter carries the orientation aspect of an inclined terrain surface towards cardinal directions. It is expressed in 0° to 360°, where 0° = North, 90° = East, 180° = South, 270° = West, among other values in between.

[Back to top](#)

## 8 Spatial Characteristics

Arrangement in space and the inner structure of land units. This character category is further subdivided into several pattern types and their instances.

[Back to top](#)

### 8.1 Spatial Distribution Pattern

Data type: code list

Under spatial distribution patterns 2-dimensional spatial patterns give indications on how specific land cover components are distributed in space and what kind of spatial relation they have to each other. There are four kinds of spatial patterns preset, but can be extended.

[Back to top](#)

#### 8.1.1 Homogeneous, evenly textured

Data type: code list value

The spatial pattern “homogenous” indicates that a certain land surface unit is uniform in structure, and composition and evenly textured. Every spot inside the unit is supposed to be of the same kind.

Example: The lawn of a football field is homogenous. Fruit trees in a plantation are arranged in a homogenous way.

[Back to top](#)

#### 8.1.2 Heterogeneous, mixed, unevenly textured

Data type: code list value

The spatial pattern “heterogeneous” describes the more or less equal distribution of several features inside a land unit, with an uneven texture. Certain different land cover components that may occur inside a land unit are distributed in a mixed manner. A varying density in distribution can be the appearance of heterogeneity.

Example: a mixed forest consists out of mixed stands of broad leaved trees and needle leaved trees.

[Back to top](#)

#### 8.1.3 Mosaic pattern

Data type: code list value

The spatial pattern “mosaic” describes the distribution of features in space in relation and together with other surrounding features, which are homogeneous within themselves but clearly distinct from each other. A land unit with a mosaic pattern contains several sub- units/components that can be identified as stand-alone sub-parts of the larger “mosaic” unit holding them together. It is applied for land surface units on a higher abstracted level. The single parts inside the mosaic may have their

own spatial pattern (e.g. homogeneous or heterogeneous) to be distinguishable. Altogether, the sub-units inside the characterized “mosaic” unit form a patchwork pattern, where each patch is clearly distinct.

Example: a forest area with appearing grassland clearings in between.

[Back to top](#)

#### **8.1.4 Scattered pattern**

Data type: code list value

The spatial pattern “scattered” describes the scattered distribution of a feature in space. It indicates that the specific feature does occur only sporadically, is not dominating and distributed not equally.

[Back to top](#)

#### **8.1.5 Regular spacing**

Data type: code list value

The spatial pattern “regular spacing” describes the spatial arrangement of all kinds of landscape objects in a regular form, where the space between the objects follow an evenly distributed pattern. This can apply for artificial objects (e.g. houses in built-up areas, wind turbines, solar panels etc.) or woody crop plantations (e.g. olive or fruit trees, Christmas trees, vineyards), and others.

[Back to top](#)

### **8.2 Linear feature pattern**

Data type: code list

This collection of linear landscape pattern has been set up to capture information about certain linear elements in landscape that are too small or narrow to be capture as single features, but still can have a significant influence on the character of a land surface unit. The linear patterns are not exclusive and may occur in combinations. Four subtypes are here to distinguish (others can be added):

[Back to top](#)

#### **8.2.1 hedge rows**

Data type: code list value

The character hedge rows indicate that a land parcel is surrounded by or contains several hedge rows. Through them, the land parcel has a kind of sub-parcel structure. Mostly occurs in agricultural areas.

[Back to top](#)

#### **8.2.2 rows of trees**

Data type: code list value

The character rows of trees indicate that a land parcel is surrounded by or contains several rows of trees. Through them, the land parcel has a kind of sub-parcel structure. Occurs for example in rural areas, but also along alleys inside urban zones.

[Back to top](#)

#### **8.2.3 stone walls**

Data type: code list value

The character “stone walls” indicate that a land parcel is surrounded by or contains several stone walls. This pattern refers to man-made piled up dry stone walls that are part of old traditional agricultural areas, typically can be found in rural areas of southern European countries. From a

habitat perspective, those stone walls are valuable objects that offer refuge for reptiles and insects.

[Back to top](#)

### 8.3 Linear technical network

Data type: code list

This character describes the presence of some linear technical networks that are distributed within a certain land unit and that give a typical structure to it. It may have some small roads, ditches, fences, wires, pipelines or similar linear network elements. Some values are pre-defined, others can be added to the open code list.

[Back to top](#)

#### 8.3.1 roads or railways

Data type: code list value

A land unit can contain a clearly recognizable network of roads which give a special character to the land unit. The location or geometry of the road network is not necessarily known, but only its presence.

[Back to top](#)

#### 8.3.2 pipelines

Data type: code list value

A land unit can contain a single track or a network of pipelines. The location or geometry is not necessarily known, but only its presence.

[Back to top](#)

### 8.4 Vertical position

Data type: code list

The elements under Vertical position describe the position of an object in landscape, whether it is located on the ground surface, suspended/elevated, or under the ground surface. Sometimes it may be necessary or useful to have information of such positioning of objects in landscape, for example when describing roads over bridges across rivers.

[Back to top](#)

#### 8.4.1 on ground surface

Data type: code list value

[Back to top](#)

#### 8.4.2 suspended, elevated

Data type: code list value

[Back to top](#)

#### 8.4.3 under ground

Data type: code list value

[Back to top](#)

## 9 Object Characteristics

Data type: heading

This segment contains object-related information about their spatial dimensions and geometric

parameters, their occurrence, and temporal parameters to describe their appearance along time axes. They all cannot stand alone and need to be combined with other content-carrying elements (LCC, LUA, or LCH):

## 9.1 Geometric parameters

Data type: code list

### 9.1.1 object area size

Data type: code list value

This element stands for the area size of an object. The measuring unit is in square meters, to be applied in the numeric elements below (from..to). In case there is no value range but distinct exact figures, use the same figure for “value from..” and “value..to”. The elements from this segment need to be combined with the addressed content-carrying model elements (LCC, LUA, LCH).

[Back to top](#)

#### 9.1.1.1 object area size value from...

Data type: numeric value

This parameter expresses the lower range value for the area size of an object. The measuring unit is in square meters.

[Back to top](#)

#### 9.1.1.2 object area size value to...

Data type: numeric value

This parameter expresses the upper range value for the area size of an object. The measuring unit is in square meters.

[Back to top](#)

### 9.1.2 object length

Data type: code list value

This element stands for the length of an object. The measuring unit is in meters, to be applied in the numeric elements below (from..to). In case there is no value range but distinct exact figures, use the same figure for “value from..” and “value..to”.

[Back to top](#)

#### 9.1.2.1 object length value from..

Data type: numeric value

This parameter expresses the lower range value for the length of an object. The measuring unit is in meters.

[Back to top](#)

#### 9.1.2.2 object length value to..

Data type: numeric value

This parameter expresses the upper range value for the length of an object. The measuring unit is in meters.

[Back to top](#)

### 9.1.3 object width

Data type: code list value

This element stands for the width of an object. The measuring unit is in meters, to be applied in the numeric elements below (from..to). In case there is no value range but distinct exact figures, use the same figure for “value from..” and “value..to”.

[Back to top](#)

#### **9.1.3.1 object width value from..**

Data type: numeric value

This parameter expresses the lower range value for the width of an object. The measuring unit is in meters.

[Back to top](#)

#### **9.1.3.2 object width value to..**

Data type: numeric value

This parameter expresses the upper range value for the width of an object. The measuring unit is in meters.

[Back to top](#)

#### **9.1.4 object height**

Data type: code list value

This element stands for the height of an object, meaning not height above sea level but how tall an object is above ground. The measuring unit is in meters, to be numerically expressed in the elements below (from..to). In case there is no value range but distinct exact figures, use the same figure for “value from..” and “value..to”.

[Back to top](#)

##### **9.1.4.1 object height value from..**

Data type: numeric value

This parameter expresses the lower range value for the height of an object. The measuring unit is in meters.

[Back to top](#)

##### **9.1.4.2 object height value to..**

Data type: numeric value

This parameter expresses the upper range value for the height of an object. The measuring unit is in meters.

[Back to top](#)

#### **9.1.5 area coverage**

Data type: code list value

This element stands for the percentage share of a Land Cover Component (or Land Use Attribute) within a larger land unit, to be numerically expressed in the elements below (from..to). In case there is no value range but distinct exact figures, use the same figure for “value from..” and “value..to”.

[Back to top](#)

##### **9.1.5.1 area coverage value from..**

Data type: Integer percentage value

This element expresses the lower range value for the percentage share of a Land Cover Component (or Land Use Attribute) within a larger land unit.

[Back to top](#)

### 9.1.5.2 area coverage value to..

Data type: Integer percentage value

This element expresses the upper range value for the percentage share of a Land Cover Component (or Land Use Attribute) within a larger land unit.

[Back to top](#)

## 9.2 Occurrence Type

Data type: code list

This segment describes how many or how much of certain elements occur in the given land unit. The elements under this segment need to be combined with other content-carrying (LCC, LUA, LCH) model elements.

### 9.2.1 Percentage occurrence

Data type: code list value

This elements stands for how big is the quantitative percentage share – expressed as a relative figure - of the addressed particular objects among all other distinct objects within a certain land unit. To be numerically expressed in the elements below (from..to). In case there is no value range but distinct exact figures, use the same figure for “value from..” and “value..to”.

[Back to top](#)

#### 9.2.1.1 Percentage occurrence value from..

Data type: integer percentage value

This elements expresses the upper range value for the quantitative percentage share of the addressed particular objects among all other distinct objects within a certain land unit.

[Back to top](#)

#### 9.2.1.2 Percentage occurrence value to..

Data type: integer percentage value

This elements expresses the upper range value for the quantitative percentage share of the addressed particular objects among all other distinct objects within a certain land unit.

[Back to top](#)

### 9.2.2 Countable occurrence

Data type: code list value

This elements stands for how many of the addressed objects occur in absolute numbers in the given land unit. To be numerically expressed in the elements below (from..to). In case there is no value range but distinct exact figures, use the same figure for “value from..” and “value..to”.

[Back to top](#)

#### 9.2.2.1 Countable occurrence value from..

Data type: numeric value

This elements expresses the lower range value for how many of the addressed objects occur in absolute numbers in the given land unit.

[Back to top](#)

#### 9.2.2.2 Countable occurrence value to..

Data type: numeric value

This element expresses the upper range value for how many of the addressed objects occur in absolute numbers in the given land unit.

[Back to top](#)

### 9.2.3 Present occurrence

Data type: boolean

The element combined with and addressed by is generally present in the given land unit, however a discrete number and quantity cannot be specified.

[Back to top](#)

## 9.3 Temporal Parameters

Data type: code list

This segment describes the temporal appearance over time of certain addressed elements in the given land unit. The elements under this segment need to be combined with other content-carrying (LCC, LUA, LCH) model elements. The date respectively the period or event is expressed in the elements below by stating the counted number of days into the year, starting with 1. January as “1” and 31. December as “365”.

### 9.3.1 Instant event date

Data type: code list value

This LCH stands for the instant date of a certain event without considerable temporal duration, counted from 1<sup>st</sup> January onwards into the year. It applies for sudden events that lead to a temporary or long-term change of landscape situation. To be expressed with a counted number of days into the year with the element below. When it is clear that a single event (expressed by a model element, e.g. mowed meadow) took place, however the precise day cannot be identified but rather a certain time window, use the “from..to” elements below. Instead, when the day is clear, fill the same figure for “from..” and “to..”.

[Back to top](#)

#### 9.3.1.1 Instant event date value from..

Data type: TM\_Position

This LCH stores the instant date respectively the entry date for a short time window where an event without considerable temporal duration took place.

[Back to top](#)

#### 9.3.1.2 Instant event date value to..

Data type: TM\_Position

This LCH stores the instant date respectively the end date for a short time window where an event without considerable temporal duration took place.

[Back to top](#)

### 9.3.2 duration

Data type: code list value

This LCH can store the relative length (seasonal duration) of a certain situation or status of a land unit, like for example the duration of a crop cycle, a construction site, a forest fire or a flooding event. It is expressed by the counted number of days. If the exact duration is unclear, values from .. to (see elements below) can be used as a range. If no range is needed, use the same figures for the elements

“from..” and “to..”.

[Back to top](#)

### 9.3.2.1 duration value from..

Data type: TM\_PeriodDuration

This LCH stores the lower range value for the temporal length in days (seasonal duration) of a certain situation or status of a land unit.

[Back to top](#)

### 9.3.2.2 duration value to..

Data type: TM\_PeriodDuration

This LCH stores the upper range value for the temporal length in days (seasonal duration) of a certain situation or status of a land unit.

[Back to top](#)

## 9.3.3 period

Data type: code list value

This LCH can store the period of an event or status which is limited by two definite positions in time. IT is determined by an explicit start and end date.

[Back to top](#)

### 9.3.3.1 period start date

Data type: code list value

This LCH stores the start date of a certain period in form of the number of a day, counted from 1<sup>st</sup> January (“1”) onwards into the year until 31. December (“365”).

[Back to top](#)

#### 9.3.3.1.1 period start date value from..

Data type: TM\_Date

This LCH expresses the lower range value for the start date of an element-related period. If the exact period start is unclear, values from .. to (see elements below) can be used as a range. If no range is needed, use the same figures for the elements “from..” and “to..”.

[Back to top](#)

#### 9.3.3.1.2 period start date value to..

Data type: TM\_Date

This LCH expresses the upper range value for the start date of an element-related period. If the exact period start is unclear, values from .. to (see elements below) can be used as a range. If no range is needed, use the same figures for the elements “from..” and “to..”.

[Back to top](#)

### 9.3.3.2 period end date

Data type: code list value

This LCH stores the end date of a certain period in form of the number of a day, counted from 1<sup>st</sup> January onwards into the year.

[Back to top](#)

#### 9.3.3.2.1 period end date value from..

Data type: TM\_Date



This LCH expresses the lower range value for the end date of an element-related period. If the exact period start is unclear, values from .. to (see elements below) can be used as a range. If no range is needed, use the same figures for the elements “from..” and “to..”.

[Back to top](#)

#### **9.3.3.2.2 period end date value to..**

Data type: TM\_Date

This LCH expresses the upper range value for the end date of an element-related period. If the exact period start is unclear, values from .. to (see elements below) can be used as a range. If no range is needed, use the same figures for the elements “from..” and “to..”.

[Back to top](#)

### **9.3.4 recurring frequency**

Data type: integer value

Seasonal frequency to store the number of changes per year, how often a situation is altering, recurring, or repeatedly happening. It is applicable e.g. to describe the recurring frequency of mowing events on a meadow, in combination with the content-carrying LCH “mowing”.

[Back to top](#)

#### **9.3.4.1 recurring frequency value from..**

Data type: TM\_Date

This LCH expresses the lower range value for the recurring frequency of an addressed element. If the exact frequency is unclear, values from .. to (see elements below) can be used as a range. If no range is needed, use the same figures for the elements “from..” and “to..”.

[Back to top](#)

#### **9.3.4.2 recurring frequency value to..**

Data type: TM\_Date

This LCH expresses the upper range value for the recurring frequency of an addressed element. If the exact frequency is unclear, values from .. to (see elements below) can be used as a range. If no range is needed, use the same figures for the elements “from..” and “to..”.

[Back to top](#)

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