Translating and evaluating land cover legends using the UN Land Cover Classification System (LCCS)

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List of Abbreviations

ACS	-	Anderson Classification System
AVHRR	-	Advanced Very High Resolution Radiometer
CLC	-	CORINE Land Cover
CORINE	-	COoRdination of INformation on the Environment
EEA	-	European Environment Agency
ESA	-	European Space Agency
ETC/TE	-	European Topic Centre on Terrestrial Environment
ETM	-	Enhanced Thematic Mapper
FAO	-	Food and Agriculture Organization
GLC2000	-	Global Land Cover for the Year 2000
GLCN	-	Global Land Cover Network
GOFC-GOLD	-	Global Observation of Forest and Land Cover Dynamics
GTOS	-	Global Terrestrial Observation System
IES	-	Institute for Environmental Sustainability
IGBP	-	International Geosphere Biosphere Programme
IGBP-DIS	-	IGBP-Data and Information System
JRC	-	Joint Research Centre
LCCS	-	Land Cover Classification System
LCTC	-	Land Cover Topic Centre
LUCAS	-	Land Use and land Cover Area frame Sampling
MMU	-	Minimum Mapping Unit
MODIS	-	Moderate Resolution Imaging Spectroradiometer
NDVI	-	Normalised Difference Vegetation Index
NLCD	-	National Land Cover Data
RMSE	-	Root Mean Square Error
UMd	-	University of Maryland
UN	-	United Nations
UNEP	-	United Nations Environment Programme
USGS	-	United States Geological Survey

1   Towards harmonized land cover mapping

A number of global and regional land cover datasets, classification systems and legends have been developed with the establishment of satellite remote sensing for large scale land monitoring. Monitoring initiatives have different interests, objectives, methodologies and mapping standards, which limit the capacity of land cover data compatibility and comparability. The large and growing user community and the variety of applications require consistency and continuity in land observations, and could benefit from harmonizing the multitude of existing datasets. In particular harmonization could improve the analysis of changes, cross-comparison and validation, and derive advanced product aggregating or integrating different datasets and level of information, and improved standardized land cover monitoring in future efforts.

Harmonization is the process whereby similarities between existing definitions of land characterization are emphasized, and inconsistencies reduced. Beginning from a state of divergence in land cover datasets, harmonization seeks compatibility and comparability, however, does not necessarily eliminate all differences. Ideally, harmonization should be guided by existing or evolving standards, and, thus, has to use a common language for reference. Specific existing legends often lack a consistent way to formalize the meaning of the classes they propose. The UN Land Cover Classification System currently provides the most comprehensive, most flexible and internationally most accepted approach for land cover characterization. The essential first steps towards harmonization is the translation of existing legends in a common language provided by LCCS, to improve land cover monitoring in the future.

This report presents the translation results of the Anderson Classification System, the CORINE, IGBP and UMd land cover legend. The translations were developed through a cooperation between the Land Cover Topic Centre (LCTC) of the UN GLCN (http://www.glcn-lccs.org) and the GTOS/GOFC-GOLD Land Cover Implementation Team Project Office (http://www.gofc-gold.uni-jena.de/, HEROLD *et al.*, 2006a, TOWNSEND & BRADY, 2006). The translations and suggestions made in this report are open for discussions and commenting from the international community.

2   UN Land Cover Classification System (LCCS)

2.1   The LCCS concept

The Land Cover Classification System (LCCS, DI GREGORIO, 2005) has been developed by the Food and Agriculture Organization (FAO) and the United Nations Environment Programme (UNEP) to meet the requirements for a standardized global reference classification system. LCCS is a classification system, not a land cover legend which have distinct differences (MCCONNELL AND MORAN, 2001, DI GREGORIO, 2005). A single standardized legend significantly reduces application relevance of land cover datasets (Wyatt et al., 1994). The principle characteristics of LCCS are:

- **flexibility**: mapping at different scales and at different levels of detail, allowing cross-reference from local up to global maps without loss of information
- **consistency**: systematic class description with clearly defined land cover criteria unambiguously delimited from environmental and technical attributes
- **comprehensiveness**: allows the description of a complete range of land cover features

- **comprehensibility**: an essential set of classifiers minimizes possible errors and validation efforts
- **applicability**: multipurpose land cover classification that can be adapted according to user necessities

LCCS provides a system of common diagnostic criteria (land cover classifiers) that are in no particular hierarchy, thus providing a standardization of terminology, not categories. LCCS was created to ensure fundamentals rules of unambiguous definition of each class, to avoid overlap on the class boundaries, to provide consistency in class description, and to clearly define class relationships (possibly with mathematical parameters). Existing "classifications" usually fail to meet the above rules, since many of them often are geographically limited "legends". The LCCS approach is therefore, in this way, different from most other examples (like CORINE and IGBP) of standardized land cover systems (AHLQVIST et al., 2008). It can considered as a "boundary object" to evaluate and mediate different approaches to represent land cover features around which similarities, differences and internal consistencies can be understood and expressed in a rigorous way.

The LCCS classification concepts were endorsed in 1996. The initiative developed an internationally agreed reference base for land cover. LCCS was used for the first time within FAO's Africover project (DI GREGORIO & JANSEN, 1996a/b). Based on the experience gained a second version of the software was developed. Currently version 2.4 is in use and version 3 is available as a prototype. In addition, the LCCS concept is a form of the Land Cover Data Marco Language which is currently aiming to become an ISO standard for land cover classification.

In order to facilitate the data collection coming from different land cover projects GLCN LCTC provides a translation form designed according to LCCS methodology/ translation concepts (JANSEN, 2004, HEROLD *et al.*, 2006a,b). This form is filled with information coming from the original legend and LCCS translation data. Furthermore, users can add notes and GLCN LCTC staff members can evaluate the translation.

2.2   Classification with LCCS

LCCS is a priori classification system, meaning all classes have to be defined in advance of data collection and land cover classification. Usually, priori classification systems have a disadvantage, since a large amount of classes have to be defined to describe any occurring land cover all over the world in a consistent way. However, instead of pre-defined classes LCCS offers a set of pre-defined classification criteria– preventing inconsistencies while simultaneously providing standardization. This is an independent diagnostic criterion where the classifiers are hierarchically arranged, differing depending on the land cover type – different land cover demands a suitable set of classifiers. Hence, the classification process with LCCS goes through two main phases, the dichotomous phase (Fig. 1) at first and the modular-hierarchical phase following (Fig. 2).
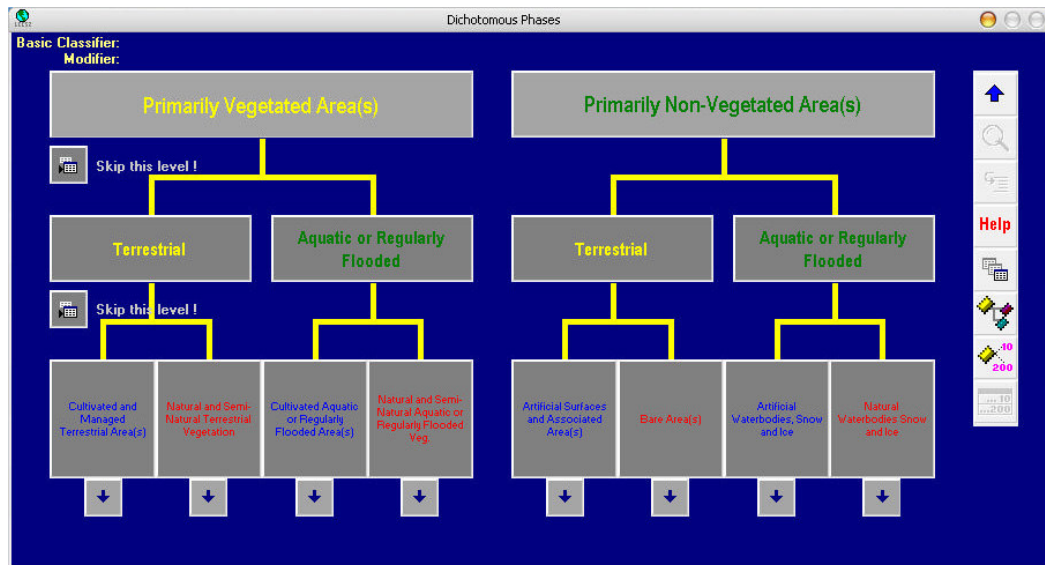
Fig. 1: The initial dichotomous phase in LCCS

The initial dichotomous phase distinguishes eight major land types. The appropriate set of classifiers in the modular-hierarchical phase (Fig. 2) assures certainty, standardization and comprehensibility of the classification. Higher levels of detail can be achieved by using optional modifiers and attributes. These involve environmental (e.g. climate, lithology) as well as technical properties (e.g. crop type, salinity of water bodies), going beyond the usage of "pure" land cover classifiers.

Fig. 2: The modular-hierarchical phase (1st level of 'Natural and Semi-Natural Terrestrial Vegetation).

For each defined class LCCS creates a unique Boolean formula (comprising the classifiers used), a unique numerical code and a standard name. User-defined names can be linked to this nomenclature.
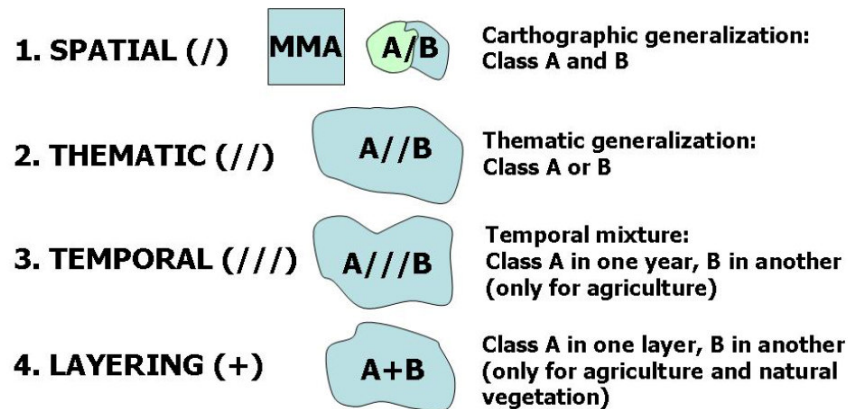
Fig. 3: Mixed unit concept within LCCS (MMA = minimum mapable area).

LCCS allows the definition of mixed classes, which can be either thematic or cartographic (spatial and/or time-related) mixes. In the first case no unique thematic information is provided, i.e. a land cover class "A" or a land cover class "B" might be found in the observed area (A//B). The second case can be applied if the scale (minimum mapable area) limits the representation of unique land cover classes, i.e. when all defined features ("A" and "B", A/B) are present in the observed area. A special case of spatial mixed coding may occur within cultivated areas when crops are alternating annually. Then the time-related mixed coding applies (temporal, A///B). Furthermore, LCCS is able to describe the presence of different layers (A+B) (Fig. 3).

Besides Di Gregorio (2005), a detailed description of LCCS v 2 as a classification language was first presented by DI COSTANZO & ONGARO (2004) and later formalized in a complete mathematical form Di Costanzo & Di Gregorio.. The authors define language syntax and semantics building a complete description of LCCS v2 rules, which would be basic for the development of new tools that could integrate LCCS into existing applications of GIS or remote sensing, thus benefiting both software developers and researcher. As consequence of these efforts to create a formal language to share the meaning of different ontologies, FAO has started the development of a new version of LCCS. The LCCS v.3 will be supported by an UML and an XML to better share within the user community the conceptual bases of the system. LCCS v.3 could be considered a Metalanguage containing a logical general framework of rules to describe land cover features.

3 Legends overview

Four legends that are included in the translation are described in the following sections. There are some global legends developed using LCCS which do not require translation. These include the legend for Global Land Cover 2000 (GLC 2000, Bartolome and Belward, 2005, http://www-gvm.jrc.it/glc2000/legend.htm) and the new GLOBCOVER 2005 product (Arino et al., 2007).

3.1 Anderson Classification System

The classification system, essentially developed by J. R. Anderson et al., was designed for national use in the United States aiming to categorize remote sensing information. It was meant to be open for supplemental information from conventional sources, that would to suit user needs from local to regional levels.

The classification system itself offers four levels of increasing detail from level I to

Table 1: The Anderson Classification Systems Classification System (ACS)

Level 1	Level 2
1 Urban or Built-up	11 Residential
	12 Commercial and Services
	13 Industrial
	14 Transportation, Communications, and Utilities
	15 Industrial and Commercial Complexes
	16 Mixed Urban or Built-up Land
	17 Other Urban or Built-up Land
2 Agricultural Land	21 Cropland and Pasture
	22 Orchards, Groves, Vineyards, Nurseries, and Ornamental Horticultural Areas
	23 Confined Feeding Operations
	24 Other Agricultural Land
3 Rangeland	31 Herbaceous Rangeland
	32 Shrub and Brush Rangeland
	33 Mixed Rangeland
4 Forest Land	41 Deciduous Forest Land
	42 Evergreen Forest Land
	43 Mixed Forest Land
5 Water	51 Streams and Canals
	52 Lakes
	53 Reservoirs
	54 Bays and Estuaries
6 Wetland	61 Forested Wetland
	62 Nonforested Wetland
7 Barren Land	71 Dry Salt Flats
	72 Beaches
	73 Sandy Areas other than Beaches
	74 Bare Exposed Rock
	75 Strip Mines, Quarries and Gravel Pits
	76 Transitional Areas
	77 Mixed Barren Land
8 Tundra	81 Shrub and Brush Tundra
	82 Herbaceous Tundra
	83 Bare Ground Tundra
	84 Wet Tundra
	85 Mixed Tundra
9 Perennial Snow or Ice	91 Perennial Snowfields
	92 Glaciers

level IV, being adaptable to user demands by defining categories that are more detailed and simultaneously compatible for generalizations up to the smaller scales at the national level. Level II was intended for statewide and interstate regional land

use, land cover compilation and mapping, building the backbone of the classification system, that, in this work, is translated into LCCS (ANDERSON *et al*. 1976).

A modified version of the ACS was used by the USGS Land Cover Institute within their Landsat TM based National Land Cover Data (NLCD) classification scheme (see http://landcover.usgs.gov/classes.php).

3.2 CORINE Land Cover

CORINE (COoRdination of INformation on the Environment) Land Cover, CLC is jointly managed by the EEA and the JRC. The priority objective of CLC is to provide a land cover data set for the European environmental policy that is comparable across Europe. Initiated in the mid-eighties the first data set (Table 2) shows the land cover of the 15 EC member states around 1990 (CLC90), whereas the exact date differs mainly between 1986 and 1995. It is using a 3-level nomenclature with 5 classes on the first, 15 classes on the second and 44 classes on the third level. The mapping scale is 1 : 100 000. Recently an updated database, CORINE Land Cover 2000 (CLC2000), is available with the reference year 2000 (+/- 1 year). Initially designed for the EU-15 states eventually the EU-25 member states and some other European countries (Bulgaria, Croatia, Liechtenstein and Romania) participated in the project. This new version also includes information to CLC changes between the reference years 1990 and 2000. Updates are intended to come out every 10 years, i.e. the next update is expected for 2010. Major data source of CLC2000 are orthocorrected Landsat-7 ETM satellite images (< 25 m RMSE) with a spatial resolution of 25 m or rather 12.5 m for multispectral and panchromatic bands respectively. The minimum mapping unit (MMU) is 25 ha, changes are accounted for areas of at least 5 ha (BÜTTNER *et al*., 2004, JRC-IES, 2005).

Table 2: The 3-level nomenclature of CLC

Level 1	Level 2	Level 3
1 Artificial surfaces	1.1 Urban fabric	1.1.1 Continuous urban fabric
		1.1.2 Discontinuous urban fabric
	1.2 Industrial, commercial and transport units	1.2.1 Industrial or commercial units
		1.2.2 Road and rail networks and associated land
		1.2.3 Port areas
		1.2.4 Airports
	1.3 Mine, dump and construction sites	1.3.1 Mineral extraction sites
		1.3.2 Dump sites
		1.3.3 Construction sites
	1.4 Artificial non-agricultural vegetated areas	1.4.1 Green urban areas
		1.4.2 Sport and leisure facilities
2 Agricultural areas	2.1 Arable land	2.1.1 Non-irrigated arable land
		2.1.2 Permanently irrigated land
		2.1.3 Rice fields
	2.2 Permanent crops	2.2.1 Vineyards
		2.2.2 Fruit trees and berry plantations
		2.2.3 Olive groves
	2.3 Pastures	2.3.1 Pastures
	2.4 Heterogeneous agricultural areas	2.4.1 Annual crops associated with permanent crops
		2.4.2 Complex cultivation patterns
		2.4.3 Land principally occupied by agriculture, with significant areas of natural vegetation
		2.4.4 Agro-forestry areas

3 Forests and semi-natural areas	3.1 Forests	3.1.1 Broad-leaved forest
		3.1.2 Coniferous forest
		3.1.3 Mixed forest
	3.2 Shrub and/or herbaceous vegetation associations	3.2.1 Natural grassland
		3.2.2 Moors and heathland
		3.2.3 Sclerophyllous vegetation
		3.2.4 Transitional woodland-shrub
	3.3 Open spaces with little or no vegetation	3.3.1 Beaches, dunes, and sand plains
		3.3.2 Bare rock
		3.3.3 Sparsely vegetated areas
		3.3.4 Burnt areas
		3.3.5 Glaciers and perpetual snow
4 Wetlands	4.1. Inland wetlands	4.1.1 Inland marshes
		4.1.2 Peatbogs
	4.2. Coastal wetlands	4.2.1 Salt marshes
		4.2.2 Salines
		4.2.3 Intertidal flats
5 Water bodies	5.1 Inland waters	5.1.1 Water courses
		5.1.2 Water bodies
	5.2 Marine waters	5.2.1 Coastal lagoons
		5.2.2 Estuaries
		5.2.3 Sea and Ocean

3.3 IGBP DISCover

On behalf of the Land Cover Working Group of the International Geosphere-Biosphere Programme Data and Information System (IGBP-DIS) the U.S. Geological Service guided the development of the DISCover data set in order to meet the demands of various IGBP initiatives for global land cover data since existing data sets proved unsuitable for upcoming IGBP core projects (IGBP 1990). 1 kilometre resolution data from the Advanced Very High Resolution Radiometer (AVHRR) was considered as the adequate basis for the DISCover data set. Its legend comprises 17 classes (Table 3) designed to provide a consistent and exhaustive characterization of global land cover. More detailed DISCover specifications can be found in BELWARD (1996).

The data set is based on unsupervised classification of multitemporal monthly maximum NDVI composites collected from April 1992 to March 1993. For final class assignment, ancillary data sets were used during post-classification processing. Primary intentions of use targeted the environmental modelling community, especially for global-scale applications (e.g. climate) (HANSEN & REED 2000, LOVELAND et al. 2000). The DISCover data set is available through the Global Land Cover Characteristics database via the World Wide Web (http://edcdaac.usgs.gov/glcc/glcc.html).

Table 3: IGBP DISCover Nomenclature

Classification Code	IGBP class
1	Evergreen Needleleaf Forests
2	Evergreen Broadleaf Forests
3	Deciduous Needleleaf Forests
4	Deciduous Broadleaf Forests
5	Mixed Forests
6	Closed Shrublands
7	Open Shrublands
8	Woody Savannas
9	Savannas
10	Grasslands
11	Permanent Wetlands
12	Cropland
13	Urban and Built-up
14	Cropland/Natural Vegetation Mosaics
15	Snow and Ice
16	Barren or Sparsely Vegetated
17	Water Bodies

3.4 UMd Legend

A second legend based on the AVHRR data set mentioned above was developed by the University of Maryland. The UMd legend essentially is a modified IGBP legend renouncing the IGBP classes 11 (*Permanent Wetlands*), 14 (*Cropland/Natural Vegetation Mosaics*), and 15 (*Snow and Ice*) (Table 4). Contrary to the IGBP classification basing on unsupervised clustering of NDVI composites, UMd used a supervised classification tree algorithm considering 41 multi-temporal metrics derived not only from NDVI values but from all five AVHRR bands (HANSEN & REED 2000, HANSEN *et al.* 2000).

Access for the data set is provided through the University of Maryland's Global Land Cover Facility via web (http://glcf.umiacs.umd.edu/data/landcover/).

Though classification methods, input variables and the used ancillary data sets of IGBP and UMd differ substantially both methods will, for the most part be referred to together as both versions focus on classification techniques but only on the (extensively conform) land cover class definitions.

Table 4: UMd Nomenclature

Classification Code	UMd class
0	Water Bodies
1	Evergreen Needleleaf Forests
2	Evergreen Broadleaf Forests
3	Deciduous Needleleaf Forests
4	Deciduous Broadleaf Forests
5	Mixed Forests
6	Woodlands
7	Wooded Grasslands / Shrublands
8	Closed Bushlands or Shrublands
9	Open Shrublands
10	Grasslands
11	Croplands
12	Barren
13	Urban and Built-up

4 Legend translation into LCCS

4.1 Objectives

The objectives of the LCCS translation process are to:

- create a translation of the legends and their land using into LCCS classifiers (Annex A+D),
- show the feasibility, possibilities and discrepancies regarding the translation (Annex A+C),
- evaluate known issues to overcome possible difficulties that may have been encountered (Chapter 6).

The initial background for this work arose from the intention to study the possibility to link CORINE Land Cover to global land cover activities and foster interaction and comparability between these land cover mapping activities - an idea originating from the harmonisation workshop held at FAO, Rome (HEROLD & SCHMULLIUS 2004).

4.2 Translation process

Using the LCCS software a translation of the legends was performed for each single class (Annex A). ACS and CLC translations were realized on the 2nd and 3rd level respectively. All classes went through a first translation done by the GOFC-GOLD land cover office and were then adjusted according to advice from GLCN-LCTC staff members. A translation form was prepared for every class (see Annex D). Problems that occurred during the translation were pointed out with special attention given to inconsistencies.

Legend properties and class descriptions of the ACS were found in its revision paper published by the U.S. Geological Survey (ANDERSON *et al*. 1976).

In order to produce the most suitable translation of CLC classes, they were studied in detail using the addendum to the CORINE technical guide (BOSSARD *et al*. 2000) and CEC (1994). Additional information was found on the web portal of the European Topic Centre on Terrestrial Environment (http://terrestrial.eionet.eu.int/CLC2000) which is part of the European Environment Agency (EEA).

IGBP DISCover and UMd classes were translated with the aid of HANSEN *et al*. (2000), HANSEN & REED (2000) and LOVELAND *et al*. (2000).

5 Results

The translation is a way to assess the degree of consistency (or vagueness) of the processed legends. The process was not straightforward for all classes. Some problematic issues occurred through all legends but differed in their extent and magnitude, other ones were legend specific. Legend criteria usually could be translated with LCCS, however the criteria could often not be completely complied with the LCCS classifiers. Before taking a closer and more specific look at the individual legends the most important general translation issues will be discussed in more detail:

- Threshold differences,
- Occurrences of land-use and other non land cover terminology, and
- Difficulties related to mixed classes (cartographic standards).

Other particular issues are addressed in the legend-specific part of this chapter and within the individual class translation forms (Annex D). These sheets contain translator judgments on the consistency of the class description and the quality of the LCCS translation. High consistency and high confidence point at a successful LCCS translation and, vice versa, low consistency and low quality refer to problems discussed in more detail hereafter and in the translation forms itself.

5.1 Threshold differences

Threshold differences for specific classifiers are of key importance for land cover comparability, i.e. vegetation/tree canopy cover in the case of vegetated areas, density thresholds for urban areas indicating the composition of impervious surfaces or height thresholds for identifying trees. The difference should not exceed 5 - 10 points for being neglected. These differences however don't affect the evaluation of the class consistency because the values reported in LCCS cannot be taken as reference, therefore don't serve as evaluation element for the consistency. An overview for all of them is provided in Annex C.

A more detailed description is attached within the translation forms (Annex D). For natural vegetation, a cover density threshold has to be defined when creating a LCCS class. In the legends analyzed, however, no vegetation cover information were specified in some cases, i.e. some provide only qualitative (i.e. "dense") or sometimes contradictory specifications. In such cases the translator has to decide which values are most suitable. This choice was not made following a strict rule (e.g. defining the most wide range from 100 to 15 percent), but following common sense and conclusions drawn from other class descriptions.

5.2 Land use and other non-land cover terminology

There is a link between land cover and land use and many applications often use both types of information. Hence, the need or desire to include this information in a multipurpose legend is obvious. However this intention often results in a mix of land cover and non-land cover terminology and favors inconsistencies and a general vagueness of the class meaning. LCCS, on the contrary is primarily designed to describe land cover in a rather rigorous way. Thematic incompatibilities or when a lack of suitable translations is found for some categories. In fact, LCCS does offer a range of possibilities to describe artificially covered surfaces – urban (built-up) as well as cultivated areas – but, these capabilities are controlled and regulated by the attempt to describe these categories purely from a land cover point of view. Part of the translated legends, especially CLC and ACS, are not restricted to 'pure' land cover and land use terms.

Examples of affected classes are often referring to:
- processes (CLC classes 133 *Construction sites*, 324 *Transitional woodland-shrub*; ACS class 76 *Transitional Areas*),
- cultural practices (CLC classes 212 *Permanently irrigated land*, 231 *Pastures*; ACS category 3 *Rangeland*).
- environmental events (CLC class 334 *Burnt areas*) or even
- an entire ecoregion (ACS category 8 *Tundra*)

Other classes include very specific elements, e.g. ACS class 22 *Orchards, Groves, Vineyards, Nurseries, and Ornamental Horticultural Areas* and ACS class 24 *Other*

Agricultural Land. Within this context for the CORINE legend, 'Nurseries of fruit trees and shrubs' are included in CLC class 211 *Non-irrigated arable land* or 'Gravel accumulation along stream channels. Such specifics are not generally available in LCCS but can be eventually accommodated by defining user-defined attributes. In all of those cases the actual land cover characteristics often remain uncertain. This again implies imprecise class boundary definitions, leaving the possibilities of overlaps or gaps between classes, thus, making interpretation susceptible to errors and increasing the time and resources required for mapping.

One main point of discussion, in the translation process, was given to the definition of 'pasture' especially regarding the translation of CLC class 231. As a consensus, the LCCS mode function was used to leave out the differentiation between 'Cultivated and Managed Terrestrial Area(s)' and 'Natural and Semi-Natural Terrestrial Vegetation', certainly this decision was a compromise. Pastures are covered with herbaceous vegetation used for grazing and are usually considered semi-natural vegetation. Typically in the U.S. the definition for 'artificial' pasture, where non-native domesticated forage plants have replaced the native herbaceous vegetation, is called rangeland – as is evident in the ACS. According to ACS the question depends on how pasture is defined. Apparently, there is more than one definition and the meaning of this term, which may differ from country to country or from technical terminology to common speech. Thus the problem is merely semantic. For the translation only the definition (here the one provided by CORINE) is crucial. Since CLC includes artificial pasture and the sowing of plants, the proper translation has to include this option. Furthermore a specific thematic extension of CLC (e.g., up to 50 % tree cover for specific pastures) has been neglected in the translations. Such issues are assumed to be rare cases, otherwise this would lead to major class inconsistencies.

Non-land cover distinction criteria cannot precisely define land cover characteristics. Frequently more than one land cover type may be present within such a class. This becomes noticeable especially when observing the classes belonging to 2.4 *Heterogeneous agricultural areas*. These classes are so vague from a land cover point of view, that a perfect translation with LCCS remains a problem and the result has to be seen as an approximation trying to represent the most relevant characteristics of the class. Similar observations exists for other classes, among them CLC classes 212 *Permanently irrigated land*, 322 *Moors and heathland* and 324 *Transitional woodland-shrub*. The translation forces the creation of mixed classes because their definitions are not based on a land cover perspective

5.3   Translation of mixed unit classes

LCCS has a rigorous way to handle the mixed unit concept. In effect the mixed classes concept not automatically needs to be addressed in the land cover class ontology. Mixed units concept is more a cartographic rule that is applied in particular cases when a particular type of geographic area (heterogeneous areas) need to be represented in a map with the constraint of scale. Being scale sensitive it cannot be considered in the classification system itself that by definition should define the ontology of different Land Cover features independently from the way how they are represented in a specific map. In LCCS therefore cartographic mixed units are considered only when passing from classification to legend that is the practical application of classes derived from the classification system to a specific geographic context and are formed by different combinations (depending from each specific situation) of the

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original classes defined in the classification schema. Unfortunately in the existing legends examined, mixed classes don't follows strict criteria and very often have the effect to increase the vagueness and ambiguity of class definition.

One example is CLC class 243 *land principally occupied by agriculture, with significant areas of natural vegetation.* The class description defines the share for cultivated and natural/seminatural vegetation in the range with 25 to 75 percent each. This share is in contradiction with the class name were the term *principally* should indicate a prevalence of agriculture respect to natural vegetation. Even the high flexibility of LCCS on handling cartographic mixed units cannot properly represent this contradiction.

For mixed forest LCCS offers the option 'Mixed' that can be selected when defining the leaf phenology. However LCCS includes only broad-leaved deciduous and needle-leaved evergreen vegetation. The CLC, IGBP, and UMd class definitions do not have these restrictions and not every mixed forest will follow this guideline either. Possibly occurring broad-leaved evergreen or needle-leaved deciduous species inside a population are excluded per definition. Nevertheless, this kind of translation was preferred to the creation of a spatial mixture of broad-leaved and needle-leaved trees due to the reason explained in the previous example. The GLC2000 legend defines its mixed forest class as a thematic mixed unit. However that is only where broad-leaved <u>or</u> needle-leaved species would occur (cf. chapter 2.2) – what actually is not consistent.

Mixing of classes occurs not only through explicit class descriptions, but in some cases it is a result of definition deficiencies. The ACS specifies a kind of "rest class" (ACS classes 17 *Other Urban or Built-up Land*, 24 *Other Agricultural Land*), i.e. classes collecting those areas characteristics, do not match any of the characteristics described within the other, more specific thematic neighbor classes. Though in certain respects gaps between classes are prevented, one type of inconsistency (definition gaps) is compensated by another (indistinct definition). A similar issue affects some "mixed" classes of the ACS (classes 16 *Mixed Urban or Built-up Land*, 77 *Mixed Barren Land*, 85 *Mixed Tundra*), which limits the definition of mixed units to the particular hierarchical level.

5.4 Legend specific issues

The consistency of class definitions is evaluated in four grades (*insufficient*, *fair*, *good*, and *very good*), translation confidence in three grades (*fair*, *good*, and *very good*). In order to quantify both parameters we assigned the following values to them.

- consistency: *insufficient* = 0
  fair = 1
  good = 2
  very good = 3

The evaluation of a class definition's consistency comprises some guidelines, which are decisive for the grade that is achieved by each class. A *very good* rating requires perfect class consistency without overlaps to any other class of the legend. Class boundaries should be clearly discernible and class characteristics should use inherently concordant separation criteria. A *good* rating still assumes consistent core defi-

nition and separation criterion for the class, though possible definition uncertainties (e.g. due to land use or other terminology or lack of vegetation cover specifications) may cause a blurred class boundary. In order to gain a *fair* rating the core definition of the class has to allow a unique separation against its immediate neighbour classes and/or the class has to provide legend-inherent consistency although overlaps in terms of land cover cannot be excluded. A class's consistency is rated *insufficient* when it does not comply with any of the requirements mentioned. The class definition does not allow a clear separation from other classes of the legend (major overlaps) and/or is either ambiguous in the description of its land cover/use features or does not sufficiently specify them.

In case of asymmetric overlaps of classes the more common or generic class is rated better, whereas the special class that introduces land use or other terms (and hence inconsistencies) is rated worse. Overlaps of classes can be asymmetric when, for instance, one class could be part of another class relating to its land cover specifications but is defined further by non-land cover characteristics. An example is apparent from the ACS *Tundra* classes 8x which specify a whole set of land cover classes especially for this ecological zone. In this case, the more generic *Rangeland* classes (representing natural/semi-natural vegetation) or the basic class 74 *Bare Exposed Rock* are not penalized for the overlap and achieve a higher consistency rating although they are affected just as much. Since the *Tundra* classes cause these inconsistencies (non-land cover terminology) their score will suffer from adequate penalties.

- confidence: *fair* = 0
  good = 1
  very good = 2

According to consistency, a *very good* rating can be attained only with absolute confidence in the translation that is complete and unambiguous. If an alternative translation is conceivable, yet the actual version is an appropriate choice to represent the class description, the translation confidence is rated *good*. When the translation can reflect a class only with deviations to its definition and hence can not fully agree with the class structure and all its details, it will achieve *fair* confidence. Whenever a translation is possible the translator should have a *fair* confidence at least, or else a translation is actually impossible – thus making a rating below *fair* meaningless.

We will present the evaluation scores for each legend in the following legend specific issue reviews and will discuss them comparatively in the concluding chapter 6.

5.4.1 ACS issues

Insufficient consistency for most of *Urban or Built-up* (classes 1x), *Agricultural Land* (classes 2x) and the *Tundra* category (classes 8x) is obvious from Fig. 4. Simultaneously, these classes show a tendency of a lower confidence rating. The *Rangeland* and *Forest Land* categories are less problematic in both terms.

Primarily, the Anderson classification system (ACS) is land use/resource orientated. Thus there may be discrepancies due to a rather land cover orientated classification system. Furthermore, the Anderson system fulfils certain unfavourable conditions, which deteriorate operations with it:

(1) Land cover and land use terms are used simultaneously and occur mixed in with eachother (Examples: *Rangeland* category or class 21 *Cropland and Pasture*),

(2) Class definitions are unsystematic and inconsistent, class boundaries appear barely understandable and arbitrary (Examples: Overlaps throughout the classification system, especially with the *Tundra* category)

(3) Important and commonly used characteristics are ignored (Examples: cover density, leaf type)

(4) Mixed classes are used inappropriately, they should not be a part of a classification system but can be used within a legend. Obviously, the proper meanings of "classification" and "legend" were not considered sufficiently.

Fig. 4: Evaluation of consistency of the original class description and the translator confidence in the quality of proposed translation to present the class concept within LCCS for ACS level 2 classes (see Table 1 for class names)

Urban or Built-up

Class 1 *Urban or Built-up* is a pure land use category. Most of the categories following in level II cannot be accommodated by LCCS standard classifiers, since LCCS is far less land use orientated. Thus, it is necessary to introduce user defined attributes to describe and allow discrimination of the classes. The Anderson classes neglect

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cover density – certainly some of the most common classifiers in urban areas. Cover density should be considered at an additional level.

Furthermore, overlaps between the classes exist originating from the two industrial classes 13 and 15 and from class 16 *Mixed Urban or Built-up Land*, which comprises a mixture of any of the level II urban classes. Since the mix can be complex and LCCS cannot adopt this definition as it is, a user defined attribute was added.

Agricultural Land

Again we find a pure land use category – making the description, with a primarily land cover classification system, a bit uncomfortable. Noteworthy is a shared level II class for cropland and pasture, representing the American definition of pasture as being more intensely managed areas, including cultivation practices as seeding and fertilizing, which is opposite to rangeland with a native vegetation cover regulated only by grazing.

The emphasis of land use becomes obvious again in class 23 *Confined Feeding Operations*: From a land cover point of view, this class is rather a built-up object (and hence, defined as such with LCCS). Wetland agriculture is included as well, and does not pertain to one of the wetland classes (6x). Note that the LCCS definitions, in favor of clearness, only consider terrestrial classifiers.

Class 24 *Other Agricultural Land* summarises land uses associated with any of the other level II classes of *Agricultural Land* and is meant to be negligible on smaller scales, but it brings hardly any benefit.

Rangeland

Rangeland refers to natural or semi-natural vegetation grazed by herbivores. Rangeland areas are occupied by native herbaceous or shrubby vegetation and can be grazed by both, domestic or wild herbivores.

In contrast to pastureland, generally, only native vegetation is present in rangeland areas, though ANDERSON *et al*. (1976) mention that some rangelands may present seeded or domesticated plant species. More intensive techniques (seeding, irrigation, fertilising) are typical for pastureland, whereas rangelands are managed principally by the stocking of grazing animals according to the duration and season of grazing. Thus, range management aims at sustaining, improving or protecting natural resources comprising plant and animal life as well as soil and water and simultaneously using these resources for forage production and other purposes (e.g. recreation).

From the definition it can be deduced that *Rangeland* again is a land use term. Vegetation cover can be very different including prairies/steppes, shrub-/woodlands, savannas and tundra. Tundra forms its own category in the Anderson classification system. Even forests used for grazing could be considered as rangelands.

The Anderson system distinguishes between *Herbaceous Rangeland* and *Shrub and Brush Rangeland* but does not specify any vegetation cover or other thresholds. Class 33 *Mixed Rangeland* defines the fraction of either herbaceous or shrubby rangeland as a more than one-third intermixture, which cannot be translated properly with LCCS. Hence, a cartographic mixture according to LCCS rules had to be created, defining the larger sized (shrubby) vegetation as dominating to prevent a splitting into two parts. Alternatively, only two subclasses could accommodate the Anderson

definition with the other subclass specifying herbaceous species as dominant vegetation.

Forest Land

ANDERSON *et al*. (1976) specify a minimum tree-crown cover of 10 percent for the *Forest Land* category, which is a rather low threshold (GLC2000 > 15 %, CLC ≥ 30 %, IGBP > 60 %). Even areas with little or no forest growth (< 10 % crown cover) are accounted for when no other land use is obvious. Thus, clear cuts are included in this category. Areas meeting the requirements for both *Forest Land* and *Urban or Built-up* land are assigned to the urban category. Analogous, areas that simultaneously comply with the condition for the *Wetland* category are included there, since the wetland character is supposed to be more important. As indicated above, grazed forest land is not assigned to the *Rangeland* category but rather form a part of *Forest Land*.

The Anderson classification system first distinguishes its *Forest Land* category into deciduous and evergreen species. That is undoubtedly exceptional, since no distinction into broadleaved or needle-leaved vegetation accompanies or precedes those second-level classes. Of course, a third or following level could consider leaf type but the primary criterion of the classification system remains the shedding of leaves. Consequently, class 43 *Mixed Forest Land* is not a forest species mixture in the common sense of broadleaved and needle-leaved trees but a mixture of deciduous and evergreen plants. Therefore, a mixed forest in the Anderson sense could be a pure broadleaved (or needle-leaved) forest.

LCCS does not know mixed forest land composed of deciduous and evergreen species, nor does LCCS allow the user to define leaf phenology independently from leaf type. More specifically, the user must specify either broadleaved or needle-leaved to release the evergreen/deciduous option. On the one hand this is a constraint of LCCS 2; on the other hand the primary distinction according to leaf type is common practice. That leads us to some inconveniences concerning the translation: For the classes 41 *Deciduous Forest Land* and 42 *Evergreen Forest Land* a thematic mixture was created each containing the broadleaved and the needle-leaved part. A similar solution is unavailable for class 43 Mixed Forest Land, so only a user defined attribute could accommodate Anderson's class definition.

Water

Oceans are not considered in the Anderson classification system, since only inland waters are taken into account. That is valid for class 54 *Bays and Estuaries*, as well. Those water areas are only included when considered to be inland water and hence are included within the total area of the United States.

LCCS translation could be carried out without problem, only a user defined attribute had to be added to class 54.

Wetland

ANDERSON *et al*. (1976) divide wetlands into *Forested Wetland* and *Nonforested Wetland* on their level II categories. The evident overlap to forest land classes already was mentioned above. Class 62 *Nonforested Wetland* comprises a part of herbaceous vegetation as well as nonvegetated wetlands (alluvial and tidal flats). Cultivated wetlands are classified as *Agricultural Land*, whereas grazed wetlands are re-

tained here. Overlaps to the corresponding categories (*Barren Land*, *Agricultural Land*, *and Rangeland*) are unavoidable.

Barren Land

Barren Land is defined to show less than one-third vegetation or other cover. Wet, nonvegetated barren land is considered in class 62 *Nonforested Wetland*. Barren areas found in the tundra region are accounted for in the tundra category (class 83 *Bare Ground Tundra*). Not included are those areas where it is evident from the data source that they will be returned to its former use (e.g. clear cuts). However, the *Barren Land* category covers the cases where neither the former nor the future land use is perceptible (class 76 *Transitional Areas*). Hence, overlaps occur again in the *Barren Land* category.

Following LCCS, class 77 *Mixed Barren Land* cannot be translated in the usual language. The possible land use/land cover features comprise any level II classes of *Barren Land* with none of them reaching the two-thirds threshold of the observed area. Only the usage of a user defined attribute allows a LCCS translation.

Tundra

The tundra category is another peculiarity of the Anderson classification system. The term tundra describes an entire ecoregion rather than land cover. Although those regions certainly feature characteristic vegetation, tundra describes no specific life form but comprises a set of environmental factors (climate, soil, hydrology etc.).

Class 81 *Shrub and Brush Tundra* essentially is a clone of class 32 *Shrub and Brush Rangeland*. Both classes show the same life forms, i.e. the same land cover. Only the environmental attribute *Polar Arctic* was added to form a suitable equivalence to the Anderson class description. Cover density is described as "dense to open", yet no definition of those terms and their meaning is given.

As mentioned above, among *Barren Land* class 83 *Bare Ground Tundra* actually results in a complete overlap with that category – a vegetation cover of less than one third is specified. This threshold cannot be translated exactly with LCCS, in which the maximum cover density was set to 40 percent.

Also class 84 *Wet Tundra* could be part of another category and overlaps with *Wetland*. Finally, the last tundra class raises the biggest troubles, in fact, in such a way that a translation with LCCS becomes impossible. To classify a specific area as class 85 *Mixed Tundra* a mixture of all level II tundra classes is imaginable as long as one type of tundra does not reach two-thirds of this area. Since that does not limit life form/vegetation cover and since "tundra" not even is a land cover term which one could define within LCCS, *Mixed Tundra* must remain without LCCS description.

Perennial Snow or Ice

Neither the definition nor the translation of Anderson's snow and ice category caused problems. The distinction between class 91 Perennial Snowfields and class 92 Glaciers can be made by the presence or absence of (glacial) flow features.

5.4.2 CLC issues

Comparable to ACS, we can observe low consistency values in agricultural classes, especially amongst mixed agriculture classes (24x). However, in opposite to ACS, we find higher consistency within urban classes but again lower values for natural/semi-natural vegetation (Fig. 5).
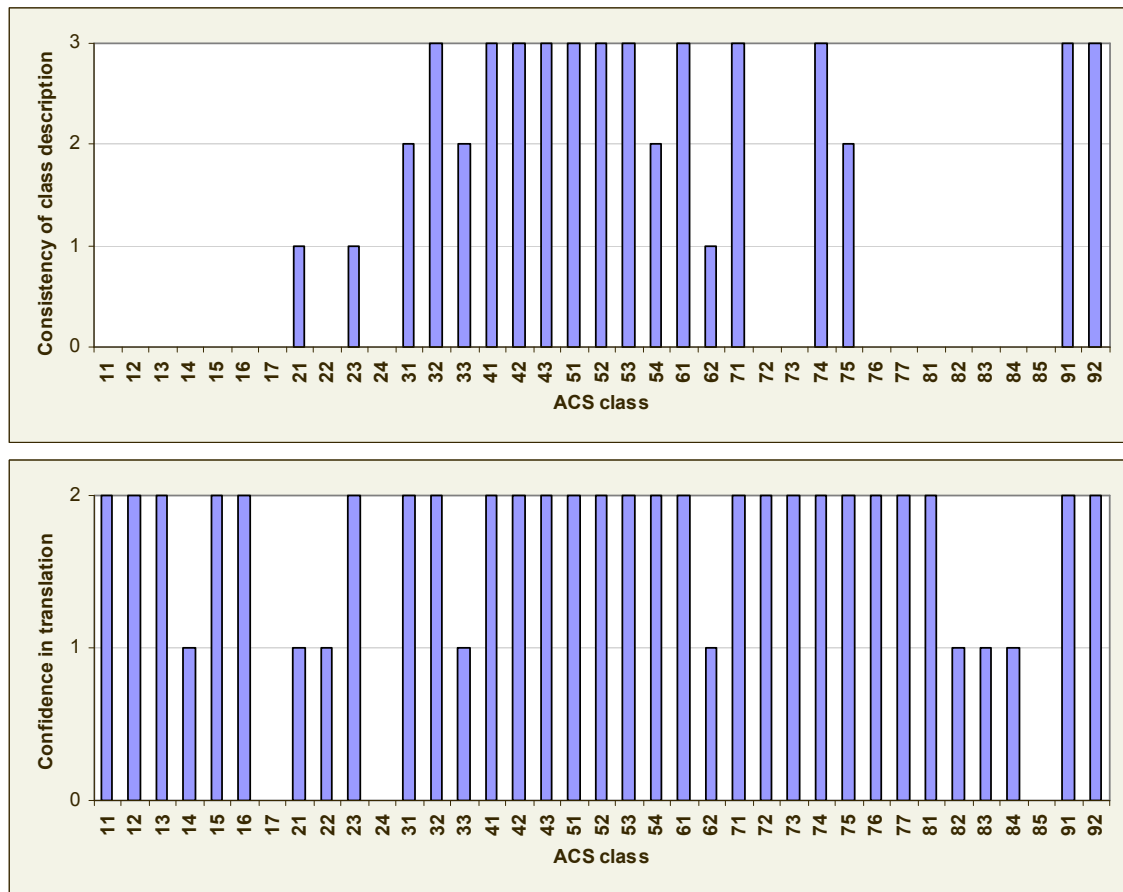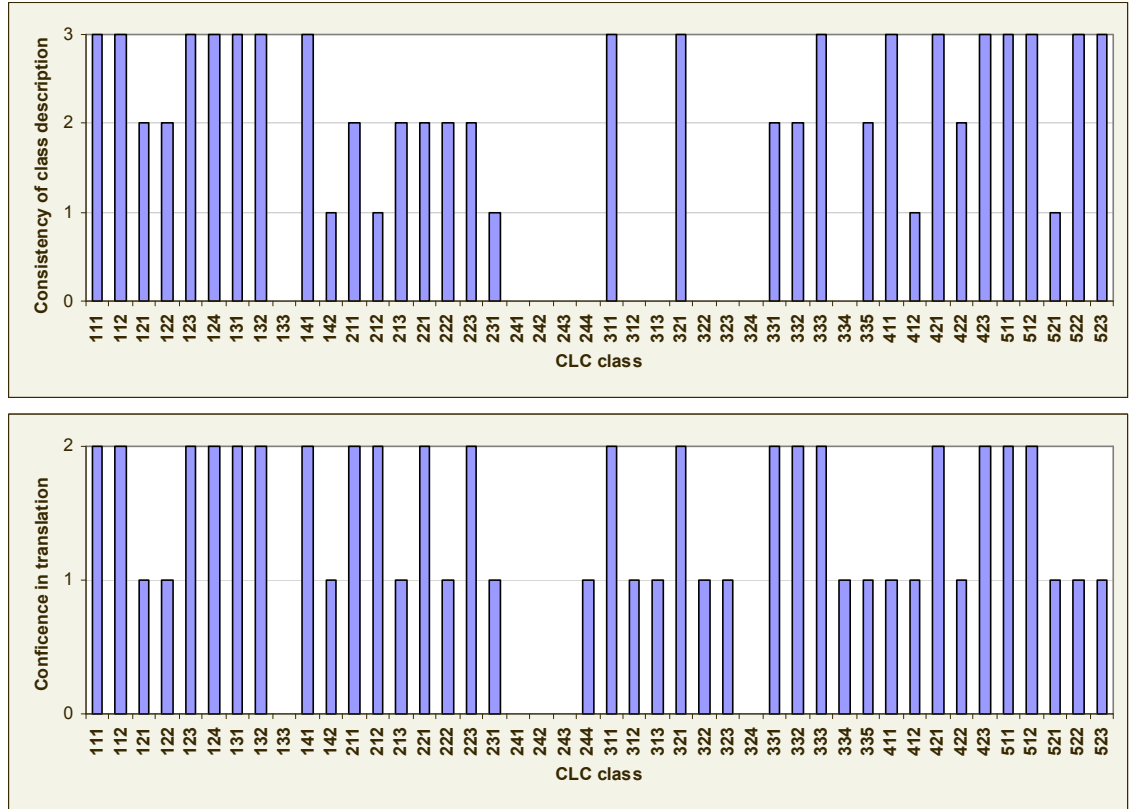

Fig. 5: Evaluation of consistency of the original class description and the translator confidence in the quality of proposed translation to present the class concept within LCCS for CORINE level 3 classes (see Table 2 for class names)

Artificial surfaces

CLC definitions focus on land use descriptions. Compared to ACS there is better consistency among the CLC classes. The main benefit is the inclusion of cover density. Yet some issues are worth mentioning: Firstly, CLC class 133 *Construction sites* does not allow us to draw any conclusions about the actual (nor past/future) land cover. Similar to CLC class 324 *Transitional woodland-shrub*, which we will discuss among the category *Forests and semi-natural areas* (see below), the class definition refers to a process. Certainly, processes are of key importance for land cover <u>change</u> mapping making the purpose to consider them clearly comprehensible. Only they should not obstruct the very sense of a land cover map that is to provide us with reliable land cover information. Unfortunately, CLC class 133 (and likewise 324) withholds this information by not providing actual land cover characteristics. Especially in areas that are the most interesting – as they are affected by changing processes – will reveal the least information about their current land cover status.

Classes 14x *Artificial, non agricultural vegetated areas* are another case where non-land cover terminology causes ambiguities. Apart from definition uncertainties owing to LCCS, classes 141 Green urban areas and 142 Sport and leisure facilities may

both represent an identical land cover feature (e.g. parks) dependent on their geographic occurrence (topology regarding urban fabric). Again becomes obvious that land use criteria are generally unsuited to distinguish land cover in a consistent way, particularly when no significance is attached to class separation criteria.

Agricultural areas
The CLC category *Agricultural areas* contains (among others) level 2 subclasses *Arable land* and *Permanent crops*. Obviously, CLC again uses different criteria to define and separate these classes. This is confirmed at the 3rd-level CLC classes where we find permanent crops among CLC's *Arable land* as well, namely inside of class 212 *Permanently irrigated land*. Thus, crops as defined in other agricultural classes can be part of CLC class 212 if irrigation infrastructure is used for water supply. On the other hand CLC class 213 *Rice fields* actually features the characteristics to identify this class as a subclass of CLC class 212.

CORINE Level 2 subclasses *Pastures* and *Heterogeneous agricultural areas* that we already discussed are exemplary for translation difficulties regarding non-land cover terminology and mixed classes (see Chapters 5.2 and 5.3). Whereas the translation of CLC class 231 *Pastures* is roughly satisfying, the translation of classes 241 *Annual crops associated with permanent crops*, 242 *Complex cultivation patterns*, 243 *Land principally occupied by agriculture, with significant areas of natural vegetation* and 244 *Agro-forestry areas* is, for the most part, not even possible, at least not thoroughly and not comprehensively representative. The class design of these classes is heavily characterised by the use of land use and topologic specifications and the lack of integrative class separation criteria. Thus, multiple sources of inconsistencies occur simultaneously resulting into major difficulties in using those classes. This is not only valid for the translation presented here and the task of land cover harmonization, but may also interfere the accuracy during the interpretation and classification process of CORINE itself. This is confirmed with the accuracy assessment of the EEA (2006) stating the highest subjectivity index percentages for classes 242, 243 and 324 (cf. Chapter 6).

Forests and semi-natural areas
The forest classes are not defined properly with CLC classes 311 *Broad-leaved forests* and 312 *Coniferous forests*. The class names target different things, the first one reflects vegetation physiognomy; the second describes floristics and refers to the cone bearing conifers, which form a division named Pinophyta in the recent taxonomic nomenclature. The classes are not consistently separated from each other. As a result, coniferous species with broad leaves could be part of both classes. In fact, the term 'coniferous' usually may be applied in a similar manner as 'needle-leaved', however, technical terminology should be used correctly, the complementary term to 'broad-leaved' is 'needle-leaved'.

CLC classes 32x (*Shrub and/or herbaceous vegetation associations*) completely neglect physiognomic parameters. Classification does not take into consideration canopy cover, leaf type or seasonality but focuses on the definition of certain vegetation associations (CLC classes 322 *Moors and heathland*, 323 *Sclerophyllous vegetation*). Regarding land cover this results in class overlaps in between the CLC shrub classes. Since mainly non land cover terminology is used to define the classes, no "neutral" shrub class exists within CLC, this causes a definition gap for shrubby land cover which, for that reason, is assigned to CLC class 322 per definition. CLC class 324

Transitional woodland-shrub has contradictory definitions regarding (tree) canopy cover and sacrifices a clear land cover description in favour of a debatable process definition. Indeed, the processes of forest degradation and regeneration can be an important factor for land cover change (possibly driven by land use change) but since both processes are contrary and not separated further, the usefulness of this class is rather limited. The descriptions of these classes by land cover terms and hence the translation with the LCCS software cannot be definite. The moderate to unsatisfactory ratings (regarding the consistency of the class description and the confidence in the translation) are reflecting this (see Fig. 5).

Open spaces with little or no vegetation (classes 33x) show slight inconsistencies in the definition of classes 332 *Bare rock* and 333 *Sparsely vegetated* areas, that are caused by the share of vegetation cover: Sparsely vegetated areas where 75 % of the land surface is covered by rocks are included in class 332. This is opposite to the classification guidelines provided for class 333 that include areas with a vegetation cover from 15 up to 50 (or between 10 and 50 percent, both value ranges can be found within the guidelines). Another class is not in agreement with the requirements for a regular description of land cover: CLC class 334 *Burnt areas* does not discriminate between any vegetation cover type that was affected by fire. Hence, all life forms could or could not be present in concerned areas. By this definition, the class is only referring to an environmental event, actual land cover remains unknown in any case making the translation with LCCS arbitrary.

Wetlands
CORINE lacks the specification of vegetation cover for its wetland classes and includes both, managed and natural wetlands. The majority of the *Wetlands* category classes achieve moderate levels of consistency and translation confidence. The following points give the main reasons for the intermediate rating. CLC class 412 *Peat bogs* does not refer to land cover, areas may be bare (and exploited) or vegetated; if vegetated a separation to CLC class 411 *Inland marshes* may be difficult. Furthermore, CORINE does not include all peat bogs because wooded peat bogs are assigned to the appropriate forest class (31x). Like *Inland Wetlands* (classes 41x) the classification of *Coastal Wetlands* (classes 42x) does not give priority to land cover: CLC classes 422 *Salines* and 423 *Intertidal flats* refer to land use and geographical (spatial) occurrence.

Water bodies
Geographic terminology can be found again in CLC classes 521 *Coastal lagoons* and 522 *Estuaries*. Apart from this, translation of the category Water bodies into the LCCS did not cause problems.

5.4.3 IGBP DISCover/UMd issues

As apparent from the evaluation scores in Fig. 6, few problems occurred during the translation of the IGBP/UMd legend. For the most part classes are outlined according to life forms and common land cover classifiers. Thus, near perfect translation into LCCS classifiers could be achieved for these classes. Difficulties appeared for some classes only concerning the IGBP legend since all of the following classes are not (or not identically) present within the UMd variant:
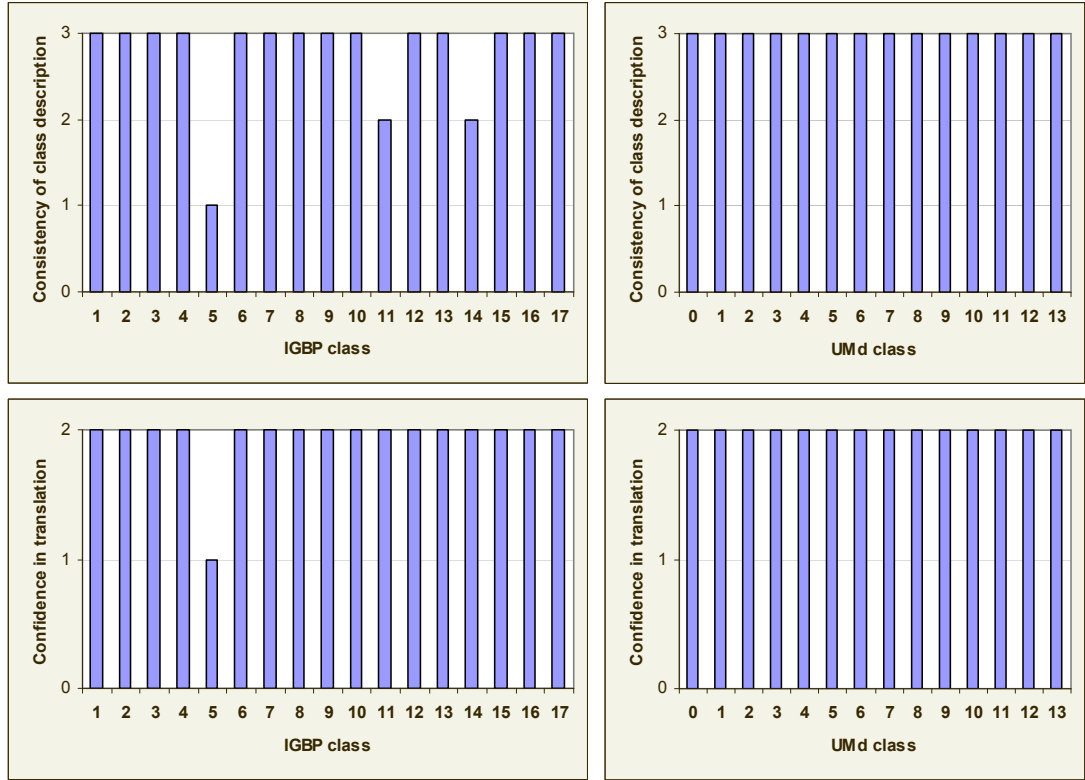
Fig. 6: Evaluation of consistency of the original class descriptions and the translator confidence in the quality of proposed translations to present the class concept within LCCS for IGBP (left) and UMd (right) classes (see Tables 3 and 4 for class names).

Mixed Forests

A mixed forest is commonly defined as a mixture of broadleaved and needleleaved species. Within the IGBP legend the four defined forest types (*Evergreen Needleleaf Forests, Evergreen Broadleaf Forests, Deciduous Needleleaf Forests, Deciduous Broadleaf Forests*) are supposed to build the mixture. A reasonable conclusion is that an area exclusively vegetated by needle-leaved (or broadleaved) species, e.g. an area with spruce and larch trees, will fall into this class as long as one part of the trees is evergreen and the other part deciduous.

This definition is contrary to the common meaning of the term *mixed forest* (specifying a mixture of broadleaved and needle-leaved trees). Additionally, during data interpretation, all possible combinations had to be considered, and as the correct (!) result, very different forest types had to be merged into one class. Furthermore the 60 percent intermixture threshold only leaves a rather narrow range for valid IGBP Mixed Forests within a 2-types intermixture (e.g. of needle-leaved evergreen and broadleaved deciduous species) - one part may easily exceed this threshold value.

Permanent Wetlands

IGBP class *Permanent Wetlands* will unavoidably produce inconsistencies with respect to life forms. The class separation criterion used by the other IGBP classes is life form. Considering that, introducing another separation criterion at the same classification level will not allow consistency among the classes. Consequently, some areas may meet the conditions of both classes, e.g. a "wetland forest". On the other

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hand, a generic wetland class comprising all of its types does not permit the identification and distinction of life forms – a clear deficiency of this approach.

Cropland/Natural Vegetation
Comparable to the *Mixed Forests* category the 60 percent threshold value provides only a narrow definition for the intermixture. LCCS defines a broader (perhaps more practical) range here, specifying between 50 and 80 percent for the first and between 20 and 50 percent for the second component of the mixed class. On the other hand, the limited capabilities of LCCS regarding the creation of (spatial) mixed classes do not allow a proper translation according to the IGBP class definition. Natural vegetation is represented by its generic LCCS category only, and since one part of the mixed class had to be defined as dominating, *Cropland* was chosen – according to the class name and its characterising nature for the concerned areas.

6 Conclusions & discussion

6.1 Comparing legend translations

The occurrences and description of translation issues (i.e. concerning their quantity as well as their quality) help to compare the results obtained from the translation analyses. To assess the legend's overall performance in respect to its consistency and translation confidence the evaluation results were summarized (Fig.7). Fig. 7 shows the legend scores for both parameters in percent of the maximum score for full translation consistency and confidence. The range of these values is indicating the differences faced across the legends during the translation process. Perhaps this evaluation, even though strictly orientated on the criteria introduced in chapter 5.4, does not follow a metric system – a score twice as high does not make a legend twice as good. Nevertheless, the quantification of the evaluation can provide an indicator of the legend translation.
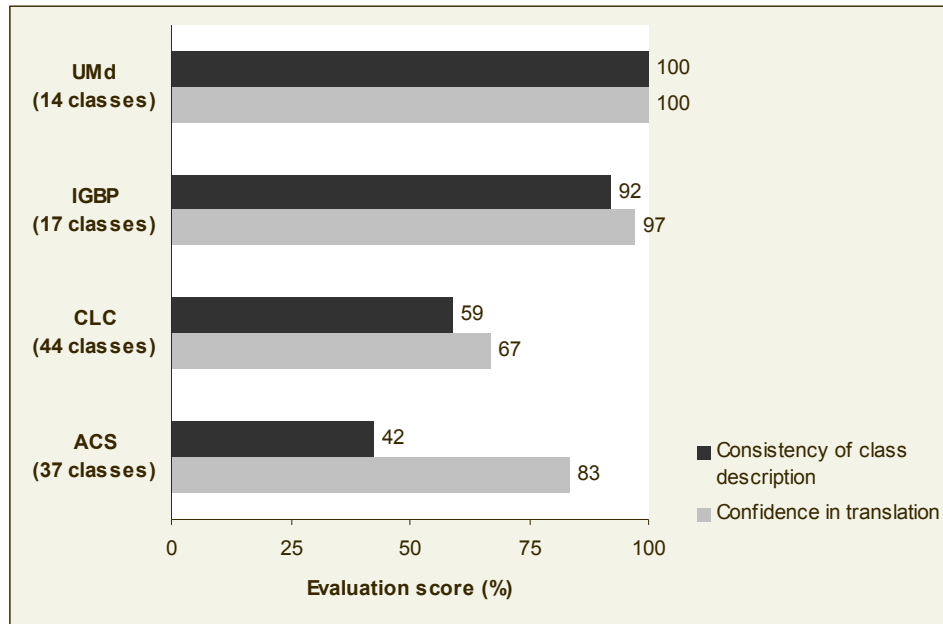
Fig. 7: **Evaluation scores for legend consistency and translation confidence**

It is apparent that both legends with higher scores (IGBP, UMd) have only about one-half to one-third of the class number compared to ACS and CLC. The more

classes exist, the smaller are thematic class distances and the more likely are inconsistencies and overlaps between classes. Furthermore, ACS and CLC were not developed for global application. Thus, they cover a more narrow thematic range of land cover. In contrast, the IGBP/UMd legend consists of rather generic classes for coarse-resolution satellite data analysis with a clear focus on land cover. CLC and the ACS were developed for more detailed analysis and include much more specifications on land use, i.e. more agricultural and urban classes. Hence, they are more susceptible to the resulting land cover / non-land cover terminology conflict (cf. chapter 5.2). Thus, the lower score of CLC and ACS is a consequence, especially, since no consistent construction set like LCCS was used for the legend creation, which could have helped to prevent some inconsistencies.

CORINE shows reasonable efforts to ensure an intrinsic thematic consistency. This can be concluded from the enormous amount of guidelines that were provided supplementary to the CLC class descriptions. The initial CLC Technical Guide (CEC 1994) offered a short definition of each class that was extensively extended by an addendum (BOSSARD *et al*. 2000), in order to limit confusion. As shown, the potential of confusion can (at least partially) originate from inconsistencies in class definitions. Of course, the core definitions (and difficulties) of the CLC classes were not altered. A consistent land cover description has to be valid for the total area of interest. CLC has to cover all particularities in its nomenclature and sometimes consistency can be provided only by excluding or including specific particularities in the appropriate class description. That way a kind of 'synthetic' (i.e. not class immanent) consistency is created. The vast number of guidelines given to the class descriptions is symptomatic.

Problematic in the context of 'synthetic' consistency is not only that new uncertainty arises from every new individual case, but also that the user has to consider them altogether – during the whole chain of data classification, validation to interpretation and analysis. There is an augmented susceptibility to errors and confusion resulting in augmented effort to maintain inherent standardization. In the face of this and recalling the already mentioned mix of land cover and non-land cover terminology automated classification may become challenging and impracticable. Moreover, directing our attention not only to technical and scientific issues but also to cost effectiveness and expense – minimizing the weight of these consequences involves costs and time.

6.2 CORINE – comparison with validation data

To analyse the results derived from this work we used a report published by the EEA providing information on the thematic accuracy of CORINE (EEA 2006). They presented a comparison with LUCAS in situ observations to derive accuracy statistics for the major CLC classes. The process of interpreting the LUCAS samples into CORINE categories revealed some interesting results worth discussing in the context of the LCCS translation results. Both, the findings of EEA (2006) and from the report presented here are plotted against each other in Fig. 8.

The interpretation of the LUCAS reference data emphasized that subjectivity (hence different interpreters came up with different results) was noted for 18 % of all samples. The most subjective CLC classes are shown in Table 5. The most prominent classes in this context are *Land principally occupied by agriculture, with significant*

areas of natural vegetation (243), *Transitional woodland-shrub* (324), *Complex cultivation patterns* (242) and *Mixed forest* (313) where more than a third of the samples were labeled as subjective.

Table 5: CLC2000 classes with largest subjectivity index in interpreting LUCAS in situ observations. The subjectivity index describes the percentage of all samples for that class with different CORINE class assignments from different interpreters.

CLC2000 class	Subjectivity index	Most frequent intermixing classes*
243	42.3 %	242, 231, 211, 311, 323, 313, 324
324	36.1 %	312, 313, 311, 323
242	34.0 %	211, 243, 231
313	33.4 %	312, 311, 324

* In order of importance

The analysis of CLC class definitions using the UN Land Cover Classification System (LCCS) highlighted similar classes with problematic translation characteristics. This fact is emphasized in Fig. 8. Obviously, classes with low translation confidence also exhibit larger amounts of subjectivity and thus inconsistencies in interpreting the LUCAS reference points. There also seems to be some relationship between the LCCS-assessed consistency of the class definition and overall agreement between the CORINE 2000 mapped classes and LUCAS reference information. The relationships are not deterministic and this is not expected since there are a number of other factors influencing mapping confidence and accuracy. Even though inconsistent land cover definitions alone are not necessarily determining product quality, they eventually complicate the comparison and scaling of CORINE land characterization features; in particular for complex and mixed unit classes.
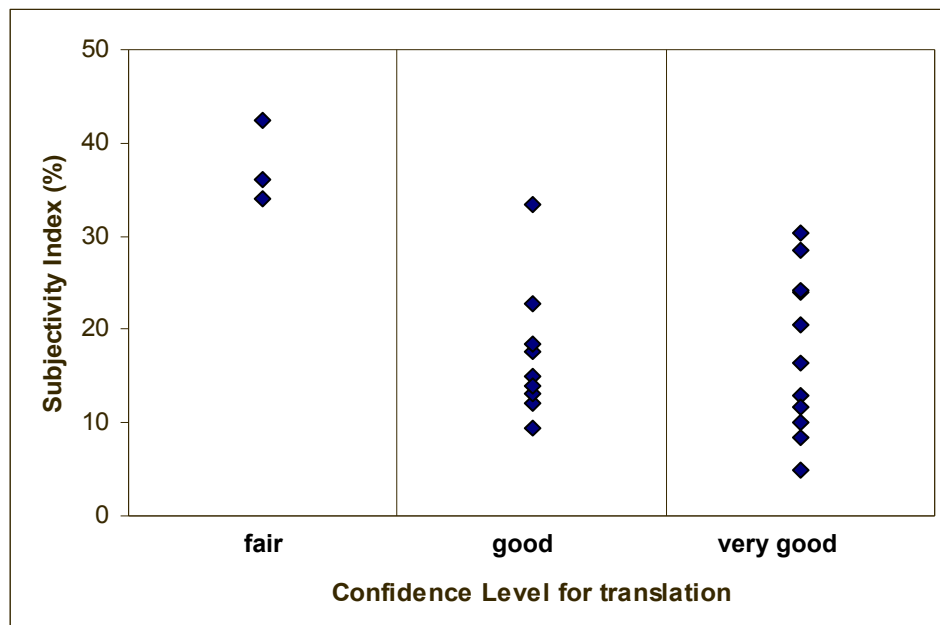
Fig. 8: Comparing Subjectivity Index (above) and LUCAS reference point agreement (below) for representative classes derived in CLC2000 validation (EEA, 2006) with results from the translation process (confidence and consistency noted in the translation forms – Annex D).

The EEA (2006) report draws some general conclusions. In any future efforts special attention should be paid to the less accurate classes which mean that there is a need for improvement of the definition of mapping rules and the use of multi-temporal satellite data during interpretation. Of particular importance is the decomposition of CLC mixed classes (e.g. 242, 243) into pure land cover classes based on LUCAS LC statistics. Both conclusions are encouraged by the results of this translation exercise.

With the observed difficulties in mind, it seems problematic to completely put CLC (level 3) on a common ground with a consistent land cover description. The CO-RINE level 3 concept is intended to not only to account for "pure" land cover. Thus CLC has much better potential of interoperability with global land cover activities, e.g. using the 2nd-level classes, aggregating several classes into a single one or also splitting specific single classes, and for linkage with global land cover activities. Further investigation in this direction would be necessary for CLC and should be carried out when the CORINE validation conclusions can be taken into consideration (cf. above). However, we will portray some thoughts representing a similar first step for the ACS since it shows comparable consistency issues.

6.3 Using land cover classifiers

The ACS also shows limitations in consistency performance and some peculiarities we already discussed in detail (cf. chapter 5). Based on these experiences we will use some issues to exemplify ways to address them. Obviously, inconsistencies of the classification system evolve to a great extent from using different separation criteria between classes within the same (1st-level) category, which result in cross-category overlaps and ambiguities. The proposed approach is to use the LCCS classifiers as independent means to characterize land cover in a non hierarchical way.

For example, the most common classification criterion for vegetated areas is life form. Each vegetation category in the Anderson classification could be characterized by life form for the benefit of consistency. Trees, shrubs, herbaceous vegetation and non-vegetated areas occur multiple times and inside various categories across the whole ACS. Other independent LCCS classifier may specify leaf type form or whether an area is terrestrial or aquatic/regularly flooded. For example, the category of a "Forest wetland" is specified by the classifiers life form (trees) and the classifier aquatic and regularly flooded.

There is already some consensus on basic internationally used classifiers for land cover that include:
- Vegetation life form (trees, shrubs, herbaceous vegetation, lichen and mosses, non-vegetated)
- Leaf type (needle-leaf, broad-leaf) and leaf longevity (deciduous, evergreen)
- Non-vegetated covers (bare soil/rock, built up, snow, ice, water)
- Density of life form and leaf characteristics in percent cover
- Terrestrial versus aquatic/regularly flooded
- Artificiality of cover and land use

The majority of Anderson level 2 classes can be defined using a combination of these classifiers. Information regarding the climatic regime or ecoregion could be included as further classification details or as user defined attributes. The translation exercise here provides the bases for approaching such an effort. In the broader harmonization context, each land cover map could be understood as different layers characterizing different land cover classifiers. On this level, existing land cover data can be much better compared and harmonized.

A translation in LCCS language does not make an inconsistent legend design "better", however, it provides a more consistent perspective describing known categories with standardized classifiers. Thus, this translation exercise provides first step in defining avenues for land cover harmonization in future efforts. For example, considerations of EEA, JRC, ESA and GOFC-GOLD are currently underway to link the GlobCover product with the European CORINE mapping programme. LCCS can aid to establish this link and a first step is done with this work. However, an advanced solution will be achieved by using LCCS classifiers in the development phase of land cover products, i.e. as done for GLC2000 and its successor GlobCover.

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Annex A – Translation tables and notes

A1   Anderson Classification System

Anderson class	LCCLabel	LCCCode	LCCLevel	Anderson description	Translation notes
1 Urban or Built-up					
11 Residential	Non-Linear Built Up Area(s)	5003(2)[Z11]	A4Z11	Residential land uses range from high density, represented by the multiple-unit structures of urban cores, to low density, where houses are on lots of more than an acre, on the periphery of urban expansion.	Pure land use category, not considering density User defined attribute Z11 Residential
12 Commercial and Services	Industrial And/Or Other Area(s)	5003-8(2)[Z12]	A4-A12Z12	Commercial areas are those used predominantly for the sale of products and services. Institutional land uses, such as the various educational, religious, health, correctional, and military facilities are also components of this category.	cf. above User defined attribute Z12 Commercial and Services Inconsistency: Overlaps with class 15 Industrial and Commercial Complexes
13 Industrial	Industrial And/Or Other Area(s) Built-Up Object: Heavy Industrial Area (e.g. Ores, Timber, Coal, Chemicals, etc.) // Industrial And/Or Other Area(s) Built-Up Object: Light Industrial Area (Design, Assembly, Finishing, Processing, Packaging of Products)	5003-8-A27 // 5003-8-A30	A4-A12-A27 // A4-A12-A30	Industrial areas include a wide array of land uses from light manufacturing to heavy manufacturing plants.	Land use category No density specifications Inconsistency: Overlaps with class 15 Industrial and Commercial Complexes

Anderson class	LCCLabel	LCCCode	LCCLevel	Anderson description	Translation notes
14 Transportation, Communications, and Utilities	Linear Built Up Area(s) // Industrial And/Or Other Area(s)	5002 // 5003-8(2)[Z14]	A3 // A4-A12Z14	Highways and railways including rights-of-way, areas used for interchanges, and service and terminal facilities. Airports including facilities (runways, intervening land, terminals, service buildings, navigation aids, fuel storage, parking lots, and a limited buffer zone), seaports, and major lake ports (including docks, shipyards, drydocks, locks, and waterway control structures). Terminal facilities generally include the associated freight and warehousing functions. Communications and utilities areas such as those involved in processing, treatment, and transportation of water, gas, oil, and electricity and areas used for airwave communications are also included in this category.	User defined attribute Z14 Transportation, Communications, and Utilities Land use category No density specifications Inconsistencies: "related areas" (cf. description) may overlap with other 1x classes, and are arbitrary
15 Industrial and Commercial Complexes	High Density Industrial And/Or Other Area(s)	5003-10	A4-A12A14	Industrial and commercial land uses that typically occur together or in close functional proximity. Such areas commonly are labelled with terminology such as "Industrial Park," but since functions such as warehousing, wholesaling, and occasionally retailing may be found in the same structures or nearby, the more inclusive category title has been adopted.	'High Density' not defined by the Anderson Classification System, but follows conclusively from the class description. Land use category Inconsistencies: Overlaps with classes 12 and 13
16 Mixed Urban or Built-up Land	Built Up Area(s)	5001(1)[Z16]	A1Z16	Mixture of Level II Urban or Built-up uses where individual uses cannot be separated at mapping scale. Where more than one-third intermixture of another use or uses occurs in a specific area, it is classified as Mixed Urban or Built-up Land.	User defined attribute Z16 – Mixed (Urban or Built-up) Incorrect use of mixed classes Inconsistencies: Overlaps to other 1x classes

Anderson class	LCCLabel	LCCCode	LCCLevel	Anderson description	Translation notes
17 Other Urban or Built-up Land	Artificial Surfaces and Associated Area(s) // Vegetated Urban Area(s)	0010 // 11176	B15 // A6	Other Urban or Built-up Land typically consists of uses such as golf driving ranges, zoos, urban parks, cemeteries, waste dumps, water-control structures and spillways, the extensive parts of such uses as golf courses and ski areas, and undeveloped land within an urban setting.	Does not define an actual cover type Incorrect use of class definition, should not be part of a classification system, symptomatic for an inconsistent use of classifiers
2 Agricultural Land					
21 Cropland and Pasture	Herbaceous Crop(s) // Shrub Crop(s)Crop Type: Fruits & Nuts	10025 // 10013-S6	A3 // A2-S6	Includes: cropland harvested, including bush fruits; cultivated summer fallow and idle cropland; land on which crop failure occurs; cropland in soil- improvement grasses and legumes; cropland used only for pasture in rotation with crops; and pasture on land more or less permanently used for that purpose.	'Pasture' here defined including cropland management practices (like seeding, fertilizing)
22 Orchards, Groves, Vineyards, Nurseries, and Ornamental Horticultural Areas	Tree Crop(s) Crop Cover: Orchard(s) // Broadleaved Deciduous Shrub Crop(s) Dominant Crop: Fruits & Nuts - Grapes (Vitis vinifera) // Shrub Crop(s) // Herbaceous Crop(s) Dominant Crop: Other Non-Food Crops - Ornamental Horticulture	10001-W8 // 10013-1891-S061010013(2) // 10025-S14Zs22[Z22]	A1-W8 // A2-A7A10-S0610 // A2Z22 // A3-S14Zs22	Orchards, groves, and vineyards produce the various fruit and nut crops. Nurseries and horticultural areas, which include floricultural and seed-and-sod areas and some greenhouses, are used perennially for those purposes. Tree nurseries which provide seedlings for plantation forestry also are included here.	User defined attribute Z22 - Tree nurseries User defined crop type Zs22 – Ornamental Horticulture
23 Confined Feeding Operations	Industrial And/Or Other Area(s)Built-Up Object: Breeding Centre	5003-8-A22	A4-A12-A22	Confined Feeding Operations are large, specialized livestock production enterprises, chiefly beef cattle feedlots, dairy operations with confined feeding, and large poultry farms, but also including hog feedlots. Confined Feeding Operations have a built-up appearance, chiefly composed of buildings, much fencing, access paths, and waste-disposal areas.	Pure land use feature Built-up appearance (from land cover perspective) leads to overlap with *Urban or Built-up* category

Anderson class	LCCLabel	LCCCode	LCCLevel	Anderson description	Translation notes
24 Other Agricultural Land	Scattered Urban Area(s) // Scattered Industrial And/Or Other Area(s) // Cultivated and Managed Terrestrial Area(s)	5003-17 // 5003-16 // 0003	A4-A13A17 // A4-A12A17 // A11	Includes farmsteads, holding areas for livestock such as corrals, breeding and training facilities on horse farms, farm lanes and roads, ditches and canals, small farm ponds, and similar uses.	Class negligible on smaller scales. Includes a wide range of land cover and land use features, no real class boundaries Incorrect use of class definition, should not be part of a classification system, symptomatic for an inconsistent use of classifiers
3 Rangeland					'Rangeland' is not a land cover term.
31 Herbaceous Rangeland	Herbaceous Closed to Open Vegetation	21453	A2A20	Lands dominated by naturally occurring grasses and forbs, areas of actual rangeland which have been modified to include grasses and forbs as their principal cover, when the land is managed for rangeland purposes and not managed using practices typical of pastureland.	Cover density not specified Blurred class boundary against class 12 (Pasture)
32 Shrub and Brush Rangeland	Closed to Open Shrubland (Thicket)	21449	A4A20	Typical for arid or semiarid regions, characterized by xerophytic vegetative types with woody stems and also by desert succulent xerophytes. Also included in this category are chaparral, the occurrences of mountain mahogany and scrub oaks, former croplands or pasture lands (cleared from original forest land) which now have grown up in brush in transition back to forest land.	*Rangeland* is a land use term Cover density not specified

Anderson class	LCCLabel	LCCCode	LCCLevel	Anderson description	Translation notes
33 Mixed Rangeland	Closed to Open Shrubland (Thicket) / Herbaceous Closed to Open Vegetation	21449 / 21453	A4A20 / A2A20	More than one-third intermixture of either herbaceous or shrub and brush rangeland species occurring in a specific area.	Mixed class inappropriate for a classification system Opposite to the LCCS class definition shrubs are not necessarily dominating the area *Rangeland* is a land use term Cover density not specified
4 Forest Land					
41 Deciduous Forest Land	Broadleaved Deciduous Closed to Open Trees // Needleleaved Deciduous Closed to Open Trees	21497 // 21500	A3A20B2XXD1E2 // A3A20B2XXD2E2	Deciduous Forest Land includes all forested areas having a predominance of trees that lose their leaves at the end of the frost-free season or at the beginning of a dry season.	Unusual class differentiation into deciduous and evergreen (class 42) species simultaneously ignoring the discrimination of broadleaved and needle-leaved species
42 Evergreen Forest Land	Broadleaved Evergreen Closed to Open Trees // Needleleaved Evergreen Closed to Open Trees	21496 // 21499	A3A20B2XXD1E1 // A3A20B2XXD2E1	Evergreen Forest Land includes all forested areas in which the trees are predominantly those which remain green throughout the year. Both coniferous and broadleaved evergreens are included in this category.	cf. notes class 41
43 Mixed Forest Land	Closed to Open Trees	21445(3)[Z43]	A3A20Z43	Includes areas where both evergreen and deciduous trees are growing. More than one third intermixture of either evergreen or deciduous species occurs in a specific area.	User defined attribute Z43 – Mixed (Evergreen & Deciduous) Classifiers 'Evergreen' and 'Deciduous'' cannot be mixed without specifying 'Broadleaved' or 'Needleleaved' in LCCS

Anderson class	LCCLabel	LCCCode	LCCLevel	Anderson description	Translation notes
5 Water					
51 Streams and Canals	Natural Waterbodies (Flowing) // Artificial Waterbodies (Flowing)	8001-1 // 7001-1	A1-A4 // A1-A4	The Streams and Canals category includes rivers, creeks, canals, and other linear water bodies. Where the water course is interrupted by a control structure, the impounded area will be placed in the Reservoirs category. The boundary between streams and other bodies of water is the straight line across the mouth of the stream up to 1 nautical mile (1.85 km).	
52 Lakes	Natural Waterbodies (Standing)	8001-5	A1-A5	Lakes are nonflowing, naturally enclosed bodies of water, including regulated natural lakes but excluding reservoirs.	
53 Reservoirs	Artificial Waterbodies (Standing)	7001-5	A1-A5	Reservoirs are artificial impoundments of water used for irrigation, flood control, municipal water supplies, recreation, hydroelectric power generation, and so forth.	
54 Bays and Estuaries	Natural Waterbodies (Standing) // Tidal Area (Flowing)	8001-5(3)[Z54] // 8004-1	A1-A5Z54 // A1B3-A4	Inlets or arms of the sea that extend inland, included only when they are considered to be inland water.	User defined attribute Z54 - Bays
6 Wetland					
61 Forested Wetland	Closed to Open Trees // Closed to Open Shrubs	41635 // 41895	A3A20 // A4A20	Dominated by woody vegetation, including seasonally flooded bottomland hardwoods, mangrove swamps, shrub swamps, and wooded swamps.	
62 Nonforested Wetland	Closed to Open Herbaceous Vegetation. // Tidal Area	42155 // 8004	A2A20 // A1B3	Dominated by wetland herbaceous vegetetion or nonvegetated. Includes tidal and nontidal fresh, brackish, and salt marshes and nonvegetated flats and also freshwater meadows, wet prairies, and open bogs.	Nonvegetated wetlands other than found within tidal areas cannot be defined with LCCS. Nonvegetated wetlands overlap with the *Barren Land* category

Anderson class	LCCLabel	LCCCode	LCCLevel	Anderson description	Translation notes
7 Barren Land					
71 Dry Salt Flats	Bare Soil And/Or Unconsolidated Material(s) With Salt Flats	6020	A5B13	Dry Salt Flats occurring on the flat-floored bottoms of interior desert basins which do not qualify as Wetland are included in this category.	
72 Beaches	Loose And Shifting Sands // Bare Rock And/Or Coarse Fragments - Gravels	6006(3)[Z72] // 6002-8	A6Z72 // A3-A14	Beaches are the smooth sloping accumulations of sand and gravel along shorelines.	Land cover inconsistency to class 73 Class refers to spatial occurrence and is not land cover related User defined attribute Z72 Beaches
73 Sandy Areas other than Beaches	Loose And Shifting Sands	6006	A6	Sandy areas other than Beaches are composed primarily of dunes accumulations of sand transported by the wind. When such sand accumulations are encountered in tundra areas, they are not included here but are placed in the Bare Ground Tundra category.	Overlaps with classes 72 and 83 Class name and definition appear crude
74 Bare Exposed Rock	Bare Rock(s)	6002-1	A3-A7	The Bare Exposed Rock category includes areas of bedrock exposure, desert pavement, scarps, talus, slides, volcanic material, rock glaciers, and other accumulations of rock without vegetative cover, with the exception of such rock exposures occurring in tundra regions.	Overlaps with class 83 regarding land cover
75 Strip Mines, Quarries and Gravel Pits	Extraction Site(s)	5004-2	A2-A6	Those extractive mining activities that have significant surface expression are included in this category. Vegetative cover and overburden are removed to expose such deposits as coal, iron ore, limestone, and copper. Quarrying of building and decorative stone and recovery of sand and gravel deposits also result in large open surface pits.	Land use definition, simultaneously part of artificial surfaces

35

Anderson class	LCCLabel	LCCCode	LCCLevel	Anderson description	Translation notes
76 Transitional Areas	Bare Area(s)	0011(3)[Z76]	B16Z76	Transition from one land use activity to another, characterized by the lack of any remote sensor information which would enable the land use interpreter to predict reliably the future use or discern the past use.	"Transitional" is not a land cover status and is hardly identifiable without ancillary data User defined attribute Z76 - Transitional
77 Mixed Barren Land	Bare Area(s)	0011(3)[Z77]	B16Z77	Mixture of Barren Land features, dominant land use occupies less than two-thirds of the area.	Mixed class inappropriate for a classification system Actual land cover remains unspecified User defined attribute Z77 – Mixed (Barren)
8 Tundra					'Tundra' is not a land cover term (should not be part of a classification system).
81 Shrub and Brush Tundra	Closed to Open Shrubland (Thicket) Climate: Polar/Arctic	21449-O8	A4A20-O8	The Shrub and Brush Tundra category consists of the various woody shrubs and brushy thickets found in the tundra environment. These occur in dense-to- open evergreen and deciduous thickets.	Life form identical to class 32
82 Herbaceous Tundra	Herbaceous Closed to Open (100-40)% Vegetation Climate: Polar/Arctic // Herbaceous Closed to Open (100-40)% Vegetation Climate: Polar/Arctic / Closed to Open Lichens/Mosses Climate: Polar/Arctic	21453-121340-O8 // 21453-121340-O8 / 21465-121340-O8	A2A20-A21-O8 // A2A20-A21-O8 / A7A20-A21-O8	Composed of various sedges, grasses, forbs, lichens, and mosses, all of which lack woody stems.	Definition of lichens and mosses may be considered optional but was transferred due to their importance in the tundra environment
83 Bare Ground Tundra	Consolidated Material(s) Climate: Polar/Arctic // Unconsolidated Material(s) Climate: Polar/Arctic // Herbaceous Sparse Vegetation Climate: Polar/Arctic // Herbaceous Open (40 - (20-10)%) Vegetation Climate: Polar/Arctic	6001-O8 // 6004-O8 // 20058-O8 // 20037-3012-O8	A1-O8 // A2-O8 // A2A14-O8 // A2A11-A13-O8	Tundra occurences less than one third vegetated. Sites visually dominated by considerable areas of exposed bare rock, sand, or gravel interspersed with low herbaceous and shrubby plants.	Overlaps with the *Barren Land* and *Range Land* category and class 62

Anderson class	LCCLabel	LCCCode	LCCLevel	Anderson description	Translation notes
84 Wet Tundra	Closed to Open Herbaceous Vegetation. Climate: Polar/Arctic / Shallow Non-Perennial Natural Waterbodies (Standing) Climate: Polar/Arctic	42155-O8 / 8020-5-O8	A2A20-O8 / A1B2C2-A5-O8	Standing water is almost always present during months when temperatures average above the freezing level. Numerous shallow lakes are also common.	Overlaps with class 62
85 Mixed Tundra					**Translation not possible.**
9 Perennial Snow or Ice					
91 Perennial Snow-fields	Perennial Snow	8006	A2B1	Perennial Snowfields are accumulations of snow and firn that did not entirely melt during previous summers. Snowfields can be quite extensive and thus representative of a regional climate, or can be quite isolated and localized, when they are known by various terms, such as snowbanks.	
92 Glaciers	Perennial Ice (Moving)	8009-9	A3B1-A6	Glacial ice originates from the compaction of snow into firn and finally to ice under the weight of several successive annual accumulations.	

A2 Corine Land Cover

CLC class	LCCLabel	LCCCode	LCCLevel	CORINE description	Translation Notes
1 Artificial surfaces					
1.1 Urban fabric					
111 Continuous urban fabric	High Density Urban Area(s)	5003-13	A4-A13A14	Most of the land is covered by structures and the transport network. Building, roads and artificially surfaced areas cover more than 80 % of the total surface. Non-linear areas of vegetation and bare soil are exceptional.	> 75 % minimum impermeable area
112 Discontinuous urban fabric	Medium Density Urban Area(s) // Low Density Urban Area(s)	5003-14 // 5003-15	A4-A13A15 // A4-A13A16	Most of the land is covered by structures. Building, roads and artificially surfaced areas associated with vegetated areas and bare soil, which occupy discontinuous but significant surfaces. [30 to 80 % of the surface are impermeable.]	Between 30 and 75 % impermeable area
1.2 Industrial, commercial and transport units					
121 Industrial or commercial units	Industrial And/Or Other Area(s)	5003-8	A4-A12	Artificially surfaced areas (with concrete, asphalt, tarmacadam, or stabilised, e.g. beaten earth) without vegetation occupy most of the area, which also contains buildings and/or vegetation.	Note: Uncertainty about included buildings/structures in LCCS, CORINE includes a wide range of them LCCS: trade, manufacturing, distribution, commerce Ports and airports form individual CLC classes
122 Road and rail networks and associated land	Road(s) // Railway(s) // Industrial And/Or Other Area(s) Built-Up Object: Other - Installations associated to roads and railways	5002-3 // 5002-6 // 5003-8-A44Zp122	A3-A7 // A3-A10 // A4-A12-A44Zp122	Motorways and railways, including associated installations (stations, platforms, embankments). Minimum width for inclusion: 100 m.	Note: 'Associated installations' land cover remains undetermined, various land cover possible. User defined Built-Up Object Zp122 – Installations associated to roads and railways
123 Port areas	Industrial And/Or Other Area(s) Built-Up Object: Port Area (including Docks, Shipyards, Locks)	5003-8-A32	A4-A12-A32	Infrastructure of port areas, including quays, dockyards and marinas.	
124 Airports	Industrial And/Or Other Area(s) Built-Up Object: Airport	5003-8-A21	A4-A12-A21	Airports installations: runways, buildings and associated land.	

CLC class	LCCLabel	LCCCode	LCCLevel	CORINE description	Translation Notes
1.3 Mine, dump and construction sites					
131 Mineral extraction sites	Extraction Site(s)	5004-2	A2-A6	Areas with open-pit extraction of construction material (sandpits, quarries) or other minerals (open-cast mines). Includes flooded gravel pits, except for river-bed extraction.	
132 Dump sites	Waste Dump(s)/Deposit(s)	5004-1	A2-A5	Public, industrial or mine dump sites.	
133 Construction sites	Built Up Area(s) / Bare Area(s)	5001 /0011	A1 / B16	Spaces under construction development, soil or bedrock excavations, earthworks.	Note: This can be anything under construction in any state – actual land cover uncertain. Hence, a mixed class with 'Bare Area(s)' was created. This choice is, of course, as arbitrary as every other would be.
1.4 Artificial, non-agricultural vegetated areas					
141 Green urban areas	Vegetated Urban Area(s)	11176	A6	Areas with vegetation within urban fabric, includes parks and cemeteries with vegetation, and mansions and their grounds.	
142 Sport and leisure facilities	Built Up Area(s) Built-Up Object: Sports and Leisure Facilities	5001-A38	A1-A38	Camping grounds, sports grounds, leisure parks, golf courses, racecourses, etc. Includes formal parks not surrounded by urban areas.	Uncertainty about the definition of man-made vegetated areas outside of urban fabric in LCCS What does LCCS's 'Sports and Leisure Facilities' include? What not? Uncertainty regarding non-'Built-Up' leisure facilities (golf courses, managed vegetated areas like gardens) CLC class 142 not referring to land cover, but land use
2 Agricultural areas					
2.1 Arable land					
211 Non-irrigated arable land	Herbaceous Crop(s) // Shrub Crop(s)	10025 // 10013(1)[Z211]	A3 // A2Z211	Cereals, legumes, fodder crops, root crops and fallow land. Includes flowers and fruit trees (nurseries cultivation) and vegetables, whether open field, under plastic or glass (includes market gardening). Includes aromatic, medicinal and culinary plants. Does not include permanent pastures.	User defined attribute Z211: Nurseries of fruit trees and shrubs

CLC class	LCCLabel	LCCCode	LCCLevel	CORINE description	Translation Notes
212 Permanently irrigated land	Surface Irrigated Herbaceous Crop(s) // Surface Irrigated Shrub Crop(s) // Surface Irrigated Tree Crop(s)	11500-13227 // 11495-13227 // 11491-13227	A3XXXXXXD3-D4 // A1XXXXXXD3-D4 // A2XXXXXXD3-D4	Crops irrigated permanently or periodically, using a permanent infrastructure (irrigation channels, drainage network). Most of these crops cannot be cultivated without an artificial water supply. Does not include sporadically irrigated land.	CORINE does not consider sprinkler irrigation here, but only flood or flush irrigation techniques which is similar to the LCCS definition of 'Surface Irrigated'. inconsistent class separation criteria (may include life forms as defined in other agricultural classes, e.g. 22x)
213 Rice fields	Graminoid Crops Dominant Crop: Cereals - Rice (Oryza spp.)	10037-S0308	A4-S0308	Land prepared for rice cultivation. Flat surfaces with irrigation channels. Surfaces periodically flooded.	LCCS mode function used (Mode 1): Rice can be cultivated in paddies (wetland cultivation) as well as on dry land (with appropriate irrigation). possible overlap to CLC class 212
2.2 Permanent crops					
221 Vineyards	Broadleaved Deciduous Shrub Crop(s) Dominant Crop: Fruits & Nuts - Grapes (Vitis vinifera)	10013-1891-S0610	A2-A7A10-S0610	Areas planted with vines.	Note: CORINE extension - unclear class boundary due to the guideline to interpret an area as vineyards if "they determine the land use of the area" Not class specific: One is forced to specify a type of 'Water Supply' in order to be able to choose an option from 'Cultivation Time Factor' although both characteristics are totally independent. 'Permanent' is not defined.
222 Fruit trees and berry plantations	Broadleaved Tree Crop(s) Crop Type: Fruits & Nuts // Broadleaved Shrub Crop(s) Crop Type: Fruits & Nuts // Broadleaved Shrub Crop(s) Crop Type: Beverage	10001-3781-S6 // 10013-3781-S6 // 10013-3781-S8	A1-A7-S6 // A2-A7-S6 // A2-A7-S8	Parcels planted with fruit trees or shrubs: single or mixed fruit species, fruit trees associated with permanently grassed surfaces. Includes chestnut and walnut groves.	Note: land cover inconsistencies to classes 221, 223, (211)

CLC class	LCCLabel	LCCCode	LCCLevel	CORINE description	Translation Notes
223 Olive groves	Broadleaved Evergreen Tree Crop(s) Dominant Crop: Industrial Crops - Olive (Olea europaea L.) // Field(s) Of Broadleaved Evergreen Tree Crop(s) (One Additional Crop) (Shrub Crop With Simultaneous Period) . Dominant Crop: Industrial Crops - Olive (Olea europaea L.) Second Crop: Fruits & Nuts - Grapes (Vitis vinifera)	10001-1-S0910 // 11345-1275-S0910S0610	A1-A7A9-S0910 // A1XXXXC2-A7A9C3C6C17 -S0910S0610	Areas planted with olive trees, including mixed occurrence of olive trees and vines on the same parcel.	Blurred class boundary to CLC class 221
2.3 Pastures					
231 Pastures	Closed to Open (100-40)% Grassland (Mode 2: Cultivated - managed and/or Natural and Semi-natural terrestrial vegetation)	21461-121340	A6A20-	Dense grass cover, of floral composition, dominated by graminacea, not under a rotation system. Mainly for grazing, but the fodder may be harvested mechanically. Includes areas with hedges (bocage).	LCCS Mode 2 used (uncertainties how to rate degree of management) Land use terminology complicates a clear classification & makes interpretation ambiguous (CORINE's 'particularities' were not regarded in the land cover description due to introducing inconsistencies)
2.4 Heterogeneous agricultural areas					
241 Annual crops associated with permanent crops	Field(s) Of Herbaceous Crop(s) (One Additional Crop) (Tree Crop With Simultaneous Period) // Field(s) Of Herbaceous Crop(s) (One Additional Crop) (Shrub Crop With Simultaneous Period) .	11370-12602 // 11370-12614	A3XXXXC2-C3C5C17 // A3XXXXC2-C3C6C17	Non-permanent crops (arable land or pasture) associated with permanent crops on the same parcel.	Notes: Translation not entirely possible – pasture is not included explicitly within the LCCS definition. Land cover inconsistency to CLC class 242 Land use terminology LCCS, generally, does not consider horizontal spatial arrangement and leaves the choice to the user to consider areas between the fields as part of the cultivated area or not (by building a mixed class). CORINE extension - Permanent crops are either in juxtaposition with arable land/pastures or located along the border of the parcels. The occupation rate of non-permanent crops is more than 50 %.

CLC class	LCCLabel	LCCCode	LCCLevel	CORINE description	Translation Notes
242 Complex cultivation patterns	Small Sized Field(s) Of Herbaceous Crop(s) // Small Sized Field(s) Of Shrubs // Small Sized Field(s) Of Tree Crop(s) // Scattered Urban Area(s)	11250 // 11215 // 11195 // 5003-17	A3B2XXC2 // A2B2XXC2 // A1B2XXC2 // A4-A13A17	Juxtaposition of small parcels of diverse annual crops, pasture and/or permanent crops.	Notes: CORINE extension - This class includes juxtaposition of small parcels of annual crops, city garden pastures, fallow land and/or permanent crops eventually with scattered houses or gardens. Pasture is not described within the LCCS class. Multiple crops are not described more detailed within the Crop Combination level of the LCCS class because every combination is possible. Scattered houses may occur within complex cultivation pattern areas. Land cover inconsistency: overlap to CLC class 241
243 Land principally occupied by agriculture, with significant areas of natural vegetation	Cultivated and Managed Terrestrial Area(s) / Natural And Semi-Natural Primarily Terrestrial Vegetation	0003 / 0004	A11 / A12	Areas principally occupied by agriculture, interspersed with significant natural areas.	Notes: CORINE extension - This class includes land occupied by agriculture with areas of natural or semi-natural origin (including wetlands and water bodies, out crops). Cultivated and Managed Terrestrial Area(s) are not necessarily dominating, the share of both parts of the mixed class extends from 25 to 75 %. Natural areas includes further wetlands, water bodies, bare areas; moreover scattered urban settlements may be found. It is not possible to consider all this for the LCCS translation. But the basic idea of the class (mosaic of agriculture & natural vegetation) may be represented by this translation. Land cover inconsistencies to CLC classes 2xx, 3xx

CLC class	LCCLabel	LCCCode	LCCLevel	CORINE description	Translation Notes
244 Agro-forestry areas	Closed to Open Woodland with Herbaceous Layer // Continuous Closed to Open Trees + Continuous Field(s) Of Herbaceous Crop(s)	21575(1)[Z244] // 2144710027	A3A20B2C1XXXXF2F4F7G4Z244 // A3A20B2C1 + A3XXB5	Annual crops or grazing land under the wooded cover of forestry species.	Notes: CORINE extension - This class includes annual crops or grazing land and fallow land covering less than 50 % of the surface. Mixture of forest trees and tree crops building the 'wooded cover' possible, but cannot be defined within LCCS. CORINE doesn't provide information about the tree cover. User defined attribute Z244 – Grazing land (Pasture)

3 Forest and semi-natural areas

3.1 Forests

CLC class	LCCLabel	LCCCode	LCCLevel	CORINE description	Translation Notes
311 Broad-leaved forests	Broadleaved Closed to Open (100-40)% Trees	21495-121340	A3A20B2XXD1-A21	Vegetation formation composed principally of trees, including shrub and bush understoreys, where broad-leaved species predominate.	≥ 40 % crown cover vs. CORINE's > 30 % Note: CORINE extension - This class includes areas with a crown cover of more than 30 % or a 500 subjects/ha density for plantation structure, broad-leaved trees represent more than 75 % of the planting pattern. In case of young plants or seedlings the proportion of broad-leaved plants to be considered is at least 75 % of the total amount of plants.
312 Coniferous forests	Needleleaved Closed to Open (100-40)% Trees	21498-121340	A3A20B2XXD2-A21	Vegetation formation composed principally of trees, including shrub and bush understoreys, where coniferous species predominate.	≥ 40 % crown cover vs. CORINE's > 30 % Notes: CORINE extension - Coniferous trees represent more than 75 % of the formation. In case of young plants or seedlings, the proportion of coniferous plants to be considered is at least 75 % of the total amount of plants and their texture is very similar to a surrounding coniferous forest texture. 'Coniferous' refers to taxonomy – no consistent separation to 'broad-leaved' which describes the shape of leaves (some species are conifers and broad-leaved)!

CLC class	LCCLabel	LCCCode	LCCLevel	CORINE description	Translation Notes
313 Mixed forests	Mixed Closed to Open (100-40)% Trees // Mixed Closed to Open (100-40)% Trees	21497-129398 // 21499-129398	A3A20B2XXD 1E2-A21E3 // A3A20B2XXD 2E1-A21E3	Vegetation formation composed principally of trees, including shrub and bush understoreys, where neither broad-leaved nor coniferous species predominate.	≥ 40 % crown cover vs. CORINE's > 30 % Notes: CORINE extension - Mixed forests with a crown cover of more than 30 % or a 500 subjects/ha density for plantation structure. The share of coniferous or broad-leaved species does not exceed 25 % *(*)* in the canopy closure. *(Comment: 25 % is perhaps a misprint, more likely is 75 %.) LCCS limits it's 'Mixed Trees' category exclusively to a layer with a mixture of broadleaved deciduous and needleleaved evergreen vegetation – disregarding possibly occuring broad-leaved evergreen and needle-leaved deciduous species in mixed forests.
3.2 Scrub and/or herbaceous vegetation associations					
321 Natural grasslands	Herbaceous Closed to Open (100-40)% Vegetation	21453-121340	A2A20-A21	Low productivity grassland. Often situated in areas of rough, uneven ground. Frequently includes rocky areas, briars and heathland.	Notes: CORINE extension - Natural grasslands are areas with herbaceous vegetation (maximum height is 150 cm and gramineous species are prevailing) which cover at least 75 % of the surface covered by vegetation which developed under a minimum human interference (not mowed, fertilized or stimulated by chemicals which might influence production of biomass); here belong for instance grass formations of protected areas, karstic areas, military training fields, etc. (even though the human interference cannot be altogether discarded in quoted areas, it does not suppress the natural development or species composition of the meadows), areas of shrub formations of scattered trees. No vegetation cover defined in CLC class 321, lower threshold was set to 40 % since CLC class 333 comprises up to 50 % vegetation cover.

CLC class	LCCLabel	LCCCode	LCCLevel	CORINE description	Translation Notes
322 Moors and heath-land	Closed to Open (100-40)% Shrubland (Thicket) // Closed to Open (100-40)% Shrubland (Thicket) / Herbaceous Closed to Open	21450-121340 // 21450-121340 / 21453-121340	A4A20B3-A21 // A4A20B3-A21 / A2A20-A21	Vegetation with low and closed cover, dominated by bushes, shrubs and herbaceous plants (heather, briars, broom, gorse, laburnum, etc.).	Notes: CORINE extension - This class includes temperate shrubby area vegetation (climax stage of development): includes dwarf forest trees with a 3 m maximum height in climax stage. CORINE does not exactly specify the vegetation cover. Land cover inconsistent to CLC classes 323, 324 (322 - describes not life form but a special vegetation association)
323 Sclerophyllous vegetation	Broadleaved Evergreen Closed to Open (100-40)% Thicket	21517-121340	A4A20B3XXD1E1-A21	Bushy sclerophyllous vegetation, includes maquis and garrigue. In case of shrub vegetation areas composed of sclerophyllous species such as Juniperus oxycedrus and heathland species such as Buxus spp. or Ostrya carpinifolia with no visible dominance (each species occupy about 50% of the area), priority will be given to sclerophyllous vegetation and the whole area will be assigned class 323.	Note: CORINE extension - This class includes evergreen sclerophyllous bushes and scrubs which compose maquis, garrigue, mattoral and phrygana. Inconsistent land cover to CLC classes 322, 324, (311) 323 refers to vegetation associations not to land cover CORINE does not specifiy vegetation cover, differences depending on actual vegetation association (Maquis = dense, Garrigue = discontinuous)

CLC class	LCCLabel	LCCCode	LCCLevel	CORINE description	Translation Notes
324 Transitional wood-land-scrub	Closed to Open (100-40)% Woody Vegetation // Closed to Open (100-40)% Woody Vegetation with Herbaceous Layer	21441-121340 // 21548-121340	A1A20-A21 // A1A20B1XXX XXXF2F4F7G 4-A21	Bushy or herbaceous vegetation with scattered trees. Can represent either woodland degradation or forest regeneration/recolonisation.	Note: CORINE extension - Areas of natural developmental forest formations (young broad–leaved and coniferous wood species with herbaceous vegetation and dispersed solitary trees) for instance; in abandoned meadows and pastures or after calamities of various origin, part of this class may be also various degenerative stages of forest caused by industrial pollution, etc. Inconsistencies: CORINE generally does specifiy a tree cover **less than 30 %**. In case of recolonization/regeneration of arable land/natural grassland the tree cover is specified with **more than 30 %** (special case?) contradicting earlier definitions and producing overlaps to CLC classes 31x, 243, 244. Additional overlaps to classes 322, 323 CLC class 324 refers to a process (not really to actual land cover) Classifier "Woody" is used in place of a thematic mixture of numerous classes; this is a concession to the inconsistency of the class description in favour of clearness.
3.3 Open spaces with little or no vegetation					
331 Beaches, dunes, and sand plains	Loose And Shifting Sands // Bare Rock And/Or Coarse Fragments - Gravels	6006 // 6002-8(1)[Z331]	A6 // A3-A14Z331	Beaches, dunes and expanses of sand or pebbles in coastal or continental locations, including beds of stream channels with torrential regime.	Note: CORINE extension - This class includes supra-littoral beaches and dunes developed at the back of the beach from high water mark towards land. User defined attribute Z331 – Gravel accumulation along stream channels Slight land cover inconsistency to CLC class 332 (CORINE does not include other gravel occurrences than defined in Z331)

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CLC class	LCCLabel	LCCCode	LCCLevel	CORINE description	Translation Notes
332 Bare rocks	Bare Rock And/Or Coarse Fragments // Herbaceous Sparse Vegetation	6002 // 20058	A3 // A2A14	Scree, cliffs, rock outcrops, including active erosion, rocks and reef flats situated above the high-water mark.	Note: Further guidelines of CORINE: Includes sparsely vegetated areas where 75 % of the land surface is covered by rocks. However, following the specifications of class 333 the vegetation cover must not exceed 15 % and the area will be classified as 332 if the ground cover exceeds 85 % of the surface.
333 Sparsely vegetated areas	Herbaceous Open (40 - (20-10)%) Vegetation	20037-3012	A2A11-A13	Includes steppes, tundra and badlands. Scattered high-altitude vegetation.	15 – 40 % vegetation cover vs. CORINE's 15 – 50 % / Note: CORINE extension - Scattered vegetation is composed of gramineous and/or ligneous and semi-ligneous species for determining the ground cover percentage, excluding cryptogams.
334 Burnt areas	Natural And Semi-Natural Primarily Terrestrial Vegetation	0004(3)[Z334]	A12Z334	Areas affected by recent fires, still mainly black.	Note: CORINE extension - This class includes burnt forest areas, moors and heathlands, transitory forest-shrub formations, areas with sparse vegetation. CORINE includes all natural and semi-natural vegetated areas, burns are considered if they are younger than three years and when they are still visible in the satellite images. 'Burnt' does refer to an environmental event – for that reason it is inconsistent regarding land cover Without describing actual land cover translation becomes arbitrary, e.g. one could consider to add a mixed class 'Natural and Semi-Natural Primarily Terrestrial Vegetation / Bare Area(s)' and/or a pure 'Bare Area(s)' part if necessary since the vegetation affected by fire may possibly no longer exist and the land cover actually is 'bare'. User defined attribute Z334 - Burnt

CLC class	LCCLabel	LCCCode	LCCLevel	CORINE description	Translation Notes
335 Glaciers and perpetual snow	Perennial Ice // Perennial Snow	8009 // 8006	A3B1 // A2B1	Land covered by glaciers or permanent snowfields.	Note: CORINE includes a possible share of bare rock cover up to 50 %, however, it is impossible to include two cartographic mixtures in a thematically mixed class.

4 Wetlands
4.1 Inland wetlands

CLC class	LCCLabel	LCCCode	LCCLevel	CORINE description	Translation Notes
411 Inland marshes	Closed to Open (100-40)% Herbaceous Vegetation	42155-60686	A2A20-A21	Low-lying land usually flooded in winter, and more or less saturated by water all year round.	Note: CORINE extension - This class includes non-forested areas of low-lying land flooded or liable to flooding by fresh, stagnant or circulating water. Covered by specific low ligneous, semi-ligneous or herbaceous vegetation. CORINE does not specify a vegetation cover, another option is to define 15 – 100 %.
412 Peat bogs	Closed to Open Herbaceous Vegetation / Closed to Open Lichens/Mosses. // Bare Soil And/Or Other Unconsolidated Material(s)	42155 / 422606005(1)[Z412]	A2A20 / A7A20 // A5Z412	Peatland consisting mainly of decomposed moss and vegetable matter. May or may not be exploited.	Notes: CORINE does not specify a vegetation cover. 'Peat bogs' does not refer to land cover, hence causes inconsistency (vegetated, bare soil, but wooded peat bogs are part of classes 31x) User defined attribute Z412 – Peat extracting areas

4.2 Maritime wetlands

CLC class	LCCLabel	LCCCode	LCCLevel	CORINE description	Translation Notes
421 Salt marshes	Closed to Open Herbaceous Vegetation Water Quality: Saline Water	42155-R3	A2A20-R3	Vegetated low-lying areas, above the high-tide line, susceptible to flooding by seawater. Often in the process of filling in, gradually being colonized by halophilic plants.	Notes: CORINE does not specify a vegetation cover. Inland salt marshes are not included (class 411) – but there is no inconsistency to be reported since class 421 is part of the 'Coastal wetlands' category.
422 Salines	Shallow Artificial Perennial Waterbodies (Standing) Salinity: Brine // Shallow Artificial Non-Perennial Waterbodies (Standing) (Surface Aspect: Bare Soil) Salinity: Brine	7013-5-V5 // 7019-7-V5	A1B1C2-A5-V5 // A1B2C2-A5B4-V5	Salt-pans, active or in process of abandonment. Sections of salt marsh exploited for the production of salt by evaporation. They are clearly distinguishable from the rest of the marsh by their parcellation and embankment systems.	Notes: Referring to land use, not lc Salinity in LCCS: The TDS scale is obsolete and should be replaced with the psu scale. LCCS does not offer the possibility to simply define 'saline', a degree of salinity always has to be specified.

CLC class	LCCLabel	LCCCode	LCCLevel	CORINE description	Translation Notes
423 Intertidal flats	Tidal Area	8004	A1B3	Generally unvegetated expanses of mud, sand or rock lying between high and low water marks. 0 m contour on maps.	Note: CORINE extension - Warning: 0 m marine contour on maps is not always based on the same reference system and might differ up to 2 m between European countries.

5 Water bodies
5.1 Inland waters

CLC class	LCCLabel	LCCCode	LCCLevel	CORINE description	Translation Notes
511 Water courses	Natural Waterbodies (Flowing) // Artificial Waterbodies (Flowing)	8001-1 // 7001-1	A1-A4 // A1-A4	Natural or artificial water-courses serving as water drainage channels. Includes canals. Minimum width for inclusion: 100 m.	
512 Water bodies	Natural Waterbodies (Standing) // Artificial Waterbodies (Standing)	8001-5 // 7001-5	A1-A5 // A1-A5	Natural or artificial stretches of water.	

5.2 Marine waters

CLC class	LCCLabel	LCCCode	LCCLevel	CORINE description	Translation Notes
521 Coastal lagoons	Natural Waterbodies (Standing) // Artificial Waterbodies (Standing)	8001-5(5)[Z521] // 7001-5(5)[Z521]	A1-A5Z521 // A1-A5Z521	Stretches of salt or brackish water in coastal areas which are separated from the sea by a tongue of land or other similar topography. These water bodies can be connected to the sea at limited points, either permanently or for parts of the year only.	Notes: LCCS clone of class 512, 'Artificial Waterbodies' included since artificially separated lagoons may occur following CLC. Degrees of salinity could be added if preferred, only they have to be mentioned individually (five possibilities). One should be able to define saline water without being forced to specify the degree of salinity. User defined attribute Z521 – Coastal lagoons, salt or brackish water
522 Estuaries	Tidal Area (Flowing) Salinity: Slightly Saline	8004-1-V2	A1B3-A4-V2	The mouth of a river within which the tide ebbs and flows.	Notes: cf. note on class 521, there is no possibility to define 'brackish' water. 'Moderately Saline' could be added if necessary.
523 Sea and ocean	Perennial Natural Waterbodies Salinity: Moderately Saline // Perennial Natural Waterbodies Salinity: Very Saline // Perennial Natural Waterbodies Salinity: Brine	8002-V3 // 8002-V4 // 8002-V5	A1B1-V3 // A1B1-V4 // A1B1-V5	Zone seaward of the lowest tide limit.	Note: cf. note 2 on class 521. If preferred a user defined attribute ('salt water') could complement a single class.

A3 IGBP DISCover

IGBP class	IGBP description	LCCCode	LCCLevel	LCCLabel	Translation Notes
Evergreen Needleleaf Forests	Lands dominated by woody vegetation with a percent cover > 60 % and height exceeding 2 meters. Almost all trees remain green all year. Canopy is never without green foliage.	20092	A3A10B2XXD2E1	Needleleaved Evergreen Trees	LCCS limits tree height classification to > 3 m
Evergreen Broadleaf Forests	Lands dominated by woody vegetation with a percent cover > 60 % and height exceeding 2 meters. Almost all trees and shrubs remain green year round. Canopy is never without green foliage.	20089	A3A10B2XXD1E1	Broadleaved Evergreen Trees	LCCS limits tree height classification to > 3 m
Deciduous Needleleaf Forests	Lands dominated by woody vegetation with a percent cover > 60 % and height exceeding 2 meters. Constists of seasonal needleleaf tree communities with an annual cycle of leaf-on and leaf-off periods.	20093	A3A10B2XXD2E2	Needleleaved Deciduous Trees	LCCS limits tree height classification to > 3 m
Deciduous Broadleaf Forests	Lands dominated by woody vegetation with a percent cover > 60 % and height exceeding 2 meters. Constists of broadleaf tree communities with an annual cycle of leaf-on and leaf-off periods.	20090	A3A10B2XXD1E2	Broadleaved Deciduous Trees	LCCS limits tree height classification to > 3 m
Mixed Forests	Lands dominated by woody vegetation with a percent cover > 60 % and height exceeding 2 meters. Consists of tree communities with interspersed mixtures or mosaics of the other four forest types. None of the forest types exceeds 60 % of landscape.	20006(3)[Z5]	A3A10B2Z5	Closed Trees	LCCS limits tree height classification to > 3 m Tricky IGBP definition, since none of the other 4 forest types should exceed a 60 % coverage. However, often not all those types are present so that one type may exceed this threshold easily. User defined attribute Z5 – IGBP Mixed Forests

IGBP class	IGBP description	LCCCode	LCCLevel	LCCLabel	Translation Notes
Closed Shrublands	Lands with woody vegetation less than 2 meters tall and with shrub canopy cover > 60 %. The shrub foliage can be either evergreen or deciduous.	20018-13476	A4A10B3-B9	Closed Medium High Shrubland (Thicket)	LCCS defines shrubland between 5 m and 0.3 m
Open Shrublands	Lands with woody vegetation less than 2 meters tall and with shrub canopy cover between 10 - 60 %. The shrub foliage can be either evergreen or deciduous.	20022-13476	A4A11B3-B9	Open Medium High Shrubs (Shrubland)	LCCS defines shrubland between 5 m and 0.3 m
Woody Savannas	Lands with herbaceous and other understory systems, and with forest canopy cover between 30 - 60 %. The forest cover height exceeds 2 meters.	20317-1	A3A11B2XXXX XXF2F4F7G4-A12	((70-60) - 40%) Woodland with Herbaceous Layer	LCCS limits tree height classification to > 3 m Lower treshold LCCS vs. IGBP: 40 vs. 30 % "and other understory systems" cannot be specified within LCCS
Savannas	Lands with herbaceous and other understory systems, and with forest canopy cover between 10 - 30 %. The forest cover height exceeds 2 meters.	20317-3012	A3A11B2XXXX XXF2F4F7G4-A13	(40 - (20-10)%) Woodland with Herbaceous Layer	Upper treshold LCCS vs. IGBP: 40 vs. 30 % "and other understory systems" cannot be specified within LCCS
Grasslands	Lands with herbaceous types of cover. Tree and shrub cover is less than 10 %.	21453	A2A20	Herbaceous Closed to Open Vegetation	
Permanent Wetlands	Lands with a pemanent mixture of water and herbaceous or woody vegetation. The vegetation can be present in either salt, brackish, or fresh water.	0007	A24	Natural And Semi-Natural Aquatic or Regularly Flooded Vegetation	
Croplands	Lands covered with temporary crops followed by harvest and a bare soil period (e.g., single and multiple cropping systems). Note that perennial woody crops will be classified as the appropriate forest or shrub land cover type.	10025	A3	Herbaceous Crop(s)	
Urban and Built-Up Lands	Land covered by buildings and other man-made structures.	0010	B15	Artificial Surfaces and Associated Area(s)	

IGBP class	IGBP description	LCCCode	LCCLevel	LCCLabel	Translation Notes
Cropland/Natural Vegetation Mosaics	Lands with a mosaic of croplands, forests, shrubland, and grasslands in which no one component comprises more than 60 % of the landscape.	10025 / 0004	A3 / A12	Herbaceous Crop(s) / Natural And Semi-Natural Primarily Terrestrial Vegetation	Cropland - being the crucial part of the class - was defined as first part although the share of natural vegetation could surpass that of the cropland component. A more detailed description specifying the single natural life forms mentioned in the IGBP description cannot be realised with LCCS.
Snow and Ice	Lands under snow/ice cover throughout the year.	8005 // 8008	A2 // A3	Snow // Ice	
Barren or Sparsely Vegetated	Lands with exposed soil, sand, rocks, or snow and never has more than 10 % vegetated cover during any time of the year.	0011 // 20058 // 20055	B16 // A2A14 // A4A14	Bare Area(s) // Herbaceous Sparse Vegetation // Sparse Shrubs	LCCS specifies < 4 % vegetation cover for bare areas, 1 – 10/20 % for sparsely vegetated areas
Water Bodies	Oceans, seas, lakes, reservoirs, and rivers. Can be either fresh or salt-water bodies.	7001 // 8001	A1 // A1	Artificial Waterbodies // Natural Waterbodies	

A4 UMd

UMd class	UMd description	LCCCode	LCCLevel	LCCLabel	Translation Notes
Water Bodies	Oceans, seas, lakes, reservoirs, and rivers. Can be either fresh or salt water. Note that this class is derived from a land/water mask.	7001 // 8001	A1 // A1	Artificial Waterbodies // Natural Waterbodies	-
Evergreen Needleleaf Forests	Lands dominated by trees with a percent canopy cover >60% and height exceeding 5m. Almost all trees remain green all year. Canopy is never without green foliage.	20092	A3A10B2XXD2 E1	Needleleaved Evergreen Trees	LCCS limits tree height classification to > 3 m
Evergreen Broadleaf Forests	Lands dominated by trees with a percent canopy cover > 60% and height exceeding 5m. Almost all trees remain green all year. Canopy is never without green foliage.	20089	A3A10B2XXD1 E1	Broadleaved Evergreen Trees	LCCS limits tree height classification to > 3 m
Deciduous Needleleaf Forests	Lands dominated by trees with a percent canopy cover >60% and height exceeding 5m. Trees shed their leaves simultaneously in response to cold seasons.	20093	A3A10B2XXD2 E2	Needleleaved Deciduous Trees	LCCS limits tree height classification to > 3 m
Deciduous Broadleaf Forests	Lands dominated by trees with a percent canopy cover >60% and height exceeding 5m. Trees shed their leaves simultaneously in response to dry or cold seasons.	20090	A3A10B2XXD1 E2	Broadleaved Deciduous Trees	LCCS limits tree height classification to > 3 m
Mixed Forests	Lands dominated by trees with a percent canopy cover >60% and height exceeding 5m. Consists of tree communities with interspersed mixtures or mosaics of needleleaf and broadleaf forest types. Neither type has <25% or >75% landscape coverage.	20090-15045 // 20092-15045	A3A10B2XXD1 E2-E3 // A3A10B2XXD2 E1-E3	Mixed Trees // Mixed Trees	LCCS limits tree height classification to > 3 m.

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UMd class	UMd description	LCCCode	LCCLevel	LCCLabel	Translation Notes
Woodlands	Lands with herbaceous or woody under-stories and tree canopy cover of >40% and <60%. Trees exceed 5m in height and can be either evergreen or deciduous.	20317-1 // 20314-1	A3A11B2XXXX XXF2F4F7G4-A12 // A3A11B2XXXX XXF2F6F7G3-A12	((70-60) - 40%) Woodland with Herbaceous Layer // ((70-60) - 40%) Woodland with Shrubs	LCCS limits tree height classification to > 3 m.
Wooded Grasslands / Shrublands	Lands with herbaceous or woody under-stories and tree canopy cover of >10% and <40%. Trees exceed 5m in height and can be either evergreen or deciduous.	20317-3012 // 20314-3012	A3A11B2XXXX XXF2F4F7G4-A13 // A3A11B2XXXX XXF2F6F7G3-A13	(40 - (20-10)%) Woodland with Herbaceous Layer // (40 - (20-10)%) Woodland with Shrubs	LCCS limits tree height classification to > 3 m.
Closed Bushlands or Shrublands	Lands dominated by bushes or shrubs. Bush and shrub percent canopy cover is >40%. Bushes do not exceed 5m in height. Shrubs or bushes can be either evergreen or deciduous. Tree canopy cover is <10%. The remaining cover is either barren or herbaceous.	21449-121340	A4A20-A21	Closed to Open (100-40)% Shrubland (Thicket)	Although explicitly mentioned a possible additional herbaceous cover was neglected since the resulting class only would form a subclass of this definition.
Open Shrublands	Lands dominated by shrubs. Shrub can-opy cover is >10% and <40%. Shrubs do not exceed 2m in height and can be either evergreen or deciduous. The remaining cover is either barren or of annual herba-ceous type.	20022-4439	A4A11B3-A13B9	Open (40 - (20-10)%) Medium High Shrubs (Shrubland)	Although explicitly mentioned a possible additional herbaceous cover was neglected since the resulting class only would form a subclass of this definition.
Grasslands	Lands with continuous herbaceous cover and <10% tree or shrub canopy cover.	21455	A2A20B4C1	Continuous Closed to Open Herbaceous Vegetation	Cover density was defined in a broad range up from 15 %. Though this threshold is not apparent from the UMd description it is corresponding to the 'Barren' class definition.

UMd class	UMd description	LCCCode	LCCLevel	LCCLabel	Translation Notes
Croplands	Lands with >80% of the landscape covered in crop-producing fields. Note that perennial woody crops will be classified as the appropriate forest or shrubs land cover type.	10027	A3XXB5	Continuous Field(s) Of Herbaceous Crop(s)	"continuous" within a LCCS single class is defined as "inside the mapping unit, the fields take up more than 80 percent"
Barren	Lands of exposed soil, sand, rocks, snow or ice which never have more than 10% vegetated cover during any time of year	0011 // 8005 // 8008	B16 // A2 // A3	Bare Area(s) // Snow // Ice	Heterogeneous class, problematic for cross validation with other legends.
Urban and Builtup	Lands covered by buildings or other man-made structures. Note that this class is not mapped from the AVHRR imagery but is developed from the populated places layer that is part of the Digital Chart of the World (Danko 1992).	5001	A1	Built Up Area(s)	-

Annex B – Land cover classifiers used

B1   Anderson Classification System

Classifier	Classifier Label
Dichotomous Phase	
A11	Cultivated and Managed Terrestrial Area(s)
B15	Artificial Surfaces and Associated Area(s)
B16	Bare Area(s)
Cultivated and Managed Terrestrial Area(s)	
A1	Tree Crops
A10	Deciduous
A2	Shrub Crops
A3	Herbaceous Crops
A6	Urban Vegetated Area(s)
A7	Broadleaved
S0610	Grapes (Vitis vinifera)
S6	Fruits & Nuts
W8	Orchard(s)
Natural And Semi-Natural Primarily Terrestrial Vegetation	
A11	Open General (70-60) - (20-10)% (Main Layer)
A13	Very Open 40 - (10-20)% (Main Layer)
A14	Sparse (20-10) - 1% (Main Layer)
A2	Herbaceous Vegetation (Main Layer)
A20	Closed to Open (100-15)%
A21	Closed to Open (100-40)%
A3	Trees (Main Layer)
A4	Shrubs (Main Layer)
A7	Lichens/Mosses
B2	> 30 - 3m (Trees Height Main Layer)
D1	Broadleaved
D2	Needleleaved
E1	Evergreen
E2	Deciduous
Natural And Semi-Natural Aquatic or Regularly Flooded Vegetation	
A2	Herbaceous Vegetation (Main Layer)
A20	Closed to Open (100-15)%
A3	Trees (Main Layer)
A4	Shrubs (Main Layer)
Artificial Surfaces and Associated Area(s)	
A1	Built Up Area(s)
A12	Industrial And/Or Other Area(s)
A13	Urban Area(s)
A14	High Density
A17	Scattered Density
A2	Non Built Up Area(s)
A22	Breeding Centre
A27	Heavy Industrial Area (e.g. Ores, Timber, Coal, Chemicals, etc.)
A3	Linear
A30	Light Industrial Area (Design, Assembly, Finishing, Processing, Packaging of Products)
A4	Non-Linear (Feature)
A6	Extraction Site(s)

Classifier	Classifier Label
Bare Area(s)	
A1	Consolidated Material(s)
A14	Gravel
A2	Unconsolidated Material(s)
A3	Bare Rock And/Or Coarse Fragments
A5	Bare Soil And/Or Other Unconsolidated Material(s)
A6	Loose and Shifting Sands
A7	Bare Rock
B13	Salt Falts
Artificial Waterbodies, Snow and Ice	
A1	Artificial Waterbodies
A4	(Flowing)
A5	(Standing)
Natural Waterbodies, Snow and Ice	
A1	Inland Water
A2	Snow
A3	Ice
A4	(Flowing)
A5	(Standing)
A6	(Moving)
B1	Perennial
B2	Non-Perennial Or Seasonal
B3	Tidal Area
C2	Shallow
Environmental attributes	
O8	Polar Arctic
User-defined codes	
Z11	Residential
Z12	Commercial and Services
Z14	Transportation, Communications, and Utilities
Z16	Mixed (Urban or Built-up)
Z22	Tree Nurseries
Zs22	Ornamental Horticulture
Z43	Mixed (Evergreen & Deciduous)
Z54	Bays
Z72	Beaches
Z76	Transitional
Z77	Mixed (Barren)

B2   Corine Land Cover

Classifier	Classifier Label
Dichotomous Phase	
A11	Cultivated and Managed Terrestrial Area(s)
A12	Natural And Semi-Natural Primarily Terrestrial Vegetation
B16	Bare Area(s)
Cultivated and Managed Terrestrial Area(s)	
A1	Tree Crops
A10	Deciduous
A2	Shrub Crops
A3	Herbaceous Crops
A4	Graminoid Crops
A6	Urban Vegetated Area(s)
A7	Broadleaved
A9	Evergreen
B2	Small Sized Field(s)
C17	With Simultaneous Period (Second Crop)
C2	Intercropped (Second Crop)
C3	One Additional Crop
C5	Tree Crop (Additional Crop)
C6	Shrub Crop (Additional Crop)
D3	Irrigated (General)
D4	Surface Irrigated
S0308	Rice (Oryza spp.)
S0610	Grapes (Vitis vinifera)
S0910	Olive (Olea europaea L.)
S6	Fruits & Nuts
S8	Beverages
Natural And Semi-Natural Primarily Terrestrial Vegetation	
A1	Woody Vegetation (Main Layer)
A11	Open General (70-60) - (20-10)% (Main Layer)
A13	Very Open 40 - (10-20)% (Main Layer)
A14	Sparse (20-10) - 1% (Main Layer)
A2	Herbaceous Vegetation (Main Layer)
A20	Closed to Open (100-15)%
A21	Closed to Open (100-40)%
A3	Trees (Main Layer)
A4	Shrubs (Main Layer)
A6	Graminoids
B1	7 - 2m (Height for Woody Vegetation Main Layer)
B2	> 30 - 3m (Trees Height Main Layer)
B3	5 - 0.3m (Shrubs Height Main Layer)
C1	Continuous (Vegetation Main Pattern)
D1	Broadleaved
D2	Needleleaved
E1	Evergreen
E2	Deciduous
E3	Mixed
F2	Second and/or Third Layer Present
F4	Herbaceous Vegetation (Second or Third Layer)
F7	Closed (> 70-60%) To Open (70-60) - (20-10)% (Second or Third Layer)
G4	3 - 0.03m (Herbaceous Height Second or Third Layer)
Natural And Semi-Natural Aquatic or Regularly Flooded Vegetation	
A2	Herbaceous Vegetation (Main Layer)

Classifier	Classifier Label
A20	Closed to Open (100-15)%
A21	Closed to Open (100-40)%
A7	Lichens/Mosses

Artificial Surfaces and Associated Area(s)

A1	Built Up Area(s)
A10	Railway(s)
A12	Industrial And/Or Other Area(s)
A13	Urban Area(s)
A14	High Density
A15	Medium Density
A16	Low Density
A17	Scattered Density
A2	Non Built Up Area(s)
A21	Airport
A3	Linear
A32	Port Area (including Docks, Shipyards, Locks)
A38	Sports and Leisure Facilities
A4	Non-Linear (Feature)
A44	Other
A5	Waste Dump(s)/Deposit(s)
A6	Extraction Site(s)
A7	Road(s)

Bare Area(s)

A14	Gravel
A3	Bare Rock And/Or Coarse Fragments
A6	Loose and Shifting Sands

Artificial Waterbodies, Snow and Ice

A1	Artificial Waterbodies
A4	(Flowing)
A5	(Standing)
B1	Perennial
B2	Non-Perennial
B4	(Surface Aspect: Bare Soil)
C2	Shallow
V5	Brine

Natural Waterbodies, Snow and Ice

A1	Inland Water
A2	Snow
A3	Ice
A4	(Flowing)
A5	(Standing)
B1	Perennial
B3	Tidal Area
V2	Slightly Saline
V3	Moderately Saline
V4	Very Saline
V5	Brine

Environmental attributes

R3	Saline Water

User defined codes

Zp122	Installations associated to roads and railways
Z211	Nurseries of fruit trees and shrubs
Z244	Grazing land (Pasture)
Z331	Gravel accumulations along stream channels
Z334	Burnt
Z412	Peat extracting areas
Z521	Coastal lagoons, salt or brackish water

B3   IGBP DISCover

Classifier   Classifier Label

Dichotomous Phase
A12   Natural And Semi-Natural Primarily Terrestrial Vegetation
A24   Natural And Semi-Natural Aquatic or Regularly Flooded Vegetation
B15   Artificial Surfaces and Associated Area(s)
B16   Bare Area(s)
Cultivated and Managed Terrestrial Area(s)
A3   Herbaceous Crops
Natural And Semi-Natural Primarily Terrestrial Vegetation
A10   Closed > (70-60)% (Main Layer)
A11   Open General (70-60) - (20-10)% (Main Layer)
A12   Open (70-60) - 40% (Main Layer)
A13   Very Open 40 - (10-20)% (Main Layer)
A14   Sparse (20-10) - 1% (Main Layer)
A2   Herbaceous Vegetation (Main Layer)
A20   Closed to Open (100-15)%
A3   Trees (Main Layer)
A4   Shrubs (Main Layer)
B2   > 30 - 3m (Trees Height Main Layer)
B3   5 - 0.3m (Shrubs Height Main Layer)
B9   Medium High 3-0.5m (Shrubs Height Main Layer)
D1   Broadleaved
D2   Needleleaved
E1   Evergreen
E2   Deciduous
F2   Second and/or Third Layer Present
F4   Herbaceous Vegetation (Second or Third Layer)
F7   Closed (> 70-60%) To Open (70-60) - (20-10)% (Second or Third Layer)
G4   3 - 0.03m (Herbaceous Height Second or Third Layer)
Artificial Waterbodies, Snow and Ice
A1   Artificial Waterbodies
Natural Waterbodies, Snow and Ice

A1   Inland Water
A2   Snow
A3   Ice
User defined codes
Z5   IGBP Mixed Forest

B4   UMd

Classifier   **Classifier Label**

Dichotomous Phase
B16   Bare Area(s)
Cultivated and Managed Terrestrial Area(s)
A3   Herbaceous Crops
B5   Continuous (Field Spatial Distribution)
Natural And Semi-Natural Primarily Terrestrial Vegetation
A10   Closed > (70-60)% (Main Layer)
A11   Open General (70-60) - (20-10)% (Main Layer)
A12   Open (70-60) - 40% (Main Layer)
A13   Very Open 40 - (10-20)% (Main Layer)
A2   Herbaceous Vegetation (Main Layer)
A20   Closed to Open (100-15)%
A21   Closed to Open (100-40)%
A3   Trees (Main Layer)
A4   Shrubs (Main Layer)
B2   > 30 - 3m (Trees Height Main Layer)
B3   5 - 0.3m (Shrubs Height Main Layer)
B4   3 - 0.03m (Herbaceous Height Main Layer)
B9   Medium High 3-0.5m (Shrubs Height Main Layer)
C1   Continuous (Vegetation Main Pattern)
D1   Broadleaved
D2   Needleleaved
E1   Evergreen
E2   Deciduous
E3   Mixed
F2   Second and/or Third Layer Present
F4   Herbaceous Vegetation (Second or Third Layer)
F6   Shrubs (Second or Third Layer)
F7   Closed (> 70-60%) To Open (70-60) - (20-10)% (Second or Third Layer)
G3   5 - 0.3m (Shrubs Height Second or Third Layer)
G4   3 - 0.03m (Herbaceous Height Second or Third Layer)
Artificial Surfaces and Associated Area(s)
A1   Built Up Area(s)
Artificial Waterbodies, Snow and Ice
A1   Artificial Waterbodies
Natural Waterbodies, Snow and Ice
A1   Inland Water
A2   Snow
A3   Ice

Annex C – Threshold comparison

C1 Anderson Classification System

ACS class	Feature	ACS threshold	LCCS threshold
1 Urban or Built-up			
11 Residential	n/a	n/a	n/a
12 Commercial and Services	n/a	n/a	n/a
13 Industrial	n/a	n/a	n/a
14 Transportation, Communications, and Utilities	n/a	n/a	n/a
15 Industrial and Commercial Complexes	n/a	n/a	n/a
16 Mixed Urban or Built-up Land	n/a	n/a	n/a
17 Other Urban or Built-up Land	n/a	n/a	n/a
2 Agricultural Land			
21 Cropland and Pasture	n/a	n/a	n/a
22 Orchards, Groves, Vineyards, Nurseries, and Ornamental Horticultural Areas	n/a	n/a	n/a
23 Confined Feeding Operations	n/a	n/a	n/a
24 Other Agricultural Land	n/a	n/a	n/a
3 Rangeland			
31 Herbaceous Rangeland	vegetation cover	not specified	15 – 100 %
32 Shrub and Brush Rangeland	vegetation cover	not specified	15 – 100 %
33 Mixed Rangeland	vegetation cover	not specified	15 – 100 %
4 Forest Land			
41 Deciduous Forest Land	vegetation cover	≥ 10 %	15 – 100 %
	tree height	not specified	≥ 3 m
42 Evergreen Forest Land	vegetation cover	≥ 10 %	15 – 100 %
	tree height	not specified	≥ 3 m
43 Mixed Forest Land	vegetation cover	≥ 10 %	15 – 100 %
	tree height	not specified	≥ 3 m
5 Water			
51 Streams and Canals	n/a	n/a	n/a
52 Lakes	n/a	n/a	n/a
53 Reservoirs	n/a	n/a	n/a
54 Bays and Estuaries	n/a	n/a	n/a
6 Wetland	n/a	n/a	n/a
61 Forested Wetland	vegetation cover	not specified	15 – 100 %
62 Nonforested Wetland	vegetation cover	not specified	15 – 100 %

ACS class	Feature	ACS threshold	LCCS threshold
7 Barren Land			
71 Dry Salt Flats	n/a	n/a	n/a
72 Beaches	n/a	n/a	n/a
73 Sandy Areas other than Beaches	n/a	n/a	n/a
74 Bare Exposed Rock	n/a	n/a	n/a
75 Strip Mines, Quarries and Gravel Pits	n/a	n/a	n/a
76 Transitional Areas	n/a	n/a	n/a
77 Mixed Barren Land	n/a	n/a	n/a
8 Tundra			
81 Shrub and Brush Tundra	vegetation cover	not specified	15 – 100 %
82 Herbaceous Tundra	vegetation cover	not specified	40 – 100 %
83 Bare Ground Tundra	vegetation cover	< 1/3 vegetated	10 – 40 %
84 Wet Tundra	vegetation cover	not specified	15 – 100 %
85 Mixed Tundra	n/a	n/a	n/a
9 Perennial Snow or Ice			
91 Perennial Snowfields	n/a	n/a	n/a
92 Glaciers	n/a	n/a	n/a

C2   *Corine Land Cover*

CLC class	Feature	CLC threshold	LCCS threshold
1 Artificial surfaces			
11 Urban fabric			
111 Continuous urban fabric	impermeable area	≥ 80 %	> 75 %
112 Discontinuous urban fabric	impermeable area	30 – 80 %	30 – 75 %
1.2 Industrial, commercial and transport units			
121 Industrial or commercial units	n/a	n/a	n/a
122 Road and rail networks and associated land	n/a	n/a	n/a
123 Port areas	n/a	n/a	n/a
124 Airports	n/a	n/a	n/a
13 Mine, dump and construction sites			
131 Mineral extraction sites	n/a	n/a	n/a
132 Dump sites	n/a	n/a	n/a
133 Construction sites	n/a	n/a	n/a
14 Artificial, non-agricultural vegetated areas			
141 Green urban areas	n/a	n/a	n/a
142 Sport and leisure facilities	n/a	n/a	n/a
2 Agricultural areas			
21 Arable land			
211 Non-irrigated arable land	n/a	n/a	n/a
212 Permanently irrigated land	n/a	n/a	n/a
213 Rice fields	n/a	n/a	n/a
22 Permanent crops			
221 Vineyards	n/a	n/a	n/a
222 Fruit trees and berry plan-tations	n/a	n/a	n/a
223 Olive groves	n/a	n/a	n/a
23 Pastures			
231 Pastures	vegetation cover	40 – 100 %	40 – 100 %
24 Heterogeneous agricultural areas			
241 Annual crops associated with permanent crops	n/a	n/a	n/a
242 Complex cultivation pat-terns	n/a	n/a	n/a
243 Land principally occupied by agriculture, with significant areas of natural vegetation	agricultural vegetation natural vegetation	25 – 75 % 25 – 75 %	> 50 % < 50 %
244 Agro-forestry areas	n/a	n/a	n/a

CLC class	Feature	CLC threshold	LCCS threshold
3 Forest and semi-natural areas			
31 Forests			
311 Broad-leaved forests	crown cover	> 30 %	40 – 100 %
	tree height	≥ 5 m	≥ 3 m
312 Coniferous forests	crown cover	> 30 %	40 – 100 %
	tree height	≥ 5 m	≥ 3 m
313 Mixed forests	crown cover	> 30 %	40 – 100 %
	tree height	≥ 5 m	≥ 3 m
32 Scrub and/or herbaceous vegetation associations			
321 Natural grasslands	vegetation cover	not specified	40 – 100 %
322 Moors and heathland	vegetation cover	not specified ("closed cover")	40 – 100 %
323 Sclerophyllous vegetation	vegetation cover	not specified	40 – 100 %
324 Transitional woodland-scrub	vegetation cover	various specifications, not consistent	various specifications (depending on life form)
33 Open spaces with little or no vegetation			
331 Beaches, dunes, and sand plains	n/a	n/a	n/a
332 Bare rocks	vegetation cover	0 – 15 % (specifications inconsistent)	0 – 15 %
333 Sparsely vegetated areas	vegetation cover	15 – 50 %	15 – 40 %
334 Burnt areas	n/a	n/a	n/a
335 Glaciers and perpetual snow	snow/ice cover	≥ 50 %	not specified
4 Wetlands			
41 Inland wetlands			
411 Inland marshes	vegetation cover	not specified	40 – 100 %
412 Peat bogs	vegetation cover	not specified	15 – 100 %
42 Maritime wetlands			
421 Salt marshes	vegetation cover	not specified	15 – 100 %
422 Salines	n/a	n/a	n/a
423 Intertidal flats	n/a	n/a	n/a
5 Water bodies			
51 Inland waters			
511 Water courses	n/a	n/a	n/a
512 Water bodies	n/a	n/a	n/a
52 Marine waters			
521 Coastal lagoons	n/a	n/a	n/a
522 Estuaries	n/a	n/a	n/a
523 Sea and ocean	n/a	n/a	n/a

C3 IGBP DISCover

IGBP class	Feature	IGBP threshold	LCCS threshold
1 Evergreen Needleleaf Forests	canopy cover	> 60 %	> 60/70 %
	tree height	> 2 m	≥ 3 m
2 Evergreen Broadleaf Forests	canopy cover	> 60 %	> 60/70 %
	tree height	> 2 m	≥ 3 m
3 Deciduous Needleleaf Forests	canopy cover	> 60 %	> 60/70 %
	tree height	> 2 m	≥ 3 m
4 Deciduous Broadleaf Forests	canopy cover	> 60 %	> 60/70 %
	Tree height	> 2 m	≥ 3 m
5 Mixed Forests	canopy cover	> 60 %	> 60/70 %
	Tree height	> 2 m	≥ 3 m
6 Closed Shrublands	canopy cover	> 60 %	> 60/70 %
	Height	< 2 m	0.5 – 3 m
7 Open Shrublands	canopy cover	10 – 60 %	10/20 – 60/70 %
	Height	< 2 m	0.5 – 3 m
8 Woody Savannas	canopy cover	30 – 60 %	40 – 60/70 %
	Tree height	> 2 m	≥ 3 m
9 Savannas	canopy Cover	10 – 30 %	10/20 – 40 %
	Tree height	> 2 m	≥ 3 m
10 Grasslands	Vegetation cover	not specified	15 – 100 %
11 Permanent Wetlands	n/a	n/a	n/a
12 Cropland	n/a	n/a	n/a
13 Urban and Built-up	n/a	n/a	n/a
14 Cropland/Natural Vegetation Mosaics	Share of a single mosaic component	≤ 60 %	1st part dominating (>50 %, < 80 %) 20 % minimum (2nd part)
15 Snow and Ice	n/a	n/a	n/a
16 Barren or Sparsely Vegetated	Vegetation cover	≤ 10 %	10 - 20 %
17 Water Bodies	n/a	n/a	n/a

C4 UMd

UMd class	Feature	UMd threshold	LCCS threshold
0 Water Bodies	n/a	n/a	n/a
1 Evergreen Needleleaf Forests	Canopy cover	> 60 %	> 60/70 %
	Tree height	> 5 m	≥ 3 m
2 Evergreen Broadleaf Forests	Canopy cover	> 60 %	> 60/70 %
	Tree height	> 5 m	≥ 3 m
3 Deciduous Needleleaf Forests	Canopy cover	> 60 %	> 60/70 %
	Tree height	> 5 m	≥ 3 m
4 Deciduous Broadleaf Forests	Canopy cover	> 60 %	> 60/70 %
	Tree height	> 5 m	≥ 3 m
5 Mixed Forests	Canopy cover	> 60 %	> 60/70 %
	Tree height	> 5 m	≥ 3 m
6 Woodlands	Canopy cover	40 – 60 %	40 – 60/70 %
	Tree height	> 5 m	≥ 3 m
7 Wooded Grass-lands/Shrublands	Canopy cover	10 – 40 %	10/20 – 40 %
	Tree Height	> 5 m	≥ 3 m
8 Closed Bushlands or Shrublands	Canopy cover	> 40 %	40 – 100 %
	Height	< 5 m	< 5 m
9 Open Shrublands	Canopy Cover	10 – 40 %	10/20 – 40 %
	Height	< 2 m	0.5 – 3 m
10 Grasslands	Vegetation Cover	-	15 – 100 %
11 Cropland	Crop producing area	> 80 %	> 80 %
12 Barren	Vegetation cover	≤ 10 %	1 – 10/20 %
13 Urban and Built-up	n/a	n/a	n/a

Annex D – Class translation sheets

D1 Anderson Classification System

G.L.C.N. – TRANSLATION UNIT	
Country: USA	**Legend: Anderson Classification System**

Original Class name: Residential	

Original Description: Residential land uses range from high density, represented by the multiple-unit structures of urban cores, to low density, where houses are on lots of more than an acre, on the periphery of urban expansion.

Map code:	Original: 11	Translated: 11

LCCS translation		

LCCLabel: Non-Linear Built Up Area(s)

Classifiers: A4Z11

A4   Non-Linear (Feature)
Z11   Residential

LCCCode: 5003(2)[Z11]

Notes:

- Land use category
- No quantitative density specifications

Consistency of original class definition:	Insufficient		Fair ✖		Good		very good
Correspondence of range values and lifeform definition:	Yes				No		
Confidence level of translation:	Fair		Good			very good ✖	

G.L.C.N. – TRANSLATION UNIT	
Country: USA	**Legend: Anderson Classification System**

Original Class name: Commercial and Services

Original Description: Commercial areas are those used predominantly for the sale of products and services. Institutional land uses, such as the various educational, religious, health, correctional, and military facilities are also components of this category.

Map code:	Original: 12	Translated: 12

LCCS translation

LCCLabel: Industrial And/Or Other Area(s)

Classifiers: A4-A12Z12

A4	Non-Linear (Feature)
A12	Industrial And/Or Other Area(s)
Z12	Commercial and Services

LCCCode: 5003-8(2)[Z12]

Notes:

- Land use category
- No density specifications
- Inconsistency: Overlaps with class 15 Industrial and Commercial Complexes

Consistency of original class definition:	Insufficient ✖		Fair		Good		very good
Correspondence of range values and lifeform definition:	Yes				No		
Confidence level of translation:	Fair		Good			very good ✖	

G.L.C.N. – TRANSLATION UNIT	
Country: USA	**Legend: Anderson Classification System**

Original Class name: Industrial

Original Description: Industrial areas include a wide array of land uses from light manufacturing to heavy manufacturing plants.

Map code:	Original: 13	Translated: 13

LCCS translation

LCCLabel: Industrial And/Or Other Area(s) Built-Up Object: Heavy Industrial Area (e.g. Ores, Timber, Coal, Chemicals, etc.) // Industrial And/Or Other Area(s) Built-Up Object: Light Industrial Area (Design, Assembly, Finishing, Processing, Packaging of Products)

Classifiers: A4-A12-A27 // A4-A12-A30

A4 Non-Linear (Feature)
A12 Industrial And/Or Other Area(s)
A27 Heavy Industrial Area (e.g. Ores, Timber, Coal, Chemicals, etc.)
A30 Light Industrial Area (Design, Assembly, Finishing, Processing, Packaging of Products)

LCCCode: 5003-8-A27 // 5003-8-A30

Notes:

- Land use category
- No density specifications
- Inconsistency: Overlaps with class 15 Industrial and Commercial Complexes

Consistency of original class definition:	Insufficient ✖		Fair		Good		very good	
Correspondence of range values and lifeform definition:		Yes				No		
Confidence level of translation:	Fair			Good			very good ✖	

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G.L.C.N. – TRANSLATION UNIT

Country: USA	Legend: Anderson Classification System

Original Class name: Transportation, Communications, and Utilities

Original Description: Highways and railways including rights-of-way, areas used for interchanges, and service and terminal facilities. Rail facilities include stations, parking lots, roundhouses, repair and switching yards, and related areas, as well as overland track and spur connections of sufficient width for delineation at mapping scale. Airports including facilities (runways, intervening land, terminals, service buildings, navigation aids, fuel storage, parking lots, and a limited buffer zone), seaports, and major lake ports (including docks, shipyards, drydocks, locks, and waterway control structures). Terminal facilities generally include the associated freight and warehousing functions. Communications and utilities areas such as those involved in processing, treatment, and transportation of water, gas, oil, and electricity and areas used for airwave communications are also included in this category.

Map code:	Original: 14	Translated: 14

LCCS translation

LCCLabel: Linear Built Up Area(s) // Industrial And/Or Other Area(s)

Classifiers: A3 // A4-A12Z14

A3	Linear
A4	Non-Linear (Feature)
A12	Industrial And/Or Other Area(s)
Z14	Transportation, Communications, and Utilities

LCCCode: 5002 // 5003-8(3)[Z14]

Notes:

- Land use category
- No density specifications
- Inconsistencies: "related areas" (cf. description) may overlap with other 1x classes, and are arbitrary

Consistency of original class definition:	Insufficient ✖	Fair	Good	very good
Correspondence of range values and lifeform definition:	Yes		No	
Confidence level of translation:	Fair	Good ✖	very good	

G.L.C.N. – TRANSLATION UNIT

Country: USA	Legend: Anderson Classification System

Original Class name: Industrial and Commercial Complexes

Original Description: Industrial and commercial land uses that typically occur together or in close functional proximity. Such areas commonly are labelled with terminology such as "Industrial Park," but since functions such as warehousing, wholesaling, and occasionally retailing may be found in the same structures or nearby, the more inclusive category title has been adopted.

Map code:	Original: 15	Translated: 15

LCCS translation

LCCLabel: High Density Industrial And/Or Other Area(s)

Classifiers: A4-A12A14

A4	Non-Linear (Feature)
A12	Industrial And/Or Other Area(s)
A14	High Density

LCCCode: 5003-10

Notes:

- 'High Density' not defined by the Anderson Classification System, but follows conclusively from the class description.
- Land use category
- Inconsistencies: Overlaps with classes 12 and 13

Consistency of original class definition:	Insufficient ✖	Fair	Good	very good
Correspondence of range values and lifeform definition:	Yes		No	
Confidence level of translation:	Fair	Good	very good ✖	

G.L.C.N. – TRANSLATION UNIT	
Country: USA	**Legend: Anderson Classification System**

Original Class name: Mixed Urban or Built-up Land

Original Description: Mixture of Level II Urban or Built-up uses where individual uses cannot be separated at mapping scale. Where more than one-third intermixture of another use or uses occurs in a specific area, it is classified as Mixed Urban or Built-up Land.

Map code:	Original: 16	Translated: 16

LCCS translation		

LCCLabel: Built Up Area(s)

Classifiers: A1Z16

A1   Built Up Area(s)
Z16   Mixed (Urban or Built-up)

LCCCode: 5001(1)[Z16]

Notes:

- Inconsistencies: Overlaps to other 1x classes
- Incorrect use of mixed classes, should not occur within a classification system

Consistency of original class definition:	Insufficient ✖		Fair		Good		very good
Correspondence of range values and lifeform definition:	Yes				No		
Confidence level of translation:	Fair		Good		very good ✖		

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G.L.C.N. – TRANSLATION UNIT	
Country: USA	**Legend: Anderson Classification System**

Original Class name: Other Urban or Built-up Land

Original Description: Other Urban or Built-up Land typically consists of uses such as golf driving ranges, zoos, urban parks, cemeteries, waste dumps, water-control structures and spillways, the extensive parts of such uses as golf courses and ski areas, and undeveloped land within an urban setting.

Map code:	Original: 17	Translated: 17

LCCS translation

LCCLabel: Artificial Surfaces and Associated Area(s) // Vegetated Urban Area(s)

Classifiers: B15 // A6

B15   Artificial Surfaces and Associated Area(s)
A6   Urban Vegetated Areas

LCCCode: 0010 // 11176

Notes:

- Includes a wide range of land cover and land use features, does not define an actual land cover/use class
- Incorrect use of class definition, should not be part of a classification system, symptomatic for an inconsistent use of classifiers

Consistency of original class definition:	Insufficient ✖	Fair	Good	very good
Correspondence of range values and lifeform definition:	Yes		No	
Confidence level of translation:	Fair ✖	Good	very good	

G.L.C.N. – TRANSLATION UNIT	
Country: USA	**Legend: Anderson Classification System**

Original Class name: Cropland and Pasture

Original Description: Includes: cropland harvested, including bush fruits; cultivated summer fal-low and idle cropland; land on which crop failure occurs; cropland in soil- improvement grasses and legumes; cropland used only for pasture in rotation with crops; and pasture on land more or less permanently used for that purpose.

Map code:	Original: 21	Translated: 21

LCCS translation		

LCCLabel: Herbaceous Crop(s) // Shrub Crop(s) Crop Type: Fruits & Nuts

Classifiers: A3 // A2-S6

A3   Herbaceous Crops
A2   Shrub Crops
S6   Fruits & Nuts

LCCCode: 10025 // 10013-S6

Notes:

- 'Pasture' here defined including cropland management practices (like seeding, fertilizing)
- Option: Herbaceous Vegetation (from Natural/Semi-Natural branch of LCCS) could be add-ed with an user defined attribute "Pasture"
- Overlaps with class 22

Consistency of original class definition:	Insufficient		Fair ✖		Good		very good
Correspondence of range values and lifeform definition:		Yes				No	
Confidence level of translation:	Fair			Good ✖		very good	

G.L.C.N. – TRANSLATION UNIT		

Country: USA | **Legend: Anderson Classification System**

Original Class name: Orchards, Groves, Vineyards, Nurseries, and Ornamental Horticultural Areas

Original Description: Orchards, groves, and vineyards produce the various fruit and nut crops. Nurseries and horticultural areas, which include floricultural and seed-and-sod areas and some greenhouses, are used perennially for those purposes. Tree nurseries which provide seedlings for plantation forestry also are included here.

Map code:	Original: 22	Translated: 22

LCCS translation

LCCLabel: Tree Crop(s) Crop Cover: Orchard(s) // Broadleaved Deciduous Shrub Crop(s) Dominant Crop: Fruits & Nuts - Grapes (Vitis vinifera) // Shrub Crop(s) // Herbaceous Crop(s) Dominant Crop: Other Non-Food Crops - Ornamental Horticulture

Classifiers: A1-W8 // A2-A7A10-S0610 // A2Z22 // A3-S14Zs22

A1	Tree Crops	Z22	Tree Nurseries
W8	Orchard(s)	A3	Herbaceous Crops
A2	Shrub Crops	S14	Other Non-Food Crops
A7		Zs22	Ornamental Horticulture
A10			
S0610	Grapes (Vitis vinifera)		

LCCCode: 10001-W8 // 10013-1891-S061010013(2) // 10025-S14Zs22[Z22]

Notes:

Consistency of original class definition:	Insufficient ✖		Fair		Good		very good
Correspondence of range values and lifeform definition:		Yes				No	
Confidence level of translation:	Fair			Good ✖			very good

G.L.C.N. – TRANSLATION UNIT	
Country: USA	**Legend: Anderson Classification System**

Original Class name: Confined Feeding Operations

Original Description: Confined Feeding Operations are large, specialized livestock production enterprises, chiefly beef cattle feedlots, dairy operations with confined feeding, and large poultry farms, but also including hog feedlots. Confined Feeding Operations have a built-up appearance, chiefly composed of buildings, much fencing, access paths, and waste-disposal areas.

Map code:	Original: 23	Translated: 23

LCCS translation

LCCLabel: Industrial And/Or Other Area(s) Built-Up Object: Breeding Centre

Classifiers: A4-A12-A22

A4   Non-Linear (Feature)
A12   Industrial And/Or Other Area(s)
A22   Breeding Centre

LCCCode: 5003-8-A22

Notes:

- Pure land use feature
- Built-up appearance (from land cover perspective) leads to overlap with *Urban or Built-up* category

Consistency of original class definition:	Insufficient		Fair ✖		Good		very good
Correspondence of range values and lifeform definition:		Yes				No	
Confidence level of translation:	Fair			Good			very good ✖

G.L.C.N. – TRANSLATION UNIT

Country: USA	Legend: Anderson Classification System

Original Class name: 24 Other Agricultural Land

Original Description: Includes farmsteads, holding areas for livestock such as corrals, breeding and training facilities on horse farms, farm lanes and roads, ditches and canals, small farm ponds, and similar uses.

Map code:	Original: 24	Translated: 24

LCCS translation

LCCLabel: Scattered Urban Area(s) // Scattered Industrial And/Or Other Area(s) // Cultivated and Managed Terrestrial Area(s)

Classifiers: A4-A13A17 // A4-A12A17 // A11

A4   Non-Linear (Feature)
A13   Urban Area(s)
A17   Scattered Density
A12   Industrial And/Or Other Area(s)
A11   Cultivated and Managed Terrestrial Area(s)

LCCCode: 5003-17 // 5003-16 // 0003

Notes:

- Class negligible on smaller scales.
- Includes a wide range of land cover and land use features, no real class boundaries
- Incorrect use of class definition, should not be part of a classification system, symptomatic for an inconsistent use of classifiers

Consistency of original class definition:	Insufficient ✖		Fair		Good		very good
Correspondence of range values and lifeform definition:		Yes				No	
Confidence level of translation:	Fair ✖			Good		very good	

G.L.C.N. – TRANSLATION UNIT	
Country: USA	**Legend: Anderson Classification System**

Original Class name: Herbaceous Rangeland

Original Description: Lands dominated by naturally occurring grasses and forbs, areas of actual rangeland which have been modified to include grasses and forbs as their principal cover, when the land is managed for rangeland purposes and not managed using practices typical of pasture-land.

Map code:	Original: 31	Translated: 31

LCCS translation

LCCLabel: Herbaceous Closed to Open Vegetation

Classifiers: A2A20

A2   Herbaceous Vegetation (Main Layer)
A20   Closed to Open (100-15)%

LCCCode: 21453

Notes:

- *Rangeland* is a land use term
- Cover density not specified
- Blurred class boundary against class 12 (Pasture)

Consistency of original class definition:	Insufficient		Fair		Good ✖		very good
Correspondence of range values and lifeform definition:	Yes				No		
Confidence level of translation:	Fair		Good			very good ✖	

G.L.C.N. – TRANSLATION UNIT	
Country: USA	**Legend: Anderson Classification System**

Original Class name: Shrub and Brush Rangeland	

Original Description: Typical for arid or semiarid regions, characterized by xerophytic vegetative types with woody stems and also by desert succulent xerophytes. Also included in this category are chaparral, the occurrences of mountain mahogany and scrub oaks, former croplands or pasture lands (cleared from original forest land) which now have grown up in brush in transition back to forest land.

Map code:	Original: 32	Translated: 32

LCCS translation		

LCCLabel: Closed to Open Shrubland (Thicket)

Classifiers: A4A20

A4 Shrubs (Main Layer)
A20 Closed to Open (100-15)%

LCCCode: 21449

Notes:

- *Rangeland* is a land use term
- Cover density not specified

Consistency of original class definition:	Insufficient		Fair		Good		very good ✖
Correspondence of range values and lifeform definition:	Yes				No		
Confidence level of translation:	Fair			Good		very good ✖	

G.L.C.N. – TRANSLATION UNIT	
Country: USA	**Legend: Anderson Classification System**

Original Class name: Mixed Rangeland

Original Description: More than one-third intermixture of either herbaceous or shrub and brush rangeland species occurring in a specific area.

Map code:	Original: ´33	Translated: 33

LCCS translation

LCCLabel: Closed to Open Shrubland (Thicket) / Herbaceous Closed to Open Vegetation

Classifiers: A4A20 / A2A20

A4 Shrubs (Main Layer)
A20 Closed to Open (100-15)%
A2 Herbaceous Vegetation (Main Layer)

LCCCode: 21449 / 21453

Notes:

- Mixed class inappropriate for a classification system
- Opposite to the LCCS class definition shrubs are not necessarily dominating the area
- *Rangeland* is a land use term
- Cover density not specified

Consistency of original class definition:	Insufficient		Fair		Good	✖	very good
Correspondence of range values and lifeform definition:		Yes				No	
Confidence level of translation:	Fair			Good	✖		very good

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G.L.C.N. – TRANSLATION UNIT	
Country: USA	**Legend: Anderson Classification System**

Original Class name: Mixed Rangeland

Original Description: More than one-third intermixture of either herbaceous or shrub and brush rangeland species occurring in a specific area.

Map code:	Original: ´33	Translated: 33

LCCS translation

LCCLabel: Closed to Open Shrubland (Thicket) / Herbaceous Closed to Open Vegetation

Classifiers: A4A20 / A2A20

A4 Shrubs (Main Layer)
A20 Closed to Open (100-15)%
A2 Herbaceous Vegetation (Main Layer)

LCCCode: 21449 / 21453

Notes:

- Mixed class inappropriate for a classification system
- Opposite to the LCCS class definition shrubs are not necessarily dominating the area
- *Rangeland* is a land use term
- Cover density not specified

Consistency of original class definition:	Insufficient		Fair		Good	✖	very good
Correspondence of range values and lifeform definition:		Yes				No	
Confidence level of translation:	Fair			Good	✖		very good

G.L.C.N. – TRANSLATION UNIT	
Country: USA	**Legend: Anderson Classification System**

Original Class name: Deciduous Forest Land

Original Description: Deciduous Forest Land includes all forested areas having a predominance of trees that lose their leaves at the end of the frost-free season or at the beginning of a dry season.

Map code:	Original: 41	Translated: 41

LCCS translation

LCCLabel: Broadleaved Deciduous Closed to Open Trees // Needleleaved Deciduous Closed to Open Trees

Classifiers: A3A20B2XXD1E2 // A3A20B2XXD2E2

A3	Trees (Main Layer)
A20	Closed to Open (100-15)%
B2	>30 – 3m (Trees Height Main Layer)
D1	Broadleaved
E2	Deciduous
D2	Needleleaved

LCCCode: 21497 // 21500

Notes:

- Unusual class differentiation into deciduous and evergreen (class 42) species simultaneously ignoring the discrimination of broadleaved and needle-leaved species

Consistency of original class definition:	Insufficient		Fair		Good		very good ✖
Correspondence of range values and lifeform definition:		Yes				No	
Confidence level of translation:	Fair			Good		very good ✖	

G.L.C.N. – TRANSLATION UNIT	
Country: USA	**Legend: Anderson Classification System**

Original Class name: Evergreen Forest Land

Original Description: Evergreen Forest Land includes all forested areas in which the trees are predominantly those which remain green throughout the year. Both coniferous and broadleaved evergreens are included in this category.

Map code:	Original: 42	Translated: 42

LCCS translation

LCCLabel: Broadleaved Evergreen Closed to Open Trees // Needleleaved Evergreen Closed to Open Trees

Classifiers: A3A20B2XXD1E1 // A3A20B2XXD2E1

A3   Trees (Main Layer)
A20   Closed to Open (100-15)%
B2   >30 – 3m (Trees Height Main Layer)
D1   Broadleaved
E1   Evergreen
D2   Needleleaved

LCCCode: 21496 // 21499

Notes:

- cf. note class 41

Consistency of original class definition:	Insufficient		Fair		Good		very good ✘
Correspondence of range values and lifeform definition:		Yes				No	
Confidence level of translation:	Fair			Good		very good ✘	

G.L.C.N. – TRANSLATION UNIT

Country: USA	Legend: Anderson Classification System

Original Class name: Mixed Forest Land

Original Description: Includes areas where both evergreen and deciduous trees are growing. More than one third intermixture of either evergreen or deciduous species occurs in a specific area.

Map code:	Original: 43	Translated: 43

LCCS translation

LCCLabel: Closed to Open Trees

Classifiers: A3A20Z43

A3 Trees (Main Layer)
A20 Closed to Open (100-15)%
Z43 Mixed (Evergreen & Deciduous)

LCCCode: 21445(3)[Z43]

Notes:

- LCCS mixed dedicated only to a broadleaved/needle-leaved mixture, mix of evergreen and deciduous impossible without regard to leaf type
- cf. note class 41

Consistency of original class definition:	Insufficient		Fair		Good		very good ✖
Correspondence of range values and lifeform definition:	Yes				No		
Confidence level of translation:	Fair		Good		very good ✖		

G.L.C.N. – TRANSLATION UNIT	
Country: USA	**Legend: Anderson Classification System**

Original Class name: Streams and Canals

Original Description: The Streams and Canals category includes rivers, creeks, canals, and other linear water bodies. Where the water course is interrupted by a control structure, the impounded area will be placed in the Reservoirs category. The boundary between streams and other bodies of water is the straight line across the mouth of the stream up to 1 nautical mile (1.85 km).

Map code:	Original: 51	Translated: 51

LCCS translation

LCCLabel: Natural Waterbodies (Flowing) // Artificial Waterbodies (Flowing)

Classifiers: A1-A4 // A1-A4

A1   Inland Water
A4   (Flowing)

LCCCode: 8001-1 // 7001-1

Notes:

Consistency of original class definition:	Insufficient		Fair		Good		very good	✘
Correspondence of range values and lifeform definition:	Yes					No		
Confidence level of translation:	Fair			Good			very good	✘

G.L.C.N. – TRANSLATION UNIT	
Country: USA	**Legend: Anderson Classification System**

Original Class name: Lakes

Original Description: Lakes are nonflowing, naturally enclosed bodies of water, including regulated natural lakes but excluding reservoirs.

Map code:	Original: 52	Translated: 52

LCCS translation		

LCCLabel: Natural Waterbodies (Standing)

Classifiers: A1-A5

A1   Inland Water
A5   (Standing)

LCCCode: 8001-5

Notes:

Consistency of original class definition:	Insufficient		Fair		Good		very good ✖
Correspondence of range values and lifeform definition:	Yes				No		
Confidence level of translation:	Fair		Good			very good ✖	

G.L.C.N. – TRANSLATION UNIT

Country: USA	Legend: Anderson Classification System

Original Class name: Reservoirs

Original Description: Reservoirs are artificial impoundments of water used for irrigation, flood control, municipal water supplies, recreation, hydroelectric power generation, and so forth.

Map code:	Original: 53	Translated: 53

LCCS translation

LCCLabel: Artificial Waterbodies (Standing)

Classifiers: A1-A5

A1   Artificial Waterbodies
A5   (Standing)

LCCCode: 7001-5

Notes:

Consistency of original class definition:	Insufficient		Fair		Good		very good ✖
Correspondence of range values and lifeform definition:	Yes				No		
Confidence level of translation:	Fair		Good			very good ✖	

G.L.C.N. – TRANSLATION UNIT	
Country: USA	**Legend: Anderson Classification System**

Original Class name: Bays and Estuaries

Original Description: Inlets or arms of the sea that extend inland, included only when they are considered to be inland water.

Map code:	Original: 54	Translated: 54

LCCS translation		

LCCLabel: Natural Waterbodies (Standing) // Tidal Area (Flowing)

Classifiers: A1-A5Z54 // A1B3-A4

A1	Inland Water
A5	(Standing)
Z54	Bays
B3	Tidal Area
A4	(Flowing)

LCCCode: 8001-5(3)[Z54] // 8004-1

Notes:

- Class refers to morphology

Consistency of original class definition:	Insufficient		Fair		Good ✖		very good
Correspondence of range values and lifeform definition:	Yes				No		
Confidence level of translation:	Fair		Good		very good ✖		

G.L.C.N. – TRANSLATION UNIT

Country: USA	Legend: Anderson Classification System

Original Class name: Forested Wetland

Original Description: Dominated by woody vegetation, including seasonally flooded bottomland hardwoods, mangrove swamps, shrub swamps, and wooded swamps.

Map code:	Original: 61	Translated: 61

LCCS translation

LCCLabel: Closed to Open Trees // Closed to Open Shrubs

Classifiers: A3A20 // A4A20

A3   Trees (Main Layer)
A20   Closed to Open (100-15)%
A4   Shrubs (Main Layer)

LCCCode: 41635 // 41895

Notes:

Consistency of original class definition:	Insufficient		Fair		Good		very good ✖
Correspondence of range values and lifeform definition:		Yes				No	
Confidence level of translation:	Fair			Good		very good ✖	

G.L.C.N. – TRANSLATION UNIT	
Country: USA	**Legend: Anderson Classification System**

Original Class name: Nonforested Wetland	

Original Description: Dominated by wetland herbaceous vegetetion or nonvegetated. Includes tidal and nontidal fresh, brackish, and salt marshes and nonvegetated flats and also freshwater meadows, wet prairies, and open bogs.

Map code:	Original: 62	Translated: 62

LCCS translation

LCCLabel: Closed to Open Herbaceous Vegetation // Tidal Area

Classifiers: A2A20 // A1B3

A2	Herbaceous Vegetation (Main Layer)
A20	Closed to Open (100-15)%
A1	Inland Water
B3	Tidal Area

LCCCode: 42155 // 8004

Notes:

- Nonvegetated wetlands other than found within tidal areas cannot be defined with LCCS.
- Nonvegetated wetlands overlap with the *Barren Land* category
- Option: Adding a third part to the class consisting of bare area and an user defined attribute *Wetland*

Consistency of original class definition:	Insufficient		Fair ✘		Good		very good
Correspondence of range values and lifeform definition:		Yes				No	
Confidence level of translation:	Fair			Good ✘		very good	

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G.L.C.N. – TRANSLATION UNIT

Country: USA	Legend: Anderson Classification System

Original Class name: Dry Salt Flats

Original Description: Dry Salt Flats occurring on the flat-floored bottoms of interior desert basins which do not qualify as Wetland are included in this category.

Map code:	Original: 71	Translated: 71

LCCS translation

LCCLabel: Bare Soil And/Or Unconsolidated Material(s) With Salt Flats

Classifiers: A5B13

A5   Bare Soil And/Or Other Unconsolidated Material(s)
B13   Salt Flats

LCCCode: 6020

Notes:

Consistency of original class definition:	Insufficient		Fair		Good		very good ✖
Correspondence of range values and lifeform definition:	Yes				No		
Confidence level of translation:	Fair		Good			very good ✖	

G.L.C.N. – TRANSLATION UNIT

Country: USA	Legend: Anderson Classification System

Original Class name: Beaches

Original Description: Beaches are the smooth sloping accumulations of sand and gravel along shorelines.

Map code:	Original: 72	Translated: 72

LCCS translation

LCCLabel: Loose And Shifting Sands // Bare Rock And/Or Coarse Fragments - Gravels

Classifiers: A6Z72 // A3-A14

A6   Loose and Shifting Sands
Z72   Beaches
A3   Bare Rock And/Or Coarse Fragments
A14   Gravel

LCCCode: 6006(3)[Z72] // 6002-8

Notes:

- Land cover inconsistency to class 73
- Class refers to spatial occurrence and is not land cover related

Consistency of original class definition:	Insufficient ✖	Fair	Good	very good
Correspondence of range values and lifeform definition:	Yes		No	
Confidence level of translation:	Fair	Good	very good ✖	

G.L.C.N. – TRANSLATION UNIT	
Country: USA	**Legend: Anderson Classification System**

Original Class name: Sandy Areas other than Beaches

Original Description: Sandy areas other than Beaches are composed primarily of dunes accumu-lations of sand transported by the wind. Sand accumulations most commonly are found in deserts although they also occur on coastal plains, river flood plains, and deltas and in periglacial environ-ments. When such sand accumulations are encountered in tundra areas, they are not included here but are placed in the Bare Ground Tundra category.

Map code:	Original: 73	Translated: 73

LCCS translation		

LCCLabel: Loose And Shifting Sands

Classifiers: A6

A6   Loose and Shifting Sands

LCCCode: 6006

Notes:

- Overlaps with classes 72 and 83
- Class name and definition appear crude

Consistency of original class definition:	Insufficient ✖	Fair	Good	very good
Correspondence of range values and lifeform definition:	Yes		No	
Confidence level of translation:	Fair	Good	very good ✖	

G.L.C.N. – TRANSLATION UNIT	
Country: USA	**Legend: Anderson Classification System**

Original Class name: Bare Exposed Rock

Original Description: The Bare Exposed Rock category includes areas of bedrock exposure, desert pavement, scarps, talus, slides, volcanic material, rock glaciers, and other accumulations of rock without vegetative cover, with the exception of such rock exposures occurring in tundra regions.

Map code:	Original: 74	Translated: 74

LCCS translation		

LCCLabel: Bare Rock(s)

Classifiers: A3-A7

A3   Bare Rock And/Or Coarse Fragments
A7   Bare Rock

LCCCode: 6002-1

Notes:

-   Overlaps with class 83 regarding land cover

Consistency of original class definition:	Insufficient		Fair		Good		very good ✖
Correspondence of range values and lifeform definition:	Yes				No		
Confidence level of translation:	Fair		Good		very good ✖		

G.L.C.N. – TRANSLATION UNIT	
Country: USA	**Legend: Anderson Classification System**

Original Class name: Strip Mines, Quarries and Gravel Pits

Original Description: Those extractive mining activities that have significant surface expression are included in this category. Vegetative cover and overburden are removed to expose such deposits as coal, iron ore, limestone, and copper. Quarrying of building and decorative stone and recovery of sand and gravel deposits also result in large open surface pits.

Map code:	Original: 75	Translated: 75

LCCS translation		

LCCLabel: Extraction Site(s)

Classifiers: A2-A6

A2   Non Built Up Area(s)
A6   Extraction Site(s)

LCCCode: 5004-2

Notes:

- Land use definition, simultaneously part of artificial surfaces

Consistency of original class definition:	Insufficient		Fair		Good ✖		very good
Correspondence of range values and lifeform definition:		Yes			No		
Confidence level of translation:	Fair		Good			very good ✖	

G.L.C.N. – TRANSLATION UNIT	
Country: USA	**Legend: Anderson Classification System**

Original Class name: Transitional Areas

Original Description: Transition from one land use activity to another, characterized by the lack of any remote sensor information which would enable the land use interpreter to predict reliably the future use or discern the past use.

Map code:	Original: 76	Translated: 76

LCCS translation		

LCCLabel: Bare Area(s)

Classifiers: B16Z76

B16   Bare Area(s)
Z76   Transitional

LCCCode: 0011(3)[Z76]

Notes:

- "Transitional" is not a land cover status and is hardly identifiable without ancillary data

Consistency of original class definition:	Insufficient ✘	Fair	Good	very good
Correspondence of range values and lifeform definition:	Yes		No	
Confidence level of translation:	Fair	Good	very good ✘	

G.L.C.N. – TRANSLATION UNIT	
Country: USA	**Legend: Anderson Classification System**

Original Class name: Mixed Barren Land

Original Description: Mixture of Barren Land features, dominant land use occupies less than two-thirds of the area.

Map code:	Original: 77	Translated: 77

LCCS translation		

LCCLabel: Bare Area(s)

Classifiers: B16Z77

B16   Bare Area(s)
Z77   Mixed (Barren)

LCCCode: 0011(3)[Z77]

Notes:

- Mixed class inappropriate for a classification system
- Actual land cover remains unspecified

Consistency of original class definition:	Insufficient ✘	Fair	Good	very good
Correspondence of range values and lifeform definition:	Yes		No	
Confidence level of translation:	Fair	Good	very good ✘	

G.L.C.N. – TRANSLATION UNIT	
Country: USA	**Legend: Anderson Classification System**

Original Class name: Shrub and Brush Tundra

Original Description: The Shrub and Brush Tundra category consists of the various woody shrubs and brushy thickets found in the tundra environment. These occur in dense-to- open ever-green and deciduous thickets.

Map code:	Original: 81	Translated: 81

LCCS translation

LCCLabel: Closed to Open Shrubland (Thicket) Climate: Polar/Arctic

Classifiers: A4A20-O8

A4   Shrubs (Main Layer)
A20   Closed to Open (100-15)%
O8   Polar Arctic

LCCCode: 21449-O8

Notes:

- Life form identical to class 32
- Tundra is not a land cover term, should not be part of a classification system

Consistency of original class definition:	Insufficient ✘		Fair		Good		very good
Correspondence of range values and lifeform definition:	Yes				No		
Confidence level of translation:	Fair		Good			very good ✘	

G.L.C.N. – TRANSLATION UNIT	
Country: USA	**Legend: Anderson Classification System**

Original Class name: Herbaceous Tundra	

Original Description: Herbaceous tundra is composed of various sedges, grasses, forbs, lichens, and mosses, all of which lack woody stems

Map code:	Original: 82	Translated: 82

LCCS translation

LCCLabel: Herbaceous Closed to Open (100-40)% Vegetation Climate: Polar/Arctic // Herbaceous Closed to Open (100-40)% Vegetation Climate: Polar/Arctic / Closed to Open Lichens/Mosses Climate: Polar/Arctic

Classifiers: A2A20-A21-O8 // A2A20-A21-O8 / A7A20-A21-O8

A2   Herbaceous Vegetation (Main Layer)
A20   Closed to Open (100-15)%
A21   Closed to Open (100-40)%
O8   Polar Arctic
A7   Lichens/Mosses

LCCCode: 21453-121340-O8 // 21453-121340-O8 / 21465-121340-O8

Notes:

- Tundra is not a land cover term, should not be part of a classification system
- Definition of lichens and mosses may be considered optional but was transferred due to their importance in the tundra environment

Consistency of original class definition:	Insufficient ✖	Fair	Good	very good
Correspondence of range values and lifeform definition:	Yes		No	
Confidence level of translation:	Fair	Good ✖	very good	

G.L.C.N. – TRANSLATION UNIT	
Country: USA	**Legend: Anderson Classification System**

Original Class name: Bare Ground Tundra

Original Description: Tundra occurrences less than one third vegetated. Sites visually dominated by considerable areas of exposed bare rock, sand, or gravel interspersed with low herbaceous and shrubby plants.

Map code:	Original: 83	Translated: 83

LCCS translation

LCCLabel: Consolidated Material(s) Climate: Polar/Arctic // Unconsolidated Material(s) Climate: Polar/Arctic // Herbaceous Sparse Vegetation Climate: Polar/Arctic // Herbaceous Open (40 - (20-10)%) Vegetation Climate: Polar/Arctic

Classifiers: A1-O8 // A2-O8 // A2A14-O8 // A2A11-A13-O8

A1   Consolidated Material(s)
O8   Polar Arctic
A2   Unconsolidated Material(s)
A2   Herbaceous Vegetation (Main Layer)
A14   Sparse (20-10) - 1% (Main Layer)
A11   Open General (70-60) - (20-10)% (Main Layer)
A13   Very Open 40 - (10-20)% (Main Layer)

LCCCode: 6001-O8 // 6004-O8 // 20058-O8 // 20037-3012-O8

Notes:

- Tundra is not a land cover term, should not be part of a classification system
- Overlaps with the *Barren Land* and *Range Land* category and class 62

Consistency of original class definition:	Insufficient ✖		Fair		Good		very good
Correspondence of range values and lifeform definition:		Yes				No	
Confidence level of translation:	Fair			Good ✖		very good	

G.L.C.N. – TRANSLATION UNIT	
Country: USA	**Legend: Anderson Classification System**

Original Class name: Wet Tundra

Original Description: Standing water is almost always present during months when temperatures average above the freezing level. Numerous shallow lakes are also common.

Map code:	Original: 84	Translated: 84

LCCS translation	

LCCLabel: Closed to Open Herbaceous Vegetation. Climate: Polar/Arctic / Shallow Non-Perennial Natural Waterbodies (Standing) Climate: Polar/Arctic

Classifiers: A2A20-O8 / A1B2C2-A5-O8

A2	Herbaceous Vegetation (Main Layer)
A20	Closed to Open (100-15)%
O8	Polar Arctic
A1	Inland Water
B2	Non-Perennial Or Seasonal
C2	Shallow
A5	(Standing)

LCCCode: 42155-O8 / 8020-5-O8

Notes:

- Tundra is not a land cover term, should not be part of a classification system
- Overlaps with class 62

Consistency of original class definition:	Insufficient ✖		Fair		Good		very good
Correspondence of range values and lifeform definition:		Yes				No	
Confidence level of translation:	Fair			Good ✖		very good	

G.L.C.N. – TRANSLATION UNIT	
Country: USA	**Legend: Anderson Classification System**

Original Class name: Mixed Tundra

Original Description: The Mixed Tundra category is used for a mixture of the Level II Tundra occurrences where any particular type occupies less than two-thirds of the area of the mapping unit. Where more than onethird intermixture of another use or uses occurs in a specific area, it is classified as Mixed Tundra. Where the intermixed land cover categories total less than one-third of the specific area, the category appropriate to the dominant type of Tundra is applied.

Map code:	Original: 85	Translated:

LCCS translation		

LCCLabel:

Classifiers:

LCCCode:

Notes:

Transation not possible

Consistency of original class definition:	Insufficient ✖		Fair		Good		very good
Correspondence of range values and lifeform definition:		Yes				No	
Confidence level of translation:	Fair			Good			very good

G.L.C.N. – TRANSLATION UNIT	
Country: USA	**Legend: Anderson Classification System**

Original Class name: Perennial Snowfields

Original Description: Perennial Snowfields are accumulations of snow and firn that did not entirely melt during previous summers. Snowfields can be quite extensive and thus representative of a regional climate, or can be quite isolated and localized, when they are known by various terms, such as snowbanks.

Map code:	Original: 91	Translated: 91

LCCS translation		

LCCLabel: Perennial Snow

Classifiers: A2B1

A2   Snow
B1   Perennial

LCCCode: 8006

Notes:

Consistency of original class definition:	Insufficient		Fair		Good		very good ✘
Correspondence of range values and lifeform definition:		Yes				No	
Confidence level of translation:	Fair			Good		very good ✘	

G.L.C.N. – TRANSLATION UNIT	
Country: USA	**Legend: Anderson Classification System**

Original Class name: Glaciers

Original Description: Glacial ice originates from the compaction of snow into firn and finally to ice under the weight of several successive annual accumulations. Refrozen melt water usually contributes to the increasing density of the glacial ice mass. With sufficient thickness, weight, and bulk, flow begins, and all glaciers exhibit evidence of present or past motion in the form of moraines, crevasses, and so forth.

Map code:	Original: 92	Translated: 92

LCCS translation		

LCCLabel: Perennial Ice (Moving)

Classifiers: A3B1-A6

A3	Ice
B1	Perennial
A6	(Moving)

LCCCode: 8009-9

Notes:

Consistency of original class definition:	Insufficient	Fair	Good	very good ✖
Correspondence of range values and lifeform definition:	Yes		No	
Confidence level of translation:	Fair	Good	very good ✖	

D2   Corine Land Cover

G.L.C.N. – TRANSLATION UNIT	
Country: EU	**Legend: CORINE Land Cover**

Original Class name: Continuous urban fabric

Original Description: Most of the land is covered by structures and the transport network. Building, roads and artificially surfaced areas cover more than 80 % of the total surface. Non-linear areas of vegetation and bare soil are exceptional.

Extension: 80 % of the total surface at least should be impermeable.

Map code:	Original: 111	Translated: 111

LCCS translation

LCCLabel: High Density Urban Area(s)

Classifiers: A4-A13A14

A4 Non-Linear (Feature)
A13 Urban Area(s)
A14 High Density

LCCCode: 5003-13

Notes:

- Threshold difference
  CORINE: 80 % minimum impermeable area
  LCCS: > 75 % impermeable area

Consistency of original class definition:	Insufficient		Fair		Good		very good	✖
Correspondence of range values and lifeform definition:		Yes	✖			No		
Confidence level of translation:		Fair		Good			very good	✖

G.L.C.N. – TRANSLATION UNIT		
Country: EU		**Legend: CORINE Land Cover**
Original Class name: Discontinuous urban fabric		
Original Description: Most of the land is covered by structures. Building, roads and artificially surfaced areas associated with vegetated areas and bare soil, which occupy discontinuous but significant surfaces. Extension: Between 30 to 80 % of the total surface should be impermeable.		
Map code:	Original: 112	Translated: 112
LCCS translation		
LCCLabel: Medium Density Urban Area(s) // Low Density Urban Area(s)		
Classifiers: A4-A13A15 // A4-A13A16 A4 Non-Linear (Feature) A13 Urban Area(s) A15 Medium Density A16 Low Density		
LCCCode: 5003-14 // 5003-15		

Notes:
 	
  -   Threshold difference
      CORINE: 30 – 80 % impermeable area
      LCCS: 30 – 75 % impermeable area		

Consistency of original class definition:	Insufficient	Fair	Good	very good ✖
Correspondence of range values and lifeform definition:	Yes ✖		No	
Confidence level of translation:	Fair	Good	very good ✖	

G.L.C.N. – TRANSLATION UNIT	
Country: EU	**Legend: CORINE Land Cover**

Original Class name: Industrial or commercial units

Original Description: Artificially surfaced areas (with concrete, asphalt, tarmacadam, or stabilised, e.g. beaten earth) without vegetation occupy most of the area, which also contains buildings and/or vegetation.

Map code:	Original: 121	Translated: 121

LCCS translation		

LCCLabel: Industrial And/Or Other Area(s)

Classifiers: A4-A12

A4   Non-Linear (Feature)
A12   Industrial And/Or Other Area(s)

LCCCode: 5003-8

Notes:

- Uncertainty about included buildings/structures in LCCS, CLC includes a wide range of them, LCCS: trade, manufacturing, distribution, commerce
- Ports and airports form individual CLC classes

Consistency of original class definition:	Insufficient		Fair		Good	✖		very good	
Correspondence of range values and lifeform definition:	Yes						No		
Confidence level of translation:	Fair			Good	✖		very good		

G.L.C.N. – TRANSLATION UNIT	
Country: EU	**Legend: CORINE Land Cover**

Original Class name: Road and rail networks and associated land

Original Description: Motorways and railways, including associated installations (stations, platforms, embankments). Minimum width for inclusion: 100 m.

Map code:	Original: 122	Translated: 122

<div align="center">

LCCS translation

</div>

LCCLabel: Road(s) // Railway(s) // Industrial And/Or Other Area(s) Built-Up Object: Other - Installations associated to roads and railways

Classifiers: A3-A7 // A3-A10 // A4-A12-A44Zp122

A3	Linear
A7	Road(s)
A10	Railway(s)
A4	Non-Linear (Feature)
A12	Industrial And/Or Other Area(s)
A44	Other
Zp122	Installations associated to roads and railways

LCCCode: 5002-3 // 5002-6 // 5003-8-A44Zp122

Notes:

- 'Associated installations' land cover remains undetermined, various land cover possible

Consistency of original class definition:	Insufficient		Fair		Good	✖	very good
Correspondence of range values and lifeform definition:		Yes				No	
Confidence level of translation:	Fair			Good	✖		very good

G.L.C.N. – TRANSLATION UNIT	
Country: EU	**Legend: CORINE Land Cover**

Original Class name: Port areas

Original Description: Infrastructure of port areas, including quays, dockyards and marinas.

Map code:	Original: 123	Translated: 123

LCCS translation

LCCLabel: Industrial And/Or Other Area(s) Built-Up Object: Port Area (including Docks, Shipyards, Locks)

Classifiers: A4-A12-A32

A4   Non-Linear (Feature)
A12   Industrial And/Or Other Area(s)
A32   Port Area (including Docks, Shipyards, Locks)

LCCCode: 5003-8-A32

Notes:

Consistency of original class definition:	Insufficient		Fair		Good		very good	✖
Correspondence of range values and lifeform definition:		Yes				No		
Confidence level of translation:	Fair			Good			very good	✖

G.L.C.N. – TRANSLATION UNIT

Country: EU	Legend: CORINE Land Cover

Original Class name: Airports

Original Description: Airports installations: runways, buildings and associated land.

Map code:	Original: 124	Translated: 124

LCCS translation

LCCLabel: Industrial And/Or Other Area(s) Built-Up Object: Airport

Classifiers: A4-A12-A21

A4   Non-Linear (Feature)
A12   Industrial And/Or Other Area(s)
A21   Airport

LCCCode: 5003-8-A21

Notes:

Consistency of original class definition:	Insufficient		Fair		Good		very good	✖
Correspondence of range values and lifeform definition:	Yes				No			
Confidence level of translation:	Fair		Good			very good	✖	

G.L.C.N. – TRANSLATION UNIT

Country: EU	Legend: CORINE Land Cover

Original Class name: Mineral extraction sites

Original Description: Areas with open-pit extraction of construction material (sandpits, quarries) or other minerals (open-cast mines). Includes flooded gravel pits, except for river-bed extraction.

Map code:	Original: 131	Translated: 131

LCCS translation

LCCLabel: Extraction Site(s)

Classifiers: A2-A6

A2   Non Built Up Area(s)
A6   Extraction Site(s)

LCCCode: 5004-2

Notes:

Consistency of original class definition:	Insufficient		Fair		Good		very good	✖
Correspondence of range values and lifeform definition:	Yes				No			
Confidence level of translation:	Fair		Good			very good	✖	

G.L.C.N. – TRANSLATION UNIT		
Country: EU		**Legend: CORINE Land Cover**
Original Class name: Dump sites		
Original Description: Public, industrial or mine dump sites.		
Map code:	Original: 132	Translated: 132
LCCS translation		
LCCLabel: Waste Dump(s)/Deposit(s)		

Classifiers: A2-A5

A2   Non Built Up Area(s)
A5   Waste Dump(s)/Deposit(s)

LCCCode: 5004-1

Notes:

Consistency of original class definition:	Insufficient		Fair		Good		very good	✘
Correspondence of range values and lifeform definition:	Yes				No			
Confidence level of translation:	Fair		Good			very good	✘	

114

G.L.C.N. – TRANSLATION UNIT	
Country: EU	**Legend: CORINE Land Cover**

Original Class name: Construction sites

Original Description: Spaces under construction development, soil or bedrock excavations, earthworks.

Map code:	Original: 133	Translated: 133

LCCS translation	

LCCLabel: Built Up Area(s) / Bare Area(s)

Classifiers: A1 / B16

A1   Built Up Area(s)
B16   Bare Area(s)

LCCCode: 5001 /0011

Notes:

- This can be anything under construction in any state – actual land cover is uncertain. Hence, a mixed class with 'Bare Area(s)' was created. This choice is, of course, as arbitrary as every other would be.

Consistency of original class definition:	Insufficient ✖	Fair	Good	very good
Correspondence of range values and lifeform definition:	Yes		No	
Confidence level of translation:	Fair ✖	Good	very good	

115

G.L.C.N. – TRANSLATION UNIT

Country: EU	Legend: CORINE Land Cover

Original Class name: Green urban areas

Original Description: Areas with vegetation within urban fabric, includes parks and cemeteries with vegetation, and mansions and their grounds.

Map code:	Original: 141	Translated: 141

LCCS translation

LCCLabel: Vegetated Urban Area(s)

Classifiers: A6

A6   Urban Vegetated Area(s)

LCCCode: 11176

Notes:

Consistency of original class definition:	Insufficient		Fair		Good		very good ✖
Correspondence of range values and lifeform definition:	Yes				No		
Confidence level of translation:	Fair		Good			very good ✖	

G.L.C.N. – TRANSLATION UNIT	
Country: EU	**Legend: CORINE Land Cover**

Original Class name: Sport and leisure facilities

Original Description: Camping grounds, sports grounds, leisure parks, golf courses, racecourses, etc. Includes formal parks not surrounded by urban areas.

Map code:	Original: 142	Translated: 142

LCCS translation

LCCLabel: Built Up Area(s) Built-Up Object: Sports and Leisure Facilities

Classifiers: A1-A38

A1   Built Up Area(s)
A38   Sports and Leisure Facilities

LCCCode: 5001-A38

Notes:
- Uncertainty about the definition of man-made vegetated areas outside of urban fabric in LCCS
- LCCS's 'Sports and Leisure Facilities' not further defined
- Uncertainty regarding non-'Built-Up' leisure facilities (golf courses, managed vegetated areas like gardens)
- 142 not referring to land cover, but land use

Consistency of original class definition:	Insufficient		Fair	✖	Good		very good
Correspondence of range values and lifeform definition:		Yes				No	
Confidence level of translation:		Fair		Good	✖		very good

G.L.C.N. – TRANSLATION UNIT	
Country: EU	**Legend: CORINE Land Cover**

Original Class name: Non-irrigated arable land

Original Description: Cereals, legumes, fodder crops, root crops and fallow land. Includes flowers and fruit trees (nurseries cultivation) and vegetables, whether open field, under plastic or glass (includes market gardening). Includes aromatic, medicinal and culinary plants. Does not include permanent pastures.

Extension: Includes flower, tree (nurseries) and vegetable cultivations. Includes other annually harvested plants with more than 75 % of the area under a rotation system.

Map code:	Original: 211	Translated: 211

LCCS translation		

LCCLabel: Herbaceous Crop(s) // Shrub Crop(s)

Classifiers: A3 // A2Z211

A3   Herbaceous Crops
A2   Shrub Crops
Z211 Nurseries of fruit trees and shrubs

LCCCode: 10025 // 10013(1)[Z211]

Notes:

Consistency of original class definition:	Insufficient		Fair		Good	✖		very good
Correspondence of range values and lifeform definition:		Yes	✖			No		
Confidence level of translation:	Fair			Good			very good	✖

G.L.C.N. – TRANSLATION UNIT	
Country: EU	**Legend: CORINE Land Cover**

Original Class name: Permanently irrigated land

Original Description: Crops irrigated permanently or periodically, using a permanent infrastructure (irrigation channels, drainage network). Most of these crops cannot be cultivated without an artificial water supply. Does not include sporadically irrigated land.

Map code:	Original: 212	Translated: 212

LCCS translation		

LCCLabel: Surface Irrigated Herbaceous Crop(s) // Surface Irrigated Shrub Crop(s) // Surface Irrigated Tree Crop(s)

Classifiers: A3XXXXXXD3-D4 // A2XXXXXXD3-D4 // A1XXXXXXD3-D4

A3	Herbaceous Crops
D3	Irrigated (General)
D4	Surface Irrigated
A2	Shrub Crops
A1	Tree Crops

LCCCode: 11500-13227 // 11495-13227 // 11491-13227

Notes:

- CORINE does not consider sprinkler irrigation here, but only flood or flush irrigation techniques which is similar to the LCCS definition of 'Surface Irrigated'.
- inconsistent class separation criteria (may include life forms as defined in other agricultural classes, e.g. 22x)

Consistency of original class definition:	Insufficient		Fair ✘		Good		very good
Correspondence of range values and lifeform definition:		Yes ✘				No	
Confidence level of translation:	Fair			Good		very good ✘	

G.L.C.N. – TRANSLATION UNIT	
Country: EU	**Legend: CORINE Land Cover**

Original Class name: Rice fields	
Original Description: Land prepared for rice cultivation. Flat surfaces with irrigation channels. Surfaces periodically flooded.	

Map code:	Original: 213	Translated: 213

LCCS translation

LCCLabel: Graminoid Crops Dominant Crop: Cereals - Rice (Oryza spp.)

Classifiers: A4-S0308

A4   Graminoid Crops
S0380 Rice (Oryza spp.)

(Mode 1: Terrestrial and/or Aquatic or regularly flooded)

LCCCode: 10037-S0308

Notes:
- LCCS mode function used (Mode 1): Rice can be cultivated in paddies (wetland cultivation) as well as on dry land (with appropriate irrigation).
- possible overlap to CLC class 212

Consistency of original class definition:	Insufficient		Fair		Good	✖	very good	
Correspondence of range values and lifeform definition:		Yes	✖			No		
Confidence level of translation:	Fair			Good	✖		very good	

G.L.C.N. – TRANSLATION UNIT	
Country: EU	**Legend: CORINE Land Cover**

Original Class name: Vineyards

Original Description: Areas planted with vines.

Extension:
Vineyard areas are classified as 221 if the vineyard parcels exceed 50 % of the area and/or they determine the land use of the area.

Map code:	Original: 221	Translated: 221

LCCS translation		

LCCLabel: Broadleaved Deciduous Shrub Crop(s) Dominant Crop: Fruits & Nuts - Grapes (Vitis vinifera)

Classifiers: A2-A7A10-S0610

A2   Shrub Crops
A7   Broadleaved
A10   Deciduous
S0610 Grapes (Vitis vinifera)

LCCCode: 10013-1891-S0610

Notes:

- unclear class boundary due to the guideline to interpret an area as vineyards if "they determine the land use of the area"

- Not class specific:
One is forced to specify a type of 'Water Supply' in LCCS in order to be able to choose an option from 'Cultivation Time Factor' although both characteristics are totally independent. 'Permanent' is not defined.

Consistency of original class definition:	Insufficient		Fair		Good	✖	very good	
Correspondence of range values and lifeform definition:		Yes	✖			No		
Confidence level of translation:		Fair		Good			very good	✖

G.L.C.N. – TRANSLATION UNIT	
Country: EU	**Legend: CORINE Land Cover**

Original Class name: Fruit trees and berry plantations

Original Description: Parcels planted with fruit trees or shrubs: single or mixed fruit species, fruit trees associated with permanently grassed surfaces. Includes chestnut and walnut groves.

Map code:	Original: 222	Translated: 222

LCCS translation

LCCLabel: Broadleaved Tree Crop(s) Crop Type: Fruits & Nuts // Broadleaved Shrub Crop(s) Crop Type: Fruits & Nuts // Broadleaved Shrub Crop(s) Crop Type: Beverage

Classifiers: A1-A7-S6 // A2-A7-S6 // A2-A7-S8

A1   Tree Crops
A7   Broadleaved
S6   Fruits & Nuts
A2   Shrub Crops
S8   Beverages

LCCCode: 10001-3781-S6 // 10013-3781-S6 // 10013-3781-S8

Notes:

- land cover inconsistencies to classes 221, 223, (211)

Consistency of original class definition:	Insufficient		Fair		Good	✖	very good
Correspondence of range values and lifeform definition:		Yes	✖			No	
Confidence level of translation:	Fair			Good	✖		very good

G.L.C.N. – TRANSLATION UNIT	
Country: EU	**Legend: CORINE Land Cover**

Original Class name: Olive groves	

Original Description: Areas planted with olive trees, including mixed occurrence of olive trees and vines on the same parcel.

Map code:	Original: 223	Translated: 223

LCCS translation

LCCLabel: Broadleaved Evergreen Tree Crop(s) Dominant Crop: Industrial Crops - Olive (Olea europaea L.) // Field(s) Of Broadleaved Evergreen Tree Crop(s) (One Additional Crop) (Shrub Crop With Simultaneous Period). Dominant Crop: Industrial Crops - Olive (Olea europaea L.) Second Crop: Fruits & Nuts - Grapes (Vitis vinifera)

Classifiers: A1-A7A9-S0910 // A1XXXXC2-A7A9C3C6C17-S0910S0610

A1	Tree Crops	C3	One Additional Crop
A7	Broadleaved	C6	Shrub Crop (Additional Crop)
A9	Evergreen	C17	With Simultaneous Period (Second Crop)
S0910	Olive (Olea europaea L.)	S0610	Grapes (Vitis vinifera)
C2	Intercropped (Second Crop)		

LCCCode: 10001-1-S0910 // 11345-1275-S0910S0610

Notes:

-   Blurred class boundary to CLC class 221

Consistency of original class definition:	Insufficient		Fair		Good	✖	very good	
Correspondence of range values and lifeform definition:		Yes	✖			No		
Confidence level of translation:	Fair			Good			very good	✖

G.L.C.N. – TRANSLATION UNIT	
Country: EU	**Legend: CORINE Land Cover**

Original Class name: Pastures

Original Description: Dense grass cover, of floral composition, dominated by graminacea, not under a rotation system. Mainly for grazing, but the fodder may be harvested mechanically. Includes areas with hedges (bocage).

Map code:	Original: 231	Translated: 231

LCCS translation	

LCCLabel: Closed to Open (100-40)% Grassland

Classifiers: A6A20-A21

A6   Graminoids
A20   Closed to Open (100-15)%
A21   Closed to Open (100-40)%

(Mode 2: Cultivated - managed and/or Natural and Semi-natural terrestrial vegetation)

LCCCode: 21461-121340

Notes:

- LCCS Mode 2 used because of uncertainties how to rate the degree of management.
- Land use terminology complicates a clear classification & makes interpretation ambiguous

(CORINE's 'particularities' were not regarded within the land cover description due to introducing inconsistencies)

Consistency of original class definition:	Insufficient		Fair	✖	Good		very good
Correspondence of range values and lifeform definition:		Yes	✖			No	
Confidence level of translation:	Fair			Good	✖		very good

G.L.C.N. – TRANSLATION UNIT	
Country: EU	**Legend: CORINE Land Cover**

Original Class name: Annual crops associated with permanent crops

Original Description: Non-permanent crops (arable land or pasture) associated with permanent crops on the same parcel.

Extension:
Permanent crops are either in juxtaposition with arable land/pastures or located along the border of the parcels. The occupation rate of non-permanent crops is more than 50 %.

Map code:	Original: 241	Translated: 241

LCCS translation

LCCLabel: Field(s) Of Herbaceous Crop(s) (One Additional Crop) (Tree Crop With Simultaneous Period) // Field(s) Of Herbaceous Crop(s) (One Additional Crop) (Shrub Crop With Simultaneous Period)

Classifiers: A3XXXXC2-C3C5C17 // A3XXXXC2-C3C6C17

A3 Herbaceous Crops
C2 Intercropped (Second Crop)
C3 One Additional Crop
C5 Tree Crop (Additional Crop)
C17 With Simultaneous Period (Second Crop)
C6 Shrub Crop (Additional Crop)

LCCCode: 11370-12602 // 11370-12614

Notes:
- Translation not entirely possible - pasture is not included explicitly within the LCCS definition.
- Land cover inconsistency: to CLC class 242, 'permanent crops' is not a land cover term
- LCCS, generally, does not consider horizontal spatial arrangement and leaves the choice to the user to consider areas between the fields as part of the cultivated area or not (by building a mixed class).

Consistency of original class definition:	Insufficient ✖	Fair	Good	very good
Correspondence of range values and lifeform definition:	Yes		No ✖	
Confidence level of translation:	Fair ✖	Good	very good	

G.L.C.N. – TRANSLATION UNIT	
Country: EU	**Legend: CORINE Land Cover**

Original Class name: Complex cultivation patterns

Original Description: Juxtaposition of small parcels of diverse annual crops, pasture and/or permanent crops.

Extension:
This class includes juxtaposition of small parcels of annual crops, city garden pastures, fallow land and/or permanent crops eventually with scattered houses or gardens.

Map code:	Original: 242	Translated: 242

LCCS translation

LCCLabel: Small Sized Field(s) Of Herbaceous Crop(s) // Small Sized Field(s) Of Shrubs // Small Sized Field(s) Of Tree Crop(s) // Scattered Urban Area(s)

Classifiers: A3B2XXC2 // A2B2XXC2 // A1B2XXC2 // A4-A13A17
A3   Herbaceous Crops
B2   Small Sized Field(s)
C2   Intercropped (Second Crop)
A2   Shrub Crops
A1   Tree Crops
A4   Non-Linear (Feature)
A13   Urban Area(s)
A17   Scattered Density

LCCCode: 11250 // 11215 // 11195 // 5003-17

Notes:

- Translation not entirely possible, pasture is not described within the LCCS class
- Multiple crops are not described more detailed within the Crop Combination level of the LCCS class because every combination is possible.
- Scattered houses may occur within complex cultivation pattern areas.
- Land cover inconsistency: overlap to CLC class 241

Consistency of original class definition:	Insufficient ✖	Fair	Good	very good
Correspondence of range values and lifeform definition:	Yes		No ✖	
Confidence level of translation:	Fair ✖	Good	very good	

G.L.C.N. – TRANSLATION UNIT	
Country: EU	**Legend: CORINE Land Cover**

Original Class name: Land principally occupied by agriculture, with significant areas of natural vegetation

Original Description: Areas principally occupied by agriculture, interspersed with significant natural areas.

Extension:
This class includes land occupied by agriculture with areas of natural or semi-natural origin (including wetlands and water bodies, out crops).

Map code:	Original: 243	Translated: 243

LCCS translation

LCCLabel: Cultivated and Managed Terrestrial Area(s) / Natural And Semi-Natural Primarily Terrestrial Vegetation

Classifiers: A11 / A12

A11   Cultivated and Managed Terrestrial Area(s)
A12   Natural And Semi-Natural Primarily Terrestrial Vegetation

LCCCode: 0003 / 0004

Notes:

- Cultivated and Managed Terrestrial Area(s) are not necessarily dominating, the share of both parts of the mixed class extends from 25 to 75 %.
- Natural areas include further wetlands, water bodies, bare areas; moreover scattered urban settlements may be found. It is not possible to consider all this for the LCCS translation. But the basic idea of the class (mosaic of agriculture & natural vegetation) may be represented by this translation.
- Land cover inconsistencies to CLC classes 2xx, 3xx

Consistency of original class definition:	Insufficient ✖	Fair	Good	very good
Correspondence of range values and lifeform definition:	Yes		No ✖	
Confidence level of translation:	Fair ✖	Good	very good	

<table>
<tr><td colspan="3" align="center">**G.L.C.N. – TRANSLATION UNIT**</td></tr>
<tr><td colspan="2">**Country: EU**</td><td>**Legend: CORINE Land Cover**</td></tr>
<tr><td colspan="3">**Original Class name: Agro-forestry areas**</td></tr>
<tr><td colspan="3">**Original Description:** Annual crops or grazing land under the wooded cover of forestry species.
Extension:
This class includes annual crops or grazing land and fallow land covering less than 50 % of the surface.</td></tr>
<tr><td>**Map code:**</td><td>Original: 244</td><td>Translated: 244</td></tr>
<tr><td colspan="3" align="center">**LCCS translation**</td></tr>
<tr><td colspan="3">**LCCLabel: Closed to Open Woodland with Herbaceous Layer // Continuous Closed to Open Trees + Continuous Field(s) Of Herbaceous Crop(s)**</td></tr>
<tr><td colspan="3">**Classifiers: A3A20B2C1XXXXF2F4F7G4Z244 // A3A20B2C1 + A3XXB5**

A3   Trees (Main Layer)
A20   Closed to Open (100-15)%
B2   > 30 - 3m (Trees Height Main Layer)
C1   Continuous (Vegetation Main Pattern)
F2   Second and/or Third Layer Present
F4   Herbaceous Vegetation (Second or Third Layer)
F7   Closed (> 70-60%) To Open (70-60) - (20-10)% (Second or Third Layer)
G4   3 - 0.03m (Herbaceous Height Second or Third Layer)
Z244 Grazing land (Pasture)
A3   Herbaceous Crops
B5   Continuous</td></tr>
<tr><td colspan="3">**LCCCode: 21575(1)[Z244] // 2144710027**</td></tr>
<tr><td colspan="3">**Notes:**
-   Mixture of forest trees and tree crops (fruit or olive trees) building the 'wooded cover' possible, but cannot be defined within LCCS.
-   CORINE doesn't provide information about the tree cover.
-   Land cover inconsistencies to CLC classes 31x, 243 (mosaic pattern), 324 (development stage)</td></tr>
</table>

Consistency of original class definition:	Insufficient ✖	Fair	Good	very good
Correspondence of range values and lifeform definition:	Yes		No	
Confidence level of translation:	Fair	Good ✖	very good	

G.L.C.N. – TRANSLATION UNIT	
Country: EU	**Legend: CORINE Land Cover**

Original Class name: Broad-leaved forest

Original Description: Vegetation formation composed principally of trees, including shrub and bush understoreys, where broad-leaved species predominate.

Extension:
This class includes areas with a crown cover of more than 30 % or a 500 subjects/ha density for plantation structure, broad-leaved trees represent more than 75 % of the planting pattern. In case of young plants or seedlings the proportion of broad-leaved plants to be considered is at least 75 % of the total amount of plants.

Map code:	Original: 311	Translated: 311

LCCS translation	
LCCLabel: Broadleaved Closed to Open (100-40)% Trees	

Classifiers: A3A20B2XXD1-A21

A3   Trees (Main Layer)
A20   Closed to Open (100-15)%
B2   > 30 - 3m (Trees Height Main Layer)
D1   Broadleaved
A21   Closed to Open (100-40)%

LCCCode: 21495-121340

Notes:
- Threshold differences
  CORINE: > 30 % cover, 5 m height
  LCCS: 40 % minimum cover, 3 m height
- Woodland areas composed of broad-leaved trees smaller than 5 m high are classified as 322.

Consistency of original class definition:	Insufficient		Fair		Good		very good	✖
Correspondence of range values and lifeform definition:		Yes	✖			No		
Confidence level of translation:		Fair		Good			very good	✖

G.L.C.N. – TRANSLATION UNIT	
Country: EU	**Legend: CORINE Land Cover**

Original Class name: Coniferous forest

Original Description: Vegetation formation composed principally of trees, including shrub and bush understoreys, where coniferous species predominate.

Extension:
Coniferous trees represent more than 75 % of the formation. In case of young plants or seedlings, the proportion of coniferous plants to be considered is at least 75 % of the total amount of plants and their texture is very similar to a surrounding coniferous forest texture.

Map code:	Original: 312	Translated: 312

LCCS translation

LCCLabel: Needleleaved Closed to Open (100-40)% Trees

Classifiers: A3A20B2XXD2-A21

A3   Trees (Main Layer)
A20   Closed to Open (100-15)%
B2   > 30 - 3m (Trees Height Main Layer)
D2   Needleleaved
A21   Closed to Open (100-40)%

LCCCode: 21498-121340

Notes:
- Threshold differences
  CORINE: > 30 % cover, 5 m height
  LCCS: 40 % minimum cover, 3 m height

The term '**coniferous**' refers to taxonomy (division 'conifers' is - following the recent taxonomic nomenclature - named 'Pinophyta') and is **not a consistent separation from 'broad-leaved'** which is a phenological term describing the shape of the leaves. For this reason some trees could be part of both classes:
- most of Cupressaceae, Cypresses (scale-like leaves)
- some of Podocarpaceae (mainly Southern Hemisphere conifers, not existent in Europe), especially Nageia (6 species)
- Agathis (from Araucariaceae), Kauri (only in New Zealand)

(Translation as *Needleleaved* provides definition consistency)

Consistency of original class definition:	Insufficient ✖	Fair	Good	very good
Correspondence of range values and lifeform definition:	Yes		No ✖	
Confidence level of translation:	Fair	Good ✖	very good	

G.L.C.N. – TRANSLATION UNIT	
Country: EU	**Legend: CORINE Land Cover**

Original Class name: Mixed forests	

Original Description: Vegetation formation composed principally of trees, including shrub and bush understoreys, where neither broad-leaved nor coniferous species predominate.

Extension:
Mixed forests with a crown cover of more than 30 % or a 500 subjects/ha density for plantation structure. The share of coniferous or broad-leaved species does not exceed 25 % in the canopy closure.

Map code:	Original: 313	Translated: 313

LCCS translation		

LCCLabel: Mixed Closed to Open (100-40)% Trees // Mixed Closed to Open (100-40)% Trees

Classifiers: A3A20B2XXD1E2-A21E3 // A3A20B2XXD2E1-A21E3
A3   Trees (Main Layer)
A20   Closed to Open (100-15)%
B2   > 30 - 3m (Trees Height Main Layer)
D1   Broadleaved
E2   Deciduous
A21   Closed to Open (100-40)%
E3   Mixed
D2   Needleleaved
E1   Evergreen

LCCCode: 21497-129398 // 21499-129398

Notes:
- Threshold difference
  CORINE: > 30 % crown cover
  LCCS: ≥ 40 % crown cover
- 'coniferous' vs. 'needle-leaved' see comment on CLC class 312
- LCCS limits it's 'Mixed Trees' category exclusively to a layer with a mixture of broad-leaved deciduous and needle-leaved evergreen vegetation – disregarding possibly occurring broad-leaved evergreen and needle-leaved deciduous species in mixed forests. Nevertheless this definition was preferred to a cartographic mixture (broad-leaved / needle-leaved) unintentional specifying the first part of the mixture as dominating following the definition of LCCS.
- LCCS issue: Two possibilities to define mixed forest seem unnecessary.

(Comment to CORINE's description extension: "The share of coniferous or broad-leaved species does not exceed 25 %in the canopy closure." - **25 %** is perhaps a misprint, more likely is 75 %.)

Consistency of original class definition:	Insufficient ✖	Fair	Good	very good
Correspondence of range values and lifeform definition:	Yes		No ✖	
Confidence level of translation:	Fair	Good ✖	very good	

G.L.C.N. – TRANSLATION UNIT	
Country: EU	**Legend: CORINE Land Cover**

Original Class name: Natural grasslands

Original Description: Low productivity grassland. Often situated in areas of rough, uneven ground. Frequently includes rocky areas, briars and heathland.

Extension:
Natural grasslands are areas with herbaceous vegetation (maximum height is 150 cm and gramineous species are prevailing) which cover at least 75 % of the surface covered by vegetation which developed under a minimum human interference (not mowed, fertilized or stimulated by chemicals which might influence production of biomass); here belong for instance grass formations of protected areas, karstic areas, military training fields, etc. (even though the human interference cannot be altogether discarded in quoted areas, it does not suppress the natural development or species composition of the meadows), areas of shrub formations of scattered trees.

Map code:	Original: 321	Translated: 321

LCCS translation

LCCLabel: Herbaceous Closed to Open (100-40)% Vegetation

Classifiers: A2A20-A21

A2   Herbaceous Vegetation (Main Layer)
A20   Closed to Open (100-15)%
A21   Closed to Open (100-40)%

LCCCode: 21453-121340

Notes:

- No vegetation cover density defined in CLC class 321, lower threshold was set to 40 % since CLC class 333 comprises up to 50 % vegetation cover.

Consistency of original class definition:	Insufficient		Fair		Good		very good	✖
Correspondence of range values and lifeform definition:		Yes	✖			No		
Confidence level of translation:		Fair		Good			very good	✖

G.L.C.N. – TRANSLATION UNIT	
Country: EU	**Legend: CORINE Land Cover**

Original Class name: Moors and heathland

Original Description: Vegetation with low and closed cover, dominated by bushes, shrubs and herbaceous plants (heather, briars, broom, gorse, laburnum, etc.).

Extension:
This class includes temperate shrubby area vegetation (climax stage of development): includes dwarf forest trees with a 3 m maximum height in climax stage.

Map code:	Original: 322	Translated: 322

LCCS translation

LCCLabel: Closed to Open (100-40)% Shrubland (Thicket) // Closed to Open (100-40)% Shrubland (Thicket) / Herbaceous Closed to Open

Classifiers: A4A20B3-A21 // A4A20B3-A21 / A2A20-A21

A4   Shrubs (Main Layer)
A20   Closed to Open (100-15)%
B3   5 - 0.3m (Shrubs Height Main Layer)
A21   Closed to Open (100-40)%
A2   Herbaceous Vegetation (Main Layer)

LCCCode: 21450-121340 // 21450-121340 / 21453-121340

Notes:

- CORINE does not exactly specify the vegetation cover.
- Land Cover inconsistent to CLC classes 323, 324 (322 - describes not life form but a special vegetation association)

Consistency of original class definition:	Insufficient ✖	Fair	Good	very good
Correspondence of range values and lifeform definition:	Yes		No	
Confidence level of translation:	Fair	Good ✖	very good	

G.L.C.N. – TRANSLATION UNIT

Country: EU	Legend: CORINE Land Cover

Original Class name: Sclerophyllous vegetation

Original Description: Bushy sclerophyllous vegetation, includes maquis and garrigue. In case of shrub vegetation areas composed of sclerophyllous species such as Juniperus oxycedrus and heathland species such as Buxus spp. or Ostrya carpinifolia with no visible dominance (each species occupy about 50% of the area), priority will be given to sclerophyllous vegetation and the whole area will be assigned class 323.

Extension:
This class includes evergreen sclerophyllous bushes and scrubs which compose maquis, garrigue, mattoral and phrygana.

Map code:	Original: 323	Translated: 323

LCCS translation

LCCLabel: Broadleaved Evergreen Closed to Open (100-40)% Thicket

Classifiers: A4A20B3XXD1E1-A21

A4	Shrubs (Main Layer)
A20	Closed to Open (100-15)%
B3	5 - 0.3m (Shrubs Height Main Layer)
D1	Broadleaved
E1	Evergreen
A21	Closed to Open (100-40)%

LCCCode: 21517-121340

Notes:

- Inconsistent land cover to CLC classes 322, 324, (311)
- 323 refers to vegetation associations not to land cover
- CORINE does not specify vegetation cover, differences depending on actual vegetation association (Maquis = dense, Garrigue = discontinuous)

Consistency of original class definition:	Insufficient ✖	Fair	Good	very good
Correspondence of range values and lifeform definition:	Yes		No	
Confidence level of translation:	Fair	Good ✖	very good	

G.L.C.N. – TRANSLATION UNIT	
Country: EU	**Legend: CORINE Land Cover**

Original Class name: Transitional woodland-shrub	

Original Description: Bushy or herbaceous vegetation with scattered trees. Can represent either woodland degradation or forest regeneration/recolonisation.

Extension:
Areas of natural developmental forest formations (young broad–leaved and coniferous wood species with herbaceous vegetation and dispersed solitary trees) for instance; in abandoned meadows and pastures or after calamities of various origin, part of this class may be also various degenerative stages of forest caused by industrial pollution, etc.

Map code:	Original: 324	Translated: 324

LCCS translation		

LCCLabel: Closed to Open (100-40)% Woody Vegetation // Closed to Open (100-40)% Woody Vegetation with Herbaceous Layer

Classifiers: A1A20-A21 // A1A20B1XXXXXXF2F4F7G4-A21

A1	Woody Vegetation (Main Layer)
A20	Closed to Open (100-15)%
A21	Closed to Open (100-40)%
B1	7 – 2m (Height for Woody Vegetation Main Layer)
F2	Second and/or Third Layer Present
F4	Herbaceous Vegetation (Second or Third Layer)
F7	Closed (> 70-60%) To Open (70-60) - (20-10)% (Second or Third Layer)
G4	3 - 0.03m (Herbaceous Height Second or Third Layer)

LCCCode: 21441-121340 // 21548-121340

Notes:
- Inconsistencies: CORINE generally does specify a tree cover **less than 30 %**. In case of recolonisation/regeneration of arable land/natural grassland the tree cover is specified with **more than 30 %** (special case?) contradicting earlier definitions and producing overlaps to CLC classes 31x, 243, 244.
- Additional overlaps to classes 322, 323
- CLC class 324 refers to a process (not really to actual land cover)
- Classifier "Woody" is used in place of a thematic mixture of numerous classes, this is a concession to the inconsistency of the class description in favour of clearness.

Consistency of original class definition:	Insufficient ✖		Fair		Good		very good
Correspondence of range values and lifeform definition:		Yes				No	
Confidence level of translation:	Fair ✖			Good		very good	

	G.L.C.N. – TRANSLATION UNIT	
Country: EU		**Legend: CORINE Land Cover**

Original Class name: Beaches, dunes, sands

Original Description: Beaches, dunes and expanses of sand or pebbles in coastal or continental locations, including beds of stream channels with torrential regime.

Extension:
This class includes supra-littoral beaches and dunes developed at the back of the beach from high water mark towards land.

Map code:	Original: 331	Translated: 331
	LCCS translation	

LCCLabel: Loose And Shifting Sands // Bare Rock And/Or Coarse Fragments - Gravels

Classifiers: A6 // A3-A14Z331

A6   Loose and Shifting Sands
A3   Bare Rock And/Or Coarse Fragments
A14   Gravel
Z331   Gravel accumulation along stream channels

LCCCode: 6006 // 6002-8(1)[Z331]

Notes:

- Slight land cover inconsistency to CLC class 332 (CORINE does not include other gravel occurrences than defined in Z331)

Consistency of original class definition:	Insufficient		Fair		Good	✖	very good
Correspondence of range values and lifeform definition:		Yes				No	
Confidence level of translation:	Fair			Good		very good	✖

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G.L.C.N. – TRANSLATION UNIT		
Country: EU		**Legend: CORINE Land Cover**

Original Class name: Bare rocks

Original Description: Scree, cliffs, rock outcrops, including active erosion, rocks and reef flats situated above the high-water mark.

Map code:	Original: 332	Translated: 332

LCCS translation

LCCLabel: Bare Rock And/Or Coarse Fragments // Herbaceous Sparse Vegetation

Classifiers: A3 // A2A14

A3   Bare Rock And/Or Coarse Fragments
A2   Herbaceous Vegetation (Main Layer)
A14   Sparse (20-10) - 1% (Main Layer)

LCCCode: 6002 // 20058

Notes:

-    Further guidelines of CORINE: Includes sparsely vegetated areas where 75 % of the land surface is covered by rocks. However, following the specifications of class 333 the vegetation cover must not exceed 15 % and the area will be classified as 332 if the ground cover exceeds 85 % of the surface.

Consistency of original class definition:	Insufficient		Fair		Good	✖	very good
Correspondence of range values and lifeform definition:	Yes				No		
Confidence level of translation:	Fair		Good			very good	✖

G.L.C.N. – TRANSLATION UNIT	
Country: EU	**Legend: CORINE Land Cover**

Original Class name: Sparsely vegetated areas	

Original Description: Includes steppes, tundra and badlands. Scattered high-altitude vegetation.

Extension:
Scattered vegetation is composed of gramineous and/or ligneous and semi-ligneous species for determining the ground cover percentage, excluding cryptogams.

Map code:	Original: 333	Translated: 333

LCCS translation		

LCCLabel: Herbaceous Open (40 - (20-10)%) Vegetation

Classifiers: A2A11-A13

A2   Herbaceous Vegetation (Main Layer)
A11   Open General (70-60) - (20-10)% (Main Layer)
A13   Very Open 40 - (10-20)% (Main Layer)

LCCCode: 20037-3012

Notes:

-    Threshold difference
     CORINE: up to 50 % vegetation cover
     LCCS: up to 40 % vegetation cover

Consistency of original class definition:	Insufficient		Fair		Good		very good	✖
Correspondence of range values and lifeform definition:	Yes	✖				No		
Confidence level of translation:	Fair			Good			very good	✖

G.L.C.N. – TRANSLATION UNIT	
Country: EU	**Legend: CORINE Land Cover**

Original Class name: Burnt areas

Original Description: Areas affected by recent fires, still mainly black.

Extension:
This class includes burnt forest areas, moors and heathlands, transitory forest-shrub formations, areas with sparse vegetation.

Map code:	Original: 334	Translated: 334

LCCS translation	

LCCLabel: Natural And Semi-Natural Primarily Terrestrial Vegetation

Classifiers: A12Z334

A12   Natural And Semi-Natural Primarily Terrestrial Vegetation
Z334   Burnt

LCCCode: 0004(3)[Z334]

Notes:

- CORINE includes all natural and semi-natural vegetated areas, burns are considered if they are younger than three years and when they are still visible in the satellite images.
- 'Burnt' does refer to an environmental event – for that reason it is inconsistent regarding land cover
- Without describing actual land cover translation becomes arbitrary, e.g. one could consider to add a mixed class 'Natural and Semi-Natural Primarily Terrestrial Vegetation / Bare Area(s)' and/or a pure 'Bare Area(s)' part if necessary since the vegetation affected by fire may possibly no longer exist and the land cover actually is 'bare'.

Consistency of original class definition:	Insufficient ✖	Fair	Good	very good
Correspondence of range values and lifeform definition:	Yes		No	
Confidence level of translation:	Fair	Good ✖	very good	

G.L.C.N. – TRANSLATION UNIT	
Country: EU	**Legend: CORINE Land Cover**

Original Class name: Glaciers and perpetual snow

Original Description: Land covered by glaciers or permanent snowfields.

Map code:	Original: 335	Translated: 335
	LCCS translation	

LCCLabel: Perennial Ice // Perennial Snow

Classifiers: A3B1 // A2B1

A3   Ice
B1   Perennial
A2   Snow

LCCCode: 8009 // 8006

Notes:

- CORINE includes a possible share of bare rock cover up to 50 %, however, it is impossible to include two cartographic mixtures in a thematically mixed class.

Consistency of original class definition:	Insufficient		Fair		Good	✖	very good
Correspondence of range values and lifeform definition:		Yes				No	
Confidence level of translation:	Fair			Good	✖		very good

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G.L.C.N. – TRANSLATION UNIT		
Country: EU	**Legend: CORINE Land Cover**	

Original Class name: Inland marshes		

Original Description: Low-lying land usually flooded in winter, and more or less saturated by water all year round.

Extension:
This class includes non-forested areas of low-lying land flooded or liable to flooding by fresh, stagnant or circulating water. Covered by specific low ligneous, semi-ligneous or herbaceous vegetation.

Map code:	Original: 411	Translated: 411

LCCS translation		

LCCLabel: Closed to Open (100-40)% Herbaceous Vegetation

Classifiers: A2A20-A21

A2   Herbaceous Vegetation (Main Layer)
A20 Closed to Open (100-15)%
A21 Closed to Open (100-40)%

LCCCode: 42155-60686

Notes:

- CORINE does not specify a vegetation cover, another option is to define 15 – 100 %.

Consistency of original class definition:	Insufficient		Fair		Good		very good	✖
Correspondence of range values and lifeform definition:	Yes				No			
Confidence level of translation:	Fair			Good	✖		very good	

G.L.C.N. – TRANSLATION UNIT	
Country: EU	**Legend: CORINE Land Cover**

Original Class name: Peat bogs

Original Description: Peatland consisting mainly of decomposed moss and vegetable matter. May or may not be exploited.

Map code:	Original: 412	Translated: 412

LCCS translation

LCCLabel: Closed to Open Herbaceous Vegetation / Closed to Open Lichens/Mosses. // Bare Soil And/Or Other Unconsolidated Material(s)

Classifiers: A2A20 / A7A20 // A5Z412

A2	Herbaceous Vegetation (Main Layer)
A20	Closed to Open (100-15)%
A7	Lichens/Mosses
A5	Bare Soil and Other Unconsolidated Materials
Z412	Peat extracting areas

LCCCode: 42155 / 422606005(1)[Z412]

Notes:

- CORINE does not specify vegetation cover.
- 'Peat bogs' does not refer to land cover, hence causes inconsistency (vegetated, bare soil, but wooded peat bogs are part of classes 31x)

Consistency of original class definition:	Insufficient		Fair	✖	Good		very good
Correspondence of range values and lifeform definition:		Yes				No	
Confidence level of translation:	Fair			Good	✖	very good	

G.L.C.N. – TRANSLATION UNIT

Country: EU	Legend: CORINE Land Cover

Original Class name: Salt marshes

Original Description: Vegetated low-lying areas, above the high-tide line, susceptible to flooding by seawater. Often in the process of filling in, gradually being colonized by halophilic plants.

Map code:	Original: 421	Translated: 421

LCCS translation

LCCLabel: Closed to Open Herbaceous Vegetation Water Quality: Saline Water

Classifiers: A2A20-R3

A2   Herbaceous Vegetation (Main Layer)
A20   Closed to Open (100-15)%
R3   Saline Water

LCCCode: 42155-R3

Notes:

- Inland salt marshes are not included (class 411) – but there is no inconsistency to be reported since class 421 is part of the *Coastal wetlands* category.

Consistency of original class definition:	Insufficient		Fair		Good		very good ✖
Correspondence of range values and lifeform definition:		Yes				No	
Confidence level of translation:	Fair			Good		very good ✖	

G.L.C.N. – TRANSLATION UNIT	
Country: EU	**Legend: CORINE Land Cover**

Original Class name: Salines

Original Description: Salt-pans, active or in process of abandonment. Sections of salt marsh exploited for the production of salt by evaporation. They are clearly distinguishable from the rest of the marsh by their parcellation and embankment systems.

Map code:	Original: 422	Translated: 422

LCCS translation

LCCLabel: Shallow Artificial Perennial Waterbodies (Standing) Salinity: Brine // Shallow Artificial Non-Perennial Waterbodies (Standing) (Surface Aspect: Bare Soil) Salinity: Brine

Classifiers: A1B1C2-A5-V5 // A1B2C2-A5B4-V5

A1	Artificial Waterbodies
B1	Perennial
C2	Shallow
A5	(Standing)
V5	Brine
B2	Non-Perennial
B4	(Surface Aspect: Bare Soil)

LCCCode: 7013-5-V5 // 7019-7-V5

Notes:

- Referring to land use, not land cover
- Salinity in LCCS: The TDS scale is obsolete and should be replaced with the psu scale.

Consistency of original class definition:	Insufficient		Fair		Good	✖	very good
Correspondence of range values and lifeform definition:	Yes				No		
Confidence level of translation:	Fair			Good	✖		very good

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G.L.C.N. – TRANSLATION UNIT	
Country: EU	**Legend: CORINE Land Cover**

Original Class name: Intertidal flats

Original Description: Generally unvegetated expanses of mud, sand or rock lying between high and low water marks. 0 m contour on maps.

Extension:
Warning: 0 m marine contour on maps is not always based on the same reference system and might differ up to 2 m between European countries.

Map code:	Original: 423	Translated: 423
LCCS translation		

LCCLabel: Tidal Area

Classifiers: A1B3

A1   Inland water
B3   Tidal Area

LCCCode: 8004

Notes:

- LCCS' appellation of classifier A1 (Inland water), actually 'Natural Waterbodies', appears odd, especially considering the option to define it as 'Tidal Area'.

Consistency of original class definition:	Insufficient	Fair	Good	very good ✘
Correspondence of range values and lifeform definition:	Yes		No	
Confidence level of translation:	Fair	Good	very good ✘	

G.L.C.N. – TRANSLATION UNIT

Country: EU	Legend: CORINE Land Cover

Original Class name: Water courses

Original Description: Natural or artificial water-courses serving as water drainage channels. Includes canals. Minimum width for inclusion: 100 m.

Map code:	Original: 511	Translated: 511

LCCS translation

LCCLabel: Natural Waterbodies (Flowing) // Artificial Waterbodies (Flowing)

Classifiers: A1-A4 // A1-A4

A1   Inland Water
A4   (Flowing)
A1   Artificial Waterbodies

LCCCode: 8001-1 // 7001-1

Notes:

Consistency of original class definition:	Insufficient		Fair		Good		very good	✖
Correspondence of range values and lifeform definition:	Yes					No		
Confidence level of translation:	Fair			Good			very good	✖

G.L.C.N. – TRANSLATION UNIT

Country: EU	Legend: CORINE Land Cover

Original Class name: Water bodies

Original Description: Natural or artificial stretches of water.

Map code:	Original: 512	Translated: 512

LCCS translation

LCCLabel: Natural Waterbodies (Standing) // Artificial Waterbodies (Standing)

Classifiers: A1-A5 // A1-A5

A1   Inland Water
A5   (Standing)
A1   Artificial Waterbodies

LCCCode: 8001-5 // 7001-5

Notes:

Consistency of original class definition:	Insufficient		Fair		Good		very good	✖
Correspondence of range values and lifeform definition:		Yes				No		
Confidence level of translation:	Fair			Good			very good	✖

G.L.C.N. – TRANSLATION UNIT	
Country: EU	**Legend: CORINE Land Cover**

Original Class name: Coastal lagoons

Original Description: Stretches of salt or brackish water in coastal areas which are separated from the sea by a tongue of land or other similar topography. These water bodies can be connected to the sea at limited points, either permanently or for parts of the year only.

Map code:	Original: 521	Translated: 521

LCCS translation

LCCLabel: Natural Waterbodies (Standing) // Artificial Waterbodies (Standing)

Classifiers: A1-A5Z521 // A1-A5Z521

A1   Inland Water
A5   (Standing)
A1   Artificial Waterbodies
Z521 Coastal lagoons, salt or brackish water

LCCCode: 8001-5(5)[Z521] // 7001-5(5)[Z521]

Notes:

- LCCS clone of class 512, 'Artificial Waterbodies' included since artificially separated lagoons may occur following CLC.
- Degrees of salinity could be added if preferred, only they have to be mentioned individually (five possibilities). One should be able to define saline water without being forced to specify the degree of salinity.

Consistency of original class definition:	Insufficient		Fair ✖		Good	very good
Correspondence of range values and lifeform definition:		Yes			No	
Confidence level of translation:	Fair			Good ✖		very good

G.L.C.N. – TRANSLATION UNIT	
Country: EU	**Legend: CORINE Land Cover**

Original Class name: Estuaries

Original Description: The mouth of a river within which the tide ebbs and flows.

Map code:	Original: 522	Translated: 522

LCCS translation	

LCCLabel: Tidal Area (Flowing) Salinity: Slightly Saline

Classifiers: A1B3-A4-V2

A1   Inland Water
B3   Tidal Area
A4   (Flowing)
V2   Slightly Saline

LCCCode: 8004-1-V2

Notes:

- LCCS cannot define 'brackish'
- 'Moderately Saline' could be added if necessary.

Consistency of original class definition:	Insufficient		Fair		Good		very good	✖
Correspondence of range values and lifeform definition:		Yes				No		
Confidence level of translation:	Fair			Good	✖		very good	

G.L.C.N. – TRANSLATION UNIT	
Country: EU	**Legend: CORINE Land Cover**

Original Class name: Sea and ocean

Original Description: Zone seaward of the lowest tide limit.

Map code:	Original: 523	Translated: 523

LCCS translation

LCCLabel: Perennial Natural Waterbodies Salinity: Moderately Saline // Perennial Natural Waterbodies Salinity: Very Saline // Perennial Natural Waterbodies Salinity: Brine

Classifiers: A1B1-V3 // A1B1-V4 // A1B1-V5

A1   Inland Water
B1   Perennial
V3   Moderately Saline
V4   Very Saline
V5   Brine

LCCCode: 8002-V3 // 8002-V4 // 8002-V5

Notes:

- If preferred a user defined attribute ('salt water') could complement a single class.
- It should be possible to simply define 'saline'/'salty'.

Consistency of original class definition:	Insufficient		Fair		Good		very good	✖
Correspondence of range values and lifeform definition:		Yes				No		
Confidence level of translation:	Fair			Good	✖		very good	

D3   IGBP DISCover

G.L.C.N. – TRANSLATION UNIT	
Country: International	**Legend: IGBP**

Original Class name: Evergreen Needleleaf Forests

Original Description: Lands dominated by trees with a percent canopy cover > 60 % and height exceeding 2 meters. Almost all trees remain green all year. Canopy is never without green foliage.

Map code:	Original: 1	Translated: 1

LCCS translation		

LCCLabel: Needleleaved Evergreen Trees

Classifiers: A3A10B2XXD2E1

A3   Trees (Main Layer)
A10   Closed > (70-60)% (Main Layer)
B2   > 30 – 3m (Trees Height Main Layer)
D2   Needleleaved
E1   Evergreen

LCCCode: 20092

Notes:

Consistency of original class definition:	Insufficient		Fair		Good		very good ✖
Correspondence of range values and lifeform definition:		Yes ✖				No	
Confidence level of translation:	Fair			Good			very good ✖

G.L.C.N. – TRANSLATION UNIT

Country: International	Legend: IGBP

Original Class name: Evergreen Broadleaf Forests

Original Description: Lands dominated by trees with a percent canopy cover > 60 % and height exceeding 2 meters. Almost all trees remain green all year. Canopy is never without green foliage.

Map code:	Original: 2	Translated: 2

LCCS translation

LCCLabel: Broadleaved Evergreen Trees

Classifiers: A3A10B2XXD1E1

A3	Trees (Main Layer)
A10	Closed > (70-60)% (Main Layer)
B2	> 30 – 3m (Trees Height Main Layer)
D1	Broadleaved
E1	Evergreen

LCCCode: 20089

Notes:

Consistency of original class definition:	Insufficient		Fair		Good		very good ✖
Correspondence of range values and lifeform definition:	Yes ✖				No		
Confidence level of translation:	Fair		Good			very good ✖	

G.L.C.N. – TRANSLATION UNIT

Country: International	**Legend: IGBP**

Original Class name: Deciduous Needleleaf Forests

Original Description: Lands dominated by trees with a percent canopy cover > 60 % and height exceeding 2 meters. Constists of seasonal needleleaf tree communities with an annual cycle of leaf-on and leaf-off periods.

Map code:	Original: 3	Translated: 3

LCCS translation

LCCLabel: Needleleaved Deciduous Trees

Classifiers: A3A10B2XXD2E2

A3 Trees (Main Layer)
A10 Closed > (70-60)% (Main Layer)
B2 > 30 – 3m (Trees Height Main Layer)
D2 Needleleaved
E2 Deciduous

LCCCode: 20093

Notes:

Consistency of original class definition:	Insufficient		Fair		Good		very good	✖
Correspondence of range values and lifeform definition:	Yes	✖				No		
Confidence level of translation:	Fair			Good			very good	✖

G.L.C.N. – TRANSLATION UNIT

Country: International	Legend: IGBP

Original Class name: Deciduous Broadleaf Forests

Original Description: Lands dominated by trees with a percent canopy cover > 60 % and height exceeding 2 meters. Constists of seasonal broadleaf tree communities with an annual cycle of leaf-on and leaf-off periods.

Map code:	Original: 4	Translated: 4

LCCS translation

LCCLabel: Broadleaved Deciduous Trees

Classifiers: A3A10B2XXD1E2

A3	Trees (Main Layer)
A10	Closed > (70-60)% (Main Layer)
B2	> 30 – 3m (Trees Height Main Layer)
D1	Broadleaved
E2	Deciduous

LCCCode: 20090

Notes:

Consistency of original class definition:	Insufficient	Fair	Good	very good ✖
Correspondence of range values and lifeform definition:	Yes ✖		No	
Confidence level of translation:	Fair	Good	very good ✖	

G.L.C.N. – TRANSLATION UNIT	
Country: International	**Legend: IGBP**

Original Class name: Mixed Forests

Original Description: Lands dominated by trees with a percent canopy cover > 60 % and height exceeding 2 meters. Consists of tree communities with interspersed mixtures or mosaics of the other four forest cover types. None of the forest types exceeds 60 % of the landscape.

Map code:	Original: 5	Translated: 5

LCCS translation	

LCCLabel: Closed Trees

Classifiers: A3A10B2Z5

A3   Trees (Main Layer)
A10   Closed > (70-60)% (Main Layer)
B2   > 30 – 3m (Trees Height Main Layer)
Z5   IGBP Mixed Forest

LCCCode: 20006(3)[Z5]

Notes:

- Awkward IGBP definition: none of the 4 IGBP forest types shall exceed 60 % coverage which easily may occur within a 2-types intermixture
- IGBP definition accounts for every mixture (i.e. includes for example a "pure" needle-leaved/broadleaved mix of evergreen and deciduous species)

Consistency of original class definition:	Insufficient		Fair ✖	Good	very good
Correspondence of range values and lifeform definition:	Yes ✖			No	
Confidence level of translation:	Fair		Good ✖	very good	

G.L.C.N. – TRANSLATION UNIT	
Country: International	**Legend: IGBP**

Original Class name: Closed Shrublands

Original Description: Lands with woody vegetation less than 2 meters tall and with shrub canopy cover > 60 %. The shrub foliage can be either evergreen or deciduous.

Map code:	Original: 6	Translated: 6

LCCS translation		

LCCLabel: Closed Medium High Shrubland (Thicket)

Classifiers: A4A10B3-B9

A4   Shrubs (Main Layer)
A10   Closed > (70-60)% (Main Layer)
B3   5 – 0.3m (Shrubs Height Main Layer)
B9   Medium High 3 – 0.5m (Shrubs Height Main Layer)

LCCCode: 20018-13476

Notes:

Consistency of original class definition:	Insufficient		Fair		Good		very good ✖
Correspondence of range values and lifeform definition:	Yes ✖				No		
Confidence level of translation:	Fair		Good			very good ✖	

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G.L.C.N. – TRANSLATION UNIT

Country: International	Legend: IGBP

Original Class name: Open Shrublands

Original Description: Lands with woody vegetation less than 2 meters tall and with shrub canopy cover between 10 - 60 %. The shrub foliage can be either evergreen or deciduous.

Map code:	Original: 7	Translated: 7

LCCS translation

LCCLabel: Open Medium High Shrubs (Shrubland)

Classifiers: A4A11B3-B9

A4   Shrubs (Main Layer)
A11   Open General (70-60) – (20-10)% (Main Layer)
B3   5 – 0.3m (Shrubs Height Main Layer)
B9   Medium High 3 – 0.5m (Shrubs Height Main Layer)

LCCCode: 20022-13476

Notes:

Consistency of original class definition:	Insufficient		Fair		Good		very good ✖
Correspondence of range values and lifeform definition:		Yes ✖				No	
Confidence level of translation:		Fair		Good		very good ✖	

G.L.C.N. – TRANSLATION UNIT	
Country: International	**Legend: IGBP**

Original Class name: Woody Savannas

Original Description: Lands with herbaceous and other understory systems, and with forest canopy cover between 30 - 60 %. The forest cover height exceeds 2 meters.

Map code:	Original: 8	Translated: 8

LCCS translation		

LCCLabel: ((70-60) - 40%) Woodland with Herbaceous Layer

Classifiers: A3A11B2XXXXXXF2F4F7G4-A12

A3	Trees (Main Layer)
A11	Open General (70-60) – (20-10)% (Main Layer)
B2	> 30 – 3m (Trees Height Main Layer)
F2	Second and/or Third Layer Present
F4	Herbaceous Vegetation (Second or Third Layer)
F7	Closed (>70-60%) To Open (70-60) – (20-10)% (Second or Third Layer)
G4	3 – 0.03m (Herbaceous Height Second or Third Layer)
A12	Open (70-60) – 40% (Main Layer)

LCCCode: 20317-1

Notes: - IGBP's "and other understory systems" remains untranslated due to the lack of concrete details

Consistency of original class definition:	Insufficient		Fair		Good		very good ✖
Correspondence of range values and lifeform definition:		Yes ✖				No	
Confidence level of translation:	Fair			Good		very good ✖	

G.L.C.N. – TRANSLATION UNIT

Country: International	Legend: IGBP

Original Class name: Savannas

Original Description: Lands with herbaceous and other understory systems, and with forest canopy cover between 10 - 30 %. The forest cover height exceeds 2 meters.

Map code:	Original: 9	Translated: 9

LCCS translation

LCCLabel: (40 - (20-10)%) Woodland with Herbaceous Layer

Classifiers: A3A11B2XXXXXXF2F4F7G4-A13

A3	Trees (Main Layer)
A11	Open General (70-60) – (20-10)% (Main Layer)
B2	> 30 – 3m (Trees Height Main Layer)
F2	Second and/or Third Layer Present
F4	Herbaceous Vegetation (Second or Third Layer)
F7	Closed (>70-60%) To Open (70-60) – (20-10)% (Second or Third Layer)
G4	3 – 0.03m (Herbaceous Height Second or Third Layer)
A13	Very Open 40 – (20-10)% (Main Layer)

LCCCode: 20317-3012

Notes:

- cf. IGBP class 8

Consistency of original class definition:	Insufficient	Fair	Good	very good ✖
Correspondence of range values and lifeform definition:	Yes ✖		No	
Confidence level of translation:	Fair	Good	very good ✖	

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G.L.C.N. – TRANSLATION UNIT

Country: International	Legend: IGBP

Original Class name: Grasslands

Original Description: Lands with herbaceous types of cover. Tree and shrub cover is less than 10 %.

Map code:	Original: 10	Translated: 10

LCCS translation

LCCLabel: Herbaceous Closed to Open Vegetation

Classifiers: A2A20

A2   Herbaceous Vegetation (Main Layer)
A20   Closed to Open (100-15)%

LCCCode: 21453

Notes:

Consistency of original class definition:	Insufficient		Fair		Good		very good ✖
Correspondence of range values and lifeform definition:	Yes ✖				No		
Confidence level of translation:	Fair		Good			very good ✖	

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G.L.C.N. – TRANSLATION UNIT	
Country: International	**Legend: IGBP**

Original Class name: Permanent Wetlands

Original Description: Lands with a pemanent mixture of water and herbaceous or woody vegetation. The vegetation can be present in either salt, brackish, or fresh water.

Map code:	Original: 11	Translated: 11

LCCS translation

LCCLabel: Natural And Semi-Natural Aquatic or Regularly Flooded Vegetation

Classifiers: A24

A24   Natural and Semi-Natural Aquatic or Regularly Flooded Vegetation

LCCCode: 0007

Notes:

-    With regard to life forms overlaps to the corresponding generic classes are unavoidable.

Consistency of original class definition:	Insufficient		Fair		Good ✖		very good
Correspondence of range values and lifeform definition:		Yes ✖				No	
Confidence level of translation:	Fair			Good		very good ✖	

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G.L.C.N. – TRANSLATION UNIT

Country: International	Legend: IGBP

Original Class name: Croplands

Original Description: Lands covered with temporary crops followed by harvest and a bare soil period (e.g., single and multiple cropping systems). Note that perennial woody crops will be classified as the appropriate forest or shrub land cover type.

Map code:	Original: 12	Translated: 12

LCCS translation

LCCLabel: Herbaceous Crop(s)

Classifiers: A3

A3   Herbaceous Crops

LCCCode: 10025

Notes:

Consistency of original class definition:	Insufficient		Fair		Good		very good ✖
Correspondence of range values and lifeform definition:		Yes ✖				No	
Confidence level of translation:	Fair			Good		very good ✖	

G.L.C.N. – TRANSLATION UNIT

Country: International	Legend: IGBP

Original Class name: Urban and Built-up

Original Description: Land covered by buildings and other man-made structures. Note that this class will not be mapped from the AVHRR imagery but will be developed from the populated places layer that is part of the Digital Chart of the World.

Map code:	Original: 13	Translated: 13

LCCS translation

LCCLabel: Artificial Surfaces and Associated Area(s)

Classifiers: B15

B15   Artificial Surfaces and Associated Area(s)

LCCCode: 0010

Notes:

Consistency of original class definition:	Insufficient	Fair	Good	very good ✖
Correspondence of range values and lifeform definition:	Yes		No	
Confidence level of translation:	Fair	Good	very good ✖	

G.L.C.N. – TRANSLATION UNIT		

Country: International | **Legend: IGBP**

Original Class name: Cropland/Natural Vegetation Mosaics

Original Description: Lands with a mosaic of croplands, forest, shrublands, and grasslands in which no one component comprises more than 60% of the landscape.

Map code:	Original: 14	Translated: 14

LCCS translation

LCCLabel: Herbaceous Crop(s) / Natural And Semi-Natural Primarily Terrestrial Vegetation

Classifiers: A3 / A12

A3   Herbaceous Crops
A12   Natural and Semi-Natural Primarily Terrestrial Vegetation

LCCCode: 10025 / 0004

Notes:

- The 60 % intermixture threshold is a rather narrow definition for this class and does not match the LCCS definitions being 20/80 % for (spatial) mixed classes.
- Limited capability of LCCS to define mosaics (spatial mixtures) leads to the generic translation.
- Although, following the IGBP definition, the share of natural vegetation could surpass the cropland part, LCCS forces to specify one dominant element. Cropland was chosen supposing this element more crucial for the concerned area.

Consistency of original class definition:	Insufficient		Fair		Good ✖		very good
Correspondence of range values and lifeform definition:	Yes				No ✖		
Confidence level of translation:	Fair		Good			very good ✖	

G.L.C.N. – TRANSLATION UNIT

Country: International	Legend: IGBP

Original Class name: Snow and Ice

Original Description: Lands under snow and/or ice cover throughout the year.

Map code:	Original: 15	Translated: 15

LCCS translation

LCCLabel: Snow // Ice

Classifiers: A2 // A3

A2   Snow
A3   Ice

LCCCode: 8005 // 8008

Notes:

Consistency of original class definition:	Insufficient		Fair		Good		very good ✖
Correspondence of range values and lifeform definition:		Yes				No	
Confidence level of translation:	Fair			Good		very good ✖	

G.L.C.N. – TRANSLATION UNIT	
Country: International	**Legend: IGBP**

Original Class name: Barren or Sparsely Vegetated

Original Description: Lands with exposed soil, sand, rocks, or snow and never has more than 10 % vegetated cover during any time of the year.

Map code:	Original: 16	Translated: 16

LCCS translation

LCCLabel: Bare Area(s) // Herbaceous Sparse Vegetation // Sparse Shrubs

Classifiers: B16 // A2A14 // A4A14

B16	Bare Area(s)
A2	Herbaceous Vegetation (Main Layer)
A14	Sparse (20-10) – 1% (Main Layer)
A4	Shrubs (Main Layer)

LCCCode: 0011 // 20058 // 20055

Notes:

Consistency of original class definition:	Insufficient		Fair		Good		very good ✖
Correspondence of range values and lifeform definition:		Yes ✖				No	
Confidence level of translation:	Fair			Good			very good ✖

G.L.C.N. – TRANSLATION UNIT		
Country: International		**Legend: IGBP**
Original Class name: Water Bodies		
Original Description: Oceans, seas, lakes, reservoirs, and rivers. Can be either fresh or salt-water bodies.		
Map code:	Original: 17	Translated: 17

LCCS translation
LCCLabel: Artificial Waterbodies // Natural Waterbodies

Classifiers: A1 // A1

A1   Artificial Waterbodies
A1   Inland Water

LCCCode: 7001 // 8001

Notes:

Consistency of original class definition:	Insufficient		Fair		Good		very good	✖
Correspondence of range values and lifeform definition:		Yes				No		
Confidence level of translation:	Fair			Good			very good	✖

D4   UMd

<table>
<tr><td colspan="5" align="center">G.L.C.N. – TRANSLATION UNIT</td></tr>
<tr><td colspan="3">Country: Global</td><td colspan="2">Legend: UMd</td></tr>
<tr><td colspan="5">Original Class name: Water Bodies</td></tr>
<tr><td colspan="5">Original Description: Oceans, seas, lakes, reservoirs, and rivers. Can be either fresh or salt water. Note that this class is derived from a land/water mask.

</td></tr>
<tr><td colspan="2">Map code:</td><td>Original: 0</td><td colspan="2">Translated: 0</td></tr>
<tr><td colspan="5" align="center">LCCS translation</td></tr>
<tr><td colspan="5">LCCLabel: Artificial Waterbodies // Natural Waterbodies</td></tr>
<tr><td colspan="5">Classifiers: A1 // A1

A1   Artificial Waterbodies
A1   Inland Water

</td></tr>
<tr><td colspan="5">LCCCode: 7001 // 8001</td></tr>
<tr><td colspan="5">Notes:

</td></tr>
<tr><td>Consistency of original class definition:</td><td>Insufficient</td><td>Fair</td><td>Good</td><td>very good ✖</td></tr>
<tr><td>Correspondence of range values and lifeform definition:</td><td colspan="2">Yes</td><td colspan="2">No</td></tr>
<tr><td>Confidence level of translation:</td><td>Fair</td><td colspan="2">Good</td><td>very good ✖</td></tr>
</table>

G.L.C.N. – TRANSLATION UNIT	
Country: Global	**Legend: UMd**

Original Class name: Evergreen Needleleaf Forests

Original Description: Lands dominated by trees with a percent canopy cover >60% and height exceeding 5m. Almost all trees remain green all year. Canopy is never without green foliage.

Map code:	Original: 1	Translated: 1

LCCS translation

LCCLabel: Needleleaved Evergreen Trees

Classifiers: A3A10B2XXD2E1

A3   Trees (Main Layer)
A10   Closed > (70-60)% (Main Layer)
B2   > 30 - 3m (Trees Height Main Layer)
D2   Needleleaved
E1   Evergreen

LCCCode: 20092

Notes:

LCCS limits tree height classification to > 3 m

Consistency of original class definition:	Insufficient		Fair		Good		very good ✖	
Correspondence of range values and lifeform definition:	Yes ✖				No			
Confidence level of translation:	Fair		Good		very good ✖			

G.L.C.N. – TRANSLATION UNIT	
Country: Global	**Legend: UMd**

Original Class name: Evergreen Broadleaf Forests

Original Description: Lands dominated by trees with a percent canopy cover > 60% and height exceeding 5m. Almost all trees remain green all year. Canopy is never without green foliage.

Map code:	Original: 2	Translated: 2

LCCS translation		

LCCLabel: Broadleaved Evergreen Trees

Classifiers: A3A10B2XXD1E1

A3   Trees (Main Layer)
A10   Closed > (70-60)% (Main Layer)
B2   > 30 - 3m (Trees Height Main Layer)
D1   Broadleaved
E1   Evergreen

LCCCode: 20089

Notes:

LCCS limits tree height classification to > 3 m

Consistency of original class definition:	Insufficient		Fair		Good		very good ✘	
Correspondence of range values and lifeform definition:		Yes ✘				No		
Confidence level of translation:		Fair		Good			very good ✘	

G.L.C.N. – TRANSLATION UNIT	
Country: Global	**Legend: UMd**
Original Class name: Deciduous Needleleaf Forests	
Original Description: Lands dominated by trees with a percent canopy cover >60% and height exceeding 5m. Trees shed their leaves simultaneously in response to cold seasons.	
Map code: Original: 3	Translated: 3

LCCS translation		
LCCLabel: Needleleaved Deciduous Trees		

Classifiers: A3A10B2XXD2E2

A3   Trees (Main Layer)
A10   Closed > (70-60)% (Main Layer)
B2   > 30 - 3m (Trees Height Main Layer)
D2   Needleleaved
E2   Evergreen

LCCCode: 20093

Notes:

LCCS limits tree height classification to > 3 m

Consistency of original class definition:	Insufficient		Fair		Good		very good ✖	
Correspondence of range values and lifeform definition:	Yes ✖				No			
Confidence level of translation:	Fair			Good			very good ✖	

G.L.C.N. – TRANSLATION UNIT

Country: Global	**Legend: UMd**

Original Class name: Deciduous Broadleaf Forests

Original Description: Lands dominated by trees with a percent canopy cover >60% and height exceeding 5m. Trees shed their leaves simultaneously in response to dry or cold seasons.

Map code:	Original: 4	Translated: 4

LCCS translation

LCCLabel: Broadleaved Deciduous Trees

Classifiers: A3A10B2XXD1E2

A3	Trees (Main Layer)
A10	Closed > (70-60)% (Main Layer)
B2	> 30 - 3m (Trees Height Main Layer)
D1	Broadleaved
E2	Deciduous

LCCCode: 20090

Notes:

LCCS limits tree height classification to > 3 m

Consistency of original class definition:	Insufficient		Fair		Good		very good ✖
Correspondence of range values and lifeform definition:	Yes ✖				No		
Confidence level of translation:	Fair			Good		very good ✖	

G.L.C.N. – TRANSLATION UNIT	
Country: Global	**Legend: UMd**

Original Class name: Mixed Forests

Original Description: Lands dominated by trees with a percent canopy cover >60% and height exceeding 5m. Consists of tree communities with interspersed mixtures or mosaics of needleleaf and broadleaf forest types. Neither type has <25% or >75% landscape coverage.

Map code:	Original: 5	Translated: 5

LCCS translation	

LCCLabel: Mixed Trees // Mixed Trees

Classifiers: A3A10B2XXD1E2-E3 // A3A10B2XXD2E1-E3

A3	Trees (Main Layer)
A10	Closed > (70-60)% (Main Layer)
B2	> 30 - 3m (Trees Height Main Layer)
D1	Broadleaved
E2	Evergreen
E3	Mixed
D2	Needleleaved
E1	Evergreen

LCCCode: 20090-15045 // 20092-15045

Notes: LCCS limits tree height classification to > 3 m

Consistency of original class definition:	Insufficient	Fair	Good	very good ✖
Correspondence of range values and lifeform definition:	Yes ✖		No	
Confidence level of translation:	Fair	Good	very good ✖	

G.L.C.N. – TRANSLATION UNIT	
Country: Global	**Legend: UMd**

Original Class name: Woodlands

Original Description: Lands with herbaceous or woody understories and tree canopy cover of >40% and <60%. Trees exceed 5m in height and can be either evergreen or deciduous.

Map code:	Original: 6	Translated: 6

LCCS translation

LCCLabel: ((70-60) - 40%) Woodland with Herbaceous Layer // ((70-60) - 40%) Woodland with Shrubs

Classifiers: A3A11B2XXXXXXF2F4F7G4-A12 // A3A11B2XXXXXXF2F6F7G3-A12

A3	Trees (Main Layer)	A12	Open (70-60) - 40% (Main Layer)
A11	Open General (70-60) - (20-10)% (Main Layer)	F6	Shrubs (Second or Third Layer)
		G3	5 - 0.3m (Shrubs Height Second or Third Layer)
B2	> 30 - 3m (Trees Height Main Layer)		
F2	Second and/or Third Layer Present		
F4	Herbaceous Vegetation (Second or Third Layer)		
F7	Closed (> 70-60%) To Open (70-60) - (20-10)% (Second or Third Layer)		
G4	3 - 0.03m (Herbaceous Height Second or Third Layer)		

LCCCode: 20317-1 // 20314-1

Notes:

LCCS limits tree height classification to > 3 m

Consistency of original class definition:	Insufficient		Fair		Good		very good ✖
Correspondence of range values and lifeform definition:		Yes ✖				No	
Confidence level of translation:	Fair			Good		very good ✖	

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G.L.C.N. – TRANSLATION UNIT	
Country: Global	**Legend: UMd**

Original Class name: Wooded Grasslands / Shrublands	

Original Description: Lands with herbaceous or woody understories and tree canopy cover of >10% and <40%. Trees exceed 5m in height and can be either evergreen or deciduous.

Map code:	Original: 7	Translated: 7

LCCS translation

LCCLabel: (40 - (20-10)%) Woodland with Herbaceous Layer // (40 - (20-10)%) Woodland with Shrubs

Classifiers: A3A11B2XXXXXXF2F4F7G4-A13 // A3A11B2XXXXXXF2F6F7G3-A13

A3	Trees (Main Layer)	A13	Very Open 40 - (10-20)% (Main Layer)
A11	Open General (70-60) - (20-10)% (Main Layer)	F6	Shrubs (Second or Third Layer)
		G3	5 - 0.3m (Shrubs Height Second or Third Layer)
B2	> 30 - 3m (Trees Height Main Layer)		
F2	Second and/or Third Layer Present		
F4	Herbaceous Vegetation (Second or Third Layer)		
F7	Closed (> 70-60%) To Open (70-60) - (20-10)% (Second or Third Layer)		
G4	3 - 0.03m (Herbaceous Height Second or Third Layer)		

LCCCode: 20317-3012 // 20314-3012

Notes:

LCCS limits tree height classification to > 3 m

Consistency of original class definition:	Insufficient		Fair		Good		very good ✖
Correspondence of range values and lifeform definition:		Yes ✖				No	
Confidence level of translation:	Fair			Good		very good ✖	

G.L.C.N. – TRANSLATION UNIT		
Country: Global	**Legend: UMd**	

Original Class name: Closed Bushlands or Shrublands

Original Description: Lands dominated by bushes or shrubs. Bush and shrub percent canopy cover is >40%. Bushes do not exceed 5m in height. Shrubs or bushes can be either evergreen or deciduous. Tree canopy cover is <10%. The remaining cover is either barren or herbaceous.

Map code:	Original: 8	Translated: 8

LCCS translation

LCCLabel: Closed to Open (100-40)% Shrubland (Thicket)

Classifiers: A4A20-A21

A4   Shrubs (Main Layer)
A20   Closed to Open (100-15)%
A21   Closed to Open (100-40)%

LCCCode: 21449-121340

Notes:

Although explicitly mentioned a possible additional herbaceous cover was neglected since the resulting class only would form a subclass of this definition.

Consistency of original class definition:	Insufficient		Fair		Good		very good ✖	
Correspondence of range values and lifeform definition:	Yes ✖				No			
Confidence level of translation:	Fair			Good			very good ✖	

G.L.C.N. – TRANSLATION UNIT	
Country: Global	**Legend: UMd**

Original Class name: Open Shrublands

Original Description: Lands dominated by shrubs. Shrub canopy cover is >10% and <40%. Shrubs do not exceed 2m in height and can be either evergreen or deciduous. The remaining cover is either barren or of annual herbaceous type.

Map code:	Original: 9	Translated: 9

LCCS translation		

LCCLabel: Open (40 - (20-10)%) Medium High Shrubs (Shrubland)

Classifiers: A4A11B3-A13B9

A4	Shrubs (Main Layer)
A11	Open General (70-60) - (20-10)% (Main Layer)
B3	5 - 0.3m (Shrubs Height Main Layer)
A13	Very Open 40 - (10-20)% (Main Layer)
B9	Medium High 3-0.5m (Shrubs Height Main Layer)

LCCCode: 20022-4439

Notes:

Although explicitly mentioned a possible additional herbaceous cover was neglected since the resulting class only would form a subclass of this definition.

Consistency of original class definition:	Insufficient	Fair	Good	very good ✖
Correspondence of range values and lifeform definition:	Yes ✖		No	
Confidence level of translation:	Fair	Good	very good ✖	

G.L.C.N. – TRANSLATION UNIT

Country: Global	Legend: UMd

Original Class name: Grasslands

Original Description: Lands with continuous herbaceous cover and <10% tree or shrub canopy cover.

Map code:	Original: 10	Translated: 10

LCCS translation

LCCLabel: Continuous Closed to Open Herbaceous Vegetation

Classifiers: A2A20B4C1

A2	Herbaceous Vegetation (Main Layer)
A20	Closed to Open (100-15)%
B4	3 - 0.03m (Herbaceous Height Main Layer)
C1	Continuous (Vegetation Main Pattern)

LCCCode: 21455

Notes:

Cover density was defined in a broad range up from 15 %. Though this threshold is not apparent from the UMd description it is corresponding to the 'Barren' class definition.

Consistency of original class definition:	Insufficient		Fair		Good		very good ✖	
Correspondence of range values and lifeform definition:		Yes ✖				No		
Confidence level of translation:		Fair		Good		very good ✖		

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G.L.C.N. – TRANSLATION UNIT	
Country: Global	**Legend: UMd**

Original Class name: Croplands

Original Description: Lands with >80% of the landscape covered in crop-producing fields. Note that perennial woody crops will be classified as the appropriate forest or shrubs land cover type.

Map code:	Original: 11	Translated: 11

LCCS translation

LCCLabel: Continuous Field(s) Of Herbaceous Crop(s)

Classifiers: A3XXB5

A3   Herbaceous Crops
B5   Continuous (Field Spatial Distribution)

LCCCode: 10027

Notes:

"continuous" within a LCCS single class is defined as "inside the mapping unit, the fields take up more than 80 percent" which corresponds to the UMd class description

Consistency of original class definition:	Insufficient		Fair		Good		very good ✘
Correspondence of range values and lifeform definition:		Yes ✘				No	
Confidence level of translation:	Fair			Good		very good ✘	

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G.L.C.N. – TRANSLATION UNIT	
Country: Global	**Legend: UMd**

Original Class name: Barren

Original Description: Lands of exposed soil, sand, rocks, snow or ice which never have more than 10% vegetated cover during any time of year.

Map code:	Original: 12	Translated: 12

LCCS translation		

LCCLabel: Bare Area(s) // Snow // Ice

Classifiers: B16 // A2 // A3

B16   Bare Area(s)
A2   Snow
A3   Ice

LCCCode: 0011 // 8005 // 8008

Notes:

Heterogeneous class, problematic for cross validation with other legends.

Consistency of original class definition:	Insufficient		Fair		Good		very good ✖	
Correspondence of range values and lifeform definition:	Yes				No			
Confidence level of translation:	Fair			Good		very good ✖		

G.L.C.N. – TRANSLATION UNIT

Country: Global	Legend: UMd

Original Class name: Urban and Builtup

Original Description: Lands covered by buildings or other man-made structures. Note that this class is not mapped from the AVHRR imagery but is developed from the populated places layer that is part of the Digital Chart of the World (Danko 1992).

Map code:	Original: 13	Translated: 13

LCCS translation

LCCLabel: Built Up Area(s)

Classifiers: A1

A1   Built Up Area(s)

LCCCode: 5001

Notes:

Consistency of original class definition:	Insufficient	Fair	Good	very good ✖
Correspondence of range values and lifeform definition:	Yes		No	
Confidence level of translation:	Fair	Good	very good ✖	