3. Harmonizing European land cover maps

Jaap Slootweg, Jean-Paul Hettelingh, Wil Tamis*, Maarten van 't Zelfde*

*Institute of Environmental Sciences (CML), Leiden, the Netherlands

3.1 Introduction

Several bodies under the Convention have addressed the issue of defining a common land cover dataset during 2003, inter alia the TFIAM (EB.AIR.GE.1/2003/4), the EB and the ICP M&M (Final draft minutes of the taskforce meeting 2003). It was stressed that the land cover data should be the same for all steps in air pollution assessment work and working bodies under the Convention and that it should be freely and easily available. In order to harmonize the land cover maps, the currently used European maps are made compatible with regard to land cover classes and coordinate system, and then compared to each other. Results of the comparison have been presented to an ad-hoc expert meeting on harmonization of land cover information for applications under the Convention on LRTAP by CCE, CIAM, MSC-W and SEI. This meeting recommended a new dataset which merges CORINE data and SEI data to be produced.

This chapter introduces the currently used land cover maps and describes how their classifications are harmonized into the EUNIS classification system. The theoretical background and results of a comparison are presented, including maps that show the largest local differences between the maps, the distinction maps. Finally this chapter documents the creation of a land cover map than can be used for all European applications under the LRTAP Convention.

3.2 Description of relevant maps

An earlier study into existing land cover databases (De Smet and Hettelingh, 2001) narrowed the comparison to three relevant sources:

- the CORINE land cover database (Version 12/2000 extended coverage),
- the Pan-European Land Cover Monitoring (PELCOM) and
- the Land Cover Map of Europe of the Stockholm Environmental Institute (SEI).

All three have been updated since, making an update of the comparison of the three sources useful.

CORINE

The CORINE land cover database is the result of the ongoing CORINE Land Cover project of the European Environment Agency (EEA). Version 12/2000, used in this comparison, covers the EU-25 countries (with the exception of Cyprus and Malta), as well as Albania, Andorra, Bosnia and Herzegovina, Macedonia and the coastal zone of Tunisia and Northern Morocco (see Figure 3-1).

The map consists of national contributions, most of which used Landsat and/or SPOT satellite images, aerial photographs and other data sources to distinguish 44 land cover categories. The 100 meter grid has been made available for the work under the convention. This map is by far the most elaborate and accurate of the three maps, and is used as reference map, the 'truth' for the comparison. (http://dataservice.eea.eu.int/dataservice/)

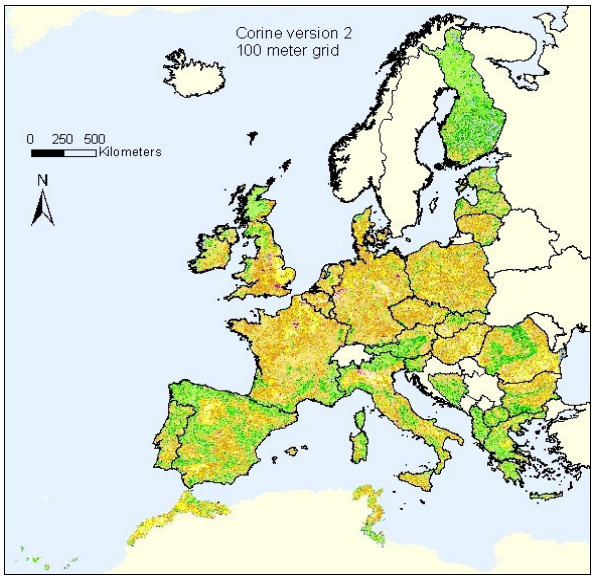

Figure 3-1 CORINE – 100 meter grid

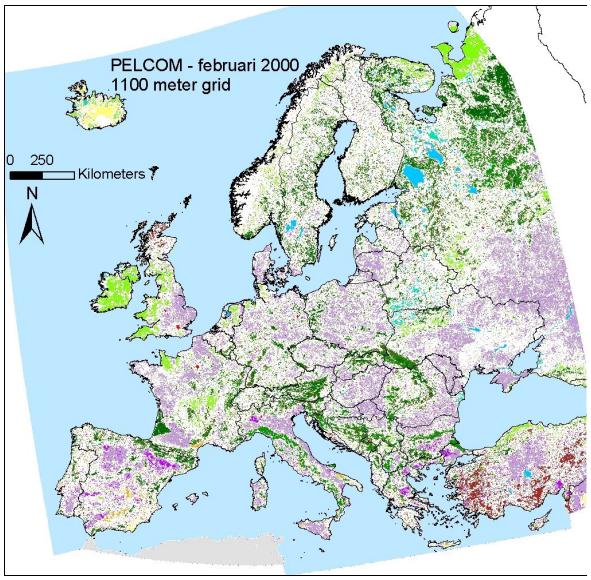

Figure 3-2 PELCOM 1100-grid (February 2000).

PELCOM

The 1-km pan-European land cover database is based on the integrative use of multi-spectral and multi-temporal 1-km resolution NOAA-AVHRR satellite data and ancillary data. PELCOM was a three years project under the Environment & Climate section of the European Union's 4th framework RTD programme. The methodology developed in the PELCOM project is based on combining both unsupervised and supervised classification approaches. The training samples are derived from selected homogeneous areas of the CORINE land cover database. The spectral characteristics of each training sample are used to determine class boundaries and pixel assignments in the supervised classification into the 15 categories used.

The version 02/2000, used in the comparison, covers Europe (http://www.gis.wageningen-ur.nl/cgi)

SEI

The SEI land cover database was originally developed for use in modelling of the impacts of various air pollutants at a continental scale. Its classification reflexes the attempts to identify an ecologically meaningful cover type and/or dominant species across Europe. Several datasets are utilized, among which PELCOM, various soil maps and other maps from international organisations related to agriculture.

The version 07/2003, used in the comparison, covers Europe including the European part of Russia, Turkey, Kazakhstan, Armenia and Azerbaijan (see Figure 3-3) (http://www.york.ac.ul/inst/sei/APS/projects.html)

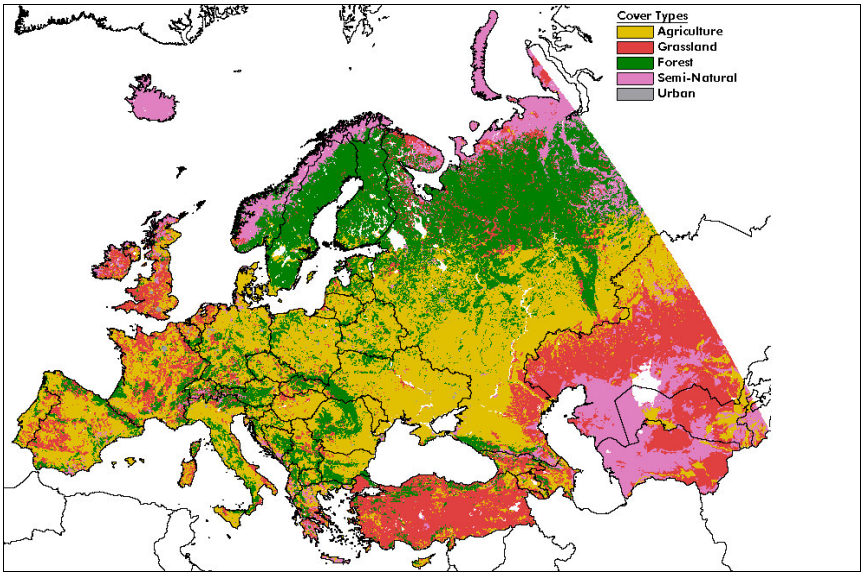

Figure 3-3. SEI coverage version 2003.

In order to identify a common land cover data set the available maps were compared. All of the maps have been created with different objectives and using different sources leading to different classification systems and different resolution and coordination systems. Therefore the next step is the reclassification of the land cover maps to one classification system. (EUNIS)

3.3 Reclassification to the EUNIS classification system

To improve on the uniformity of the ecosystem definitions for the work under the Convention a study was conducted to used classifications (Hall, 2001). The EUNIS (European Nature Information System) Habitat classification (Davies and Moss, 1999) was considered as the best 'target' classification scheme for the harmonization of the three above mentioned maps.

EUNIS is a hierarchic habitat classification system developed by the European Topic Centre for Nature Conservation (http://eunis.eea.eu.int) that uses a common framework with links to other classifications. The EUNIS system aims at defining ecological habitats, taking into account what species are present, but also incorporates features of the landscape.

Method:

The following steps in the cross-classification can be discerned:

1. An aggregated EUNIS-scheme for calculations and map presentations was derived, based on the inventory of relevant ecosystems for critical load calculations (Hall, 2001).This scheme will be referred to as EUNIS-LRTAP.
2. Two new classes were added to the EUNIS-scheme within class I (Regularly or recently agricultural, horticultural and domestic habitats):
   a. II (irrigated arable land)
   b. IN (non-irrigated arable land)
3. Inventory of existing cross-classification schemes (or schemes in development)
4. For those land use/ land cover maps for which cross-classification schemes to EUNIS do not exist yet or do exist partly, additional cross-classification was carried out. This was carried out in two steps
   a. CORINE, SEI and PELCOM were cross-classified to the second level of EUNIS
   b. These 'basic' cross-classifications were further aggregated and simplified, using a number of rules of thumb
5. For CORINE a complete cross-classification scheme was already available (Moss and Davies, 2002), but for SEI and PELCOM this was not the case.

a. For SEI a partial cross-classification scheme was available. It concerned the cross-classification of the second level of the SEI-grasslands to the second level of EUNIS (SEI, 2003). The remaining SEI-classes on the second level were cross-classified to the second level of EUNIS (with exception of the SEI classes for dominant tree species).
b. For PELCOM no cross-classification scheme was available and all 14 relevant classes were cross-classified to the second level of EUNIS.

6. As a consequence of this first cross-classification step quite often a single class within CORINE, SEI or PELCOM was cross-classified to several classes in EUNIS-level 2 (one-to-many relationship). The following rules of thumb were used in the second step to minimize the number of one-to-many relationships.
   a. Cross-classifications were as much as possible aggregated according to the EUNIS-LRTAP scheme. (For example, within CORINE several classes could be cross-classified to several different secondary levels within the EUNIS-category J (Constructed, industrial and other artificial habitats). However, within the EUNIS-LRTAP-scheme no distinction is made on the second level within this category.)
   b. When a source class was cross-classified to all EUNIS level 2 classes within a EUNIS level 1 class (because the source class contained no information, which made it possible to distinguish between level 2 classes within EUNIS); then only the cross-classification to the higher EUNIS level 1 was used.
   c. The different cross-classifications for one source class were evaluated by their importance. Less important cross-classifications were omitted; their weight was set to zero (0).
   d. EUNIS has several classification characteristics which might not be present in CORINE, SEI or PELCOM. Cross-classifications between source classes and EUNIS-classes based on features not present in the source classification were omitted; their weight was set to zero (0). N.B. This must not be misinterpreted as the absence of these EUNIS-classes!
7. The one-to-many relationships that remained after these aggregations were treated as combinations of two (or exceptionally three) EUNIS classes. Each class within the combination has the same proportional weight. Combinations are characterized with a starting X, so the combination of dry (E1) and mesic (E2) grasslands, becomes XE1E2. The combinations are only important for the GIS-manipulations of the maps. In the final use of these combinations, the information of the individual classes of the combinations will be used.

Results:

The aggregated EUNIS-LRTAP-scheme

In Table 3-1 the aggregated EUNIS-LRTAP-scheme is presented of the most relevant ecosystems for the work under the Convention, supplemented with all other ecosystems in order to cover all land use types. On the second level of EUNIS non-relevant classes have been combined, and they are marked with an X.

Table 3-1. Aggregated EUNIS-LRTAP-scheme of all relevant ecosystems marked with a 1 (level 1) or 2 (level 2) in the column L (LRTAP relevant), supplemented with other ecosystems in order to cover all land use/cover types.

Code	EUNIS-description	L
A	Marine habitats	-
B	Coastal habitats	-
C	Inland surface waters habitats	1
C1	Standing waters	2
C2	Running waters	2
C3	Littoral zone of inland surface waterbodies	2
D	Mire, bog and fen habitats	1
D1	Raised & blanket bog	2
D2	Valley mires, poor fens, transition mires	2
DX	Other mire, bog and fen habitats	-
E	Grassland and tall forb habitats	1
E1	Dry grasslands	2
E2	Mesic grasslands	2
E3	Seasonally wet & wet grasslands	2
E4	Alpine & sub-alpine grasslands	2
EX	Other grassland and tall forb habitats	-
F	Heathland, scrub and tundra habitats	1
F2	Arctic, alpine &sub-alpine scrub	2
F3	Temperate & Mediterranean montane scrub	2
F4	Temperate scrub heathland	2
FX	Other heathland, scrub and tundra	-

Code	EUNIS-description	L
	habitats	
G	Woodland and forest habitats and other wooded land	1
G1	Broadleaved deciduous woodland	2
G2	Broadleaved evergreen woodland	2
G3	Coniferous woodland	2
G4	Mixed deciduous and coniferous woodland	2
G5	Lines of trees, small anthropogenic woodlands, recently felled woodland, early-stage woodland	-
	and coppice	
H	Inland unvegetated or sparsely vegetated habitats	-
I	Regularly or recently cultivated agricultural, horticultural and domestic habitats	-
II	Irrigated arable land	-
IN	Non-irrigated arable land	-
J	Constructed, industrial and other artificial habitats	-

The total number of EUNIS-LRTAP map classes is 10 (level 1) or 32 (level 1 + level 2).

Cross-classification

PELCOM-EUNIS cross-classification

As an example a part of the cross-classification table for PELCOM to EUNIS is presented in Table 3-2 (The complete cross-classification table is stored in Annex 3A. In the third column (EUNIS L2) the results of the first step of the cross-classification are presented: classification to the second level of EUNIS. In the fourth column the aggregation/ simplification of the one-to-may cross-classifications and the conversion to the EUNIS-LRTAP-scheme is presented.

Some comments on the cross-classification table PELCOM-EUNIS to illustrate this procedure:

- For the first PELCOM-class, 11 (Coniferous forest), we see that it could be cross-classified to four level 2 classes within EUNIS: B1, B2, G3 and G5. Classes B1 and B2 are coastal areas on different types of soils. Because these class characteristics are not available in PELCOM, these cross-classifications were omitted (0 in fourth column). The same holds for G5: lines of trees etc.

- For the second PELCOM-class, 12 (Deciduous forest), we see in the eighth row that deciduous forest is also cross classified to EUNIS-G2 level: (broad leaved evergreen forest). This is of course contradictory (deciduous and evergreen), but this is the best cross-classification that could be made for this EUNIS-class. Finally this cross-classification is omitted, because PELCOM do not contain information on deciduousness. So in the final cross-classification between PELCOM and EUNIS, class G2 is not present. This must not be misinterpreted that broad-leaved evergreen forests are not present. They are included probably within the category G1, broad leaved deciduous forest.

Table 3-2. Cross-classification table for PELCOM translated to the second level of EUNIS and subsequently to the EUNIS-LRTAP classes; 0 = cross-classification omitted.

code	PELCOM name	EUNIS L2	EUNIS LRTAP
11	Coniferous forest	B1	0
11	Coniferous forest	B2	0
11	Coniferous forest	G3	G3
11	Coniferous forest	G5	0
12	Deciduous forest	B1	0
12	Deciduous forest	B2	0
12	Deciduous forest	G1	G1
12	Deciduous forest	G2	0
12	Deciduous forest	G5	0
13	Mixed forest	B1	0
13	Mixed forest	B2	0
13	Mixed forest	G4	G4
13	Mixed forest	G5	0
20	Grassland	B1	0
20	Grassland	B2	0
20	Grassland	B3	0
20	Grassland	E1	E
20	Grassland	E2	E
20	Grassland	E3	E
20	Grassland	E4	E
20	Grassland	E5	E
20	Grassland	E6	E
20	Grassland	E7	E

CORINE-EUNIS cross-classification

CORINE has three hierarchical levels, already cross-classified to all levels of EUNIS. The existing cross-classification contains many one-to-many relationships and these relationships often contain many relations (on average 3-4 for each CORINE 3 level class). Many of these relationships had been evaluated as less important. The whole cross-classification table (330 lines) is listed in Annex 3A

SEI-EUNIS cross-classification

SEI has up to four levels (for grasslands and semi-natural areas). A part of the grassland and semi-natural areas already had been cross-classified to the second level of EUNIS by SEI itself. A definitive description of the different levels and classes had not been available for the most recent version of the SEI map. This hampered the cross classification of the SEI-classes in some cases. The following choices have been made in order to produce a SEI-EUNIS cross classification:

SEI dominant crops in general and SEI dominant crops irrigated have been cross classified to EUNIS non-irrigated and irrigated agriculture. SEI dominant crops in general which were present twice or even three times with the same name or meaning (e.g. grapes and vineyard) but with different codes in the SEI classification have been cross classified to one dominant EUNIS-crop code.

There are several inconsistencies (as of November 2003) in the SEI-classification (e.g. presence of type 'dry marsh') and in the partial SEI-EUNIS cross classification produced by SEI (e.g. SEI - Wet improved tall grassland -> EUNIS - Dry grassland etc.), which have to be improved in future (cross) classifications.

The whole cross-classification table (525 lines) is listed in Annex 3A

3.4 Comparing maps using contingency matrix and kappa statistics

Comparing maps is often done by creating a contingency matrix or by Kappa statistics. Each cell of a contingency matrix gives the fraction of raster cells classified in a particular category in one map and another category in the other map. Given k categories, i and j the indexes of the categories in the maps, a contingency table looks like:

		map J (j=columns)				Total
		1	2	…	k	
map I (i=row)	1	p_{11}	p_{12}	…	p_{1k}	p_{1+}
	2	p_{21}	p_{22}	…	p_{2k}	p_{2+}
	…	…	…	…	…	…
	k	p_{k1}	p_{k2}	…	p_{kk}	p_{k+}
Total		p_{+1}	p_{+2}	…	p_{+k}	1

With $p_{+j} = \sum_{i=1}^{k} p_{ij}$ and $p_{i+} = \sum_{j=1}^{k} p_{ij}$.

Kappa gives the similarity of the maps and adjusts for the probability, p_e, that cells are equal by chance a priori to the comparison (pe). $kappa = \frac{sim - p_e}{1 - p_e}$ with $sim = \sum_{i=1}^{k} p_{ii}$

If we neglect the auto-correlation of the maps this probability p_e can be calculated from the histograms of the maps as $P_e = \sum_{i=1}^{n} p_{+i} p_{i+}$. *Kappa* equals 1 with perfect agreement and nears zero when the agreement is random.

More can be found in Cohen (1960) and in Monserud and Leemans (1992).

The land cover maps in this comparison are compiled with different objectives, resulting in different classifications. The harmonisation of the classifications will most likely result in category definitions that do not match perfectly. Also the co-ordinate system and resolution of the maps differ, leading to dislocations between the maps. To allow further analysis of the most important differences between the maps two methods have been applied. The first is to split kappa into a measure for the differences in histograms, and a measure for differences in the location of similar categories, respectively $Kappa_{Histo}$ and $Kappa_{Location}$. These quantities are defined by

$$Kappa_{Histo} = \frac{p_{\max} - p_e}{1 - p_e} \quad \text{and} \quad Kappa_{Location} = \frac{sim - p_e}{p_{\max} - p_e}$$ where $p_{\max}$ holds the maximum possible similarity, given the histograms of the distribution: $p_{\max} = \sum_{i=1}^{k} \min(p_{i+}, p_{+i})$. The second method to distinguish small from important differences in the maps is the introduction of fuzziness in category as well as in location. To compare the maps in a fuzzy way the grade of applicability of the category of the other map counts. This grade gives a fuzzy value between 0 for not applicable to 1 for completely equal. Categories of neighbouring cells as well as similarities between categories contribute to this fuzzy value. The fuzzy similarity of two corresponding raster cells is the minimum of the fuzzy value of one map compared to the other, and the value for the comparison the other way around. The fuzzy similarity between the two maps is the average of the similarities of all the corresponding rasters-cells. From this it is possible to calculate a '$Kappa_{Fuzzy}$' that is less sensitive for small differences then the classical *Kappa*.

$$Kappa_{fuzzy} = \frac{sim_{fuzzy} - p_{e,\,fuzzy}}{1 - p_{e,\,fuzzy}}$$

By applying fuzzy set theory the similarity increases in most cases, but also the probability that cells are more or less equal has increased. A way to describe the additional change is described in Hagen (2002). That article describes also the complete method in more detail. Another, but elaborate way of calculating the a priori probability of similarity is by Monte Carlo analysis. If the randomly generated maps would simulate the spatial auto-correlation this way could also adjust for this phenomena.

3.5 Results of the comparison

The histogram's of the maps, as far as they overlap spatially, is given in Table 3-3. From this, the calculated $Kappa_{Histo}$ is calculated as 0.959 between SEI and Corine, and 0.954 for PELCOM and Corine. This indicated a very high similarity for the overal contributions of the land use classes.

Table 3-3. Histograms of the maps for the overlapping area in promilles.

	CORINE	SEI	PELCOM
Water	16	18	15
Vegetation	229	268	197
Broadleaved	117	116	124
Coniferious	175	164	212
Barren	22	1	14
Agricultural	415	413	417
Urban	26	20	21

Table 3-4 and 3-5 show the contingency tables for both comparisons. The resulting Kappa's are 0.275 for CORINE vs. SEI and 0.376 for CORINE vs. PELCOM. There is a large misfit for 'Vegetation'. In the part of the SEI map that overlaps with CORINE a total of 268‰ of the raster cells is classified as such. This includes 101‰ cells that are classified as 'Agricultural' in CORINE, and only 95‰ is also classified as 'Vegetation' in CORINE. Also a large part of the agricultural areas in SEI are classified as vegetation in CORINE.

Table 3-4. Contingency table for the comparison of the CORINE map versus the SEI map. All numbers are in promilles, blank = 0 values.

SEI CORINE	Water	Vegetat.	Broadl.	Conif.	Barren	Agricult.	Urban	Sum
Water	9	2	1	2		2		16
Vegetation	2	95	24	33		73	2	229
Broadleaved	1	28	34	13		40	1	117
Coniferous	4	27	16	88		40	1	175
Barren		9	2	2		6	2	22
Agricultural	3	101	38	24		242	7	415
Urban		5	2	1		11	7	26
Sum	18	268	116	164	1	413	20	1000

Table 3-5. Contingency table for the comparison of the CORINE map versus the PELCOM map. All numbers are in promilles, blank = 0 values.

PELCOM CORINE	Water	Vegetat.	Broadl.	Conif.	Barren	Agricult.	Urban	Sum
Water	7	2	0	3	0	3	0	16
Vegetation	2	97	24	46	3	55	2	229
Broadleaved	1	18	47	19	1	30	1	117
Coniferous	3	24	19	99	2	29	1	176
Barren	0	4	1	5	4	5	2	22
Agricultural	2	50	31	37	4	284	7	415
Urban	0	3	2	2	0	12	7	26
Sum	15	197	124	212	14	417	21	1000

The differences between the maps are not uniformly distributed over Europe. For integrated assessments on a European scale, and mapping ecosystem dependant exceedences a map containing a distribution of ecosystems for each EMEP-50km. grid cell is needed. To compare the maps on this scale the Kappa-Histo's were calculated for each 50km. EMEP grid, see Figure 3-4.

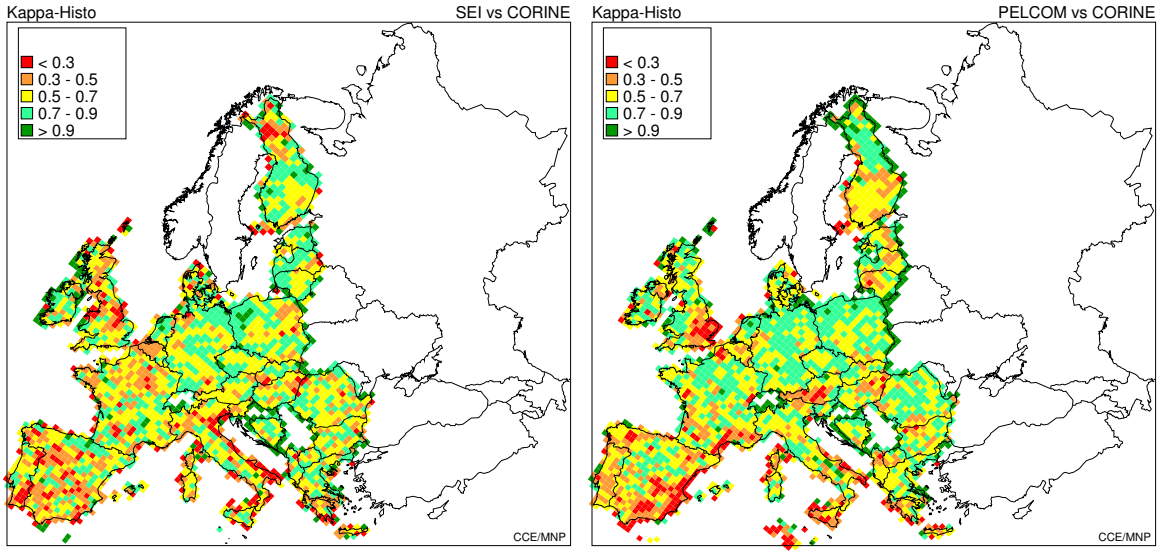

Figure 3-4. Kappa-Histo calculated for each EMEP 50km. grid. CORINE is compared to SEI (left) and PELCOM (right).

The results show a good match for most of Europe, but some areas, like for instance the Mediterranian differ considerably. On this scale PELCOM and SEI resemble CORINE to the same degree.

To investigate the differences between the maps further, the can be plotted next to each other, but only showing the areas in which they differ.

3.6 Distinction maps

Given the fact that the maps differ, it is interesting to search for the areas with the most systematic differences. In order to find those differences, the area with little or no differences needs to be obscured. This has for instance been done for Spain, Portugal and Corse by (1) resampling to a 2.5 km grid, (2) applying a fuzziness in categories according to the cross classification, (3) applying a fuzziness for small dis-locations between the maps. Application of the software made by RIKS (Research Institute for Knowledge Systems) provided a grid-map with $Kappa_{fuzzy}$ values. This map was used as a mask, to show only areas with kappa-fuzzy equal to 0. Figure 3-5 shows the masked SEI map next to the CORINE map with the same masking applied. Both maps only show original, but clustered classes to enable recognition of the colors used in the legend.

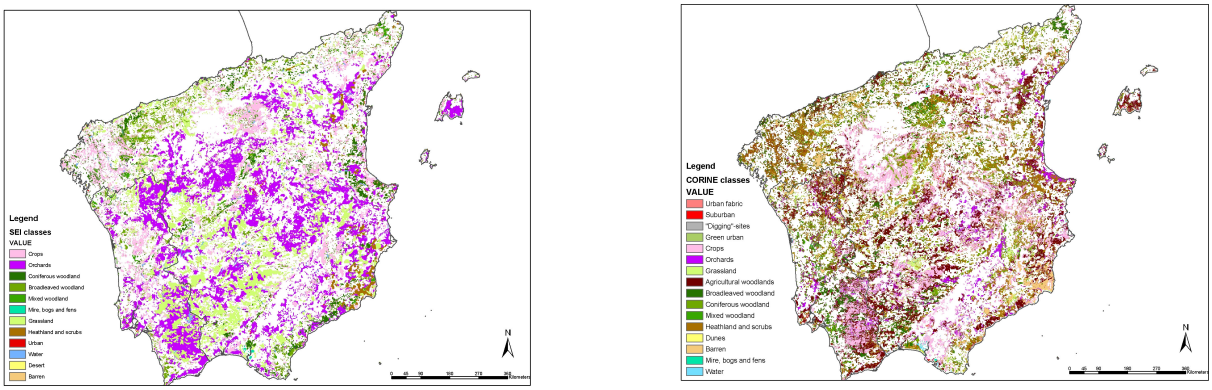

Figure 3-5. Differences between SEI (left) and CORINE (right) for Spain, Portugal and Corse.

Now it is easy to pick an area of interest and investigate the reason for differences. For instance the 'Agricultural Woodlands' in Corse on the CORINE map (in detail 'Annual crops associated with permanent crops' translated to the Agriculture in EUNIS) are in fact classified as 'Fruit' in SEI, and translated to the EUNIS class 'Broadleaved deciduous woodland.' These classes are not as contradicting as the cross classifications suggest. The same is true for an area in the south of Spain which has the classes 'Wet Neutral Unimproved Grassland' (SEI) and 'Water bodies' (CORINE) given the seasonal influences. These samples (and others) suggest that the SEI and CORINE map are more similar than the kappa statistics reveal. A detailed class to class comparison between SEI and CORINE can provide information about the actual land cover.

3.7 Conclusions and recommandations

The overall histograms of the CORINE, PELCOM and SEI maps are very much alike. For integrated studies on a European scale and for coarser resolutions like the EMEP 50km grid the maps are quite similar. For most parts of Europe the distribution of ecosystems within 50 km. EMEP grids give a good match between SEI and CORINE, as well as PELCOM and CORINE. The distributions of critical loads in the European background database are not likely to vary much by the use of either of the three land cover maps.

The contingency tables from the comparisons between SEI and CORINE, and for PELCOM and CORINE on a 250m resolution (Table 3-4 and 3-5) show relatively low similarities and low values for Kappa. Clear quality checks for the land cover category of every ecosystem that is submitted by a NFC will not be possible, but a comparison of the submitted data with a common land cover map can contribute to a consistent critical loads database.

Better results, more in line with earlier reports, are achieved if the maps are aggregated to a resolution similar to the coarser maps, PELCOM and SEI, using the majority of the 250m map. Including fuzziness in location, allowing land cover to be shifted a little between the maps, does generally not raise values for Kappa. Given the fact that 50 km. EMEP grids have relatively high values for KappaHisto, the occurrence of similar land cover in different maps are likely within the region, but not necessary in the close vicinity.

Figure 3-4 shows that the maps differ mostly in the Mediterranean area. The maps showing the differences between the maps clearly show many regions with consistent deviations. This might give clues for improving the compilation process of the maps. More investigations of these areas might also expose the different interpretations of the used categories in all of the maps used to compile CORINE, SEI and PELCOM.

PELCOM is more similar to CORINE then SEI, but this can be expected, because both maps share partly the same data sources. The slightly higher similariry of PELCOM does not nessicarily mean it is closer to the actual land cover, because also CORINE deviates from the 'thruth.'

It is possible to convert the CORINE, PELCOM and SEI maps to the EUNIS classification system. Some subjective choices/weighing had to be made in order to achieve a practical classification. To differentiate between irrigated and non-irrigated land, two EUNIS catagories were added.

The problem of one-to-many relationships has been solved by omitting the less relevant cross-classifications and also cross-classifications to EUNIS-classes for which the source classes actually do no not contain enough information. The last point relates to the problem of classification characteristics used in EUNIS but not in CORINE, SEI and/or PELCOM, see e.g. Table 3-2, PELCOM to EUNIS level 1 B Coastal habitats. There is a risk of misinterpretation that these omitted classes are absent.

Each class in a combination gets a proportional share; e.g. in case of two classes 50%. A more realistic distribution of the shares is possible on basis of map comparisons, in combination with regional differentiation

The development of EUNIS is a large step forwards in the harmonisation of ecosystem description.

Nevertheless EUNIS has some major flaws:

- it is not systematically hierarchical
- landscape and site factor properties are mixed, producing a not completely consistent classification (see e.g. coastal habitats).

A better approach would be to recognize that the classification factors are indeed strict hierarchical.

For the Netherlands a hierarchical system have been developed using factors as salinity, vegetation structure, moisture availability, nutrient availability and acidity (Tamis et al., 2005)

3.8 A harmonised land cover map of Europe

Generally the CORINE map is considered the best available land cover data, but only part of the spatial EMEP modelling domain is available. The best available map, at the time of writing this report, is a combination of CORINE, where available, and SEI data where CORINE is missing. This map has been created by the CCE as a grid map, in the EMEP coordination system. The gridsize is 250*250 meters. Also on the bases of this combination of maps, EMEP compiled a dataset of the distribution of land cover classes for each EMEP grid containing terrestrial area, focussing on dispersion of airborne pollutants. The classes used for this map are listed in Table 3-5.

Land cover classes
Temperate coniferous forest
Temperate deciduous forest
Mediterranean needleleaf forest
Mediterranean broadleaf forest
Wheat (artificial)
Temperate crops
Mediterranean crops
Root crops
Grassland
Semi-natural
Mediterranean scrub
Wetland
Tundra
Desert/Barren
Water
Ice
Urban

Table 3-5. Land cover classes used by EMEP for their dispersion modelling

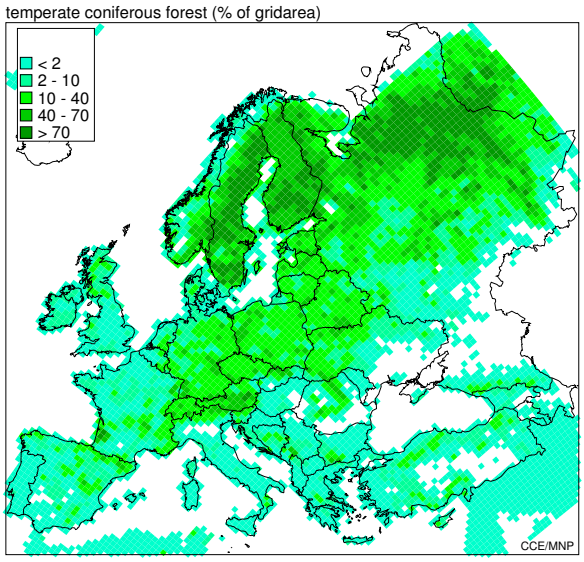

Figure 3-6. Spatial distribution of temperate coniferous forest in the EMEP compilation of the CORINE and SEI land cover data

The disadvange of this merging is the limitations in the classification of CORINE, especially after translation into the EUNIS classification system. It is possible to use the information from SEI to define the actual land cover more precisely. If an area is classified in CORINE as 'Natural grasslands', it will be listed as 'E - Grassland and tall forb habitats' in the general map used for the convention. But if the same area is indicated as being 'Dry Alpine Meadow' in SEI, it can be classified in the EUNIS system as 'E4 - Alpine & sub-alpine grasslands.' If the CORINE and SEI land cover class are not contradicting then the use of the SEI information is straight forward. But also the presents of a compatible SEI land cover class in the vicinity of the CORINE class could be used to improve on the level of the EUNIS classification used in the next version of a general land cover map.

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Annex 3A Cross-classification to EUNIS

Table 3A-1 Conversion table of CORINE to EUNIS. The descriptions of the EUNIS codes are listed in table 3-1 of the main text. CE are combined EUNIS-classes which are described in Table 3A-4*

CORINE code	CORINE name	EUNIS code
1.1.1	Continuous urban fabric	CE1
1.1.2	Discontinuous urban fabric	CE1
1.2.1	Industrial or commercial units	J
1.2.2	Road and rail networks and associated land	J
1.2.3	Port areas	J
1.2.4	Airports	J
1.3.1	Mineral extraction sites	CE4
1.3.2	Dump sites	CE4
1.3.3	Construction sites	CE4
1.4.1	Green urban areas	CE2
1.4.2	Sport and leisure facilities	CE2
2.1.1	Non-irrigated arable land	IN
2.1.2	Permanently irrigated land	II
2.1.3	Rice fields	II
2.2.1	Vineyards	FX
2.2.2	Fruit trees and berry plantations	G1
2.2.3	Olive groves	G2
2.3.1	Pastures	E2
2.4.1	Annual crops associated with permanent crops	I
2.4.2	Complex cultivation patterns	I
2.4.3	Land principally occupied by agriculture, with significant areas of natural vegetation	I
2.4.4	Agro-forestry areas	I
3.1.1	Broad-leaved forest	G1
3.1.2	Coniferous forest	G3
3.1.3	Mixed forest	G4
3.2.1	Natural grasslands	E
3.2.2	Moors and heathland	F
3.2.3	Sclerophyllous vegetation	CE3
3.2.4	Transitional woodland-shrub	F
3.3.1	Beaches, dunes, sands	B
3.3.2	Bare rocks	H
3.3.3	Sparsely vegetated areas	H
3.3.4	Burnt areas	H
3.3.5	Glaciers and perpetual snow	H
4.1.1	Inland marshes	D
4.1.2	Peat bogs	D
4.2.1	Salt marshes	A
4.2.2	Salines	A
4.2.3	Intertidal flats	A
5.1.1	Water courses	C
5.1.2	Water bodies	C
5.2.1	Coastal lagoons	A
5.2.2	Estuaries	A
5.2.3	Sea and ocean	A

Table 3A-2 Conversion table of PELCOM to EUNIS. The descriptions of the EUNIS codes are listed in table 3-1 of the main text. PE are combined EUNIS-classes which are described in Table 3A-4*

PELCOM code	PELCOM name	EUNIS code
11	Coniferous forest	G3
12	Deciduous forest	G1
13	Mixed forest	G4
20	Grassland	E
31	Rainfed arable land	IN
32	Irrigated arable land	II
40	Permanent crops	PE1
50	Shrub land	F
60	Barren land	H
80	Wetlands	D
91	Inland waters	C
92	Sea	A
100	Urban areas	J

Table 3A-3 Conversion table of SEI to EUNIS. The descriptions of the EUNIS codes are listed in table 3-1 of the main text. SE are combined EUNIS-classes which are described in Annex Table 3A-4*

SEI code	SEI name	EUNIS code
1.1.1	Wheat	I
1.1.11	Sugar Beet	I
1.1.12	Potatoes	I
1.1.15	Cotton	I
1.1.16	Olives	G2
1.1.18	Grapes	FX
1.1.19	Fruit	G1
1.1.2	Barley	I
1.1.24	Vineyards	FX
1.1.25	Orchards	G1
1.1.27	Wheat & Barley	I
1.1.28	Wheat & Barley & Orchards	I
1.1.3	Rye	II
1.1.30	Nuts	G1
1.1.31	Flowers	I
1.1.32	Berries	I
1.1.6	Maize	I
1.1.7	Rice	I
1.1.8	Soya	I
1.2.101	Wheat	I
1.2.102	Barley	I
1.2.103	Rye	II
1.2.106	Maize	I
1.2.107	Rice	I
1.2.108	Soya	I
1.2.111	Sugar Beet	I
1.2.112	Potatoes	I
1.2.115	Cotton	I
1.2.116	Olives	G2
1.2.118	Grapes	FX
1.2.119	Fruit	G1
1.2.124	Vineyards	FX
1.2.125	Orchards	G1
1.2.127	Wheat & Barley	I
1.2.128	Wheat & Barley & Orchards	I
1.2.130	Nuts	G1
1.2.131	Flowers	I
1.2.132	Berries	I
1.3.1	Wheat	II
1.3.11	Sugar Beet	II
1.3.12	Potatoes	II
1.3.13	Cotton	II
1.3.18	Grape	FX
1.3.19	Fruit	G1
1.3.2	Barley	II
1.3.24	Unaccounted	II
1.3.6	Maize	II
1.3.7	Rice	II
2.1.1	Needle Leaf	G3
2.1.2	Needle Leaf - Restricted Lumbering	G3
2.1.3	Broad Leaf	G1
2.1.3	Broad Leaf	G2
2.1.4	Broad Leaf - Restricted Lumbering	G1
2.1.4	Broad Leaf - Restricted Lumbering	G2
2.1.5	Mixed	G4
2.1.6	Mixed - Restricted Lumbering	G4
3.1.1.0	Dry Alpine Meadow	E4
3.1.1.1	Dry Acid Alpine Meadow	E4
3.1.1.2	Dry Neutral Alpine Meadow	E4
3.1.1.3	Dry Alkali Alpine Meadow	E4
3.1.2.0	Wet Alpine Meadow	E4
3.1.2.1	Wet Acid Alpine Meadow	E4
3.1.2.2	Wet Neutral Alpine Meadow	E4
3.1.2.3	Wet Alkali Alpine Meadow	E4
3.100.1.0	Dry Acid Arctic Heath	F2
3.100.2.0	Wet Acid Arctic Heath	F2
3.1000.1.0	Dry Acid Peat Bog	SE01
3.1000.2.0	Wet Acid Peat Bog	SE01
3.11.1.0	Dry Alpine Steppe Meadow	E4
3.11.1.1	Dry Acid Alpine Steppe Meadow	E4
3.11.1.2	Dry Neutral Alpine Steppe Meadow	E4
3.11.1.3	Dry Alkali Alpine Steppe Meadow	E4
3.11.2.1	Wet Acid Alpine Steppe Meadow	E4
3.11.2.2	Wet Neutral Alpine Steppe Meadow	E4
3.11.2.3	Wet Alkali Alpine Steppe Meadow	E4
3.1100.1.0	Dry Alkali Scrub	F4
3.1100.2.0	Wet Acid Scrub	F4
3.1200.1.0	Dry Snow & Ice	H
3.1200.2.0	Wet Snow & Ice	H
3.13.1.2	Dry Neutral Alpine Tugai Meadow	E4
3.13.1.3	Dry Alkali Alpine Tugai Meadow	E4
3.14.1.3	Dry Alkali Alpine Tundra Meadow	E4
3.1400.1.0	Dry Neutral Solonchak & Heath Tundra	SE02
3.1500.1.0	Dry Neutral Solnchak & Marsh	SE03
3.1700.1.0	Dry Alkali Solnchak & Tundra	SE02
3.18.1.3	Dry Alkali Creeper Pasture	SE04
3.1800.1.0	Dry Alkali Sparse Vegetation	H
3.1800.2.0	Wet Sparse Vegetation	H
3.19.1.3	Dry Alkali Creeper Short Grass Pasture	SE04
3.1900.1.0	Dry Alkali Tugai	SE05
3.200.2.0	Wet Acid Arctic Heath & Peat Bog	SE06
3.2000.1.0	Dry Neutral Tundra	FX
3.2000.2.0	Wet Acid Tundra	FX
3.2100.1.0	Dry Acid Tundra with Marsh	SE07
3.2100.2.0	Wet Acid Tundra with Marsh	SE07
3.2200.2.0	Wet Acid Tundra with Peat Bog	SE08
3.2300.1.0	Dry Acid Tundra with Wetland	SE07
3.2300.2.0	Wet Acid Tundra with Wetland	SE07
3.24.1.0	Dry Desert Grassland	E1
3.24.1.2	Dry Neutral Desert Grassland	E1
3.24.1.3	Dry Alkali Desert Grassland	E1
3.2400.1.0	Dry Acid Wetland	DX
3.2400.2.0	Wet Acid Wetland	DX
3.26.1.0	Dry Desert Steppe Pasture	E1
3.26.1.3	Dry Alkali Desert Steppe Pasture	E1
3.28.1.0	Dry Desert Tundra Pasture	E1
3.28.1.3	Dry Alkali Desert Tundra Pasture	E1
3.300.1.0	Dry Bare Stone	H
3.300.2.0	Wet Alkali Bare Stone	H
3.31.1.0	Dry Forest Pasture	EX
3.31.1.1	Dry Acid Forest Pasture	EX
3.31.1.2	Dry Neutral Forest Pasture	EX
3.31.1.3	Dry Alkali Forest Pasture	EX
3.31.2.0	Wet Forest Pasture	EX
3.31.2.1	Wet Acid Forest Pasture	EX
3.31.2.2	Wet Neutral Forest Pasture	EX
3.31.2.3	Wet Alkali Forest Pasture	EX
3.32.1.0	Dry Forest Short Grass Pasture	EX
3.32.1.1	Dry Acid Forest Short Grass Pasture	EX
3.32.1.2	Dry Neutral Forest Short Grass Pasture	EX

SEI code	SEI name	EUNIS code
3.32.1.3	Dry Alkali Forest Short Grass Pasture	EX
3.32.2.0	Wet Forest Short Grass Pasture	EX
3.32.2.1	Wet Acid Forest Short Grass Pasture	EX
3.32.2.3	Wet Alkali Forest Short Grass Pasture	EX
3.33.1.1	Dry Acid Forest Short Montane Grass Pasture	EX
3.33.1.2	Dry Neutral Forest Short Montane Grass Pasture	EX
3.33.1.3	Dry Alkali Forest Short Montane Grass Pasture	EX
3.34.1.0	Dry Forest Tall Grass Pasture	EX
3.34.1.1	Dry Acid Forest Tall Grass Pasture	EX
3.34.1.2	Dry Neutral Forest Tall Grass Pasture	EX
3.34.1.3	Dry Alkali Forest Tall Grass Pasture	EX
3.34.2.1	Wet Acid Forest Tall Grass Pasture	EX
3.36.1.0	Dry Grassland	SE09
3.36.1.1	Dry Acid Grassland	SE09
3.36.1.2	Dry Neutral Grassland	SE09
3.36.1.3	Dry Alkali Grassland	SE09
3.36.2.0	Wet Grassland	SE04
3.36.2.1	Wet Acid Grassland	SE04
3.36.2.2	Wet Neutral Grassland	SE04
3.36.2.3	Wet Alkali Grassland	SE04
3.37.1.0	Dry Grassland/Meadow/Hay	E2
3.37.1.1	Dry Acid Grassland/Meadow/Hay	E2
3.37.1.2	Dry Neutral Grassland/Meadow/Hay	E2
3.37.1.3	Dry Alkali Grassland/Meadow/Hay	E2
3.37.2.0	Wet Grassland/Meadow/Hay	SE04
3.37.2.1	Wet Acid Grassland/Meadow/Hay	SE04
3.37.2.2	Wet Neutral Grassland/Meadow/Hay	SE04
3.37.2.3	Wet Alkali Grassland/Meadow/Hay	SE04
3.38.1.1	Dry Acid Hay Meadow	E2
3.38.1.2	Dry Neutral Hay Meadow	E2
3.38.1.3	Dry Alkali Hay Meadow	E2
3.38.2.1	Wet Acid Hay Meadow	SE04
3.38.2.2	Wet Neutral Hay Meadow	SE04
3.38.2.3	Wet Alkali Hay Meadow	SE04
3.39.2.0	Wet Improved Alpine Short Grassland	E4
3.39.2.1	Wet Acid Improved Alpine Short Grassland	E4
3.39.2.2	Wet Neutral Improved Alpine Short Grassland	E4
3.39.2.3	Wet Alkali Improved Alpine Short Grassland	E4
3.400.1.0	Dry Desert	SE010
3.400.2.0	Wet Desert	SE010
3.41.1.0	Dry Improved Grassland	SE09
3.41.1.1	Dry Acid Improved Grassland	SE09
3.41.1.2	Dry Neutral Improved Grassland	SE09
3.41.1.3	Dry Alkali Improved Grassland	SE09
3.41.2.0	Wet Improved Grassland	SE04
3.41.2.1	Wet Acid Improved Grassland	SE04
3.41.2.2	Wet Neutral Improved Grassland	SE04
3.41.2.3	Wet Alkali Improved Grassland	SE04
3.42.1.0	Dry Improved Pasture	E2
3.42.1.1	Dry Acid Improved Pasture	E2
3.42.1.2	Dry Neutral Improved Pasture	E2
3.42.1.3	Dry Alkali Improved Pasture	E2
3.42.2.0	Wet Improved Pasture	SE04
3.42.2.1	Wet Acid Improved Pasture	SE04
3.42.2.2	Wet Neutral Improved Pasture	SE04
3.42.2.3	Wet Alkali Improved Pasture	SE04
3.43.1.0	Dry Improved Short Grassland	SE09
3.43.1.1	Dry Acid Improved Short Grassland	SE09
3.43.1.2	Dry Neutral Improved Short Grassland	SE09
3.43.1.3	Dry Alkali Improved Short Grassland	SE09
3.43.2.0	Wet Improved Short Grassland	SE04
3.43.2.1	Wet Acid Improved Short Grassland	SE04
3.43.2.2	Wet Neutral Improved Short Grassland	SE04
3.43.2.3	Wet Alkali Improved Short Grassland	SE04
3.44.1.1	Dry Acid Improved Short Montane Grassland	E4
3.44.2.0	Wet Improved Short Montane Grassland	E4
3.44.2.1	Wet Acid Improved Short Montane Grassland	E4
3.44.2.2	Wet Neutral Improved Short Montane Grassland	E4
3.44.2.3	Wet Alkali Improved Short Montane Grassland	E4
3.45.2.3	Wet Alkali Improved Tall Grassland	SE011
3.46.1.0	Dry Meadow	E2
3.46.1.1	Dry Acid Meadow	E2
3.46.1.2	Dry Neutral Meadow	E2
3.46.1.3	Dry Alkali Meadow	E2
3.46.2.0	Wet Meadow	SE04
3.46.2.1	Wet Acid Meadow	SE04
3.46.2.2	Wet Neutral Meadow	SE04
3.46.2.3	Wet Alkali Meadow	SE04
3.47.1.0	Dry Pasture	E2
3.47.1.1	Dry Acid Pasture	E2
3.47.1.2	Dry Neutral Pasture	E2
3.47.1.3	Dry Alkali Pasture	E2
3.47.2.0	Wet Pasture	SE04
3.47.2.1	Wet Acid Pasture	SE04
3.47.2.2	Wet Neutral Pasture	SE04
3.47.2.3	Wet Alkali Pasture	SE04
3.50.1.1	Dry Acid Semi-Arid Forest Pasture	EX
3.50.1.3	Dry Alkali Semi-Arid Forest Pasture	EX
3.500.1.0	Dry Alkali Dunes & Tidal Flats	SE012
3.500.2.0	Wet Acid Dunes & Tidal Flats	SE012
3.51.1.0	Dry Semi-Arid Grass	E1
3.51.1.1	Dry Acid Semi-Arid Grass	E1
3.51.1.2	Dry Neutral Semi-Arid Grass	E1
3.51.1.3	Dry Alkali Semi-Arid Grass	E1
3.52.1.0	Dry Semi-Arid Steppe Pasture	E1
3.52.1.1	Dry Acid Semi-Arid Steppe Pasture	E1
3.52.1.2	Dry Neutral Semi-Arid Steppe Pasture	E1
3.52.1.3	Dry Alkali Semi-Arid Steppe Pasture	E1
3.53.1.2	Dry Neutral Semi-Arid Tugai Meadow	E1
3.53.1.3	Dry Alkali Semi-Arid Tugai Meadow	E1
3.54.1.0	Dry Semi-Arid Tundra Pasture	E1
3.54.1.1	Dry Acid Semi-Arid Tundra Pasture	E1
3.54.1.2	Dry Neutral Semi-Arid Tundra Pasture	E1
3.54.1.3	Dry Alkali Semi-Arid Tundra Pasture	E1
3.55.1.0	Dry Short Grass	SE09
3.55.1.1	Dry Acid Short Grass	SE09
3.55.1.2	Dry Neutral Short Grass	SE09
3.55.1.3	Dry Alkali Short Grass	SE09
3.55.2.0	Wet Short Grass	SE04
3.55.2.1	Wet Acid Short Grass	SE04
3.55.2.2	Wet Neutral Short Grass	SE04
3.55.2.3	Wet Alkali Short Grass	SE04
3.56.1.0	Dry Short Grass Meadow	E2
3.56.1.1	Dry Acid Short Grass Meadow	E2
3.56.1.2	Dry Neutral Short Grass Meadow	E2
3.56.1.3	Dry Alkali Short Grass Meadow	E2

SEI code	SEI name	EUNIS code
3.56.2.0	Wet Short Grass Meadow	SE04
3.56.2.1	Wet Acid Short Grass Meadow	SE04
3.56.2.2	Wet Neutral Short Grass Meadow	SE04
3.56.2.3	Wet Alkali Short Grass Meadow	SE04
3.57.1.0	Dry Short Montane Grass	E4
3.57.1.1	Dry Acid Short Montane Grass	E4
3.57.1.2	Dry Neutral Short Montane Grass	E4
3.57.1.3	Dry Alkali Short Montane Grass	E4
3.57.2.0	Wet Short Montane Grass	E4
3.57.2.1	Wet Acid Short Montane Grass	E4
3.57.2.2	Wet Neutral Short Montane Grass	E4
3.57.2.3	Wet Alkali Short Montane Grass	E4
3.60.1.1	Dry Acid Steppe Meadow	SE04
3.600.2.0	Wet Acid Heath	F4
3.61.1.0	Dry Steppe Pasture	E2
3.61.1.1	Dry Acid Steppe Pasture	E2
3.61.1.2	Dry Neutral Steppe Pasture	E2
3.61.1.3	Dry Alkali Steppe Pasture	E2
3.61.2.0	Wet Steppe Pasture	SE04
3.61.2.1	Wet Acid Steppe Pasture	SE04
3.61.2.2	Wet Neutral Steppe Pasture	SE04
3.61.2.3	Wet Alkali Steppe Pasture	SE04
3.62.1.0	Dry Steppe Short Grass Pasture	E2
3.62.1.1	Dry Acid Steppe Short Grass Pasture	E2
3.62.1.2	Dry Neutral Steppe Short Grass Pasture	E2
3.62.1.3	Dry Alkali Steppe Short Grass Pasture	E2
3.62.2.1	Wet Acid Steppe Short Grass Pasture	SE04
3.62.2.2	Wet Neutral Steppe Short Grass Pasture	SE04
3.62.2.3	Wet Alkali Steppe Short Grass Pasture	SE04
3.63.1.1	Dry Acid Steppe Short Montane Grass Pasture	E4
3.63.1.2	Dry Neutral Steppe Short Montane Grass Pasture	E4
3.63.1.3	Dry Alkali Steppe Short Montane Grass Pasture	E4
3.63.2.1	Wet Acid Steppe Short Montane Grass Pasture	E4
3.63.2.2	Wet Neutral Steppe Short Montane Grass Pasture	E4
3.63.2.3	Wet Alkali Steppe Short Montane Grass Pasture	E4
3.64.1.0	Dry Steppe Tall Grass Pasture	E2
3.64.1.2	Dry Neutral Steppe Tall Grass Pasture	E2
3.64.1.3	Dry Alkali Steppe Tall Grass Pasture	E2
3.64.2.1	Wet Acid Steppe Tall Grass Pasture	SE04
3.65.1.0	Dry Tall Grass	SE09
3.65.1.1	Dry Acid Tall Grass	SE09
3.65.1.2	Dry Neutral Tall Grass	SE09
3.65.1.3	Dry Alkali Tall Grass	SE09
3.65.2.0	Wet Tall Grass	SE04
3.65.2.1	Wet Acid Tall Grass	SE04
3.65.2.2	Wet Neutral Tall Grass	SE04
3.65.2.3	Wet Alkali Tall Grass	SE04
3.68.1.2	Dry Neutral Tugai Meadow	SE04
3.68.1.3	Dry Alkali Tugai Meadow	SE04
3.700.1.0	Dry Alkali Heath Tundra	SE013
3.700.2.0	Wet Acid Heath Tundra	SE013
3.71.1.0	Dry Tundra Pasture	E2
3.71.1.1	Dry Acid Tundra Pasture	E2
3.71.1.2	Dry Neutral Tundra Pasture	E2
3.71.1.3	Dry Alkali Tundra Pasture	E2
3.71.2.0	Wet Tundra Pasture	SE04
3.71.2.1	Wet Acid Tundra Pasture	SE04
3.71.2.2	Wet Neutral Tundra Pasture	SE04
3.71.2.3	Wet Alkali Tundra Pasture	SE04
3.72.1.0	Dry Tundra Short Grass Pasture	E2
3.72.1.1	Dry Acid Tundra Short Grass Pasture	E2
3.72.1.2	Dry Neutral Tundra Short Grass Pasture	E2
3.72.1.3	Dry Alkali Tundra Short Grass Pasture	E2
3.72.2.0	Wet Tundra Short Grass Pasture	SE04
3.72.2.1	Wet Acid Tundra Short Grass Pasture	SE04
3.72.2.2	Wet Neutral Tundra Short Grass Pasture	SE04
3.72.2.3	Wet Alkali Tundra Short Grass Pasture	SE04
3.73.1.0	Dry Tundra Short Montane Grass Pasture	E4
3.73.1.1	Dry Acid Tundra Short Montane Grass Pasture	E4
3.73.1.3	Dry Alkali Tundra Short Montane Grass Pasture	E4
3.74.1.0	Dry Tundra Tall Grass Pasture	E2
3.74.1.1	Dry Acid Tundra Tall Grass Pasture	E2
3.74.1.2	Dry Neutral Tundra Tall Grass Pasture	E2
3.74.1.3	Dry Alkali Tundra Tall Grass Pasture	E2
3.74.2.1	Wet Acid Tundra Tall Grass Pasture	SE04
3.74.2.2	Wet Neutral Tundra Tall Grass Pasture	SE04
3.75.2.1	Wet Acid Unimproved Alpine Short Grassland	E4
3.75.2.2	Wet Neutral Unimproved Alpine Short Grassland	E4
3.75.2.3	Wet Alkali Unimproved Alpine Short Grassland	E4
3.76.1.0	Dry Unimproved Desert Grassland	E1
3.76.1.2	Dry Neutral Unimproved Desert Grassland	E1
3.76.1.3	Dry Alkali Unimproved Desert Grassland	E1
3.77.1.0	Dry Unimproved Grassland	SE09
3.77.1.1	Dry Acid Unimproved Grassland	SE09
3.77.1.2	Dry Neutral Unimproved Grassland	SE09
3.77.1.3	Dry Alkali Unimproved Grassland	SE09
3.77.2.0	Wet Unimproved Grassland	SE04
3.77.2.1	Wet Acid Unimproved Grassland	SE04
3.77.2.2	Wet Neutral Unimproved Grassland	SE04
3.77.2.3	Wet Alkali Unimproved Grassland	SE04
3.78.1.0	Dry Unimproved Pasture	E2
3.78.1.1	Dry Acid Unimproved Pasture	E2
3.78.1.2	Dry Neutral Unimproved Pasture	E2
3.78.1.3	Dry Alkali Unimproved Pasture	E2
3.78.2.0	Wet Unimproved Pasture	SE04
3.78.2.1	Wet Acid Unimproved Pasture	SE04
3.78.2.2	Wet Neutral Unimproved Pasture	SE04
3.78.2.3	Wet Alkali Unimproved Pasture	SE04
3.79.1.0	Dry Unimproved Short Grassland	SE09
3.79.1.1	Dry Acid Unimproved Short Grassland	SE09
3.79.1.2	Dry Neutral Unimproved Short Grassland	SE09
3.79.1.3	Dry Alkali Unimproved Short Grassland	SE09
3.79.2.0	Wet Unimproved Short Grassland	SE04
3.79.2.1	Wet Acid Unimproved Short Grassland	SE04
3.79.2.2	Wet Neutral Unimproved Short Grassland	SE04
3.79.2.3	Wet Alkali Unimproved Short Grassland	SE04
3.8.1.0	Dry Alpine Meadow Grass	E4
3.8.1.1	Dry Acid Alpine Meadow Grass	E4
3.8.1.2	Dry Neutral Alpine Meadow Grass	E4

SEI code	SEI name	EUNIS code
3.8.1.3	Dry Alkali Alpine Meadow Grass	E4
3.8.2.0	Wet Alpine Meadow Grass	E4
3.8.2.1	Wet Acid Alpine Meadow Grass	E4
3.8.2.2	Wet Neutral Alpine Meadow Grass	E4
3.8.2.3	Wet Alkali Alpine Meadow Grass	E4
3.80.1.0	Dry Unimproved Short Montane Grassland	E4
3.80.1.1	Dry Acid Unimproved Short Montane Grassland	E4
3.80.1.2	Dry Neutral Unimproved Short Montane Grassland	E4
3.80.1.3	Dry Alkali Unimproved Short Montane Grassland	E4
3.80.2.0	Wet Unimproved Short Montane Grassland	E4
3.80.2.1	Wet Acid Unimproved Short Montane Grassland	E4
3.80.2.2	Wet Neutral Unimproved Short Montane Grassland	E4
3.80.2.3	Wet Alkali Unimproved Short Montane Grassland	E4
3.800.1.0	Dry Acid Marsh	DX
3.800.2.0	Wet Acid Marsh	DX
3.81.1.0	Dry Unimproved Tall Grassland	SE09
3.81.1.1	Dry Acid Unimproved Tall Grassland	SE09
3.81.1.2	Dry Neutral Unimproved Tall Grassland	SE09
3.81.1.3	Dry Alkali Unimproved Tall Grassland	SE09
3.81.2.1	Wet Acid Unimproved Tall Grassland	SE04
3.81.2.3	Wet Alkali Unimproved Tall Grassland	SE04
3.9.1.2	Dry Neutral Alpine Short Grass	E4
3.9.1.3	Dry Alkali Alpine Short Grass	E4
3.9.2.0	Wet Alpine Short Grass	E4
3.9.2.1	Wet Acid Alpine Short Grass	E4
3.9.2.2	Wet Neutral Alpine Short Grass	E4
3.9.2.3	Wet Alkali Alpine Short Grass	E4
3.900.1.0	Dry Acid Mediterranean Scrub	FX
3.900.2.0	Wet Neutral Mediterranean Scrub	FX
4	Urban	J
5.2	Inland Water	C
5.3	Coastal Water	A

Table 3A-4 Combined EUNIS-classes with percentages.

Combined Eunis Code	EUNIS code	Percentage of Area
CE1	H	25
CE1	J	75
CE2	E2	33.33
CE2	I	33.33
CE2	J	33.33
CE3	E	50
CE3	F	50
CE4	H	50
CE5	J	50
PE1	FX	50
PE1	G1	50
SE01	D1	50
SE01	D2	50
SE02	EX	50
SE02	F1	50
SE03	EX	50
SE03	FX	50
SE04	E2	50
SE04	E3	50
SE05	FX	50
SE05	G1	50
SE06	DX	50
SE06	F2	50
SE07	DX	50
SE07	FX	50
SE08	D2	50
SE08	FX	50
SE09	E1	50
SE09	E2	50
SE10	EX	50
SE10	FX	50
SE11	E1	33.33
SE11	E2	33.33
SE11	E3	33.33
SE12	A	50
SE12	B	50
SE13	FX	50
SE13	F1	50