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Report on the activities realized within the Service Level Agreement between JRC and EFSA

as a support of the FATE and ECOREGION Working Groups of EFSA PPR
(SLA/EFSA-JRC/2008/01)

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JRC TECHNICAL REPORT

Report on the activities realized in 2010 within the Service Level Agreement between JRC and EFSA, as a support of the FATE and ECOREGION Working Groups of EFSA PPR.

(SLA/EFSA-JRC/2008/01)

Final Report of 15th December 2010

SUMMARY

The activities realized in 2010 by JRC as support to the FATE and the ECOREGION EFSA PPR Working Groups are shortly described.

For the FATE WG, the vast majority of data has been provided in 2009 during the first year of the Service Level Agreement (SLA), and in 2010 the daily weather data, for the six selected sites, were produced. All the data used for the scenario selection procedures, with additional data on land use-land cover, crop distribution, soil and climate parameters, will be made available for external user in first half of 2011.

For the ECOREGION WG the analysis has been carried out for three Member States covering a North-South gradient from Finland, Germany to Portugal. Soil and weather data have been used for the characterisation of biogeographic sampling sites, and for the implementation of the ecoregion model. Ecoregion maps were produced for earthworms and enchytraeids for Finland and Germany and revealed marked differences between the countries. The same approach has been applied also to Collembola and Isopoda, but for these two taxa led to a rather poor discrimination both between and within countries.

Key words: Meteorological data, Biogeographic data, Ecoregions, Earthworm, Enchytraeid, Collembola, Isopoda, Soil, Plant Protection Products

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1. FATE WG

1.1 INTRODUCTION AND OBJECTIVES

The revision of the Guidance Document on Persistence in Soil (9188/VI/97 rev 8) will provide notifiers, Member States and the EFSA peer review process with guidance in the area of environmental fate and behaviour of pesticides in soil in the context of the review of active substances notified for inclusion in Annex I of Directive 91/414/EEC and Council Regulation 1107/2009 as well as for the review of plant protection products for national registrations in Member States.

The aim of this revision is to develop a tiered approach for exposure assessment in soil at EU level including:

- the development of a range of scenarios representing realistic worst-case conditions including ecological and climatic considerations,
- the appropriate definition of the role of results of field persistence and soil accumulation experiments in the tiered assessment.

The tiered approach will consist of lower tiers that provide conservative estimates and higher tiers that provide more refined and realistic exposure estimates (EFSA, 2010a). The parametrisation of the scenarios selected for the Tier-1 and Tier-2 require the availability of daily weather data over 20 years time. One of the objectives of the second year of activities in 2010 was the extraction of these data sets, in correspondence to the selected scenarios.

Furthermore, in order to allow the external users to apply the models for Tier-3 and Tier-4 assessments, all the data sets used in Tier 1, with additional data on land use-land cover, crop distribution, soil and climate parameters, will be made available on a dedicated web portal, hosted by the JRC web site.

1.2. Collection and Interpolation of Daily Meteorological Data onto a Regular Climatic Grid

The MARS Unit currently collects and manages a large meteorological data set, from Europe and from the Western part of North Africa. For a detailed description of the procedures of collection and validation of meteorological data refer to the paper of Erik van der Goot (1998) or to the JRC Scientific Report (Gardi et al., 2010), available online on the EFSA Website (http://www.efsa.europa.eu/en/scdocs/doc/64e.pdf).

In this section is described the methodology adopted by the MARS Unit, for the interpolation of daily meteorological data onto a 50 x 50 km grids (25 x 25 km grids is now also available).

Globally in the MARS Data Base (DB) are present data referring to more than 6000 stations distributed in 48 countries, but of these, only one third present an adequate level of reliability and regular provided data. In table 1.1 are reported the number of meteorological stations by country used in an operational way in the MCYFS. In general, the density of the meteo stations in the monitored areas is sufficient for the purpose of the project. In figure 1.1 it is shown which is in average is the surface covered by one station.

Considering that each cell of the CGMS-grid is 50x50 km (equivalent to 2.500 km^2), is evident that the main agricultural areas present at least one station for each grid cell or one station for a group of four cells (equivalent to 10.000 Km^2).

Observations of maximum and minimum temperatures, precipitation amounts and sunshine duration (when available) are contained in the main hours synoptic. METAR data provide temperature, dew point, visibility and cloud amount. As far as available, they can be used for intermediate or even non-standard (i.e. all but main and intermediate) hours. From most countries outside Europe, 3-hourly synoptic data are exchanged world wide and can be made available through Meteo Consult.

The daily meteorological data is interpolated towards the centres of a regular climatic grid that measures 50 by 50 kilometres and amounts to 5625 cells. The data of the climatic grid is stored in table GRID_WEATHER and are related to the parameters listed in table 1.2.

Table 1.1: Available number of meteorological stations by country

Country CODE and NAME		B6	B3	R	T	E	M
AL	Albania	-	-	-	-	-	-
AM	Armenia	3	-	-	1	-	1
AT	Austria	15	15	93	93	21	6
AZ	Azerbaijan	1	-	-	1	-	1
BA	Bosnia	1	-	5	7	-	1
BE	Belgium	2	-	20	20	20	5
BG	Bulgaria	14	-	30	30	-	-
BY	Belarus	10	-	18	18	-	3
CH	Switzerland	6	-	48	51	66	7
CY	Cyprus	1	-	4	4	-	3
CZ	Czech Republic	7	-	17	27	-	3
DE	Germany	62	62	204	204	218	38
DK	Denmark	6	-	20	29	39	17
DZ	Algeria	33	-	66	64	-	11
EE	Estonia	8	-	10	10	-	-
ES	Spain	36	36	60	60	69	27
FI	Finland	15	-	26	26	29	8
FO	Faeroes	1	-	1	2	2	1
FR	France	44	-	179	179	162	59
GE	Georgia	4	-	3	5	-	2
GR	Greece	20	-	21	28	28	20
HR	Croatia	3	-	40	40	-	7
HU	Hungary	7	7	22	23	26	1
IE	Ireland	9	9	13	16	16	3
IT	Italy	56	-	90	98	101	70
KZ	Kazakhstan	46	-	-	7	-	-
LI	Liechtenstein	1	-	1	1	-	-
LT	Lithuania	7	-	7	7	-	1
LU	Luxembourg	1	-	8	8	-	1
LV	Latvia	6	-	6	6	-	-
MD	Moldavia	1	-	1	1	-	-
MK	Macedonian Rep	1	-	1	9	-	1
MO	Morocco	22	-	23	23	-	8
MT	Malta	1	-	1	1	-	-
NL	Netherlands	12	12	34	35	37	15
NO	Norway	19	15	42	43	45	7
PL	Poland	6	-	59	60	-	8
PT	Portugal	16	16	22	22	30	3
RO	Romania	20	-	20	20	-	3
RU	Russia	78	-	102	137	-	13
SE	Sweden	28	28	33	55	189	15
SI	Slovenia	1	-	19	19	-	3
SK	Slovakia	5	-	19	19	-	3
TR	Turkey	60	58	55	60	100	23
TN	Tunisia	7	-	21	20	-	10
UA	Ukraine	14	-	40	40	-	-
UK	United Kingdom	216	216	175	185	216	52
YU	Yugoslavia	9	-	36	36	-	3
Total		**941**	**474**	**1715**	**1850**	**1414**	**463**
	EU-25	587	401	1162	1234	1201	361

Legend:

JRC JRC aimed number of stations
B6 number of stations in *GBDS (main hour* observations)
B3 number of stations in *GBDS (main and intermediate hour* observations)
R mean number of stations with *precipitation* observation available
T mean number of stations with *minimum and maximum temperature* observation available
E maximum number of stations *available through ECOMET* according to ECOMET catalogue except for Greece where catalogue is wrong (main and intermediate hours, including GBDS stations)
M number of *METAR stations* available (partly overlapping GBDS and ECOMET stations)
P price per year for each additional station not in Global Basic Data Set (based on 6 synops per day)

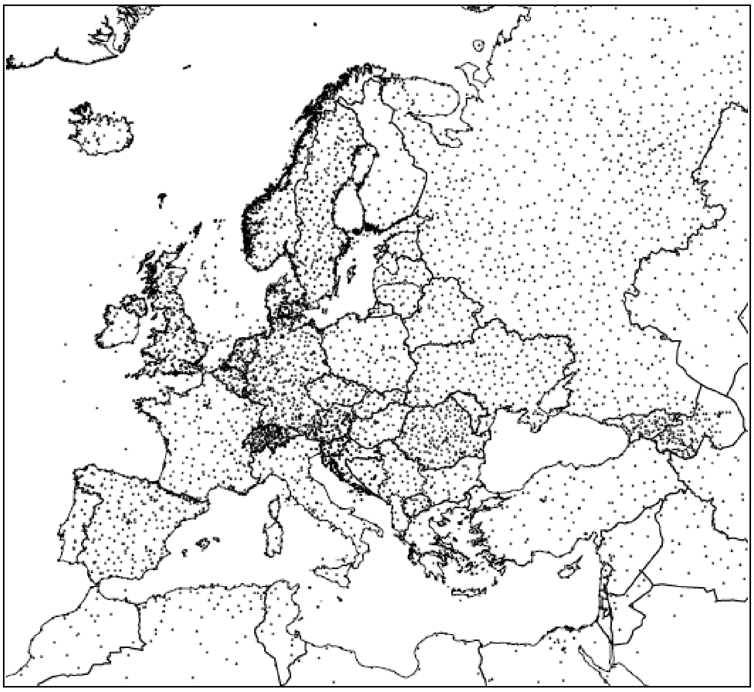

Figure 1.1: The meteorological stations for which data are available for (part of) the period from1975 until the current day.

Table 1.2: List of parameters contained in GRID_WEATHER table

Parameter	Unit	Abbreviation
• Minimum Temperature	°C	Tmin
• Maximum Temperature	°C	Tmax
• Cumulated mean Temperature	°C	Tsum
• Mean Temperature	°C	Tmean
• Precipitation	mm	Rain
• Potential Evapotranspiration (3 values)[8]	mm	E0, ES0,ETO
• Climatic water balance	mm	CWB
• Global Radiation	KJ/m^2*day	Rg
• Snow depth	cm	SD

All the input and output data, such as the climatic grid presented, are given in Lambert-Azimuthal projection system, with meters as units and the parameters:

• Radius of sphere of reference: 6.370.997 (m).

• Longitude of centre of projection: 9,00º.

• Latitude of centre of projection: 48,00º.

1.3. EXTRACTION OF DAILY METEOROLOGICAL DATA FOR THE TIER-2 SCENARIOS

For the development of the lower tiers - Tier 1 and Tier 2 the EFSA Fate working group selected six sites (two for each regulatory zone) across EU. Each site has been attributed to grid cells of MARS DB, and the completeness of weather data series was evaluated. In particular for one of these grids, due to some lack in rainfall data, it was necessary to find, among the nearest grids, an alternative cells with a complete daily data set. (Fig. 1.2)

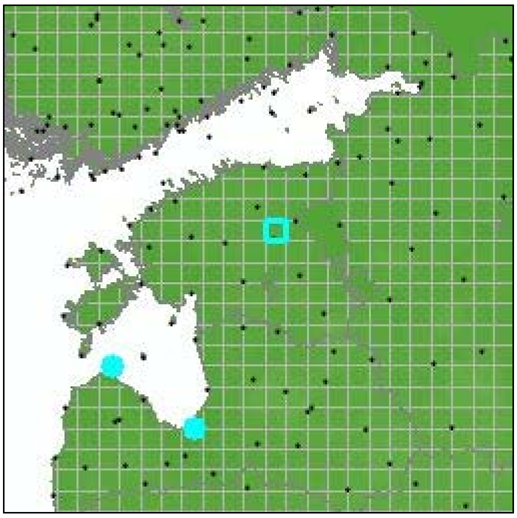

Figure 1.2: Identification of alternatives weather stations in case of incompleteness of data set

Meteorological data have been exported as text files, with the structure reported in table 1.3.

Table 1.3: Structure of the meteorological data provided for the selected scenarios

GRID_NO	DAY	MAXIMUM_TEMPERATURE	MINIMUM_TEMPERATURE	WINDSPEED	RAINFALL	ET0	CALCULATED_RADIATION	VAPOUR_PRESSURE
53067	1/1/1990	12,7	2,9	1,7	0,6	0,71527922	6129	9,25
53067	2/1/1990	10,5	5,8	2,4	3,0	0,85431975	5791	8,81
53067	3/1/1990	9,3	4,5	3,3	7,0	0,63213211	3312	9,13
53067	4/1/1990	8,5	4,3	3,3	7,0	0,56450325	3099	9,00
53067	5/1/1990	9,5	4,9	0,4	0,0	0,56357884	4853	8,24
53067	6/1/1990	10,1	0,9	1,7	0,0	0,65470117	7619	7,97
53067	7/1/1990	9,1	0,7	1,4	1,5	0,57378882	6874	7,95
53067	8/1/1990	7,3	-0,1	2,2	0,0	0,64395052	6074	6,89
53067	9/1/1990	6,9	1,9	0,2	0,0	0,48847278	5714	7,35
53067	10/1/1990	6,3	-1,7	1,5	0,0	0,5382598	5797	6,54

1.4. PREPARATION OF DATA SETS ALLOWING APPLICATION OF HIGHER TIERS

For the higher tiers Tier-3 and Tier-4 options exist for refinement, eg specific crops and/or specific plant protection products with specific properties may be considered. The procedures is essentially the same adopted for Tier-1 and Tier-2, but instead of using the total area of annual crops, the area may be limited to the intended area of use and the selection is made only for the substance under consideration. In order to enable assessors and applicants to apply the proposed methodology, the following datasets will be made available as ASCII files on the JRC Soil Portal (see Paragraph 1.5).

1.4.1. List of Datasets

In the following paragraphs a list of the available data sets are reported. These data sets have been provided by JRC or made available thank to the elaboration performed by the EFSA Fate working group members Aaldrik Tiktak and Micheal Klein.

General maps

- Masker of all files
- Countries of the EU-27 (countries.map)
- Regulatory zones (Northern, Central and Southern zone)
- FOCUS Zones

Soil maps

- Organic matter content of the topsoil
- pH of the topsoil
- Bulk density of the topsoil
- Texture of the topsoil
- Water content at field capacity

Meteorological maps

- Mean monthly temperature (12 maps)
- Mean annual temperature
- Arrhenius weighted mean annual temperature
- Mean monthly precipitation (12 maps)
- Mean annual precipitation

Land use land cover maps

- Corine land cover data
- Generalised land-use map (landuse.map)
- Capri land cover maps (24 maps)

1.5. SET-UP OF DEDICATED WEB SITE FOR DATA DOWNLOAD

In order to allow the data download, a specific web page within the JRC Soil Portal will be realized on (http://eusoils.jrc.ec.europa.eu/library/Data/EFSA/). A print screen of the main web page is shown in Fig. 1.3.

JRC will require users of the data to fill an online form, before proceeding with the data download (Fig. 1.4). The information collected by JRC will be used for updating the data users on the possible release of new soil and weather related information and data sets. However release of new information for the JRC Soil Portal will only happen after the FOCUS version control group chaired by EFSA has accepted the change of the new information.

1.5.1. Web Page structure

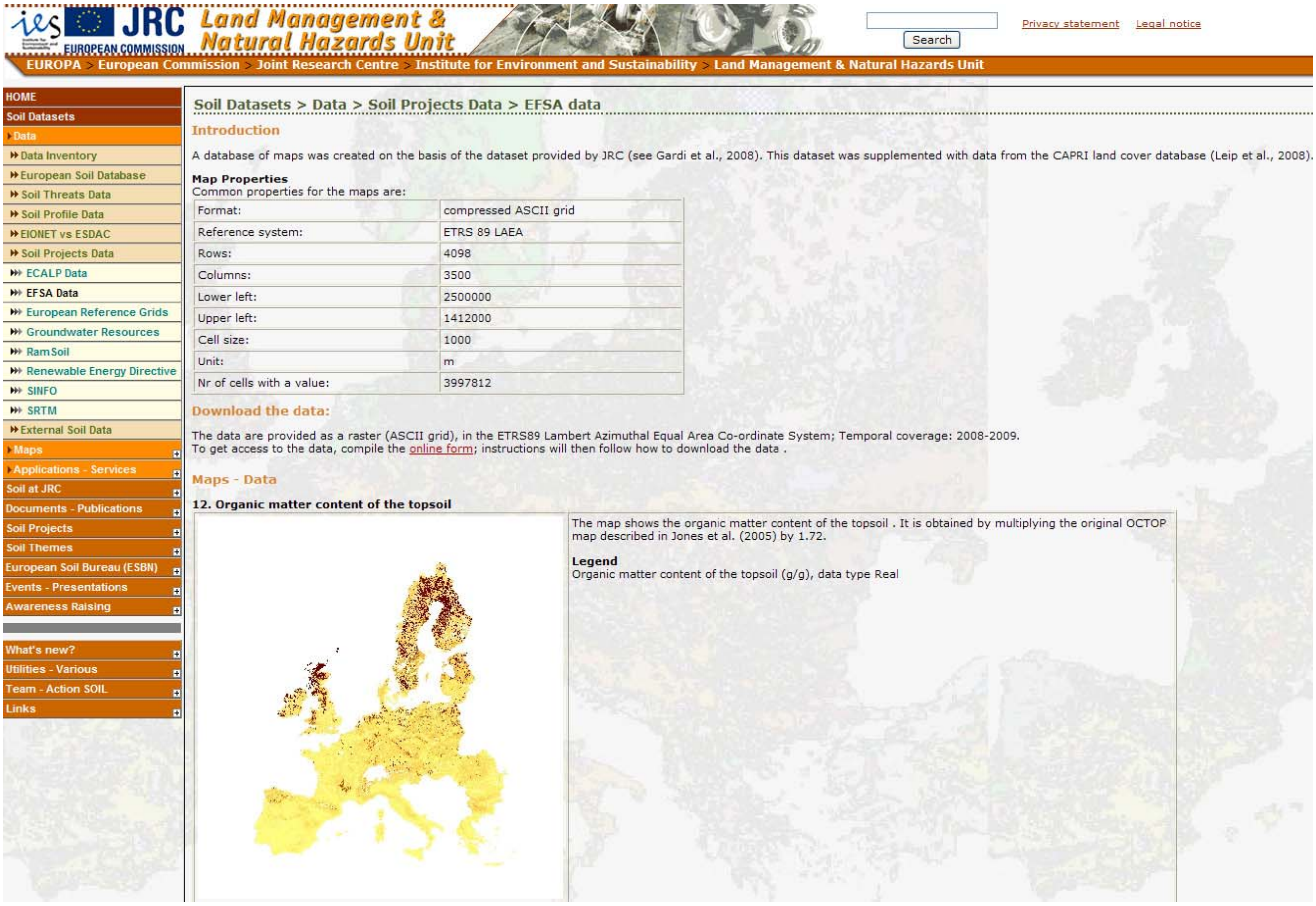

Figure 1.3: Print-screen of the page dedicated to the data download

1.5.2. Data Users Record

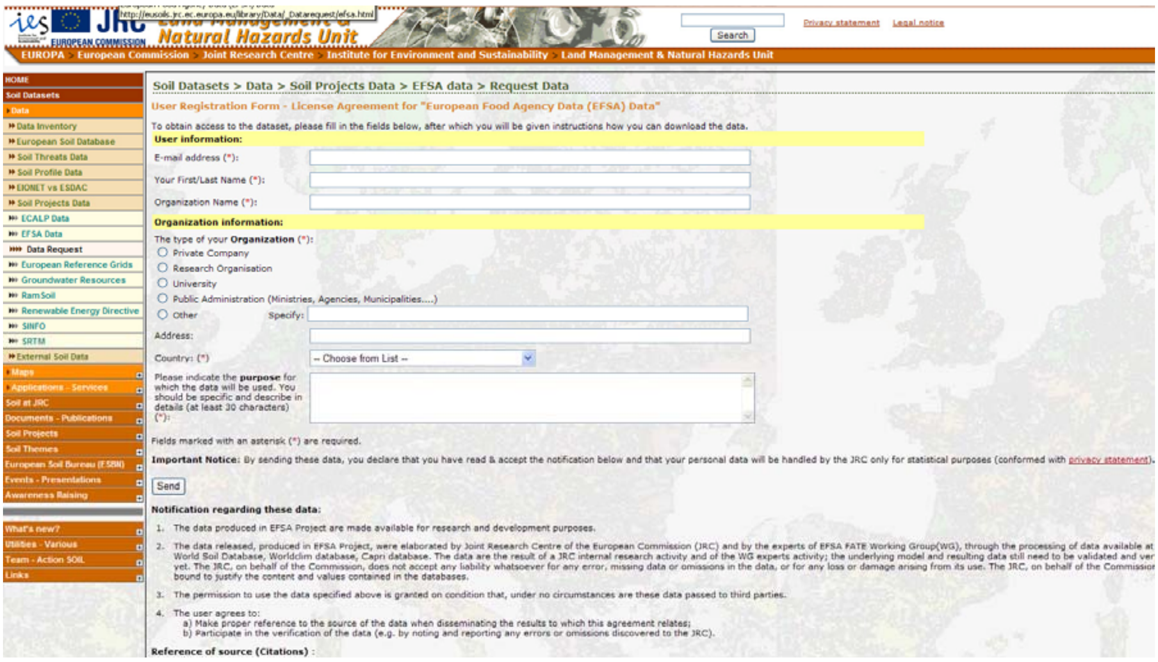

Figure 1.4: Registration form to be filled for downloading the data

2. ECOREGION WG

2.1. INTRODUCTION AND OBJECTIVES

The European Food Safety Authority (EFSA) asked the Panel on Plant Protection Products and their Residues (PPR) to further develop the concept of soil ecoregions in the context of the revision of the Guidance Document on Terrestrial Ecotoxicology (EFSA-Q-2009-00002). A modelling approach for defining soil ecoregions within Europe was developed to improve the realism of exposure scenarios for plant protection products. Biogeographic data on four soil organisms groups (earthworms, enchytraeids, collembolans and isopods) were used to assign each functional group to different life forms, representing depth horizons in which they occur. Based on information from three Member States covering a North-South gradient Finland, Germany and Portugal, species presence-absence data were modelled using soil and climate data.

The objectives of JRC contribution were:

- create a geographic database from the tabular data of the biogeographic survey;

- extract soil and weather data in correspondence of biogeographic sampling sites;

- implement the ecoregion models and create ecoregion maps.

The technical details of the activities performed for the achievement of the above reported objectives, are described in the following paragraphs and in the EFSA PPR Scientific Opinion on the development of a soil ecoregions concept using distribution data on invertebrates (EFSA, 2010b).

2.2. DESCRIPTION OF THE PROCEDURES ADOPTED

The production of the Ecoregion maps for Finland, Germany and Portugal represent the application of the proposed methodology to three test countries, according to a North-South gradient.

The complete description of the adopted approach is published as EFSA Opinion (EFSA, 2010b). In the following paragraphs however, is provided a more detailed description of the technical procedures adopted by JRC. The conceptual framework for the development of soil Ecoregions is reported in the scheme of Figure 2.1, and the activities reported in the green boxes have been developed by JRC, and described in the following paragraphs.

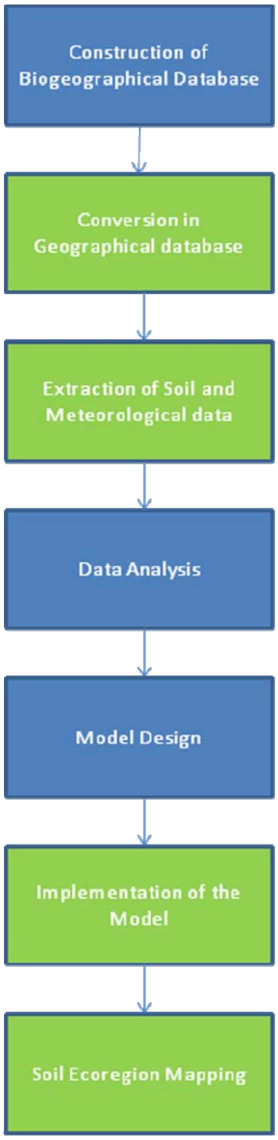

Figure 2.1: Conceptual frame of the approach adopted for the definition of Soil Ecoregion

2.2.1. From an attribute database to a geographic database

The original biogeographical database provided for the three test Member States Finland, Germany and Portugal was organized in separate Excel spreadsheets for the different groups of soil organisms, and the geographic coordinates were based on UTM[1] coordinate system, based on Datum WGS84[2].

[1] UTM: Universal Transver Maercator coordinate system is a grid-based method of specifying locations on the surface of the Earth that is a practical application of a 2-dimensional Cartesian coordinate system..

[2] WGS 84: WGS (World Geodetic System) is a standard for use in cartography, geodesy, and navigation. It comprises a standard coordinate frame for the Earth, a standard spheroidal reference surface (the datum or reference ellipsoid) for raw altitude data, and a gravitational equipotential surface (the geoid) that defines the nominal sea level. The GS 84 represent the latest revision of this standard.

In order to project these data in the EU coordinate system (Lambert Azimuthal Equal Area), and to the process in the most efficient way, it has been necessary to reorganize the database:

- One global spreadsheet for each of the three Member States has been produced;
- From each of these global spreadsheets, partial spreadsheets have been derived, grouping the records located in the same UTM zone
- In order to keep the track of the changes, a new field have been added (Fig. 2.2), produced by the concatenation of:
  - Two capital letters for the organisms group (CO= collembola, EW= earthworms, IS= isopoda)
  - The numeric value of ID Site
  - The initial letter of the country name

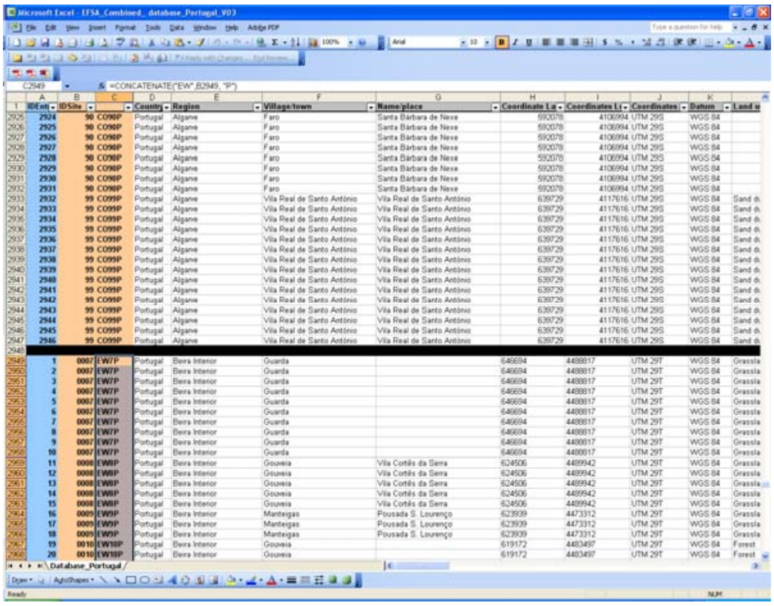

Figure 2.2: Structure of the country-based spreadsheet; the column with the new field has been outlined

These individual spreadsheets have been exported in DB4 format, in order to be easily managed in ArcGIS. ArcGIS 9.3 is the GIS software that has been used for the management and the analysis of the geographic information.

The following phase in the management of the data has been the generation of Point Shapefiles, representing the locations in which the soil organism inventory has been carried out and the re-projection of these maps.

The extraction of soil and climate data from the raster dataset, in correspondence of the of the soil organisms survey points, has been realized using the “Extract value to points” procedure; this procedure, that is a classical example of spatial query, allow to extract the cell values of a raster, based on set of points.

2.2.2.Characterization of biogeographic sampling sites in terms of soil, climate and land use characteristics

The biogeographic database consists of data on presence/absence and in some cases abundance, of selected groups of soil organisms, and in some cases also data on land use, vegetation, soil and climate were reported. The completeness of these environmental parameters, essential for the ecological characterization of soil community, however was very weak. For this reason the data on land use, soil and climate, provided by JRC, has been used to fill the gaps present in the original dataset.

This process has been carried out using the utilities of spatial analysis present in a Geographical Information System (GIS). Once the geographic position of a sampling point is known, it is possible do a spatial query in the GIS, concerning the values of soil pH, organic matter, total precipitation, and any other parameter that is available in a form of geographic database (Fig. 2.3).

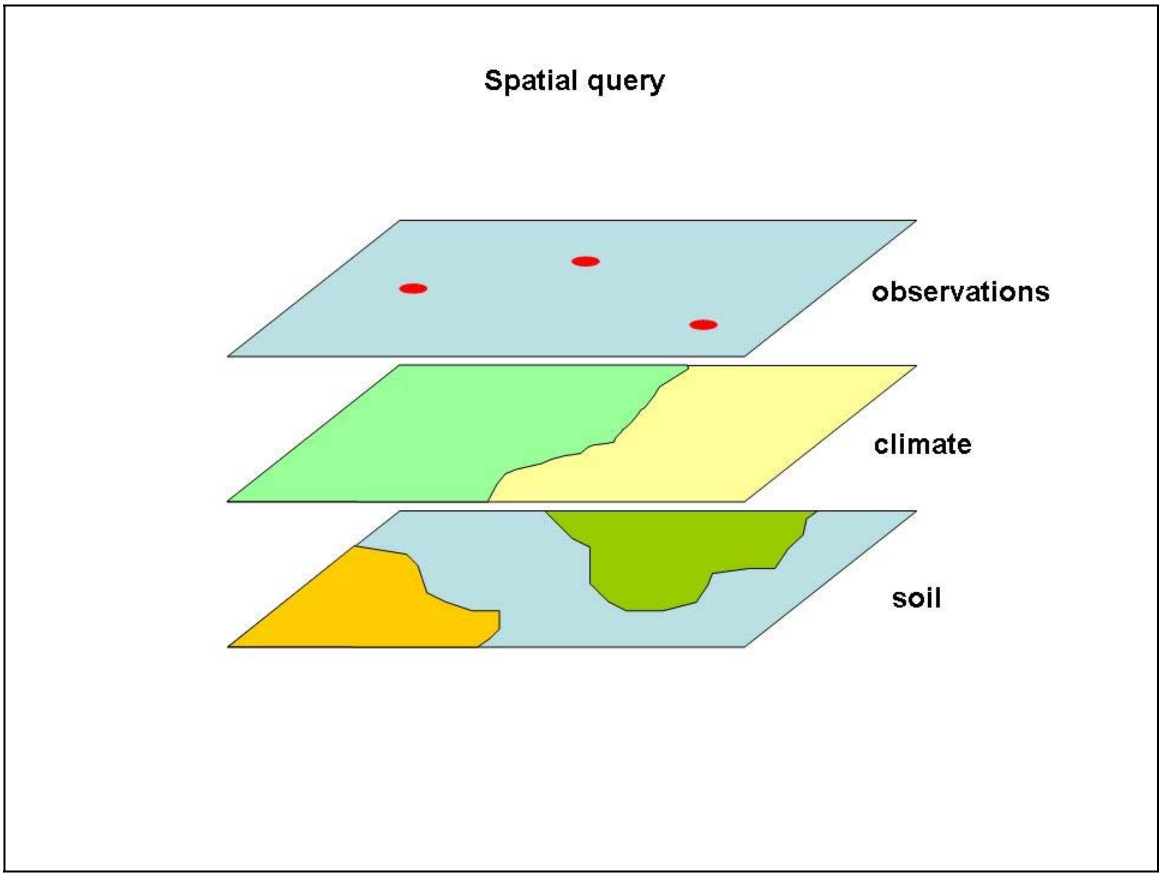

Figure 2.3: Schematic representation of the procedure adopted in a GIS, for the extraction of given parameters (i.e. climate, soil), for a given geographic position (i.e. observations)

2.2.3. Implementation of the provisional model in the selected Member States

The computation of the ecoregion maps has been based on the equations obtained in the data analysis, implemented using the Map Algebra tools of Arc GIS (Raster Calculator, Single Output Map Algebra). In Table 2.2 and 2.3, are reported the equations used for the computation of earthworm and enchytraeids maps respectively. The first set of equations, implying only the use of algebraic operators, have been calculated using the ‘raster calculator”, within the Spatial Analyst toolset, while the last expression, based on logical operators, have applied using the Single Output Map Algebra operator.

Table 2.1: Equations used for earthworms Ecoregion Map

Map Algebra Operation with Raster Calculator

t_1	-0.498 + ([Cropland] * 0.0481) + ([Grassland] * 0.9844) +([Forest3] * -0.2298) + ([ph_top_efsa] * 0.317) + ([OC_efsa] * -0.0905) + ([tmean] * -0.2494) + ([Tdiff] * -0.0418)
t_2	2.7379 + ([Cropland] * -0.1215) + ([Grassland] * 0.2189) +([Forest3] * -1.1576) + ([ph_top_efsa] * 0.0567) + ([OC_efsa] * -0.0105) +([total_prec] * -0.0018) + ([tmean] * 0.0956) + ([Tdiff] * -0.1229)
z_1	Exp([t_1]) / (1 + Exp([t_1]))
z_2	Exp([t_2]) / (1 + Exp([t_2]))
ear_arr1	z_1
ear_arr2	[z2] * (1 - [z1])
ear_arr3	(1 - [z_2]) * (1 - [z_1])

Map Algebra Operation with Single Output Map Algebra

Earthworms Ecorgegion Map	con(ear_arr1 >= 0.667, 1, ear_arr2 >= 0.667, 2, ear_arr3 >= 0.667, 3, arr1+arr2 >= 0.833 & ear_arr1 <= 0.667 & ear_arr2 <= 0.667, 12, arr1+arr3 >= 0.833 & ear_arr1 <= 0.667 & ear_arr3 <= 0.667, 13, arr2+arr3 >= 0.833 & ear_arr2 <= 0.667 & ear_arr3 <= 0.667, 23, arr1+arr2 <= 0.833 & arr2+arr3 <= 0.833 & arr1+arr3 <= 0.833, 123)

Table 2.2: Equations used for enchytraeids Ecoregion Map

Map Algebra Operation with Raster Calculator

t_1	3.3243 + ([Grassland] * 0.4764) + ([Forest3] * 2.0354) + ([ph_top_efsa] * -0.2776) + ([OC_efsa] * -0.0206) + ([Clay] * -0.0114) + ([total_prec] * -0.0025) + ([tmean] * -0.2286) + ([Tdiff] * -0.0348)
t_2	-6.5979 + ([Grassland] * -0.5418) + ([Forest3] * 1.0585) + ([ph_top_efsa] * -0.2322) + ([OC_efsa] * -0.1102) + ([Clay] * -0.0505) + ([total_prec] * -0.0010) + ([tmean] * 0.3911) + ([Tdiff] * 0.2961)
z_1	Exp([t_1]) / (1 + Exp([t_1]))
z_2	Exp([t_2]) / (1 + Exp([t_2]))
enc_arr1	z_1
enc_arr2	[z2] * (1 - [z1])
enc_arr3	(1 - [z_2]) * (1 - [z_1])

Map Algebra Operation with Single Output Map Algebra

Enchytraeids Ecorgegion Map	con(enc_arr1 >= 0.667, 1, enc_arr2 >= 0.667, 2, enc_arr3 >= 0.667, 3, arr1+arr2 >= 0.833 & enc_arr1 <= 0.667 & enc_arr2 <= 0.667, 12, arr1+arr3 >= 0.833 & enc_arr1 <= 0.667 & enc_arr3 <= 0.667, 13, arr2+arr3 >= 0.833 & enc_arr2 <= 0.667 & enc_arr3 <= 0.667, 23, arr1+arr2 <= 0.833 & arr2+arr3 <= 0.833 & arr1+arr3 <= 0.833, 123)

2.2.4. Soil Ecoregions Mapping

The output of the provisional models were a series of maps (one for each organism), where the territories of Finland, Germany and Portugal have been classified in seven classes, according to the triangles reported in figure 2.4.

Earthworm ecoregion maps have been produced only for the three investigated countries, but restricting Finland to its Southern part. Enchytraeid ecoregions maps were limited to Germany and Finland since almost no enchytraeid data were available for Portugal. For Collembola the fit of the model was very poor and the maps based on the modelled results did not show a convincing ecological meaning based on expert knowledge. In case of Isopoda the model presented a good plausibility check, with the observed and the modelled values. However the analysis gave no clear indication for patterns differing between or within countries, therefore isopods were excluded from further analysis and are not shown as maps.

Although in principle the interpolation over the entire EU 27 territory would have been technically feasible, mapping of territories without observed values were considered not to be reliable for the purpose of this opinion.

The concepts of exposure scenario and the definition of soil profile depth relevant for different soil organisms communities, led to the production of maps for earthworms and Enchytraeids, where the territory of the investigated countries has been classified on the base of the depth relevant for the proposed Risk Assessment.

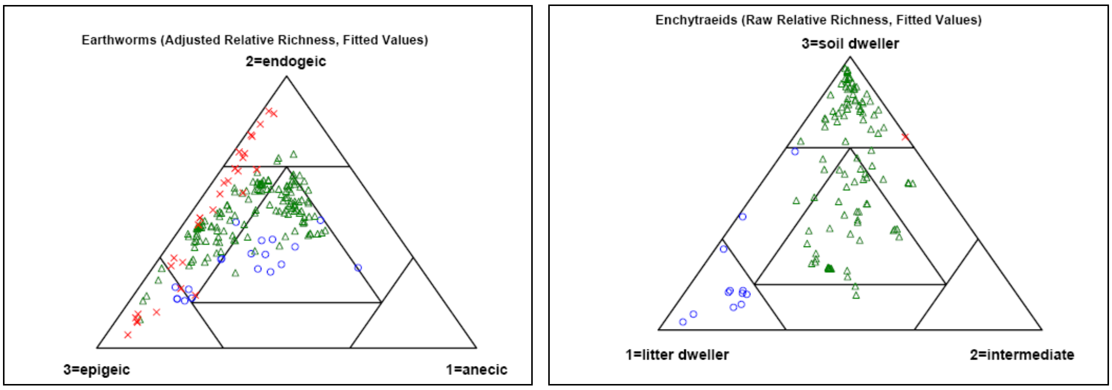

Figure 2.4: Classification triangles used to classify the earthworms and enchytraeids soil communities

3. CONCLUSIONS AND RECOMMENDATIONS

3.1. FATE

The occurrence of gaps in daily meteorological data is relatively frequent, especially over 20 year time frame. For this reason it should be preferred the adoption of a statistical procedures for gap filling, instead of selecting alternative, nearest meteorological stations.

For future applications, the availability of 25 km grids will provide an improved geographic resolution for the representation of European climate.

3.2. ECOREGION

During the analysis of the biogeographic database it was found the lack of complete soil, land use and climate data sets, for the vast majority of the observation sites. For this reason it has been necessary to derive such data from the 1 km grid data set (soil and land use), and from the 50 km grids (meteorological data).

It should be outlined that while the use of these EU wide geographic data set is optimal for modelling application, probably does not have the necessary spatial resolution for the characterization of point observation sites.

4. METADATA FOR EFSA DATASET

A database of maps was created on the basis of the dataset provided by JRC (see Gardi et al., 2008). This dataset was supplemented with data from the CAPRI land cover database (Leip et al., 2008). JRC is acknowledged for making the data available in a common resolution and projection.

Map properties

Common metadata properties for the maps are:

Format:	compressed ASCII grid
Reference system:	ETRS 89 LAEA
Rows:	4098
Columns:	3500
Lower left:	2500000
Upper left:	1412000
Cell size:	1000
Unit:	m
Nr of cells with a value:	3997812

4.1. Masker of all files (EU27.asc)

1. This map is a mask created including all the EU-27 countries and the Corine land-use classes 1-38 and 49. Surface waters and coastal lagoons are excluded from the mask.

Legend
There is only one legend unit, i.e. 1 which means that the grid cell is included.

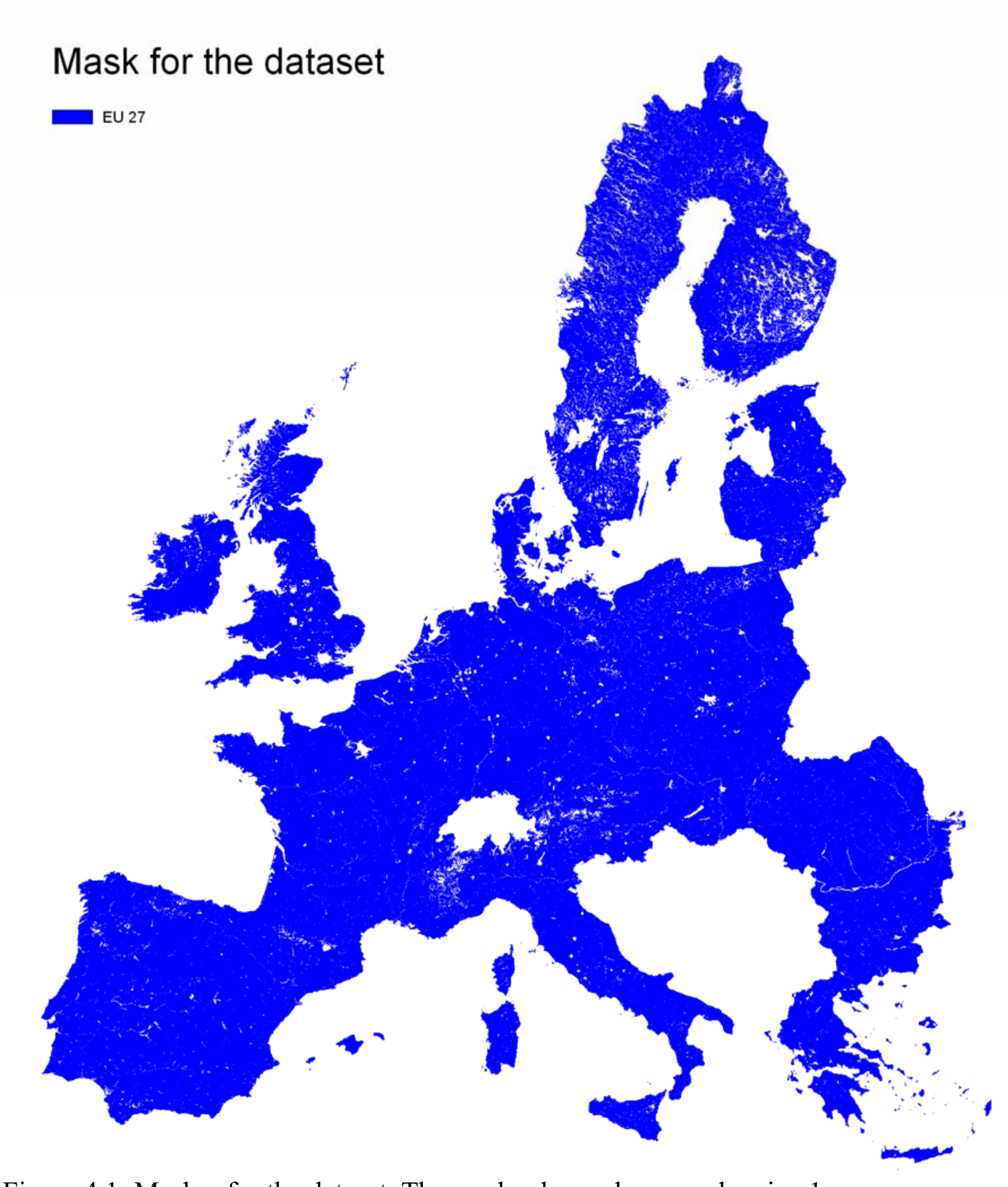

Figure 4.1: Masker for the dataset. The masker has only one value, i.e. 1.

4.2. Countries of the EU-27 (countries.asc)

The map shows the countries of the EU-27. It was obtained by masking the NUTS level 0 map with the mask EU27.

Legend

Number	Country
1	Albania
5	Austria
8	Belgium
9	Bulgaria
15	Czech Republic
16	Germany
17	Denmark
20	Estonia
23	Spain
24	Finland
26	France
31	Greece
34	Hungary
35	Ireland
41	Italy
48	Lithuania
49	Luxemburg
50	Latvia
58	Netherlands
61	Poland
62	Portugal
64	Romania
67	Sweden
68	Slovenia
70	Slovakia
78	United Kingdom

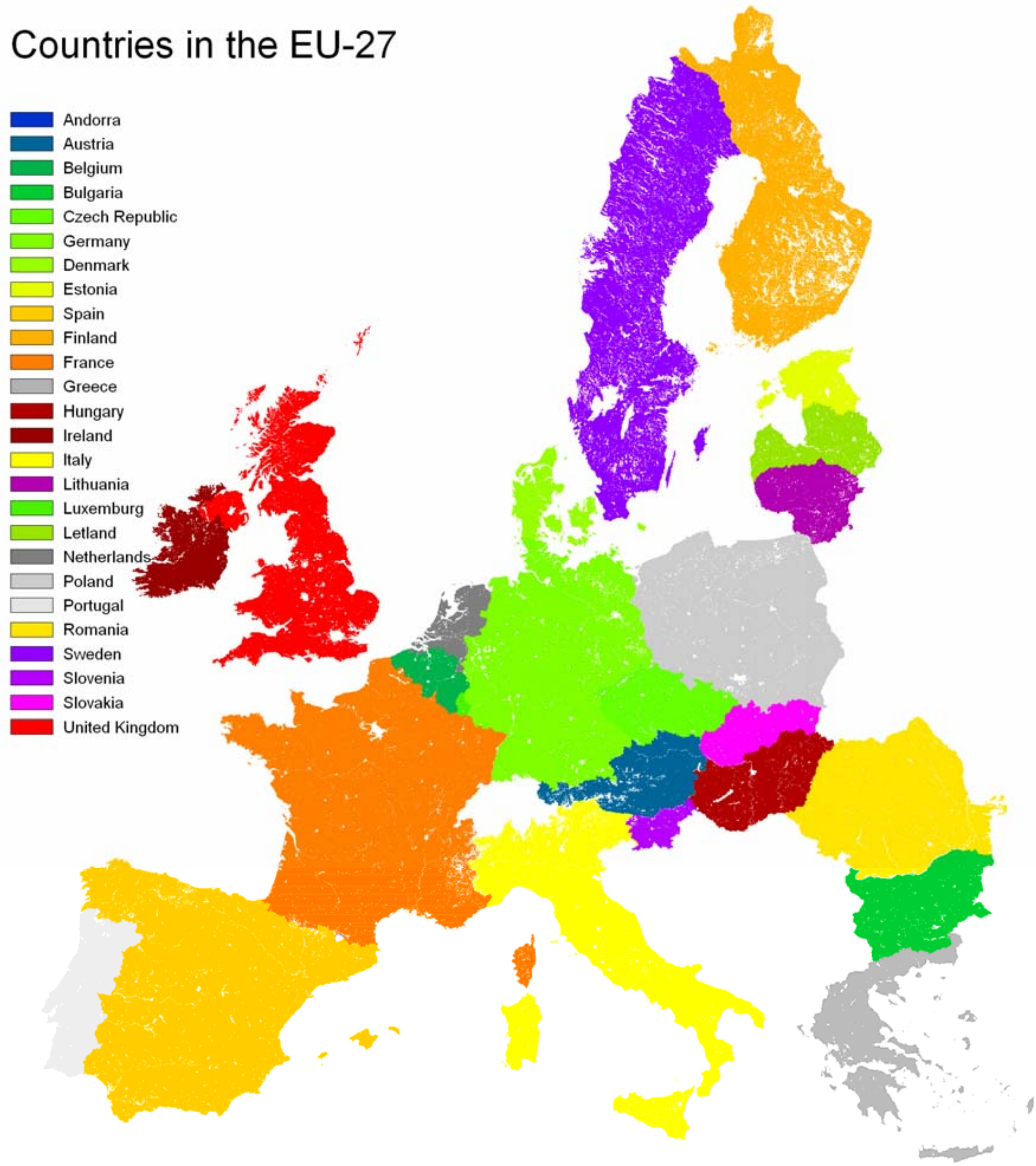

Figure 4.2: Countries of the EU-27.

4.3. Regulatory zones (zones..asc)

This map shows the regulatory zones of the EU-27. The map is a reclassification of the map countries.map.

Legend

Number	Name	Countries
1	North	17, 20, 24, 48, 50 and 67
2	Centre	5, 8, 16, 34, 35, 49, 58, 61, 64, 68, 70 and 78
3	South	1, 9, 23, 26, 31, 41 and 62

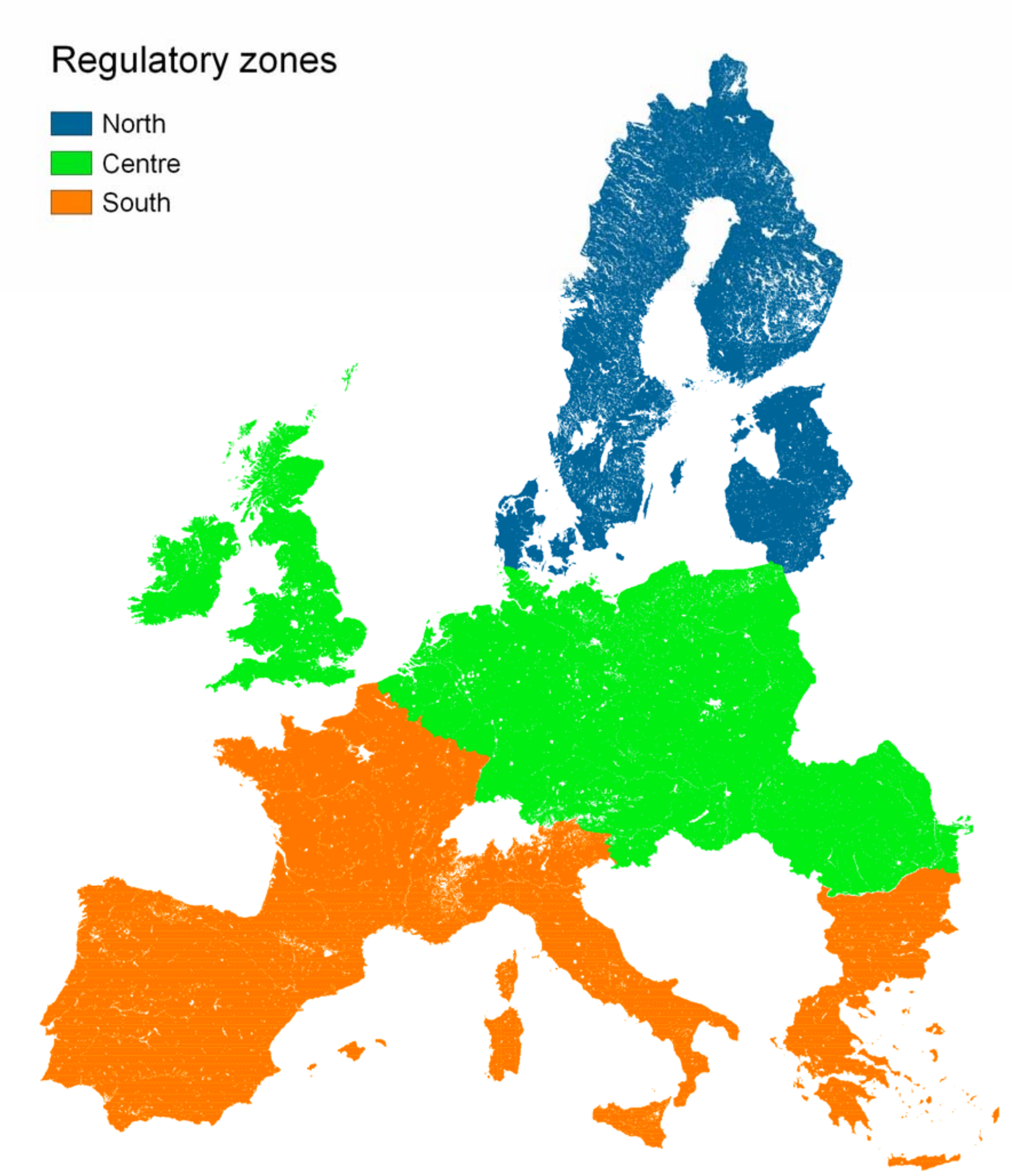

Figure 4.3: The regulatory zones of the EU-27.

4.4. Corine land cover data (CLC2000.asc)

The map shows all the possible land use classes at the Corine map. The map presented here is at a resolution of 1x1 km^2, the original map was at a resolution of 0.25 km^2. For each 1x1 km^2 grid cell, the dominant of the four underlying grid cells was taken. The dataset is described in Nunes de Lima (2005).

Legend

Number	CLC code	Description
1	111	Continuous urban fabric
2	112	Discontinuous urban fabric
3	121	Industrial or commercial units
4	122	Road and rail networks and associated land
5	123	Port areas
6	124	Airports
7	131	Mineral extraction sites
8	132	Dump sites
9	133	Construction sites
10	141	Green urban areas
11	142	Sport and leisure facilities
12	211	Non-irrigated arable land
13	212	Permanently irrigated land
14	213	Rice fields
15	221	Vineyards
16	222	Fruit trees and berry plantations
17	223	Olive groves
18	231	Pastures
19	241	Annual crops associated with permanent crops
20	242	Complex cultivation patterns
21	243	Land occupied by agriculture, with significant areas of natural vegetation
22	244	Agro-forestry areas
23	311	Broad-leaved forest
24	312	Coniferous forest
25	313	Mixed forest
26	321	Natural grasslands
27	322	Moors and heathland
28	323	Sclerophyllous vegetation
29	324	Transitional woodland-shrub
30	331	Beaches, dunes, sands
31	332	Bare rocks
32	333	Sparsely vegetated areas
33	334	Burnt areas
34	335	Glaciers and perpetual snow
35	411	Inland marshes
36	412	Peat bogs
37	421	Salt marshes

38	422	Salines
39	423	Intertidal flats
40	511	Water courses
41	512	Water bodies
42	521	Coastal lagoons
43	522	Estuaries
44	523	Sea and ocean
48	999	NODATA
49	990	UNCLASSIFIED LAND SURFACE
50	995	UNCLASSIFIED WATER BODIES

4.5. Generalised land-use map (landuse.asc)

The generalised land-use map is a reclassification of the Corine 2000 land-use map. It is created to distinguish the most important land-use types. Land use class 1 serves as the masker in EFSA (2010).

Legend

Number	Description	Number in map above
1	Annual Crops	12, 13, 19-21
2	Grass	18
3	Permanent crops	15-17 and 22
4	Rice	14
5	Non agricultural	all other classes

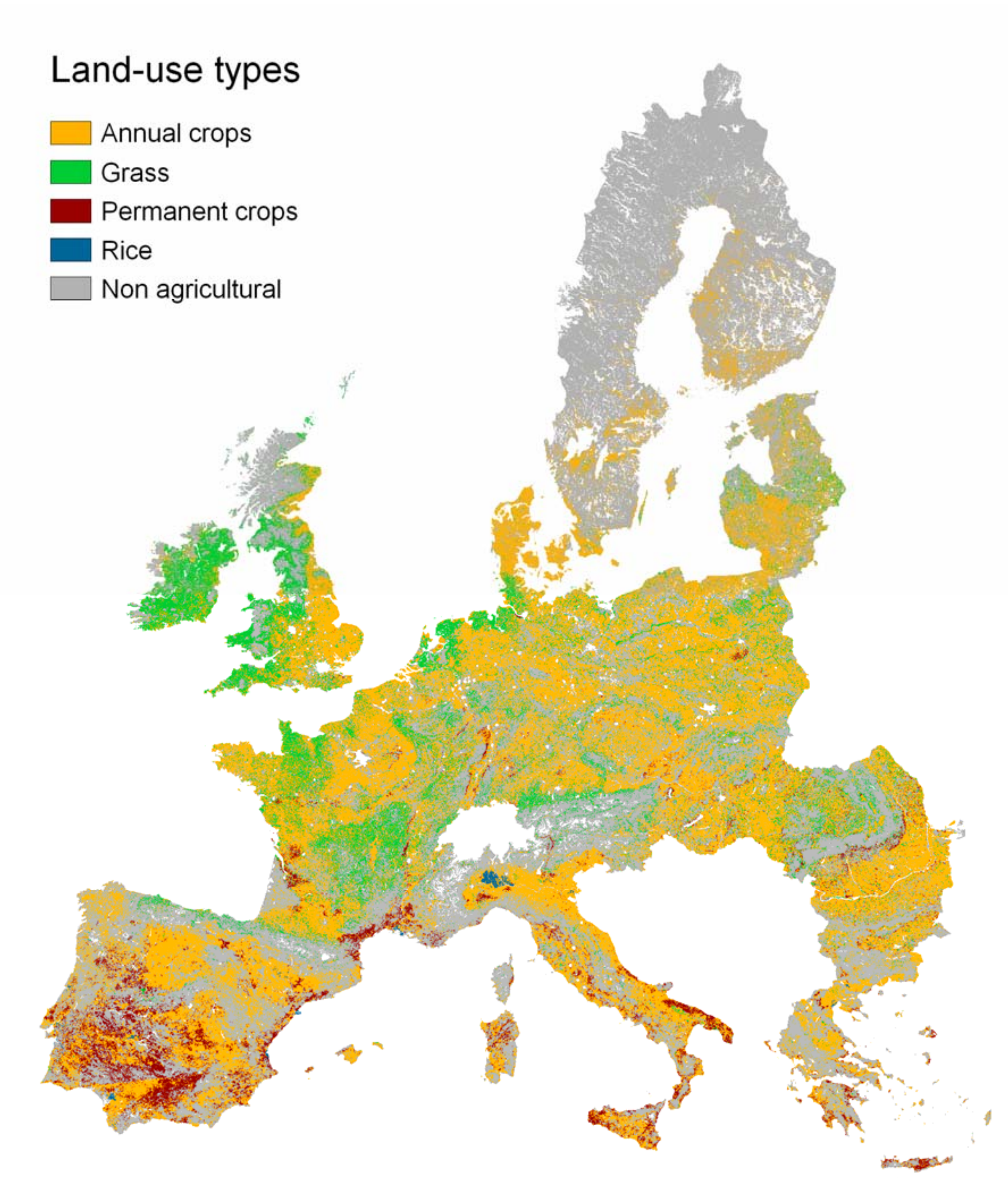

Figure 4.4: The generalised land-use map.

4.6. Mean monthly temperature (T1.asc..T12.asc)

The dataset consists of 12 maps containing the monthly mean temperature (deg C) for the period 1960-1990. The dataset is described in Hijmans et al. (2005).

Legend
Mean monthly temperature (deg C), data type Real

4.7. Mean annual temperature (TMean.asc)

The map shows the mean annual temperature (deg C) for the period 1960-1990. It is calculating by taking the arithmetic mean of maps T1..T12.asc. The dataset is described in Hijmans et al. (2005).

Legend
Mean annual temperature (deg C), data type Real

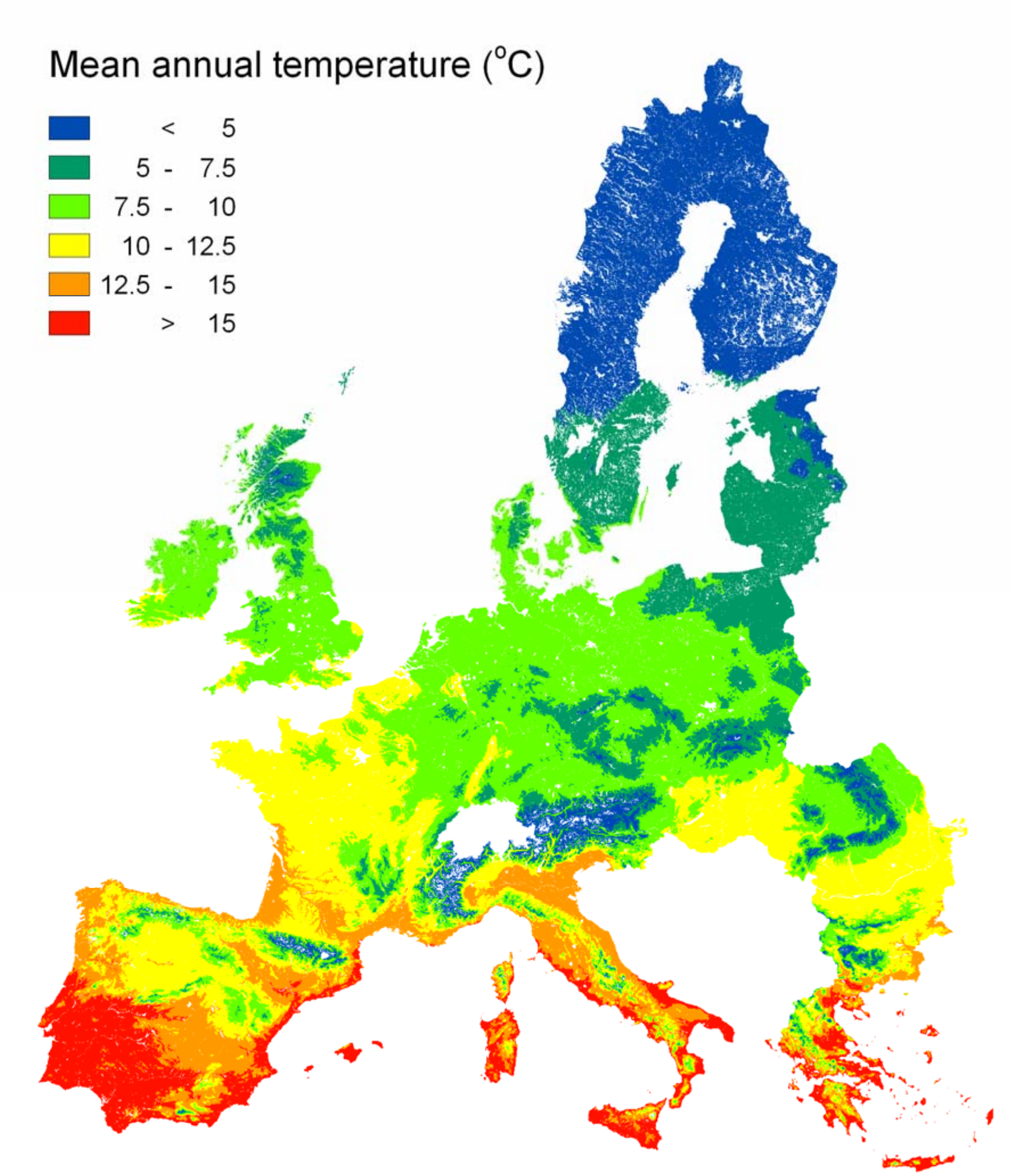

Figure 4.5: Mean annual temperature for the period 1960-1990 taken from Worldclim dataset.

4.8. Arrhenius weighted mean annual temperature (TEff.asc)

The map shows the Arrhenius weighted mean annual temperature (deg C) for the period 1960-1990. It is calculated using the equation (EFSA 2010, Appendix A3):

$$T_{eff} = -\frac{E_{act}}{R \ln\left[\frac{1}{t_{end}} \int_0^{t_{end}} f(T,t)dt\right]}$$

$$if\ \ T(t) > 273\ then\ \ f(T,t) = \exp\left[-\frac{E_{act}}{RT(t)}\right] \qquad (1)$$

$$else \quad f(T,t) = 0$$

where T_{eff} (K) is the Arrhenius weighted mean annual temperature, E_{act} is the Arrhenius activation energy, (kJ mol^{-1}), R (kJ mol^{-1} K^{-1}) is the gas constant, T (K) is the temperature, and t is time. Eact was set to 65.4 kJ mol^{-1} according to EFSA (2007). See further EFSA (2010). Notice that the temperatures in the equation are in K, whereas the temperature in the maps is in deg C.

Legend

Arrhenius weighted mean annual temperature (deg C), data type Real

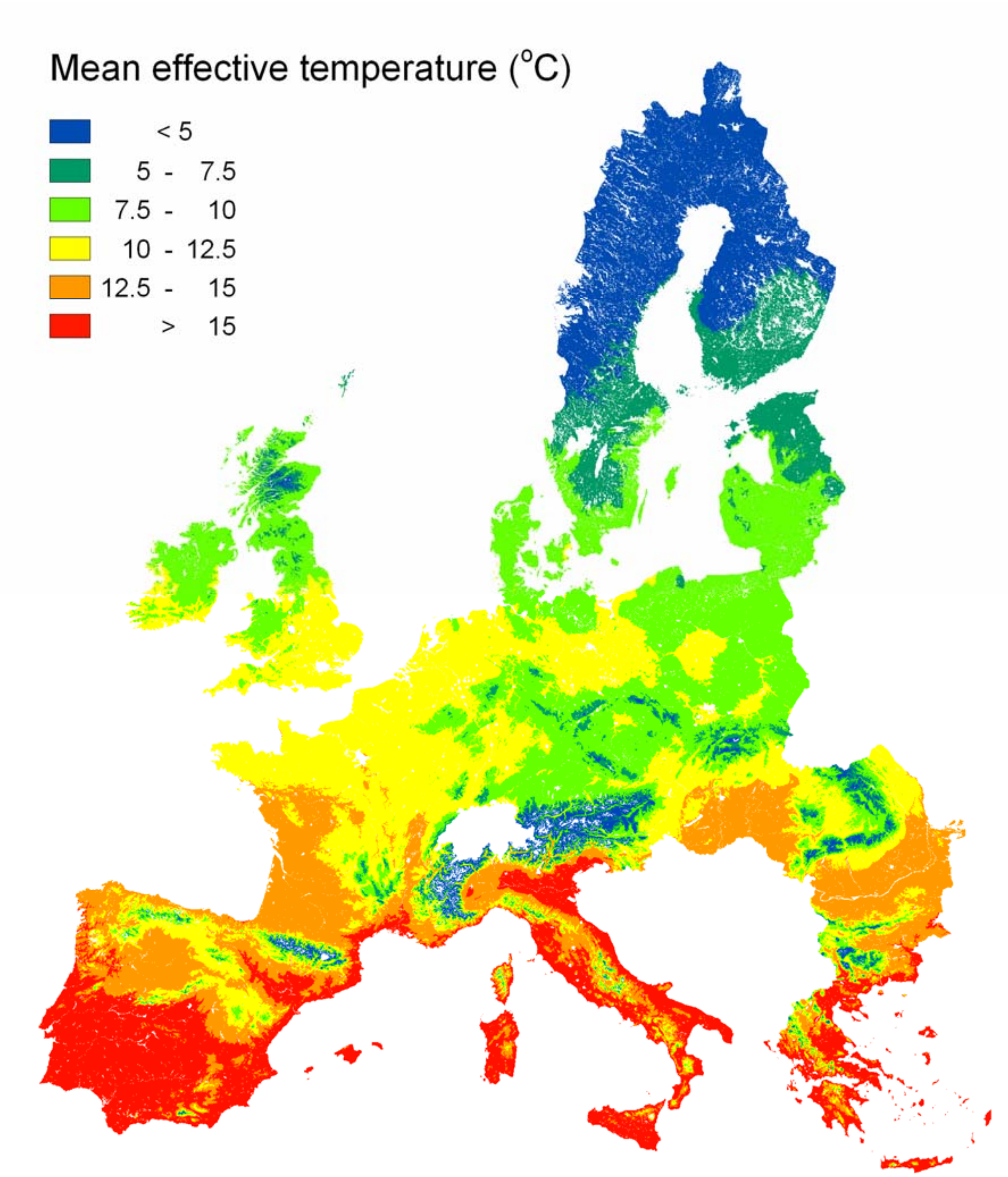

Figure 4.6: Arrhenius weighted mean temperature (deg C) for the period 1960-1990. For a description of the averaging procedure, refer to EFSA (2010).

4.9. Mean monthly precipitation (P1.asc..P12.asc)

The dataset consists of 12 maps containing the monthly mean precipitation (mm/month) for the period 1960-1990. The dataset is described in Hijmans et al. (2005).

Legend
Mean monthly precipitation (mm/mo), data type Real

4.10. Mean annual precipitation (Ptot.asc)

The map shows the mean annual precipitation for the period 1960-1990 (mm/year). It is calculated by summing P1..P12.map. The dataset is described in Hijmans et al. (2005).
Legend
Mean annual precipitation (mm/yr), data type Real

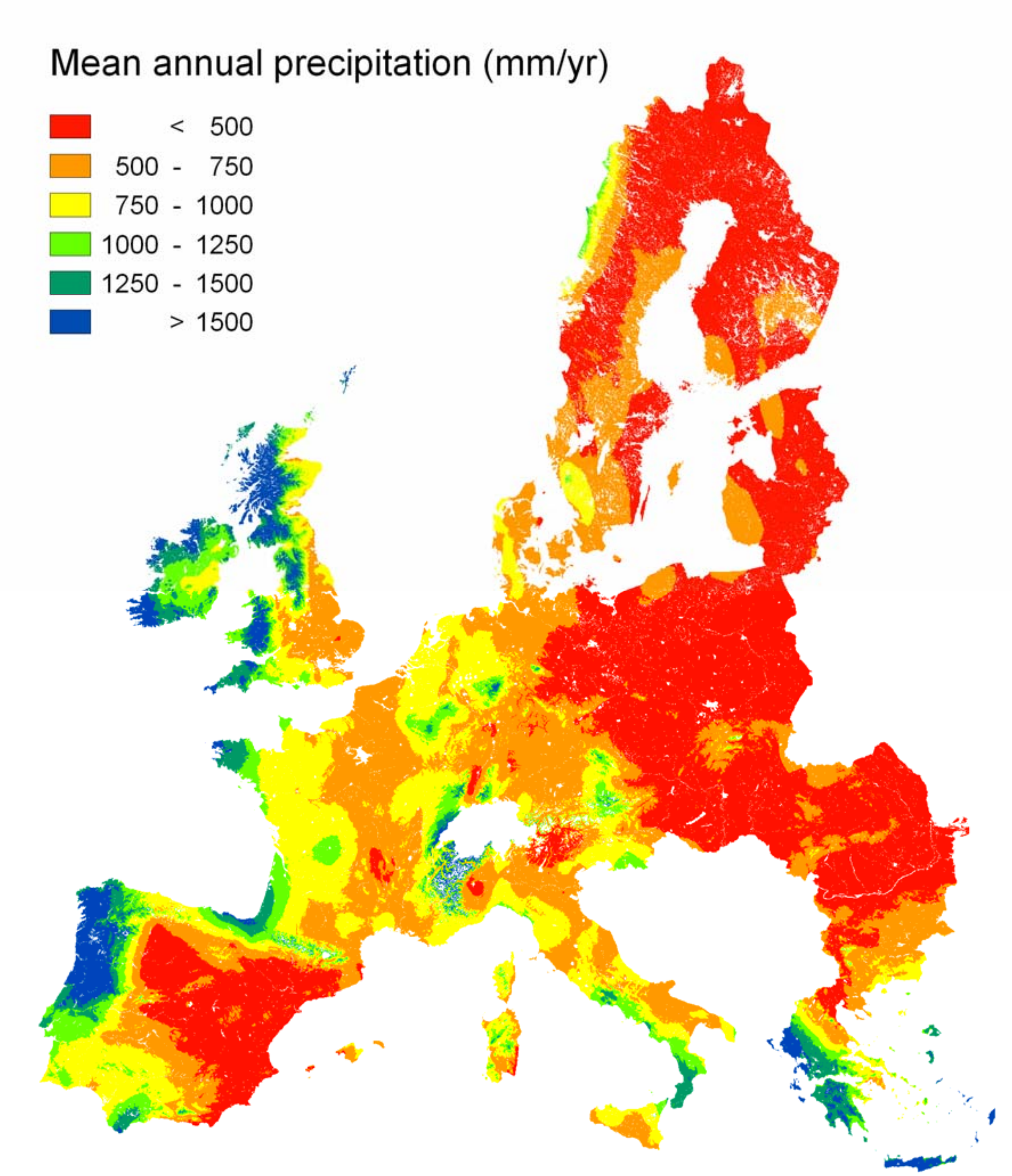

Figure 4.7: Mean annual precipitation (mm) for the period 1960-1990 as taken from the Worldclim dataset.

4.11. FOCUS Zones (FOCUS.asc)

The map shows the FOCUS zones according to the classification in FOCUS (2000). The maps Tmean.map and Ptot.map were used to create the overlay, so the classification is based on WorldClim (Hijmans et al., 2005).

Legend

Number	Name	Tmean (deg C)	Ptot (mm/yr)
1	Jokioinen	<5 deg C	> 0 mm/yr
2	Chateaudun	5 – 12.5 deg C	< 600 mm/yr
3	Hamburg	5 – 12.5 deg C	600 – 800 mm/yr
4	Kremsmünster	5 – 12.5 deg C	800 – 1000 mm/yr
5	Okehampton	5 – 12.5 deg C	> 1000 mm/yr
6	Sevilla	> 12.5 deg C	< 600 mm/yr
7	Thiva	> 12.5 deg C	600 – 800 mm/yr
8	Piacenza	> 12.5 deg C	800 – 1000 mm/yr
9	Porto	> 12.5 deg C	> 1000 mm/yr

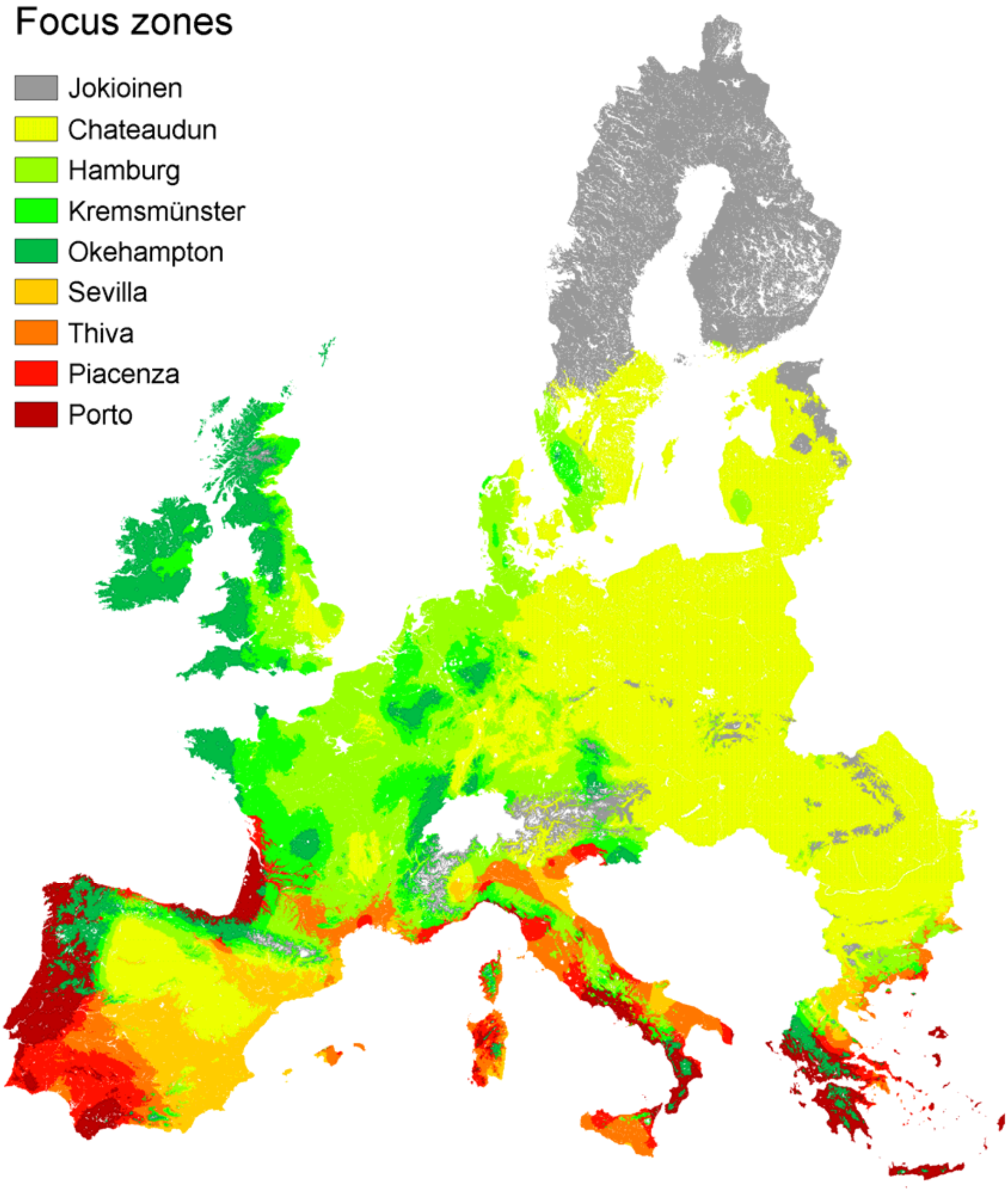

Figure 4.8: FOCUS climatic zones, based on the mean annual temperature and mean annual precipitation from Worldclim.

4.12. Organic matter content of the topsoil (OM.asc)

The map shows the organic matter content of the topsoil. It is obtained by multiplying the original OCTOP map described in Jones et al. (2005) by 1.72.

Legend
Organic matter content of the topsoil (g/g), data type Real

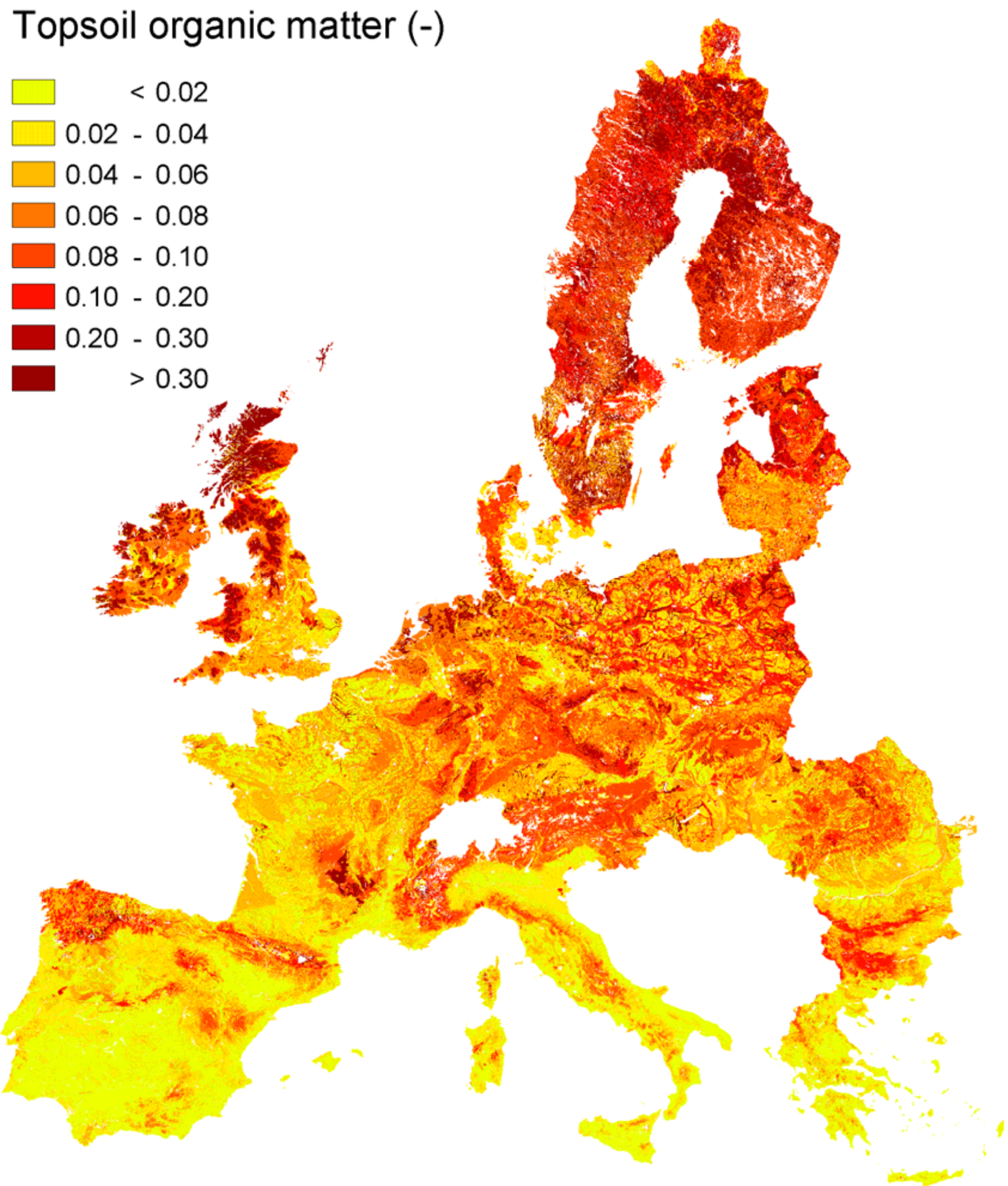

Figure 4.9: Organic matter content of the top 30 cm of the soil (g/g).

4.13. pH of the topsoil (pH.asc)

The map shows the mean pH measured in water (1:2.5) of the top 30 cm of the soil. See FAO (2008) for details.

Legend
pH measured in water of the topsoil, data type Real

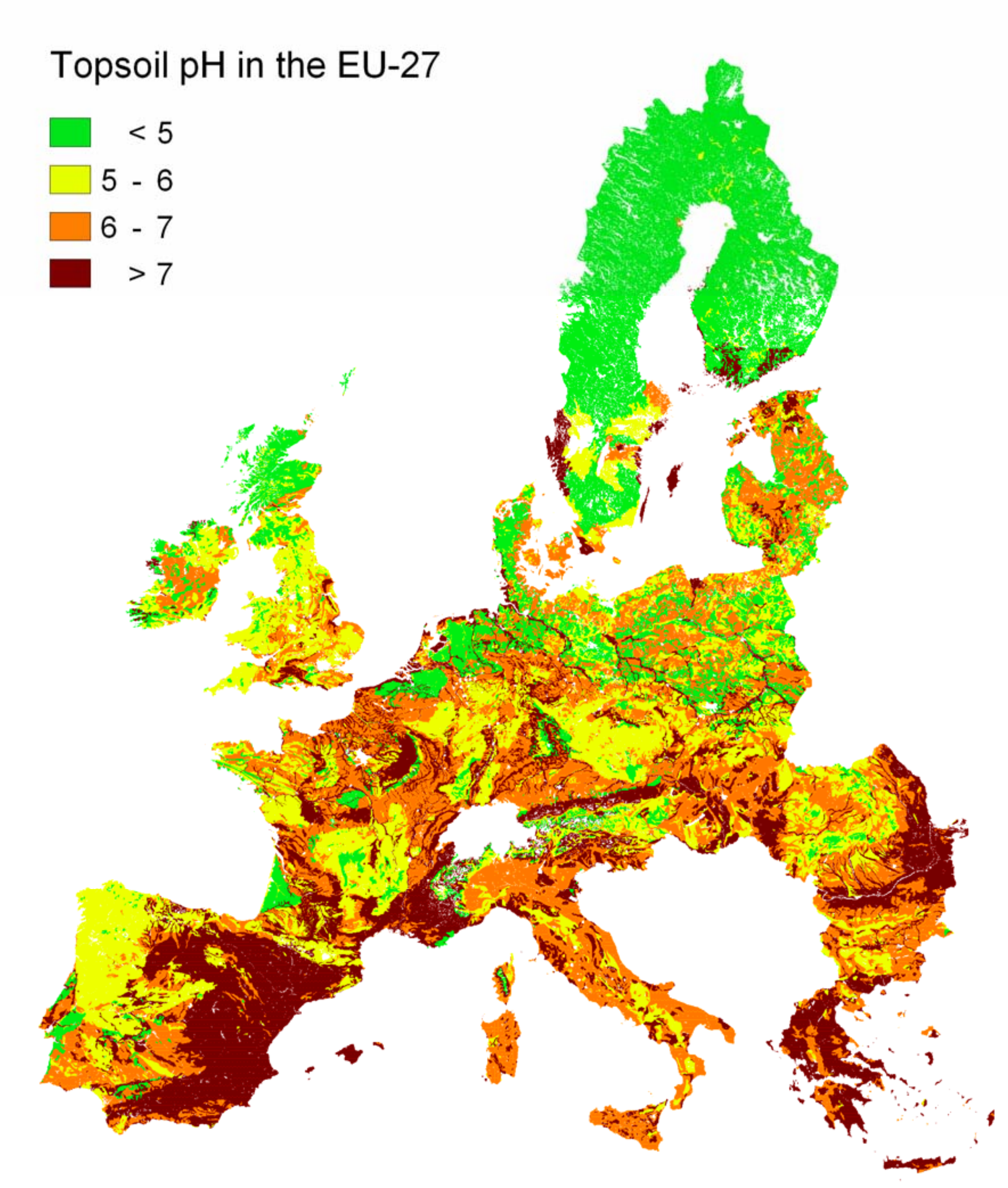

Figure 4.10: pH water (1:2.5) of the top 30 cm of the soil.

4.14. Bulk density of the topsoil (Rho.asc)

The map shows the bulk density of the topsoil. It is calculated from the organic matter content map using the equation (Tiktak *et al.*, 2002):

$$\rho = 1800 + 1236 f_{om} - 2910\sqrt{f_{om}} \qquad (r^2 = 0.91) \qquad (2)$$

Legend

Dry bulk density of the topsoil (kg m^{-3}), data type Real

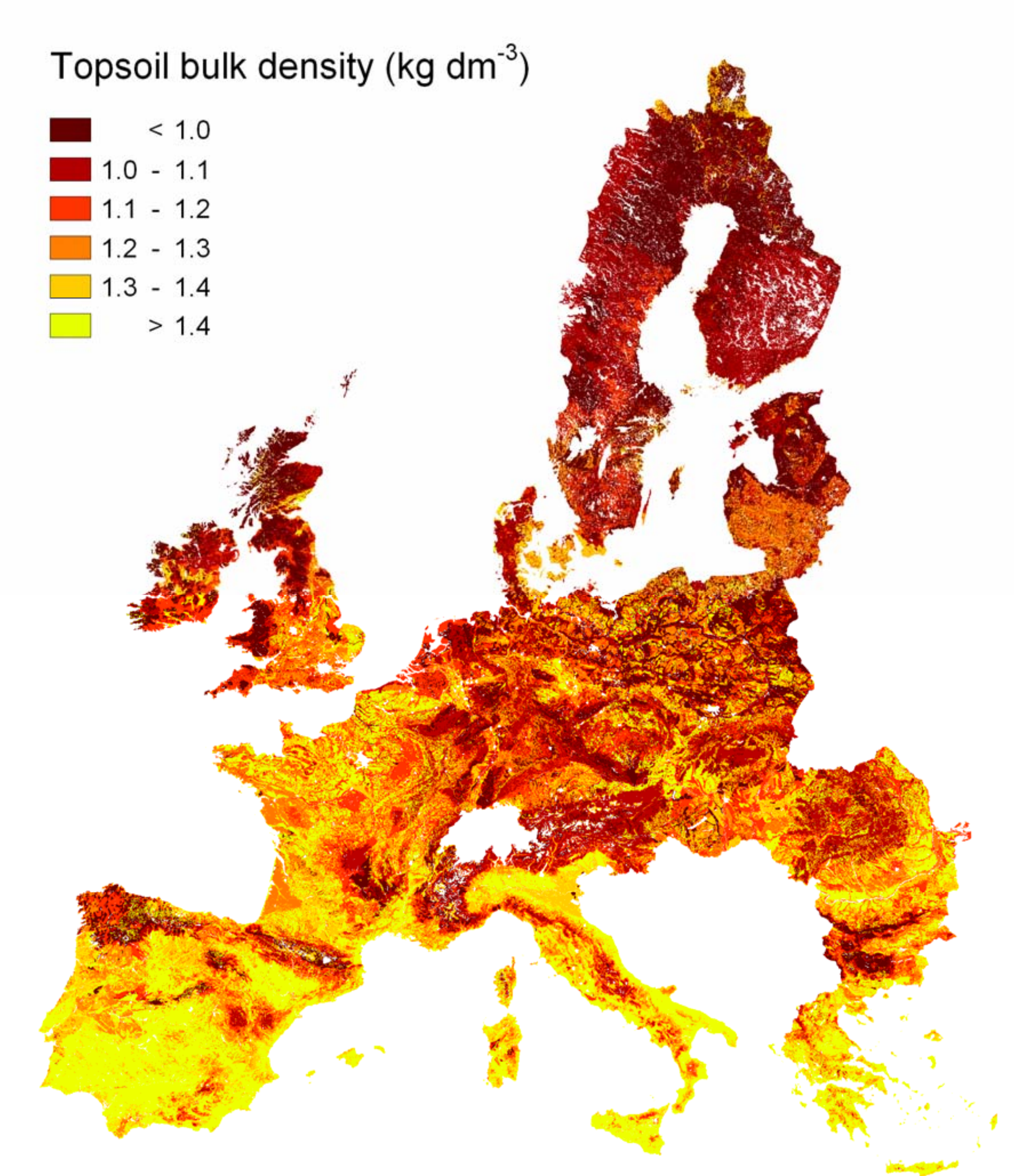

Figure 4.11: Bulk density of the top 30 cm of the soil calculated by the pedotransfer function described in Tiktak et al. (2002).

4.15. Texture of the topsoil (Texture.asc)

The map shows the textural class of the topsoil. It is obtained from the soil geographical database of Eurasia at a scale of 1:1000000 (for each grid cell, the dominant soil textural class was taken).

Legend

Number	Description
1	Coarse (18% < clay and > 65% sand)
2	Medium (18% < clay < 35% and >= 15% sand, or 18% <clay and 15% < sand < 65%)
3	Medium fine (< 35% clay and < 15% sand)
4	Fine (35% < clay < 60%)
5	Very fine (clay > 60 %)
9	No mineral texture (Peat soils)

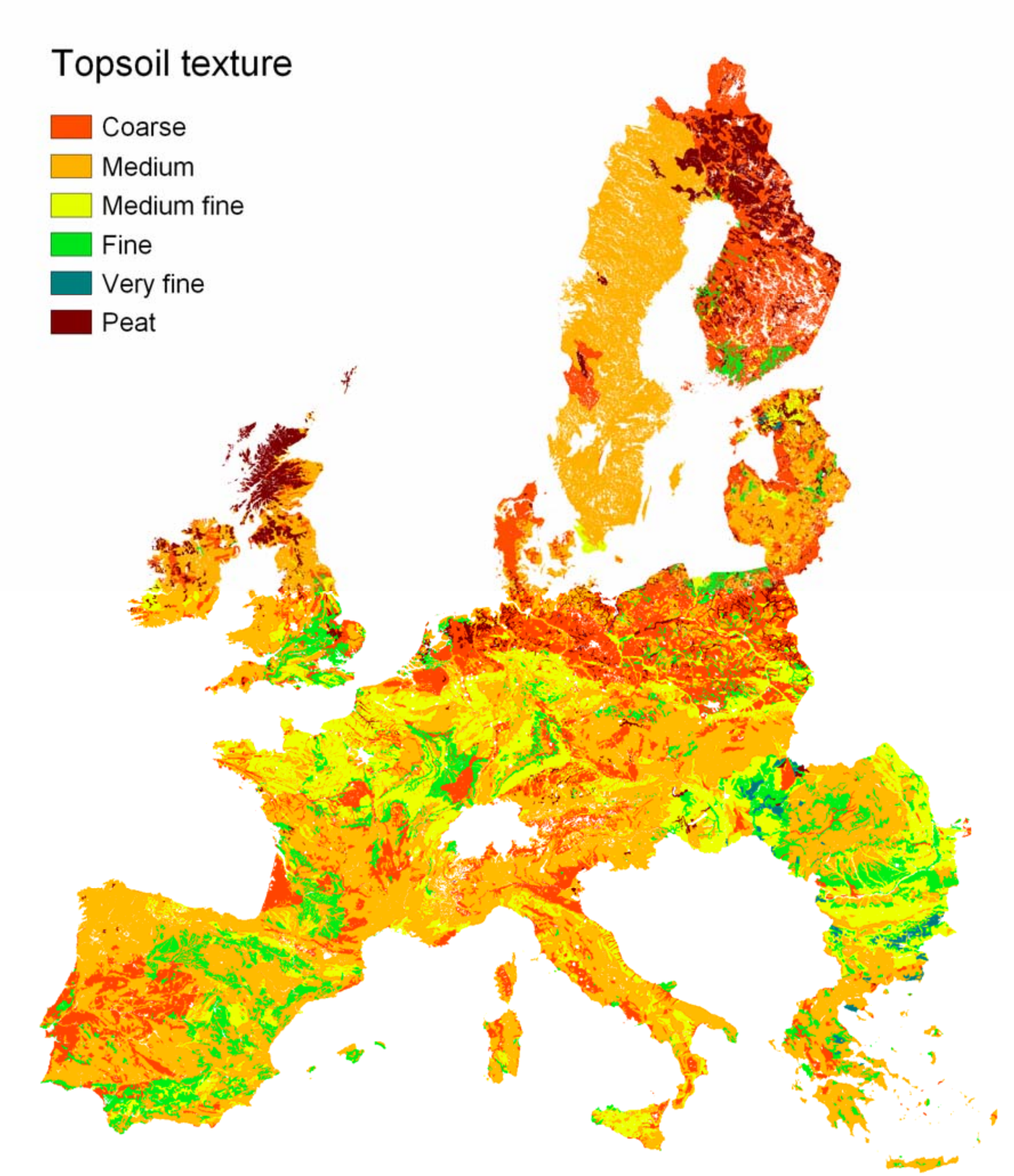

Figure 4.12:Topsoil texture obtained from the soil database of Europe 1:1.000.000.

4.16. Water content at field capacity (ThetaFC.asc)

The map shows the water content at field capacity (m^3 m^{-3}). It is calculated for each soil textural class with the Mualem-Van Genuchten equation:

$$\theta(h) = \theta_r + \frac{\theta_s - \theta_r}{\left(1 + |\alpha h|^n\right)^{-m}} \quad (1)$$

where θ (m^3 m^{-3}) is the volume fraction of water, *h* (cm) is the soil water pressure head, θ_s (m^3 m^{-3}) is the volume fraction of water at saturation, θ_r (m^3 m^{-3}) is the residual water content in the extremely dry range, α (cm^{-1}) and *n* (-) are empirical parameters, and *m* (-) can be taken equal to:

$$m = 1 - \frac{1}{n}$$

The soil water pressure head was set at -100 cm. Parameter values were obtained from the HYPRES pedotransfer rule (Wösten et al. 1999) and are given in EFSA (2010), table 3.

Legend

Volumetric water content at field capacity (m3 m^{-3}), data type Real. The map contains six discrete classes.

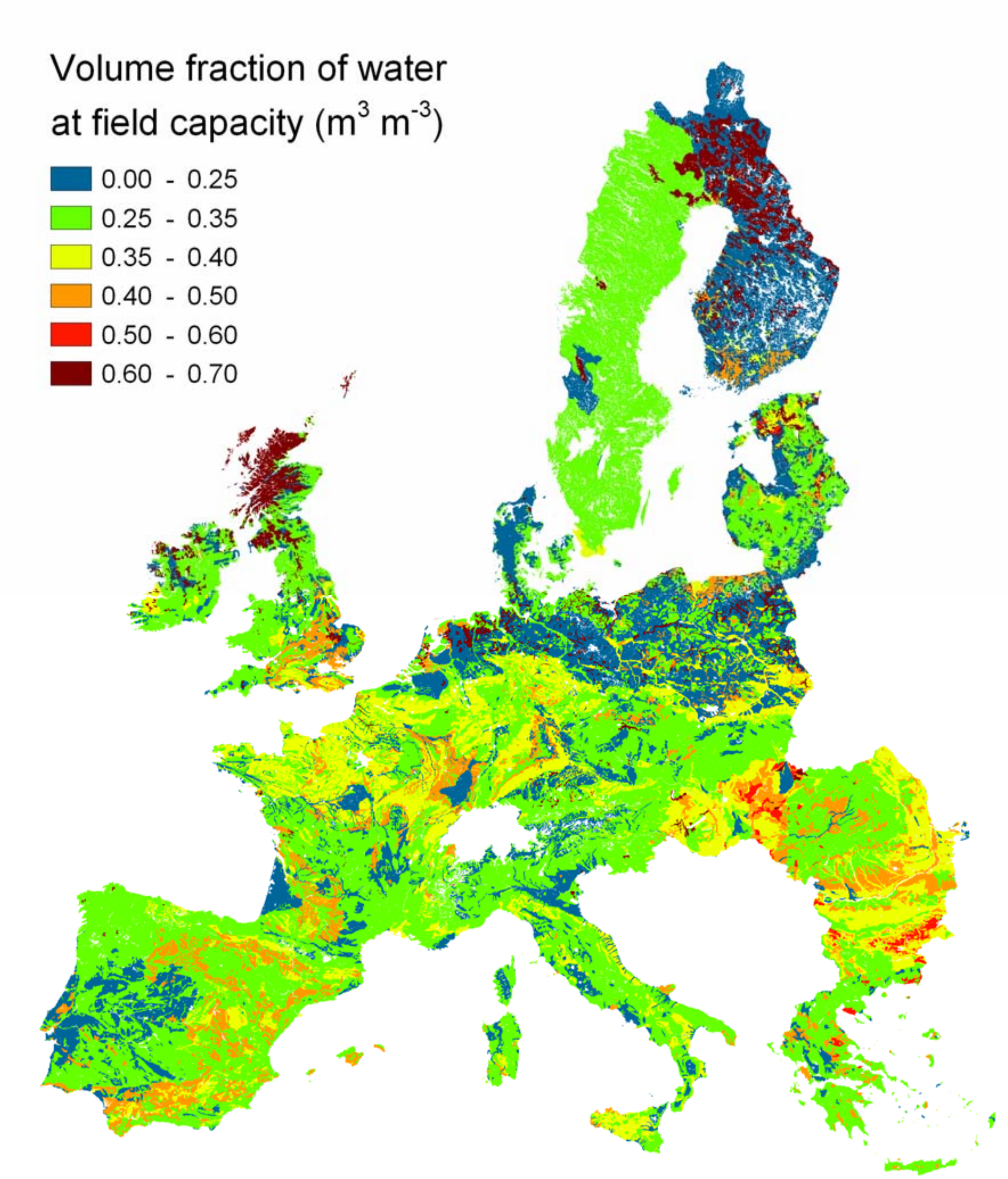

Figure 4.13: Volume fraction of water at field capacity calculated from the soil textural class, using the HYPRES pedotransfer rule.

4.17. Capri land cover maps (Cropnames.asc)

These maps show for each pixel of 1x1 km^2 the area covered with a certain crop. The CAPRI maps were obtained by combining remote sensing data, administrative crop data, land suitability data and statistical modelling. The CORINE land cover map serves as a starting point. Subdivisions within CORINE land cover classes were made based on a statistical model, regressing point observations of cropping activities on soil, relief and climate parameters (land suitability). Statistical data of agricultural production and land cover available for administrative regions were additionally used to scale the land cover classes. 18 of the CAPRI land cover classes are classified as annual crops and are included in the EFSA dataset. See Leip et al. (2008) for a description of the dataset.

Legend
Area (100%) covered by a crop, data type Real. The names of the maps are self explaining. The values range from 0 to 10000.

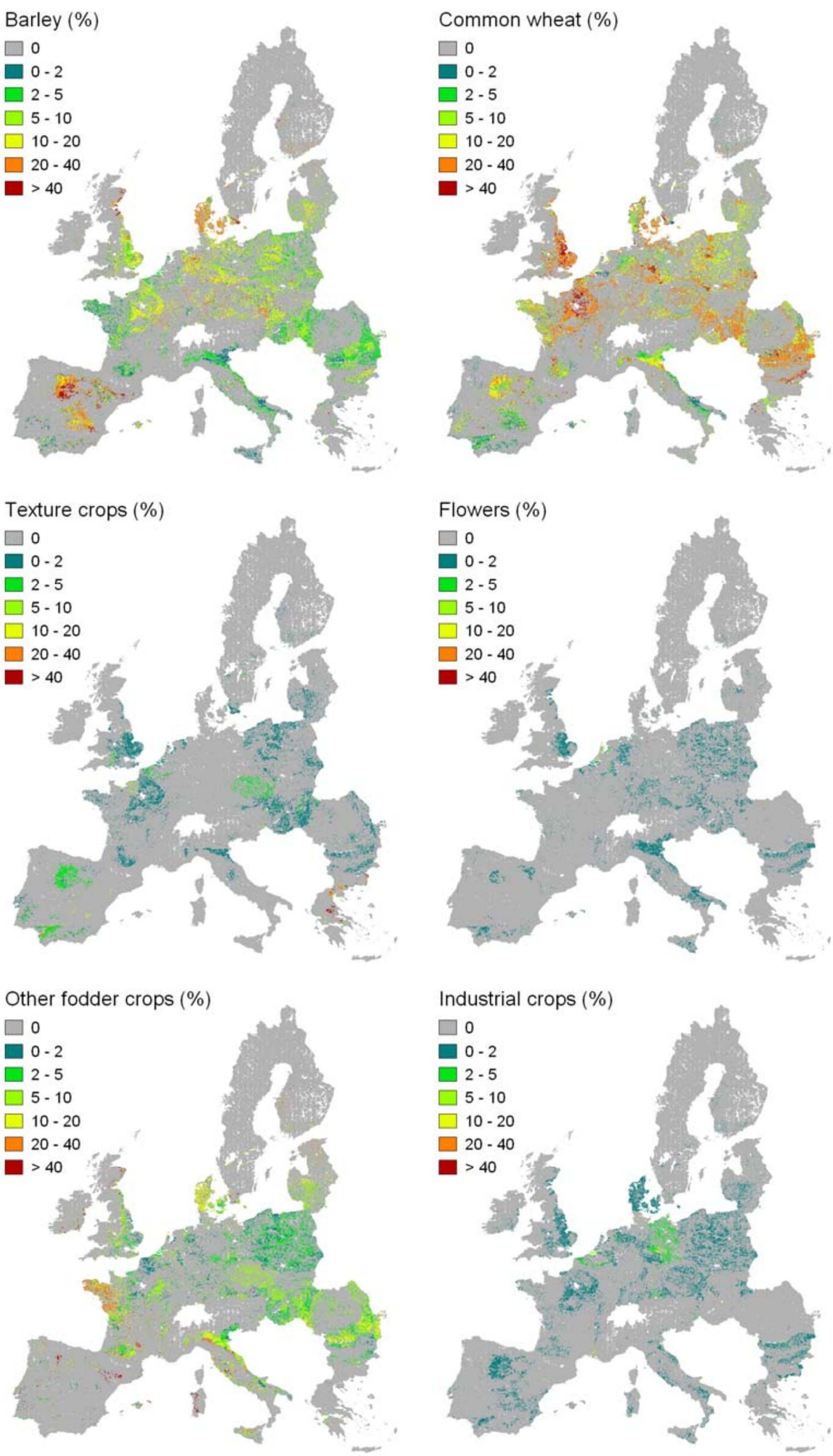

Figure 4.14: Crop cover maps (% of area) for barley, common wheat, texture crops, floriculture, other fodder crops and industrial crops.

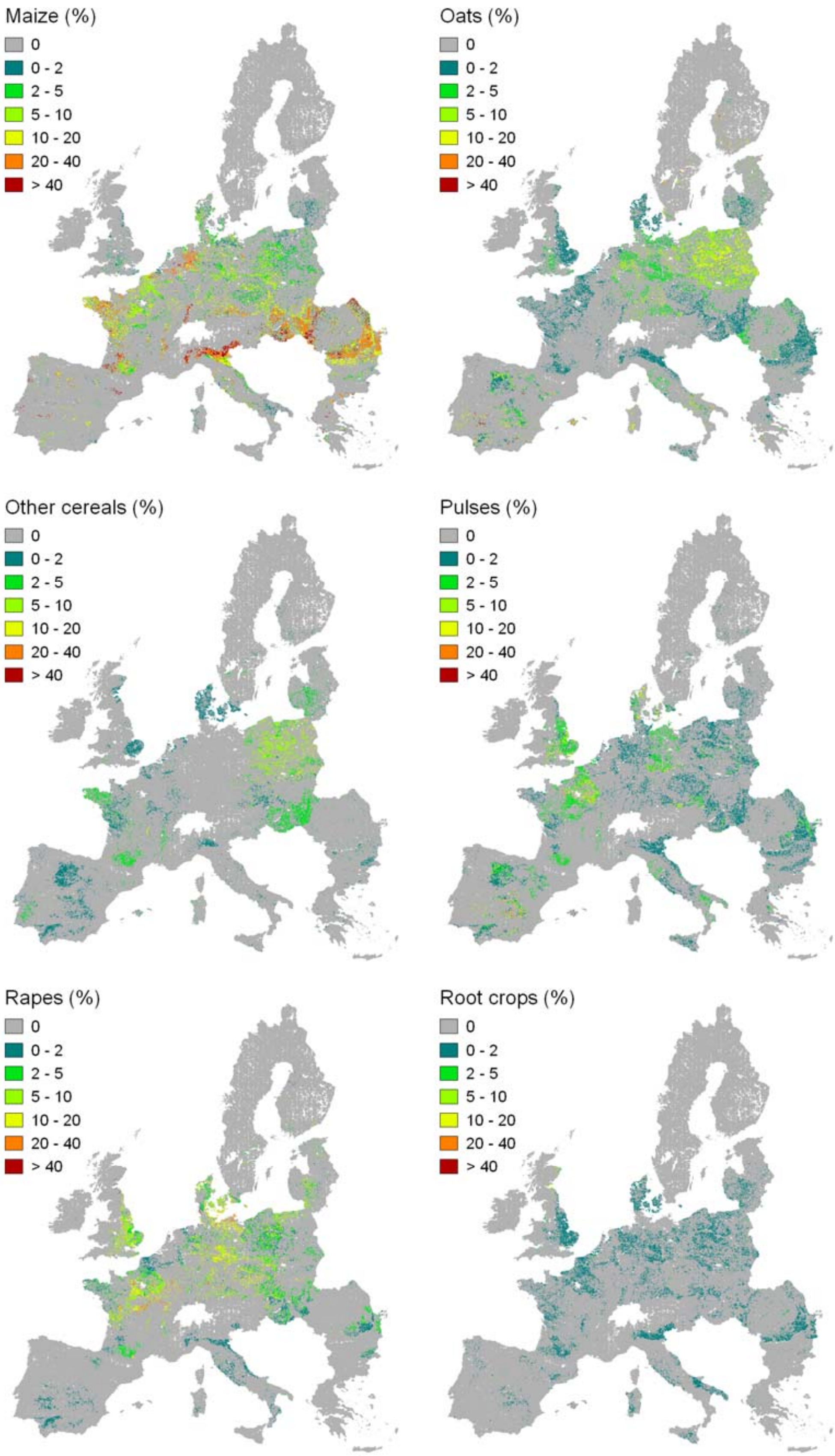

Figure 4.15: Crop cover maps (% of area) for maize, oats, other cereals, pulses, rapes and root crops.

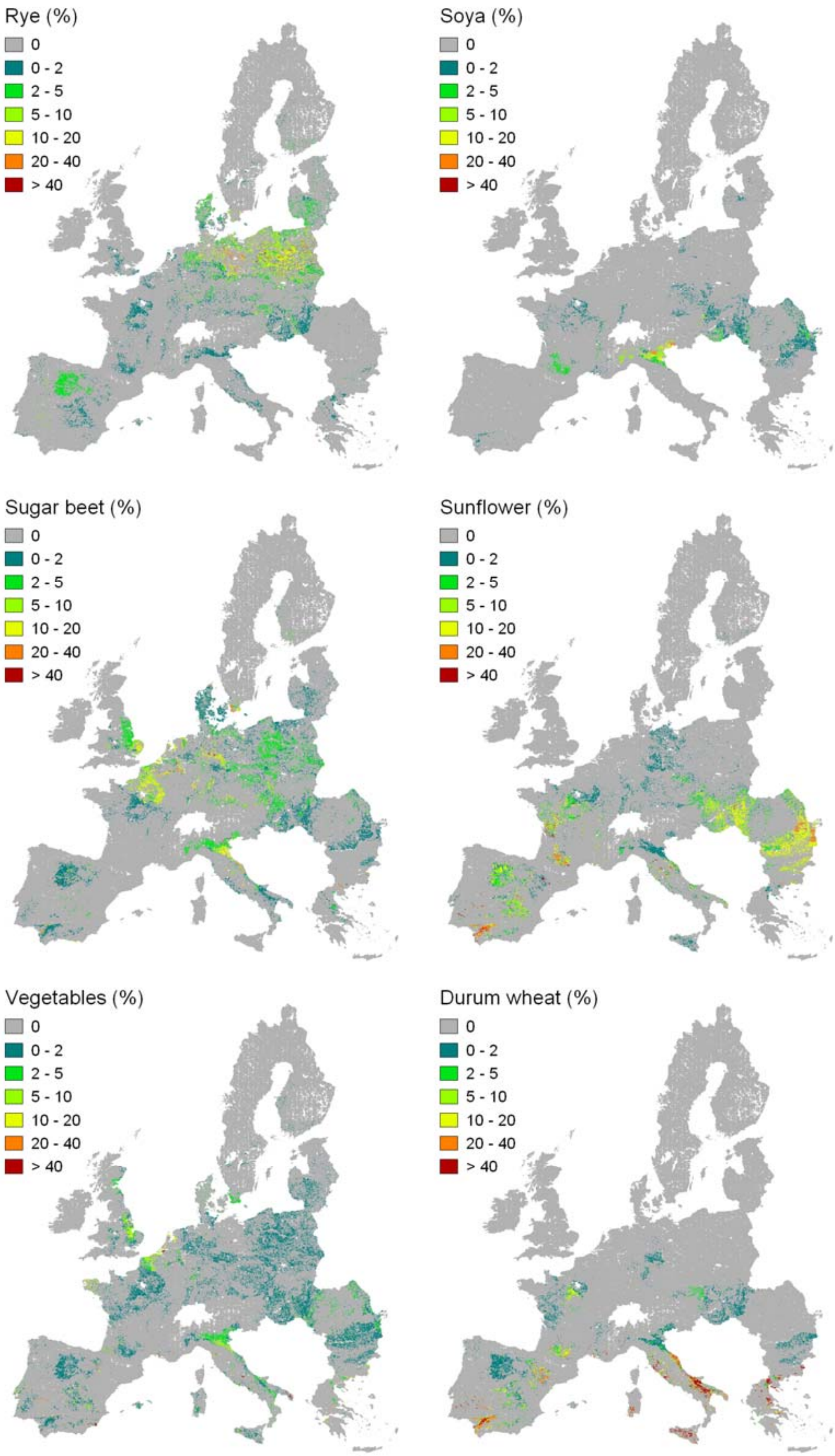

Figure 4.16: Crop cover maps (% of area) for rye, soya, sugar beet, sunflowers, vegetables and durum wheat.

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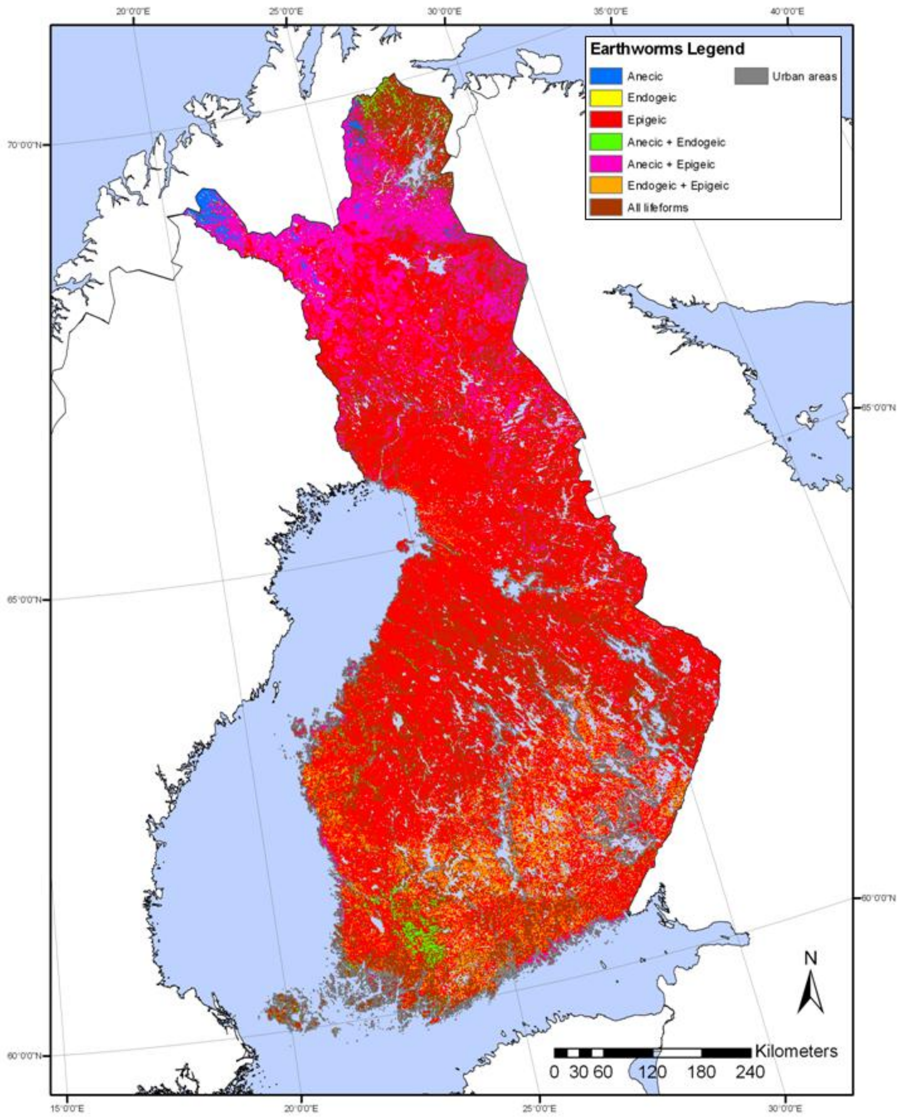
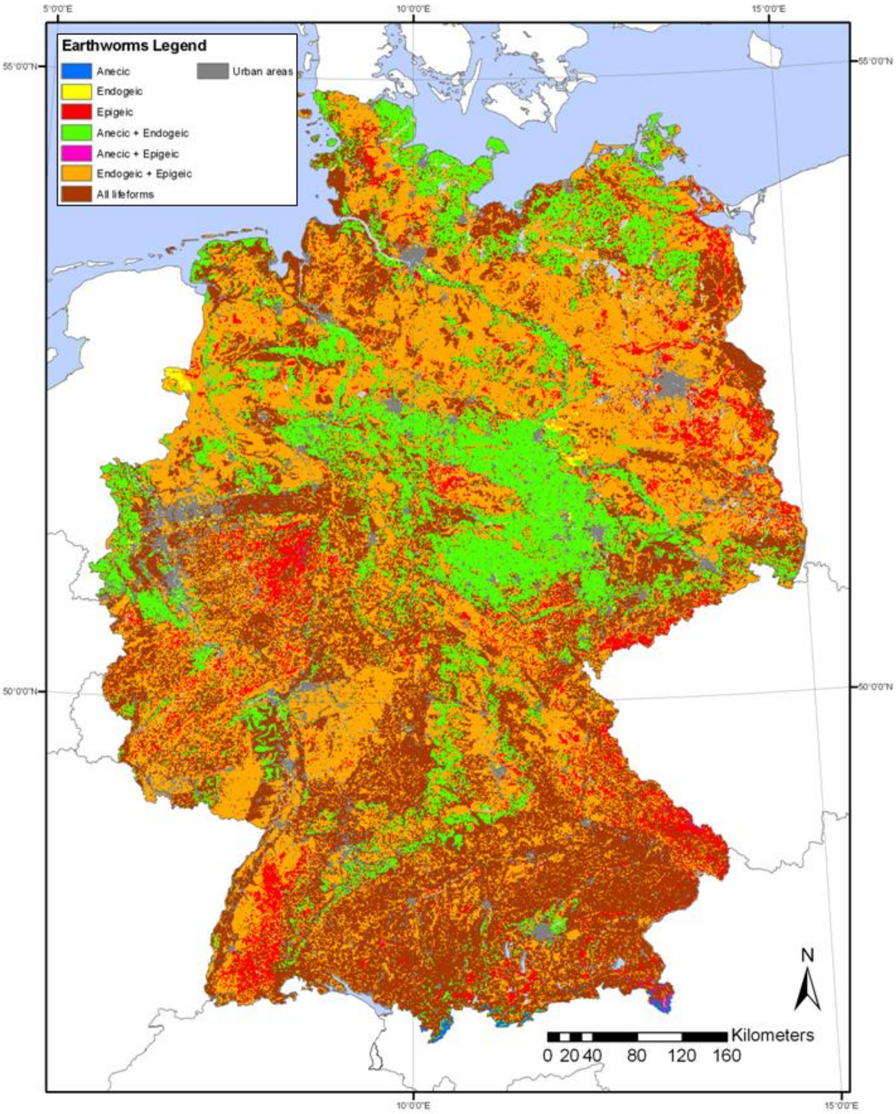
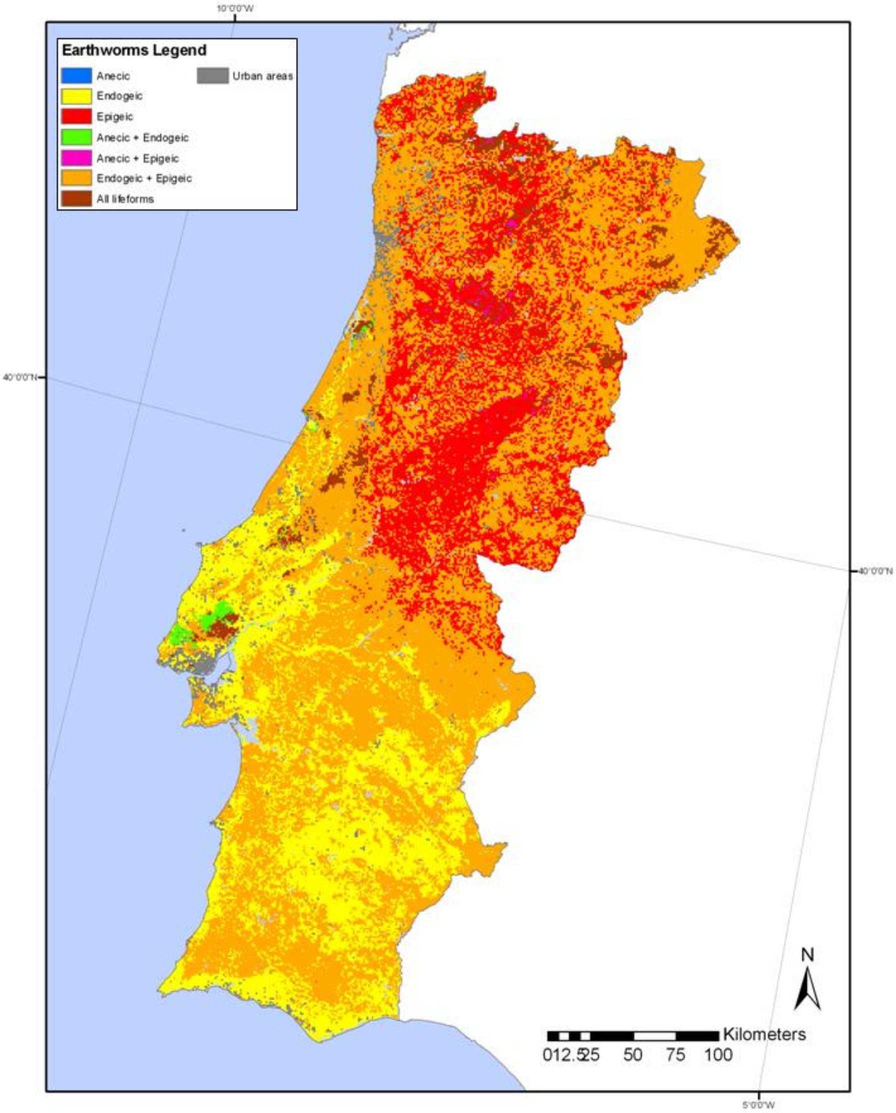
APPENDICES: ECOREGION MAPS



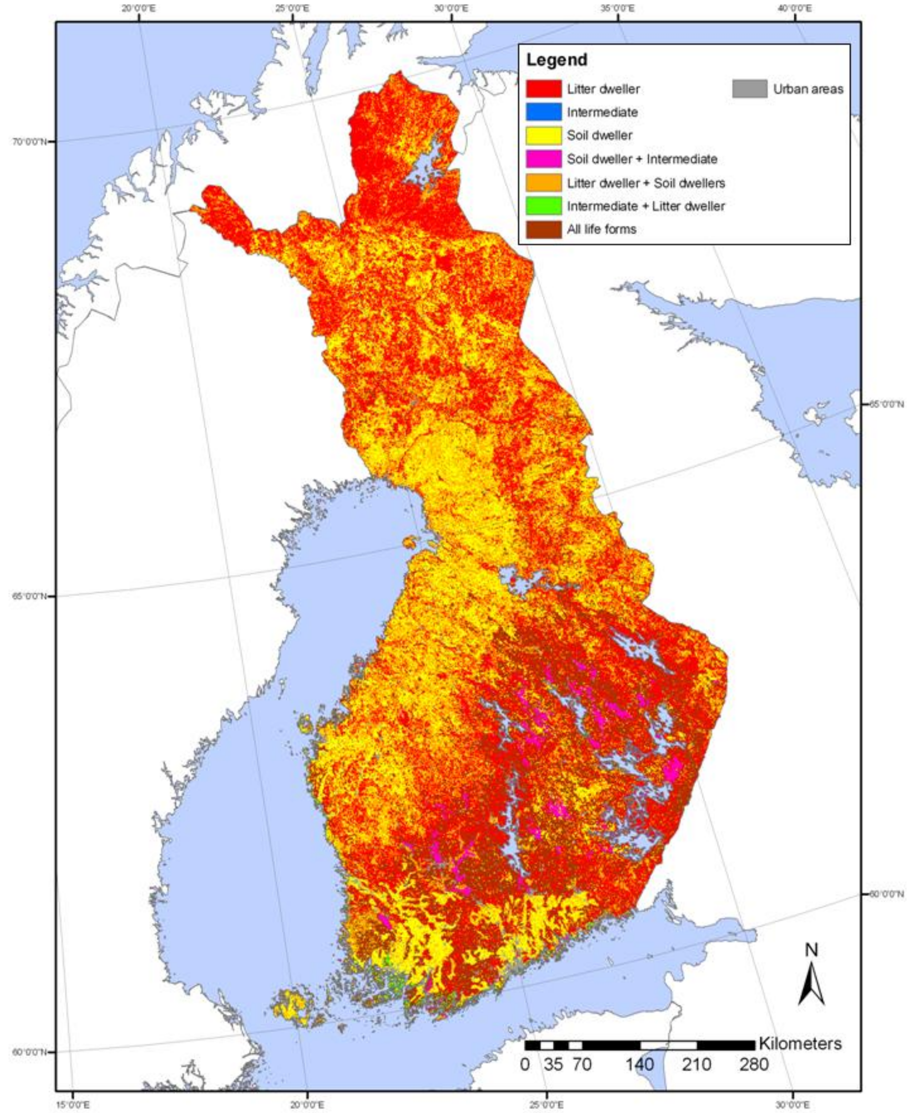
Earthworm Finland



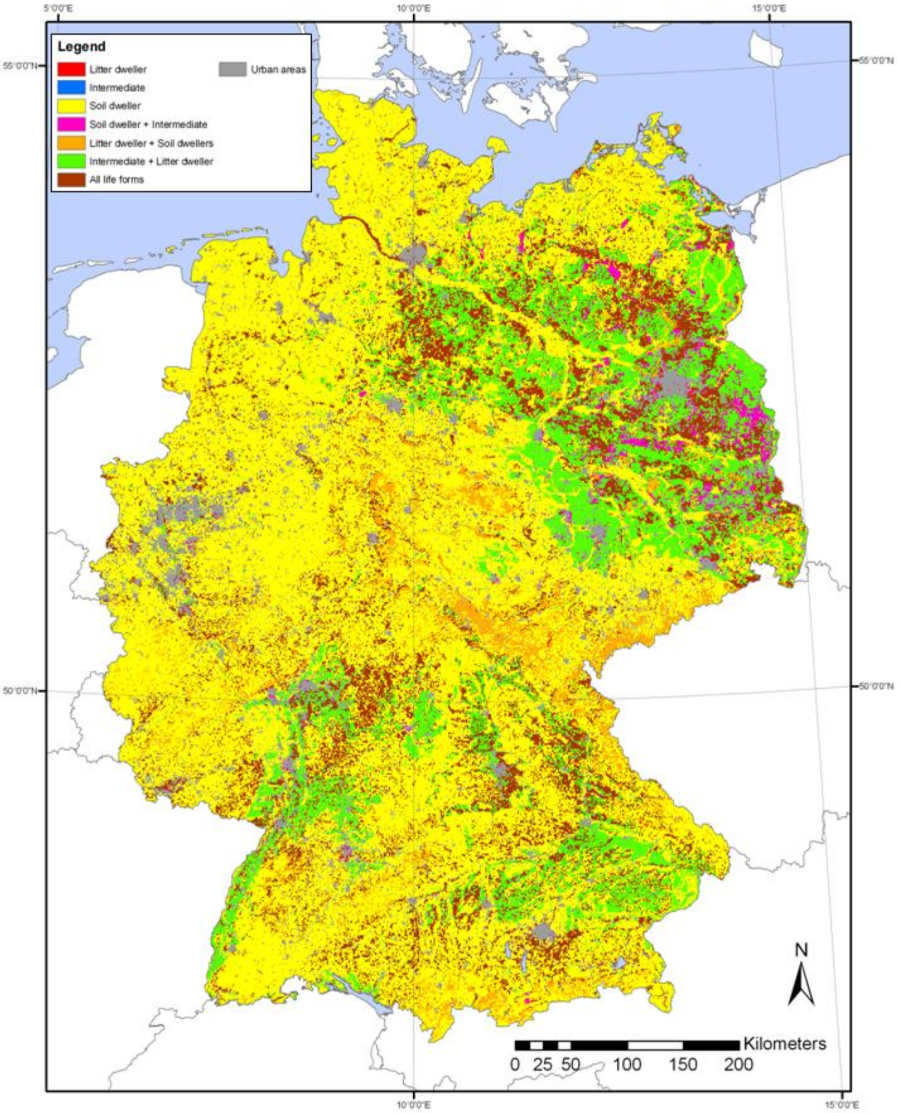
Earthworm Germany



Earthworm Portugal



Enchytraeids Finland



Enchytraeids Germany

European Commission

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Abstract
The activities realized in 2010 by JRC as support to the FATE and the ECOREGION EFSA PPR Working Groups are shortly described.

For the FATE WG, the vast majority of data has been provided in 2009 during the first year of the Service Level Agreement (SLA), and in 2010 the daily weather data, for the six selected sites, were produced. All the data used for the scenario selection procedures, with additional data on land use-land cover, crop distribution, soil and climate parameters, will be made available for external user in first half of 2011.

For the ECOREGION WG the analysis has been carried out for three Member States covering a North-South gradient from Finland, Germany to Portugal. Soil and weather data have been used for the characterisation of bio-geographic sampling sites, and for the implementation of the ecoregion model. Ecoregion maps were produced for earthworms and enchytraeids for Finland and Germany and revealed marked differences between the countries. The same approach has been applied also to Collembola and Isopoda, but for these two taxa led to a rather poor discrimination both between and within countries.

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